12-2019

The Impact of the 2010 Affordable Care Act on Reducing Racial/ Ethnic Disparties in Primary Care Acess and the Delivery of Diabetes Preventive Care in the United States

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THE IMPACT OF THE 2010 AFFORDABLE CARE ACT ON REDUCING RACIAL/ETHNIC DISPARTIES IN PRIMARY CARE ACCESS AND THE DELIVERY OF DIABETES PREVENTIVE CARE IN THE UNITED STATES

A Dissertation Presented

by

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Submitted to the Office of Graduate Studies,

University of Massachusetts Boston,

in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

December 2019

Nursing Program

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ABSTRACT

THE IMPACT OF THE 2010 AFFORDABLE CARE ACT ON REDUCING RACIAL/ETHNIC DISPARITIES IN PRIMARY CARE ACCESS AND THE DELIVERY OF DIABETES PREVENTIVE CARE IN THE UNITED STATES

December 2019

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A key focus of the 2010 Patient Protection and Affordable Care Act (ACA) was to improve access to healthcare services in the United States (U.S.) (Stolberg & Pear, 2010). The research purpose was to assess the impact of the ACA's Medicaid expansion and insurance subsidies on reducing racial/ethnic disparities in coverage, access and the delivery of primary care services, specifically diabetes prevention. Diabetes disproportionately affects minority populations, with inequities reported in the delivery of diabetes care to minorities (Chow, Foster, Gonzalez & McIver, 2012). The Modified Quality Health Outcomes Model was used to guide this research. Statistical analyses were conducted by separately analyzing the 2012-2017 Behavioral Risk Factor Surveillance System (BRFSS) and the 2012 -2015 National Ambulatory Medical Care Survey (NAMCS). Multivariate logistic regression models found that the lowest income groups (<138% FPL) continued to have the lowest levels of insurance post-ACA. In addition, there was an overall 1% gain in having a PCP, with narrowing of racial/ethnic disparities occurring post-ACA. Of interest, whites experienced declines in having a provider, despite gains in insurance. Hispanics continued to have the lowest levels of having a provider post-ACA. High-risk Hispanics were 4 times more likely to be screened than high-risk whites and high-risk adults were 96% more likely to receive diabetes prevention education than the low risk post-ACA. These results lay the groundwork for future research to address policy strategies to improve access to primary care providers and health system strategies to increase consumer awareness of their high-risk for diabetes status.

ACKNOWLEDGEMENTS

Thank you to Dr. Suzanne Leveille for your knowledge and expertise in leading my dissertation committee. I would like to also extend my sincere appreciation to my PhD committee members: Dr. Laura Hayman, Dr. Emily Jones and Dr. Jerry Cromwell. Each has greatly contributed to my success in completing this work.

This work was also supported by mentors and the generous contributions of the following programs: VA Quality Scholars Program (VAQS) (2018-2019), Jonas Philanthropies (2016-2018), and Albert Schweitzer Fellowship (ASF) (2015-2016). Through these programs I have gained valuable leadership and research tools to continue my work in improving health outcomes for underserved communities.

I would like to thank my close family and friends near and far for their words of support and encouragement, including: Christine Kathure, Elizabeth Solis, Ekta Srinivasa, Madeline Martinez, Claudia Wan, Chizoba Nwosu and Dr. James Muchira. I would also like to acknowledge Dr. Tauhid Zaman for your mentorship during the PhD program. Lastly, I would like to thank my partner, Tony Ng, for your patience and willingness to support my dreams.

DEDICATION

My Mother, Felipa M. Nava

A strong Latina woman, and educator, she instilled in me the passion to improve the livelihood of our community. Through my work, I hope that I can impact the lives of future generations of Latino communities, as much as she has touched the lives of students in the Chicagoland area.

My Father, Abel Nava

For making me believe I can achieve the impossible; and giving me the financial security, love and support to follow my dreams.

My Sisters, Catalina and Elizabette Nava

For being my best friends and keeping me focused throughout my academic pursuits.

My Mentor, Dr. Jerry Cromwell

A very special person that I have had the honor to work with throughout the PhD program. Since day one, he believed that I could produce work that would be expected “across the river”. Thank you for your mentorship and guidance.

The Future Latino Generation, Mia, Sofia and Aaron

Three children that I love dearly and wish that I spent more time with in Chicago. I hope this will inspire you to reach higher levels of academic success. This thesis is dedicated to you and your future. I will do my best to make sure it’s always bright.

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23. Primary Care Provider .... PCP

24. Primary Care Provider Supply .... SUPP

25. Socioeconomic Status .... SES

26. The National Ambulatory Medical Care Survey .... NAMCS

27. Veterans Affairs .... VA

CHAPTER 1

INTRODUCTION

In order to promote high quality health care, *access* to the health care system is a prerequisite (Dilworth-Anderson, Pierre & Hilliard, 2012). High quality health care is defined as care that is safe, effective, patient-centered, timely, efficient, and equitable (Agency for Healthcare Research and Quality, 2016). In 2010, more than 1 in 6 Americans under the age of 65 did not have health insurance coverage, which accounted for over 49 million Americans (Kaiser Family Foundation, 2012). Historically, racial and ethnic minorities have been more likely to be uninsured and face more barriers to accessing care with Hispanic-Americans being vastly overrepresented, when compared to non-Hispanic whites (Artiga, Foutz & Damico, 2018). Over 30% of the 50.5 million Hispanic-Americans in the United States (U.S.) were uninsured in 2010 (Office of the Assistant Secretary for Planning and Evaluation, 2011; Passel, Cohn & Hugo Lopez, 2011). The large number of uninsured Hispanic-Americans was of concern as this population makes up the largest minority group in the U.S. and is rapidly growing. After the passage of the ACA, the uninsured rate among nonelderly adult minority groups decreased from 26% to 17% (reduction of 4 million uninsured) for Hispanics, 17% to 12% (reduction of 1.8 million uninsured) for blacks and from 15% to 8% (reduction of 0.9 million) for Asians. Nonelderly adult whites' uninsured rate fell from 12% to 8%, but this group saw the largest decrease in the number of uninsured (reduction of 6.7 million) as a result of the larger population size (Artiga, et al., 2018).

The overall purpose of this research was to assess the impact of the ACA on reducing health disparities in coverage, access and the delivery of primary care services, specifically diabetes prevention for minority adults and those at high risk of developing diabetes. Non-

Hispanic black and minorities of Hispanic descent between the ages of 18 to 64 were the population of interest as this group has experienced poor health outcomes related to their low rate of health insurance coverage in the U.S. (Ortega, Rodriguez & Bustamante, 2015). The income threshold of interest includes individuals living between 100% to 400% of the federal poverty level (FPL) since this demographic was expected to benefit from the ACA's coverage expansion by either state Medicaid expansion or a health insurance subsidy. Diabetes was the health condition of interest as diabetes disproportionately affects racial and ethnic minorities, with minorities being at greater risk of developing diabetes than non-Hispanic whites (American Diabetes Association, 2017). Coverage, access, and the delivery of diabetes prevention is vital to ensuring high quality diabetes preventive care is being delivered to high risk individuals. The Conceptual Model of Nursing and Health Policy (CMNHP), the Institute for Healthcare Improvement's (IHI) Triple Aim and the Modified Quality Health Outcomes Model were used to understand how the ACA's coverage expansion provisions impacted diabetes preventive care in the U.S. It was anticipated that national coverage expansion would lead to increased access and delivery of diabetes prevention for individuals at high risk; ultimately leading to a decrease in health disparities in diabetes care.

Research Questions, Aims and Hypotheses

1. To what extent did the ACA's Medicaid expansion and insurance subsidies improve insurance coverage, access to primary care and the subsequent delivery of diabetes prevention for U.S. adults aged 18 to 64?
2. Did increases in insurance coverage lead to a reduction in disparities in accessing primary care and the subsequent delivery of diabetes prevention for minority adults and adults at high risk of diabetes aged 18 to 64 in the U.S.?

Specific Aim #1: (Analyze with BRFSS Data 2012-2017)

1a. To determine the impact of the ACA's coverage expansion on the likelihood that an adult aged 18 to 64 has health insurance coverage in the U.S. by income category.

- ***Hypothesis #1a:*** When compared to the pre-ACA period, ACA's subsidy and Medicaid expansions will not only lead to an increase in the percentage of lower income adults gaining health insurance coverage, but at a faster rate than for higher income adults post-ACA implementation.

1b. To determine the differential impact of the ACA's coverage expansion on the likelihood that an adult aged 18 to 64 has health care coverage between Medicaid expansion versus non-expansion states by income category.

- ***Hypothesis #1b:*** When compared to the pre-ACA period, ACA's subsidy and Medicaid expansions will not only lead to an increase in the percentage of lower income adults gaining health care coverage, but at a faster rate within Medicaid expansion states than non-expansion states post-ACA implementation.

Specific Aim #2: (Analyze with BRFSS Data 2012-2017)

2a. To determine the impact of the ACA's coverage expansion on the likelihood that an adult aged 18 to 64 has health care access (i.e. a primary care provider or visited a physician for a routine visit) in the U.S. by race, then by diabetes risk status.

- ***Hypothesis #2a:*** When compared to the pre-ACA period, ACA's subsidy and Medicaid expansions will lead to an overall increase in health care access among racial/ethnic minority adults and adults at high risk of developing diabetes when compared to non-Hispanic whites and those at low risk respectively, post ACA implementation.

2b. To determine the differential impacts of the ACA's coverage expansion on the likelihood that an adult aged 18 to 64 has health care access (i.e. a primary care provider or visited a physician for a routine visit) in a Medicaid expansion versus non-expansion states by race, then by diabetes risk status.

- ***Hypothesis #2b:*** When compared to the pre-ACA period, ACA's subsidy and Medicaid coverage expansions will lead to an overall increase in the reporting of health care access among racial/ethnic minority adults and adults at high risk of developing diabetes when compared to non-Hispanic whites and those at low risk respectively within Medicaid expansion states than non-expansion states.

Specific Aim #3: (Analyze with NAMCS Data 2012 to 2015)

3a. To determine if the ACA's coverage expansion increased the rate of diabetes screening and diabetes prevention education for adults within Medicaid expansion versus non-expansion states.

- ***Hypothesis #3a.1:*** When compared to the pre-ACA period, ACA's subsidies and Medicaid expansions will lead to an increased rate of diabetes screening and counseling overall, with greater proportions of adults receiving diabetes prevention within Medicaid expansion states than in non-expansion states post-ACA implementation.

3b. To determine if the ACA's coverage expansion increased the rate of diabetes screening and diabetes prevention education within Medicaid expansion versus non-expansion states by race/ethnic, then by diabetes risk status.

- ***Hypothesis #3b.1:*** When compared to the pre-ACA period, ACA's subsidies and Medicaid expansions will lead to an increased rate of diabetes screening and counseling overall, with greater proportions of black, Hispanic and high-risk adults receiving diabetes prevention within Medicaid expansion states than in non-expansion states post-ACA implementation.

Background and Significance

Access, Quality and Costs on the U.S. Agenda

Historically, changes to federal health policy have occurred incrementally. Leading up to 2010, the need for a reformed health care system became apparent as health care costs were escalating, millions of Americans were without health insurance coverage, and individuals and families were facing poor health outcomes nationwide. In 2009, the Organization for Economic Co-operation and Development (OECD) reported that the U.S. spent $7,598 dollars per capita on healthcare, which was roughly 48% higher than Switzerland, the next highest spending industrialized country (Kaiser Family Foundation, 2012). The dramatic increase in health care spending was associated with technological advances, an aging and chronically ill population, and heath service misuse and overuse (Cromwell, Healy, Seeley, Trebino & Cromwell, 2013). Despite the additional spending on health care in the U.S., increased spending did not result in efficient nor improved health outcomes. Overall, the Unites States ranks last among eleven industrialized countries when it comes to measures of healthcare quality, access, equity and health outcomes (Mahon & Fox, 2014).

Despite developments in prevention and treatment regimens, the benefits of these advancements have not been shared equally across economic and racial/ethnic groups in the U.S. (Havranek, Mujahid, Barr, Blair, Cohen, Cruz-Flores, Davey-Smith, Dennison-Himmelfarb, Lockwood, Rosal & Yancy, 2015). This is of concern as the census projects that the U.S. will become "minority white" by 2045, with Hispanics making up 25.6% of the minority population (Frey, 2018). Currently, ethnic minorities living in the U.S. report lower health-related quality of life

(HRQoL) than non-Hispanic whites, with health disparities being prominent among Hispanics and non-Hispanic whites (Laiteerapong, Karter, John, Schwillinger, Moffet, Liu, Adler, Chin & Huang, 2013). To add to the existing disparities in care, America's fragmented health care system has led uninsured low-income adults to be greater utilizers of the emergency room for routine care when compared to low-income adults with insurance options (Collins, Robertson, Garber & Doty, 2012). The passage of the ACA's Medicaid expansion and Marketplace subsidies was the first step to making health care accessible to low-income uninsured adults within the U.S.

Key ACA Coverage Expansion Provisions

Medicaid was the primary driver in expanding coverage among the uninsured as it was expected that two-thirds of the new population would qualify to be covered by Medicaid (Jacobs & Callagan, 2013). Medicaid is a jointly funded federal-state health insurance program and is the third largest domestic program in the federal budget after Medicare and Social Security (Robin, 2016; Social Security Administration, n.d) This safety net program is responsible for ensuring affordable health care coverage for low-income adults and children in the U.S. and is the third largest domestic program in the federal budget after Medicare and Social Security (Robin, 2016). Medicaid itself is a major source of coverage for ethnic minority groups as these groups are more likely to be in low-income, low-wage jobs that provide limited access to employer-sponsored health care coverage despite having at least one family member working in a full-time position. Nearly two-thirds of uninsured blacks and Native Americans/Alaska Natives and over half of uninsured Hispanics had incomes below 138% of the federal poverty level (FPL) (Kaiser Family Foundation, 2013).

In 2009, 27% of Hispanics were covered by Medicaid, compared to 11% of non-Hispanic whites, making Medicaid a major source of coverage for this minority population (Kaiser Family

Foundation, 2011). The benefits of adequate access to coverage for uninsured Hispanics have been demonstrated with Medicaid state expansions that occurred before the ACA. Medicaid expansion in Oregon showed that Spanish-speaking Hispanics made major coverage gains as witnessed in the drop in the uninsured rate from 64.3% to 13.7% (Alcala, et al., 2017). Across all racial and ethnic groups, previous studies on Medicaid expansion were associated with positive health outcomes including: decreased rates of delayed care due to costs, increased rates of self-reported health status of “excellent” or “very good”, and a significant reduction in adjusted all-cause mortality. The reduction in mortality was the greatest among minorities, older adults and those with the lowest incomes (Sommers, Baicker, Epstein, 2012). Despite the benefits of Medicaid expansion, the success of improving coverage for newly eligible individuals was contingent upon the expansion of Medicaid across all states.

Since the enactment of Medicaid in 1965, federal law required states to cover certain groups of people in order to receive matching federal funds. Before the ACA, the mandatory coverage groups included primarily pregnant women and children under 6 years old living at or below 133% of the FPL, children aged 6 to 18 with family incomes at or below 100% FPL, people with disabilities who qualify for Supplemental Security Income (SSI) benefits and caretaker relatives who meet the financial eligibility requirements for the former cash assistance program. Medicaid eligibility remained limited or nonexistent for working parents and non-disabled, non-pregnant adults without dependent children. To increase coverage options for low-income adults, the ACA required Medicaid participating states to cover nearly all individuals under the age of 65 who had incomes at or below 138% FPL (Kaiser Family Foundation, 2012). For low-income adults who did not meet Medicaid eligibility (< 138% FPL), a subsidized Marketplace was implemented on Oct. 1, 2013, making health insurance affordable for individuals and families living between 100 to 400% FPL. (Green, 2013; Abdus, et al., 2015). The Marketplace was a health insurance exchange made up of health plans. Through the Marketplace individuals gained access to premium tax credits and cost-sharing subsidies either through the state or federal government (Kaiser Family Foundation, 2012). It was estimated that 60% of the uninsured would obtain coverage through one of the two ACA expansion provisions by 2019 (Brown & McBride, 2015). In order to ensure individuals enrolled in coverage, the ACA also included an individual mandate which would require individuals to have health care coverage or pay a penalty beginning in 2014 (Kaiser Family Foundation, 2012).

Even before the implementation of ACA's coverage expansion, in 2011, the state of Florida, along with 25 other states filed a lawsuit challenging the constitutionality of the ACA's Medicaid expansion in the *Florida v. Department of Health and Human* Services case which was rolled up into the *National Federation of Independent Business (NFIB) v. Sebelius* case (Kaiser Family Foundation, 2012; Smith, 2012). In the *NFIB v. Sebelius* case, the U.S. Supreme court reviewed the constitutionality of the health care subsidies, the individual mandate and the ability of the government to enforce Medicaid expansion. Chief Justice John Roberts upheld the individual mandate and tax subsidies within the ACA (Liasson, Totenberg & Montagne, 2015). In June 2012, the U.S. Supreme Court ruled that the ACA could not enforce states to expand Medicaid as Chief Justice Roberts concluded that a federal condition on a grant to states was unconstitutionally coercive; as a result, expansion remained optional to states (Kaiser Family Foundation, 2012; Jacobs & Callagan, 2013).

Beginning January 1, 2014, Medicaid expanded up to 138% FPL in states that chose to expand the program (Sommers, Gunja & Finegold, 2015). Full federal financing was available from 2014 through 2016, which would be reduced to 90% by 2020 for Medicaid expansion states, allowing non-traditional Medicaid recipients (childless adults or very low-income parents) access to health care coverage through this program (Decker, Kostova, Kenney & Long, 2013; Herman & Cefalu, 2015). After 2016, the federal share (FMAP) varies by state, from a floor of 50% to a high of 74%, depending on a state's demographics (Rudowitz, 2016). From 2010 to 2014, six states (California, Colorado, Connecticut, Minnesota, New Jersey and Washington) and the District of Columbia expanded Medicaid early, with a total of 31 states expanding Medicaid by mid-2016 (Kominski et al., 2017). As of January 2018, 33 states including D.C. expanded Medicaid (FamiliesUSA, 2018). States that did not expand Medicaid left at least 4 million American low-income adults with a *coverage gap.* (Herman & Cefalu, 2015).

It is important to note that the ACA allowed for "qualified non-citizens" or green card holders to enroll in marketplace plans (Doty & Collins, 2017). There are no provisions addressing health care coverage for undocumented immigrants, although states could choose to provide coverage. For example, the state of California has allowed undocumented persons to participate in the insurance marketplace without subsidies (Alcala et al., 2017). The lack of coverage options for undocumented immigrants has been of major concern for the Hispanic population as Hispanics of Mexican origin make up the majority of undocumented immigrants in the U.S. (Passel & Cohn, 2014).

Access to Care post ACA

The coverage provisions reduced income-related inequities within our current health care system as it allowed families and individuals in the bottom half of the income distribution equal access to the health care (Collins et al., 2012). Focusing on Medicaid expansion and the reduction of socioeconomic disparities specifically, health care access for low-income individuals improved in both Medicaid expansion states and non-expansion states; with larger gains in states that expanded (Griffith, Evans & Bor, 2017). Newly insured adults with Medicaid or Marketplace coverage reported high satisfaction with their coverage, physician options, affordability and access to care (Kominski et al., 2017). By 2016, the uninsured rate for nonelderly blacks reduced from 18.9 percent to 11.7 percent, with blacks having higher uninsured rates than whites (7.5%) and Asians (6.3%) (Bailey, Broaddus, Gonzalez & Hayes, 2017). Current analyses among the remaining 19 non-expansion states show that adults with the highest uninsured rates under the current law continue to be individuals with less than a high school education (38.1%), the unemployed (32.5%) and Hispanics (26.8%) (Buettgens & Kenney, 2016). The high uninsured rates among Hispanics is of concern as Hispanics are the fastest growing population in the U.S., with 55.4 million people in 2014 self-identifying as Hispanic. By 2060, the number of Hispanics in the U.S. is expected to double, representing about a third of the U.S. population (Pew Research, 2015). Among the Hispanic population, it was estimated that 8 million (of the 10.2 million uninsured Hispanics) would qualify for Medicaid or a subsidized insurance plan via the Health Insurance Exchange (Ortega et al., 2015).

Currently, 3 in 5 Hispanics live in a state that chose to expand Medicaid with large portions of Hispanics being newly eligible for insurance coverage by the Marketplace, with high subsidies (Abdus, et al., 2015). At the end of the ACA's first open enrollment period, the uninsured rate for working-age Hispanic adults decreased from 36% to 23%, compared to 16% to 12% for non-Hispanic white adults. Hispanics continued to experience barriers to enrollment, such as language difficulties, a lack of awareness of current legislation and effects of state decisions to not expand Medicaid eligibility, leading to a number of Hispanics remaining uninsured (Doty, Blumenthal, Collins, 2014). Research on the first year of the ACA coverage expansion provisions has shown that approximately 1 in 3 Hispanics with a chronic disease continued to lack coverage and access to care after ACA implementation (Torres, Poorman, Tadepalli, Schoettler, Ho Fung, Mushero, Campbell, Basu & McCormick, 2017). Among blacks, the second largest racial group to be uninsured, The Center on Budget and Policy Priorities estimates that about 806,000 African Americans would come out of the coverage gap if non-expansion states expanded Medicaid (Bailey et al., 2017).

Diabetes on the Rise in the United States

Diabetes and Access to Care. Diabetes is classified into two distinct categories, Type 1 and Type 2. About 90 to 95% of the diabetes burden is related to Type 2 diabetes, which is a preventable health condition and the focus of this research. In Type 2 diabetes, insulin resistance leads muscle, fat and livers cells to not absorb glucose from the bloodstream. Insulin is a hormone produced in the pancreas and plays a major role in metabolism. As a result, higher levels of insulin are needed to move glucose into the cells. Research has shown that excess weight and physical inactivity are major contributors to the development of insulin resistance. Being overweight or obese, with excess abdominal fat, is a primary cause of insulin resistance (National Institute of Diabetes and Digestive and Kidney Diseases, 2009). The 2013-2014 National Health and Nutrition Examination Survey (NHANES) found that more than 2 in 3 adults or 70.2 percent were considered to be overweight (32.5%) or obese (37.7%) (National Institute of Diabetes and Digestive Kidney Diseases, 2017). Physical activity is important for overcoming insulin resistance as active muscles burn stored glucose for energy and refill reserves with glucose from the bloodstream, keeping blood glucose levels within the normal range. Additional factors found to affect insulin resistance include: ethnicity, certain diseases, hormones, steroid use, some medications, older age, sleep problems and cigarette smoking (National Institute of Diabetes and Digestive and Kidney Diseases, 2009).

Insulin resistance occurs overtime, with initial symptoms showing up as pre-diabetes, where individuals are asymptomatic. Studies have shown that individuals with prediabetes develop type 2 diabetes within 10 years if they do not change their lifestyle (National Institute of Diabetes and Digestive and Kidney Diseases, 2009). Pre-diabetes is defined as having impaired fasting glucose which is a fasting plasma blood glucose in the 100-125mg/dL or impaired glucose tolerance, which is a blood glucose of 140-199 mg/dL 2 hours after the administration of glucose, or a A1C of 5.7%-6.4% (Joslin Diabetes Center, 2017; American Diabetes Association, 2017). Non-modifiable risk factors for type 2 diabetes or pre-diabetes include: age, race/ethnicity, family history, history of gestational diabetes and low birth weight. Modifiable risk factors include: Poor mental health status, inactivity, poor nutrition, hypertension, smoking and alcohol use, with increased body mass index (> or = 25) being one of the strongest risk factors for the development of diabetes (Deshpande, Harris-Hayes, Schootman, 2008).

Even though the U.S. is home to about 6% of people living with diabetes, the U.S. accounts for nearly half of all global diabetes-related expenditures (Zeytinoglu & Huang, 2015). In fact, the U.S. spends 1 in 10 health care dollars on diabetes-related care, making diabetes one of the costliest chronic conditions to manage (Zeytinoglu & Huang, 2015). It was estimated that between 2011 and 2012, more than 13 million U.S. adults aged 19 to 64 were living with diagnosed diabetes, with almost 2 million of these individuals lacking health insurance. Being uninsured increases the rate of undiagnosed or poorly managed diabetes, which can lead to serious health conditions such as heart disease, stroke, kidney disease, hypertension, neuropathy and blindness (Brown & McBride, 2015). Among those with an existing diagnosis of diabetes, insurance coverage was associated with significantly lower hemoglobin A1C levels, indicating better management of diabetes (Hogan, Danaei, Ezzati, Clarke, Jha & Salomon, 2015).

Kaufman et al. (2015) conducted a study after the ACA coverage expansion which showed a 1.6% increase in newly identified diabetes cases across the U.S. In expansion states, Medicaid patients had a 23% increase in having newly identified diabetes, compared to a 0.4% increase in non-expansion states (Kaufman, Chen, Fonseca & McPhaul, 2015). This study highlighted the important role health care coverage plays in preventing and managing diabetes. Without adequate health insurance coverage, individuals with chronic disease do not have access to the health care system, leading to disparities in care. As the previously uninsured gained access to the health care system, an increased demand for primary care services was anticipated, especially among racial/ethnic minorities within Medicaid expansion states. Eight states (Oklahoma, Georgia, Texas, Louisiana, Arkansas, Nevada, North Carolina, and Kentucky) were expected to face the greatest challenges with Medicaid expansion since these states had weak primary care capacity before the passage of the ACA. This challenge could impact the quality of care delivered to newly insured and existing insured patients as newly insured populations demand more primary care services (Ku, Jones, Shin, Bruen & Hayes, 2011).

Diabetes and Racial/Ethnic Health Disparities

In 2003, the Institute of Medicine's (IOM) Report "Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care" noted that African Americans, Hispanics and Native Americans experience a 50-100% higher burden of illness and mortality from diabetes than white Americans (Chow, Foster, Gonzalez & McIver, 2012).Type 2 diabetes disproportionally affects racial/ethnic groups that have historically made up a disproportionate share of the poor and uninsured in the U.S. This includes Blacks, Native Americans, Hispanics, Asians and Pacific Islanders (Alliance to Reduce Disparities in Diabetes, 2011). Figure A-1 shows the U.S. poverty rates by race and ethnicity from 1961-2015. In 2015, the poverty rate for blacks was 24.1%, 21.4% for Hispanics, 11.4% of Asians, and 9.1% of whites. The overall poverty rate for the population was 13.5%. (Institute for Research and Poverty, 2016). Being of low socio-economic status increases one's risk of developing diabetes as low-income populations tend to live in low-income neighborhoods with a lack of resources to healthy foods, safe neighborhoods and health care access. As a result, the environment, in conjunction with genetic factors, plays a major role in the higher rates of overweight and obesity in minority populations, predisposing these groups to an increased prevalence of diabetes (Alliance to Reduce Disparities in Diabetes, 2011).

In addition to income, previous research has found significant associations between diabetes and age, educational attainment, marital status, health insurance, usual source of care, BMI, total dietary calories, and physical activity among Hispanics (O'Brien, et al., 2014). Among Hispanics, diabetes is the fifth leading cause of death with this population being 50% more likely to die from diabetes than non-Hispanic whites (Centers for Disease Control and Prevention, 2016). In practice, Hispanics frequently experience barriers to receiving better diabetes care which include: a lack of insurance coverage, linguistic, cultural, immigration status and socioeconomic barriers (Alcala, Chen, Langellier, Roby & Ortega, 2017). Among the U.S. Hispanic population, Mexican-Americans, the largest Hispanic subgroup, bear the largest diabetes burden when compared to non-Hispanic whites (20.1% vs. 11.0%, respectively) (O'Brien, Alos, Davey, Bueno & Whitaker, 2014). U.S.-born Hispanics tends to be less healthy than Hispanic immigrants and the expected increase in the older Hispanic population will be related to U.S. births rather than individuals from Spanish-speaking countries (PewResearch, 2008). Before coverage expansion, more than one-fourth of Hispanic adults reported that they lacked a usual health care provider. In fact, when compared to blacks, Hispanics were twice as likely to lack a regular health care provider; and three times as likely as Whites (Pew Research Center, 2008). This is problematic as diabetes prevention is most effective when a patient has a regular source of care. As a result, uninsured Hispanics are less likely to get recommended care for disease prevention and management, contributing to the health disparities seen in diabetes care (Agency for Healthcare Research and Quality, 2014).

According to the Office of Minority Health (2017), an individual's sex also plays a role in creating disparities in diabetes care. African American women have the highest rates of being overweight or obese when compared to other racial and ethnic groups in the U.S. African Americans were 1.4 times as likely to be obese than non-Hispanic whites. The Office of Minority Health estimates that four out of five black women are overweight or obese. In 2015, black women were 60% more likely to be obese than non-Hispanic white women (U.S. Department of Health and Human Services Office of Minority Health, 2017). Kieffer et al. (2001) found that disparities exist in women's health among women aged 14 to 47 of childbearing age. In their study, 47% of black women and 37% of Latinas were overweight or obese, with 53% of black women and 38% of Latinas gaining excessive weight during pregnancy. Excessive weight gain during pregnancy is of concern given the risk of developing gestational diabetes. Hispanic women were found to be 2.5 times more likely than black women to develop gestational diabetes. Having gestational diabetes increases one's risk of developing type 2 diabetes (Kieffer, Carman, Gillespie, Nolan, Worley & Guzman, 2001). Robbins et al. (2001) found that socioeconomic status was associated with type 2 diabetes prevalence among women, but not consistently among men using the National Health and Nutrition Examination Survey. Diabetes was found to be more strongly associated with poverty than education or work status. The study found no significant associations between poverty, education, occupational status and diabetes for African American men (Robbins, Vaccarino, Zhang & Kasl, 2001).

Interestingly, the Asian population is also rapidly growing and grew by 46% from 2000 to 2010. Despite their rapid growth, limited population-based research exists about diabetes and Asian Americans (Joslin Diabetes Center, 2016; McNeely & Boyko, 2004). Similar to the Hispanic population, the Asian population is very diverse. This population is comprised of Chinese (24%), Filipino (18%), Asian Indian (16%), Vietnamese (11%), Korean (11%), Japanese (8%), and other Asian (13%) ancestry (McNeely & Boyko, 2004). The 2011-2012 National Health and Nutrition Examination Survey (NHANES) showed that 20.6% of Asians have Type 1 & Type II diabetes; 32.2% of Asians have pre-diabetes; and 50.9% of Asians having undiagnosed diabetes. The percent of undiagnosed diabetes was higher than any other ethnic or racial group, meaning that one in two Asians in the U.S. will have diabetes or prediabetes. (Joslin Diabetes Center, 2016). The higher risk is most likely due to having less muscle and more abdominal fat, which increases insulin resistance. Asians, particularly men, have also been found to be higher users of tobacco products.

While some Asian populations have a lower prevalence of being overweight or obese, or lower BMIs, they still have a greater number of people with diabetes when compared to non-Hispanic whites (Asian Diabetes Prevention Initiative, n.d.). Overall, when adjusting for the lower BMI of Asians, the adjusted prevalence of diabetes is 60% higher for Asians than non-Hispanic whites (McNeely & Boyko, 2004). A study by Karter et al. (2013) found the highest prevalence among racial and ethnic groups was among Pacific Islanders (18.3%), followed by Filipinos (16.1%) South Asians (15.9%), Latinos (14%), African Americans (13.7%), Native Americans (13.4%), Southeast Asians (10.5%), Japanese (10.3%), Vietnamese (9.9%), Koreans

(9.9%) and Chinese (8.2%) (Karter, Schillinger, Adams, Moffet, Liu, Adler & Kanaya, 2013). Native Hawaiian and Pacific Islanders (NHPI) tend to be the smallest ethnic group and in the 2010 NHIS, this group had 42% of participants reporting obesity (Matias Bacong et al., 2016). When Pacific Islanders were aggregated with all Asian categories, the prevalence rate was 12.3%. The prevalence rate for diabetes for Asians as an aggregate was 12.2%. Many national health surveys before the year 2000 classified Asians as "other race" or, if recognized, combined them with Pacific Islanders, making variations among subgroups difficult to distinguish (Karter et al., 2013).

Native Americans over 18 years old have a high age-adjusted prevalence of diabetes (17.6%) (U.S. Department of Health and Human Services Office of Minority Health, 2016). Factors that contribute to a high rate of diabetes among this population include: genetic predisposition to insulin resistance, sedentary lifestyles, obesity and stress-producing environments. Throughout U.S. history, health care has been guaranteed to Native Americans in exchange for the millions of acres of lands that now make up the U.S. (National Congress of American Indians, 2018); yet Native Americans have experienced forced acculturation, warfare and severely underfunded health services through the Indian Health Services, leading to severe health disparities (Warne & Frizzell, 2014). From 1999 to 2003, the National Center for Health Statistics reported that Native adults are more likely to be obese than their white, black or Asian counterparts, with about 70% of Native adults being obese. When Schulz et al. (2006) compared the prevalence of obesity and type 2 diabetes in U.S. Pima Natives to individuals of Mexican descent, the natives had significantly higher rates of obesity and type 2 diabetes. The increase prevalence of obesity and diabetes was related to lower intake of dietary fiber, higher intake of dietary fat and less activity during work or leisure (McLaughlin, 2010).

Relationship between Health Disparities and Quality in Diabetes Care

One of the strongest predictors of health is socioeconomic status (SES) (Colen, Ramey, Cooksey & Williams, 2018). Link & Phelan's (1995) Functional Cause Model highlights SES as the basic cause of health disparities as it has become increasingly common knowledge that social, economic and environmental factors influence an individual's opportunities for developing good health behaviors (Heiman & Artiga, 2015). Although other conceptual models incorporate race when addressing health disparities, race itself is not considered a basic cause of health disparities in the functional model as previous research has closely linked socioeconomic status to race (Diez Roux, 2012). However, the association between SES and health is complex for certain minority groups. For instance, health disparities are often more prominent between African Americans and non-Hispanic whites with high SES than between the same groups with low SES. Upward mobility does not seem to improve health outcomes for African Americans as it does for whites. Among the Hispanic population, the association between SES and health is less pronounced when compared to non-Hispanic whites. Hispanics tend to experience better overall health outcomes given their low SES status (Colen et al, 2018).

In 1999, the National Academy of Medicine, then, the Institute of Medicine (IOM) found scientific evidence that ethnic minorities receive poorer quality health care than whites in both simple treatments, as well as in the most technologically advanced services (Parks, 2016). The Agency for Healthcare Research and Quality (AHRQ) has also recognized racial and ethnic minorities, women, children, low-income groups, the elderly, rural residents and individuals with disabilities as priority groups for addressing health disparities (White, Beech & Miller, 2009). Racial and ethnic health disparities are defined as variations in the quality of health care that are not due to access-related factors or clinical needs, preferences, and appropriateness of an intervention (Gold, 2014). Every year since 2003, AHRQ has documented that widespread disparities are persistent throughout the U.S. The *National Healthcare Disparities Report*, AHRQ (2003) defines a health disparity as differences among populations that are statistically significant with a difference from the reference group by at least 10% (LaVeist & Isaac, 2013).

Despite the advantages of health insurance coverage in reducing disparities in access to care, disparities in health care delivery still exist, even among the insured. Through 2013, racial and ethnic minorities continued to receive less than optimal care for 40% of the quality measures assessed, with Asians receiving worse care for 20% of the measures (Maina, Belton, Ginzberg, Singh & Joshnson, 2018).The IOM report, *Unequal Treatment,* attributed health disparities to differences in the quality of care received within health care institutions (Peek, Cargill & Huang, 2007). Even when clinicians are aware that dietary and physical activity counseling are important parts of diabetes care, significantly fewer Hispanics, blacks, lower-income individuals and individuals with less than a high school education were told by their physician that they were overweight (White et al., 2009). Differential treatment of members of a specific group by individuals and social institutions has adverse effects on physical and mental health. There is scientific evidence that links racial discrimination to poor health, leading to psychological and physiological stress responses, unhealthy coping behaviors and lower health care utilization. In fact, racial minorities who deny that racism exists are at an increased risk for adverse health outcomes and lower health care utilization. Perceived racial discrimination in diabetes care among black men and women indicated an association between perceived discrimination and higher HbA1c levels for black men, but not black women (Assari, Lee, Nicklett, Lankarani, Piette & Aikens, 2017). As IHI's Chief Scientific Officer Emeritus and Senior Fellow Don Goldman quoted, "the uncomfortable truth is that we live in a society in which stereotypes about groups of people are ubiquitous, and it follows that almost everyone has some implicit bias" (Institute for Healthcare Improvement, 2018).

Provider bias manifests itself in two forms- explicit and implicit. Explicit biases are conscious attitudes which are measured through self-report but could easily be falsely reported in order to align with current societal beliefs and attitudes (Maina, et al., 2018). Implicit biases are unconscious and the provider may not be aware of these beliefs but these beliefs influence personal behavior and actions (Hayman & Worel, 2016; Maina et al., 2018). Implicit bias can be measured by the provider or through the patient's experience of discrimination. Current research shows that when compared to non-Hispanic whites, minorities believe they would receive better care and respect from health care providers if they belonged to another racial group (Maina, et al., 2018). It has been found that in some cases, minority individuals with higher levels of SES tend to report more instances of discrimination.

Discrimination via implicit bias may result in lower-quality clinical interactions between clinicians and minority patients, leading minority patients to perceive biased treatment. In return, this perception of biased treatment has been associated with self-reports of poorer health status, self-care, adherence to treatment plans and the under-utilization of health care services (Hayman & Worel, 2016). Discrimination negatively influences the quality of clinical interactions between clinicians and patients, as well as a patient's physical well-being. The perception of biased treatment (or discrimination) has been associated with self-reports of poorer health status, self-care, adherence to treatment plans, the under-utilization of health care services, including elevated levels of stress in patient's, meaning- individuals who endure discrimination over time are expected to have worse health outcomes than those with limited or less frequent stressors (Hayman & Worel, 2016; Colen et al., 2018).

Systemically, the federal government, insurance companies and health care systems have invested substantial resources on developing quality improvement programs to improve health outcomes and reduce disparities in care. For example, the Veterans Health Administration (VHA), which is the largest integrated health care system in the country, in 2004 reported measures of diabetes care and outcomes that were much higher than the national average due to the vast investment in quality improvement initiatives. Eye examinations were reported to be 91% and HbA1c testing was 93%, with studies suggesting that improved quality improvement efforts have decreased racial and ethnic disparities in diabetes care among the veteran population. However, another study found that when VHA data is paired with Medicare claims data, health disparities among African Americans and Hispanics reemerged or worsened when compared to VHA-only data (Peek, Cargill & Huang, 2007). As the VA is not the sole provider for veteran care, disparities continued with access to non-VA data. From a system's perspective, systemic differences in treatment, access and outcomes between individuals and across populations are problematic as inequities are the worst type of variation within a system. These variations in care are unjust as they are linked to forms of oppression that inhibit specific groups from achieving positive health outcomes (Institute for Healthcare Improvement, 2018).

In order to promote positive health outcomes for racial/ethnic minorities, Weintraub et al. (2011) suggest that policy and environmental change is important to influence behavior's shaped by an individual's physical, social and cultural environments. A national policy change (such as the ACA) has the ability to improve the accessibility to health care coverage and primary care services for vulnerable populations, potentially leading to improvements in diabetes preventive care. National and state-level policies have been shown to reduce individual-specific behaviors and remove barriers for risk reduction and behavior change. In fact, research continues to demonstrate that policy change is one of the most impactful ways to improve the health of large segments of the population (Weintraub et al. 2011). The ACA's coverage expansion reduced the burden of being uninsured by increasing options for affordable health care for low-income adults, many of who were racial/ethnic minorities.

Measuring the Quality of Diabetes Prevention and Management

Measuring Health Care Quality in Populations. The IOM (2013) reports lower levels of population health are a result of varying degrees of access to health care, unhealthy health behaviors, adverse economic and social conditions, environmental factors, social values and public policies that lead to these conditions. The health disadvantages are more pronounced among racial and ethnic minority groups and socioeconomically disadvantaged groups living within the U.S. (Institute of Medicine, 2013). To improve population health, interventions directed toward preventing disease and promoting, restoring and maintaining wellness are necessary to promote the highest quality of life for groups of people (Fawcett & Ellenbecker, 2015). Although clinical guidelines are key to improving health care, care must also be individualized to the patient in order to promote optimal outcomes. As a result, efforts to improve population health require a combination of system-level and patient-level approaches and methods to track quality from a patient and system perspective (American Diabetes Association, 2017).

Health-related quality of life (HRQoL) goes beyond the direct measures of population health and focuses on the impact of health status on quality of life, from an individual's perspective. There are several measures for HRQoL, but *Health People 2010* focuses on three distinct measures: Patient-Reported Outcomes Measurement Information System (PROMIS) Measure of Global Health, Well-Being Measures and Participation Measures. NIH PROMIS Measures focus on self-rated health, physical HRQoL, mental HRQoL and individual questions on fatigue, pain, emotional distress, social activities and roles. Well-Being indicators focus on measuring when people feel very healthy and satisfied or content with life. Positive evaluations of life have been associated with a decreased risk of disease, illness and injury. Participation measures focuses on an individuals' assessment of the impact their health has on their social participation (i.e. education, employment, civic, social and leisure activities) within their environment. These measures are important to understanding how a person with functional limitations views their quality of life, without assuming poor functional status is an indicator of poor quality of life (Office of Disease Prevention and Promotion, 2017).

Measuring Health Care Quality in Systems. Provider and institutional behavior became an issue of concern when hospitals gained nation-wide attention for poor performance in 1999, with the publication of the Institute of Medicine (IOM) Report, *To Err is Human.* This report highlighted the alarming statistic that between 44,000 to 98,000 patients die in hospitals yearly due to preventable medical errors. This report was instrumental in increasing awareness around poor quality and the direct impact poor quality had on the lives of patients and families. This report also increased the awareness of the societal burden poor healthcare quality produced on costs by means of lost productivity of workers and lower levels of population health status (IOM, 1999). The American Diabetes Association has recognized that even when adjusting for barriers to care for certain segments of the population, young adults, patients with complex comorbidities, those who experience financial hardships and/or individuals with limited English proficiency continue to experience variability in the quality of diabetes care provided across providers and practice settings. This is an indication that substantial system level improvements are still needed within the health care system (American Diabetes Association, 2017).

Health care quality itself, is difficult to measure, especially within the U.S. health care system where care is highly fragmented, with limited public health and primary care resources and a large uninsured population (Institute of Medicine, 2013). The IOM has defined quality as “the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge” (Aron, 2014). Historically, quality was measured at the individual level (i.e. per procedure or per patient) and has now moved to evaluating system performance (Getzen, 2010). In order to evaluate system performance, metrics (or quality indicators) and clinical guidelines have been developed to track and reduce inappropriate variations in practice and to promote high quality care that is based on evidence (Thomas, 1999). Since the 1990’s, there have been landmark studies on diabetes that have changed the evidence over time and the results have informed the development of clinical practice guidelines by a variety of organizations with recommendations differing dependent on the interpretations of the inferences drawn from individual studies. Most quality measurement in diabetes care is focused within the ambulatory setting and includes measures of process and intermediate outcomes. Quality measurement includes having access to pertinent health information and data, which is easier to capture with the use of integrated health system technology (Aron, 2014). Health care organizations are motivated to focus on the health of populations and practicing continuous quality improvement efforts due to marketplace incentives to provide more efficient care, due to the mission of health professions to provide more effective care, and by the demands placed on providers by payers to demonstrate quality of care (Derose & Petitti, 2003).

Primary Care Measures for Diabetes Care within PCMH and ACOs. The ACA was also instrumental in improving the effectiveness of care coordination within primary care services through the creation of two new health system delivery models focusing on primary care- the patient-centered medical home (PCMH) and Accountable Care Organization (ACOs). Generally speaking, PCMHs focus on providing the direct coordination of services, whereas ACOs provide the infrastructure and incentives for collaboration to occur across providers and organizations. The two main goals of care coordination are to transfer information (to and from the patient, as well as across providers and systems) and to establish accountability for a patient's overall care (Agency for Healthcare Research and Quality, 2010). The creation of PCMHs and ACOs were essential to improving diabetes care as the Centers for Disease Control and Prevention (2010) has reported that among adults with prediabetes, only 11.6% were made aware by the physician of their health status. A greater exchange of health information and accountability was necessary to reduce disparities in care and improve health outcomes within the primary care setting.

As the demand for accurate and useful information has increased, the Centers for Medicare & Medicaid Services (CMS), Medicare and Medicaid managed care plans, purchasers, physicians and other care provider organizations have developed the Core Quality Measures Collaborative. This Collaborative developed a set of core measures to reduce variability in the selection of measures, collection of data, and cost across both commercial and government payers. Quality improvement in eight areas was the focus of CMS to provide more effective and efficient care. The eight areas include: (1) ACOs, PCMHs and Primary Care, (2) Cardiology, (3) Gastroenterology, (4) HIV and Hepatitis C, (5) Medical Oncology, (6) Obstetrics and Gynecology, (7) Orthopedics and (8) Pediatrics (Centers for Medicare & Medicaid Services, 2017).

Within the first core measure (ACOs, PCMHs and Primary Care), there are eight focus areas which include: Cardiovascular Care, Diabetes, Care Coordination/Patient Safety, Prevention and Wellness, Utilization & Cost/Overuse, Patient Experience, Behavioral Health, and Pulmonary. Within the Diabetes core measure, there are five measures which include

HbA1C control, HbA1C testing, eye exam, foot exam, and medical attention for nephropathy. Table 1 explains each measure in greater detail. The Diabetes core measure does not focus on pre-diabetes. The Core Quality Measures Collaborative was well aware of this and identified preventive diabetes measures (i.e. prediabetes) as an area for future metric development. The closest the core measure set comes to measuring pre-diabetes is under the prevention and wellness measure for Body Mass Index (BMI) Screening and Follow-up. This measure tracks the percentage of patients aged 18 and older with BMI documented in their chart during the visit or in the past 6 months. If the BMI is outside of normal range (i.e. Normal Parameters: Age 65 years and older BMI >/ = 23 and < 30; Age 18 – 64 years BMI >/ = 18.5 and < 25) a follow-up plan is documented during the encounter or in the past 6 months (Centers for Medicare & Medicaid Services, 2017).

Practice Guidelines for Diabetes Prevention and Management. Diabetes prevention is important to control the rising prevalence of diabetes, as it has been estimated that 79 million adults have pre-diabetes (Thorpe, 2012). As diabetes and obesity continue to effect individuals at younger ages, primordial and primary prevention across the lifespan are necessary (Weintraub, Daniels, Burke, Franklin, Goff, Hayman, Lloyd-Jones, Pandey, Sanchez, Parsons Schram & Whitsel, 2011). Preventive care includes: primordial, primary, secondary and tertiary prevention methods. Primordial prevention focuses on the prevention of the development of risk factors (Weintraub, et al., 2011). Primary prevention includes methods to prevent occurrence of disease; secondary prevention includes methods that identify and treat disease early; while tertiary prevention methods reduce the impact of a diagnosed disease and prevent complications (Centers for Disease Control and Prevention, n.d.). Previous research has shown that disparities exist by race/ethnicity and socioeconomic status in the use of preventative services, where minority populations are less likely than whites to receive routine preventive care (Holden, Chen & Dagher, 2015). As a result, it is important to focus on disease prevention and ensuring that disparities do not exist at the point of care in order to decrease the prevalence of diabetes.

The American Diabetes Association's (ADA's) *Standards of Medical Care in Diabetes (2018)* are new clinical guidelines with evidenced-based recommendations from an expert panel, with a focus on the primary care setting. Criteria for testing for diabetes or prediabetes in asymptomatic adults includes testing for overweight or obese (BMI >= 25kg/m^2 or 23kg/m^2 in Asian Americans) adults who have one or more of the following risk factors: A1C>=5.7%, impaired glucose tolerance, or impaired fasting glucose on previous testing, first degree relative with diabetes, high-risk race/ethnicity (including Hispanics), women diagnosed with gestational diabetes or polycystic ovary disease, history of cardiovascular disease, hypertension (>= 140/90 mmHg or on therapy for HTN), HDL cholesterol level <35mg/dl and/or triglyceride level >250mg/dL, physical inactivity and other clinical conditions associated with insulin resistance including severe obesity or acanthosis nigricans.

For all patients, testing is recommended at the age of 45. If results are normal, testing should be repeated at least every 3 years, but yearly in those with prediabetes or at high risk for diabetes (American Diabetes Association, 2018). Diabetes prevention interventions such as screening and counseling are accessible to individuals who meet the testing criteria. The ACA mandated essential health benefits to be included in all health plans which included access to free diabetes preventive care in most states (American Association of Diabetes Educators, n.d.). The preventive care benefits important for diabetes prevention include: blood pressure screening, cholesterol screening for high risk adults, diabetes (Type 2) screening for adults with high blood pressure, diet counseling for at risk adults, depression screening, obesity screening and counseling (Healthcare.gov, n.d.).

Hogan et al. (2015) estimated that 1.5 million more people would be diagnosed with one or more chronic condition (diabetes, hypercholesterolemia or hypertension) if the rate of uninsured were reduced by half by the ACA. Criteria for the diagnosis of diabetes is a fasting glucose >= 126mg/dL or a 2 hour plasma glucose >= 200mg/dL during OGTT or A1C >= 6.5% or in a symptomatic patient experiencing hyperglycemia or hyperglycemic crisis, a random plasma glucose >= 200 mg/dL. For any patient at risk of diabetes or with a confirmed diagnosis of diabetes, lifestyle management and psychosocial care are the cornerstones of diabetes management (American Diabetes Association, 2018). In addition, patients should be referred for diabetes self-management education (DSME), diabetes self-management support (DSMS), medical nutrition therapy (MNT) and psychosocial health if needed (American Diabetes Association, 2018).

Diabetes prevention is an important component of diabetes care as the benefits of diabetes-related knowledge gives patients a sense of empowerment and improved quality of life (Bruce, Davis, Cull & Davis, 2003). In addition, identifying patients at risk of diabetes allows for the use of effective interventions. Previous studies have shown that health education provided to Hispanic patients with Type 2 diabetes significantly improved blood glucose control and health outcomes (Chukwueke & Cordero-MacIntyre, 2010). Therefore, the benefits of diabetes knowledge extend beyond general improvements in knowledge and are a significant predictor of HbA1c levels (Bruce et al., 2003). Patients with diabetes should also be appropriately screened for complications and comorbidities. Optimal diabetes management includes control of blood glucose levels, blood pressure and cholesterol control in order to prevent comorbidities. In addition, frequent screening in patients with a diagnosis of diabetes is important to detect early complications of the eye and foot (Mitri & Gabbay, 2016). Shi et al. (2016) projected that the eye examination rate among U.S. adults with diabetes would improve with coverage expansion. Overall, coverage expansion through the ACA was anticipated to improve access to and utilization of services and reduce diabetes-related complications (Brown & McBride, 2015).

Research Value Added

The ACA was instrumental in providing access to health insurance for low-income adults who were previously uninsured. In addition, we recognize the need to focus on diabetes prevention, especially among high risk groups, and ensuring that racial/ethnic minorities are receiving appropriate preventive care interventions in order to reduce health disparities. This research attempts to analyze the broader effects of the ACA on the health care system, including how the ACA's coverage expansion impacted access to primary care services and the subsequent delivery of diabetes preventive care for three groups: (1) the general population; (2) racial/ethnic minorities; and (3) those at high risk of developing diabetes. Griffith et al. (2017) closely aligned with the baseline goals of this proposal, whereas we are interested in studying disparities by race and by diabetes risk status.

Griffith et al. (2017) focused on socioeconomic disparities among individuals living in Medicaid expansion and non-expansion states. The 2011-2015 BRFSS dataset was used. The authors used BRFSS to assess changes in health insurance coverage and access associated with the ACAs coverage expansion for people in different socioeconomic strata, comparing changes between Medicaid expansion and non-expansion states. The three measures of health care access included: insurance coverage, primary care provider, and avoided care due to cost. Analysis was stratified by respondents' socioeconomic characteristics which were identified as: self-reported house-hold income, educational attainment, employment status, and home ownership status. In order to identify income-related access gaps, people were placed into two groups, those with higher household incomes (>$75,000) and those with low incomes (<$25,000). To be considered a Medicaid expansion state, expansion needed to be implemented by mid-2015. Twenty-one out of forty-three states were categorized as expansion states. Final analysis contained a total of 1,089,940 respondents from 43 states (Griffith et al., 2017).

In order to show disparities in access, an adjusted pre/post difference-in-difference model was used, stratifying by whether each state had expanded Medicaid. The year 2013 was used for pre and 2015 was used for post. The first regression model was used to assess time-based changes in health care access with ACA rollout. The models controlled for state level time trends from 2011-2015 and covariates: race, sex, age, pregnancy status, veteran status, education, home ownership, household size, household income, presence of children and state. In order to identify changes associated with Medicaid expansion, difference-in difference model was used. All regression models estimated as linear probability models with BRFSS sampling weights and standard errors clustered at the state level to account for intrastate correlation. Lastly, gaps in health care access (defined as absolute and relative changes over time in percentage-point differences in access between people in high vs. low SES strata) between 2013 and 2015 were assessed. Absolute changes were assessed in regression models by interacting the socioeconomic strata with the post-reform indicator (Griffith et al., 2017).

The study found that in 2013, 90% of households with high incomes (>$75,000) were insured compared to 60% of households with incomes <$25,000 being insured. Medicaid expansion states had smaller proportions of blacks and higher average household incomes. In Medicaid expansion states, large increases in coverage for the poor, with little change in higher incomes (which was expected). After adjusting for state-trends and covariates, in Medicaid expansion states, the poor gained 15.0 percentage points in insurance and 7.7 percentage points in having a primary care provider. The percentage of poor respondents avoiding care due to cost fell by 7.5 percentage points. Residents of non-expansion states also had increased access, but smaller gains than those in expansion states. Benefits of expansion were large among poor households (6.3 % points), the unemployed (11.00% points) and those who were not college graduates (3.2% points) and renters (2.8 % points). Medicaid expansion was associated with near-zero changes in coverage among non-poor respondents, college graduates, and the employed (Griffith et al., 2017).

The Griffith et al. (2017) relates to the current study as it focuses on the ACA's effect on insurance coverage by income, with a focus on socioeconomic disparities. This research study; however, is focused on racial/ethnic disparities, overall health disparities in diabetes care (between those at high risk vs. no/low risk patients) as well as socioeconomic disparities (to provide a baseline comparison). The target population in this proposal is narrower as the focus is on those at high risk of developing diabetes; as well as ethnic minorities. Griffith et al. (2017) also divided the population into two income groups (<$25,000 and >$75,000), whereas this study also includes a focus on individuals who benefited from the insurance subsidies (those within the 100-400% FPL). Additionally, Griffith et al. (2017) took race into account, but left out those who identified as Hispanic ethnicity- which is interesting as Hispanics made major coverage gains and are a growing subset of the population. There was no focus on a health condition and even authors suggested future research should focus on improving health outcomes and reducing health disparities (Griffith et al., (2017). This recommendation led to a review of the current state of the science on the overall impact of the ACA’s coverage expansion in diabetes care for racial/ethnic minorities.

CHAPTER 2

CURRENT STATE OF THE SCIENCE

Conceptual Model of Nursing and Health Policy and IHI Triple Aim

The Conceptual Model of Nursing and Health Policy (CMNHP) (Russell & Fawcett, 2005) is a nursing discipline-specific model used to guide inquiry for nursing's involvement in health policy (Figure C-1). The CMNHP was chosen as it guides inquiry through policy analysis, policy/program evaluation, and health service research. The CMNHP includes guidelines for analysis and evaluation of health policies (Fawcett & Russell, 2001). The model includes three sources of policies, three policy components and four increasing broad levels of nursing and policy focus and outcomes. The policy sources are public, organizational, and professional. For this study, the policy source is public, represented by the 2010 Patient Protection and Affordable Care Act (ACA) or HR 3590. The ACA coverage expansion provisions included the optional Medicaid expansion and the creation of health care subsidies through the federal insurance exchange (Marketplace) which was described in greater detail in chapter 1.

The policy components within the CMNHP include: healthcare services, healthcare personnel, and healthcare expenditures. The increase in health insurance coverage increased the ability of uninsured Americans to gain access to the health care system, making the policy component within this framework focused on health care services. The health care service of interest is access to high-quality diabetes prevention for adults at high risk within the primary care setting. This is measured by the 2012-2015 Behavioral Risk Factor Surveillance System (BRFSS) and the 2012-2015 National Ambulatory Medical Care Survey (NAMCS).

The four levels of the CMNHP are level 1- efficacy of nursing processes, level-2 effectiveness of nursing processes, effectiveness and efficiency of healthcare delivery subsystems, level 3- equity of access to effective and efficient nursing processes and nursing delivery systems, (including equity in the distribution of costs and burdens of care delivery) and level 4- justice and social changes that address equity. Level III is the most relevant focus for this study as this level focuses on health system administrative practices. As the focus is on health system changes related to the 2010 Affordable Care Act, the Institute for Healthcare Improvement's (IHI) Triple Aim framework is embedded within the Level III (Institute for Healthcare Improvement, 2017). In this level, focus is placed on the equity of access to effective and efficient processes and health care delivery systems (Russell & Fawcett, 2005).

The theory behind the Triple Aim is that in order to improve the health care system, three dimensions must be considered: the per capita cost for the population, the health of a defined population and the experience of the individual. In order to meet these goals, focus is placed on individuals and families, redesigning primary care services and structures, focusing on prevention and health promotion, cost control and system integration in order to reduce inequitable variations in outcomes or undesirable variations in clinical practice. Each focus area has designated outcomes of interest that determine whether the system and health of a population has improved. The outcome of interest for per capita cost within the IHI framework is the total cost per member of the population per month and hospital and ED utilization rates. The four outcomes of interest for population health are: Health/functional status, risk status, disease burden and mortality. Lastly, the outcome of interest for patient experience is quality of care to determine if care is safe, effective, timely, efficient, equitable and patient-centered (Institute for Healthcare Improvement, 2009). As the IHI Triple Aim framework suggests, in order to study the health of a population, a greater understanding of an individual experiences' is important to optimize the performance of the health system. As a result, the Quality Health Outcomes Model was also used as a framework to gain a deeper understanding of how socioeconomic and demographic characteristics (or health disparities) fit within health service research.

Quality Health Outcomes Model

In 1998, the Expert Panel on Quality Health Care of the American Academy of Nursing published the Quality Health Outcomes Model. The Quality Health Outcomes Model is an important conceptual guide for nursing and health service research as it provides a framework for multi-level analysis among four constructs: (1) system characteristics, (2) interventions, (3) client characteristics and (4) outcomes. These constructs were built on Donabedian's (i.e. structure-process-outcome) model and Holzemer's (i.e. multi-level analysis of client, provider and setting) framework (Mitchell & Lang, 2004). The Quality Health Outcomes Model allows for the study of a policy intervention (ACA), to gain a better understanding of its effect on individuals, the health care system and outcomes of interest. Coverage expansion through the ACA was anticipated to decrease the number of uninsured Americans leading to a greater influx of patients utilizing the health care system.

In the original version, the intervention in this model is a clinical process or activity that is delivered to a client or within a system (Mitchell, Ferketich, & Jennings, 1998). Since the focus of this proposal is on a federal health policy, the word *intervention* was changed to *policy intervention* to clarify that the intervention of interest (i.e. Medicaid expansion and the Insurance Marketplace) stems from an external governing body, instead of from within the health care system. As a result, the double arrows (in the original version) were changed to single-headed arrows to reinforce that the policy intervention was developed and implemented from catalysts (or individuals) outside the health care system and the policy intervention will not change because of the system or population. This is even truer with Medicaid expansion. Medicaid expansion is a policy intervention in which policymakers have the power and choice to expand health care coverage within their states. The decision by Justice Roberts to allow states to opt-out of Medicaid expansion (Kaiser Family Foundation, 2012) highlights how policy can be implemented and reinforced irrespective of the needs of the health care system or population at risk.

The policy intervention(s), if implemented, impact health care systems and individuals. The policy intervention impacts a population by providing a means (i.e. health care coverage) to access the health care system. Primary care clinics are the health system of focus as diabetes preventive care occurs in this setting. Radwin (2002) suggested a refined quality health outcomes model where the *client*, which referred to an individual, family or community, was bifurcated into *client state characteristics* and *client trait characteristics.* Client state characteristics refer to characteristics that can change over time. In Figure D-1, this refers to clients with pre-diabetes or individuals at high risk for pre-diabetes/diabetes. Diabetes is the health condition of interest as it is the precursor for other chronic conditions when left untreated or poorly managed and is currently on the rise. Being at risk for diabetes is a transient condition as behavior modification and preventive measures can prevent an individual from developing diabetes and therefore, reduce their risk. Client trait characteristics refer to stable characteristics that cannot be changed- such as age, race and gender. As a result, client trait characteristics can only be related to other factors unilaterally (Radwin, 2002). With this refined model, health disparities and the variability in access to high quality diabetes care post ACA can be explored.

The overall population health and health systems outcome of interest is to decrease the incidence of diabetes in the U.S. among adults aged 18 to 64 at high risk. In order to meet this goal from a health system perspective, the focus is on the delivery of diabetes preventative services and ensuring variations in care due to race do not exist. Minimizing health disparities within the health care system is important to meeting the outcome goals of the IHI's Triple Aim. From a population health perspective, the outcome of interest is to ensure the population has a means to access the health care system. Both access and utilization of primary care services will lead to an increase in the quality of diabetes preventive care delivered to patients at high risk, ultimately leading to a reduction in the incidence of diabetes (dotted arrows) in this population. A post-positivist lens was used to guide the review of literature as it is expected that multiple methodological studies are needed to gain a better understanding of how the passage of the ACA brought forth the opportunity to close the coverage cap for many uninsured Americans across the U.S., reducing barriers to high quality diabetes care for all (Welford, Murphy & Casey, 2011).

Review of the Literature

Search Strategy

CINAHL, PubMed and Google Scholar were used to conduct a general review of literature on diabetes care post-ACA implementation. The search was limited to full-text, peer-reviewed journal articles published between the years of October 2013- March 2018. This timeframe was chosen as coverage expansion was implemented in 2013 and the focus of this study is on diabetes-related outcomes post ACA implementation. The key words for CINAHL were "diabetes" and "affordable care act" which yielded 79 results. The key words used for PubMed included: "diabetes" and "Affordable Care Act" which yielded 93 results. Since there were limited articles including the Insurance Marketplace, Google Scholar was used for a broader search. The key phrases included: "state insurance exchange" and "diabetes" which resulted in 6,560 results. The first 30 webpages from the Google Scholar search were reviewed as redundancy was noted soon after abstract retrieval (n=300). From all databases, 33 articles were downloaded and reviewed.

Two additional articles were retrieved from a reference list. Ultimately, seven research articles were included in this review. The PRISMA flow diagram (Figure E-1) is available in Appendix E.

Inclusion criteria for the articles reviewed included: (1) Medicaid expansion or the insurance marketplace as the policy intervention, (2) a variable for race/ethnicity, (3) a variable for diabetes and (3) analysis of data post 2013. Non-empirical articles were not included in this review in order to focus on the current state of diabetes care and outcomes post-ACA implementation. The IHI Triple Aim framework was used as a guide to assess the current state of science.

IHI Triple Aim Framework: Per Capita Cost

Access to and Utilization of Health Care Services

National Coverage Expansion. In the literature reviewed, access to and utilization of health care improved nationally for uninsured adults, but disparities continued to exist among racial and ethnic minorities. Using data from the 2012-2015 Gallup-Healthways Well-Being Index (WBI), Sommers et al (2015) conducted a secondary data analysis designed to examine trends in self-reported coverage and access to care among adults aged 18 to 64 (n=507,055). The WBI is a daily telephone survey of US adults in all 50 states and Washington, DC with a response rate of 5-10%. Using an interrupted time-series design, the study found that individuals who gained access to care post-ACA implementation were less likely to report the following: being uninsured (-7.9 percentage points [95% CI, -9.1 to -6.7]), not having a personal physician (-3.5 percentage points [95% CI, -4.8 to -2.2]), difficulty obtaining necessary medications (-2.4 percentage points [95% CI, -3.3 to -1.5]) and inability to afford medications (-5.5 percentage points [95% CI, -6.7 to -4.2]) when compared to pre-ACA values (Sommers et al., 2015). Sommers et al (2015) also found that the reduction in the rate of the uninsured was greater among the Hispanic population (-11.9%, [95% CI, -15.3% to -8.5%]) than among Non-Hispanic whites (-6.1%, [95% CI, -7.3% to -4.8%]).

Despite the increase in coverage enrollment noted in the Sommers et al. (2015) study among Hispanic adults, Alcala et al (2017) found that disparities in access and utilization of healthcare existed within the Hispanic population. In fact, in a sample of adults aged 18 to 64 from the 2011-2015 National Health Interview Survey (NHIS) (n=86,467), the authors found that Mexicans (OR 0.68) and Central Americans (OR 0.66) had lower odds of being insured compared to whites post-ACA implementation. Additionally, Mexicans (OR 0.83) and Puerto Ricans (0.86) saw a reduction in the odds of delaying necessary care, whereas Cubans (OR 1.33) and Central Americans (OR 1.28) saw poorer patterns in forgoing care. The odds of having a physician visit increased significantly among whites post-ACA, with few significant differences between Non-Hispanic whites and most Hispanic subgroups. Puerto Ricans had higher odds (OR 1.42) of using emergency services compared to whites, while Mexicans had lower odds (OR 0.83) of using emergency services as well as scheduling regular physician visits (OR 0.87) when compared to whites. As a result, this study highlighted the differences in access and utilization patterns within Hispanic subgroups. The differences were further complicated by language as participants who answered the NHIS survey in Spanish had lower odds of being insured (OR 0.79), forgoing care (OR 0.86), using an emergency room (OR 0.62) and having a physician visit (OR 0.80) when compared to those who completed the survey in English (Alcala et al, 2017).

State-based Medicaid Expansion. Just as national coverage expansion decreased the rate of the uninsured, studies focusing solely on Medicaid expansion have also shown a decrease in the rate of the uninsured. Sommers et al. (2015), Sommers, et al. (2016) and Wherry & Miller (2016) conducted quasi-experimental difference-in-difference studies to explore whether state based Medicaid expansions were associated with changes in access to and utilization of health care. Sommers et al. (2015) used the 2012-2015 Well-Being Index (WBI) database (n=86,188) to study adults aged 20 to 64, Sommers et al. (2016) administered a random-digit telephone survey to adults aged 19 to 64 (n=8,676), whereas Wherry & Miller (2016) used the 2010-2014 National Health Interview Survey (NHIS) (n=40,427) dataset to study adults aged 19 to 64. The three studies utilized a difference in difference study design to examine outcomes related to access and utilization of health care services.

In comparing expansion states to non-expansion states, two studies showed that the uninsured rate declined for both groups with a significantly greater reduction seen among low-income adults in Medicaid expansion states (Sommers et al. 2015; Wherry & Miller, 2016). Sommers et al. (2015) found that significant changes in coverage and access were more apparent in 2015 than 2014, with the net change in being uninsured between Medicaid expansion versus non-expansion states after the ACA declining by 5.2 percentage points (95% CI, -7.9 to -2.6). In addition, lacking a personal health care provider (-1.8 percentage points [95% CI, (-3.4 to -0.3)] and limited access to medications (-2.2 percentage points [95% CI, (-3.8 to -0.7) declined significantly in expansion states compared to non-expansion states (Sommers et al., 2015).

Sommers et al., (2016) found that Medicaid expansion was associated with a decrease in the uninsured rate (-22.7 percentage-point, (95% CI, [-29.1 to -16.3])) when compared with the mean uninsured rate in expansion states in 2013 (mean = 41.0). Medicaid expansion, when compared to private insurance was also associated with increased access to primary care. Increased coverage options led to an increase in having a personal physician (12.1 percentage points (95% CI, [5.4 to 18.9])) an increase in the report of a usual source of care (10.8 percentage points (95% CI, [3.5 to 18.1])) and a decrease in utilizing the ED as a usual source of care (-6.1 percentage points, (95% CI, [-10.1 to 2.2]) (Sommers et al., 2016).

Health System Utilization. In terms of self-reported health system utilization, survey data showed that hospital inpatient stays and general physician visits increased in the first year post ACA in expansion states, with no statistical significance seen by year 2 (Wherry & Miller, 2016). Sommers et al. (2016) also did not find any statistical significance in the net change between Medicaid expansion and private insurance in the utilization of office visits, ED visits or hospitalization in the past year. Statistical significance may be difficult to achieve with utilization data that is taken from self-reported information due to a reliance on patient recall. There were two articles that did utilize health system utilization records to assess the use of care.

Literature using administrative data showed that coverage expansion resulted in increased utilization of health care services as individuals gained access to the health care system. However, questions remained as to where newly insured individuals would receive care. Sharma et al. (2017) studied changes in emergency room usage by uninsured Illinois residents who obtained coverage via Medicaid expansion or through the health insurance exchange. Data was obtained from the 2011-2015 Illinois Hospital Association Comparative Health Care and Hospital Data Reporting Services. The study found that total ER visits increased by 5.6% ($p < 0.001$) in Illinois post-ACA with no change in hospital admissions. However, the percentage of emergency department visits decreased from 22.9% to 12.5% ($p < 0.001$) for uninsured patients. Interestingly, the average number of monthly emergency department visits increased sharply for Medicaid patients (41.9%, $p < 0.001$) compared to privately insured patients (10%). Among the insured, acute Ambulatory Care Sensitive Hospitalizations (ACSH) decreased from 4.9% to 4.5% ($p < 0.001$) while chronic ACSH increased from 10.5 to 11% ($p < 0.001$). Among the uninsured, the proportion of ACSH visits post-ACA decreased from 15.9% to 15% ($p<0.001$) with the decline being mostly for chronic conditions (Sharma et al., 2017).

As care was expected to shift from acute care facilities, such as the ER and into the outpatient setting, Cole et al. (2017) analyzed the impact Medicaid expansion would have on federally funded community health centers. The study used data from 2011 to 2014 from the Uniform Data System, a database that feeds information to the Department of Health Resources and Services Administration (HRSA). The sample included 1,057 U.S. based community health centers and data was analyzed using a difference-in-differences analysis to compare outcomes among centers. The results showed that community health clinics within Medicaid expansion states saw a decrease in the uninsured rate and an increase in the number of individuals covered by Medicaid. The study found no significant difference among the number of unique patients served between centers in expansion and non-expansion states although there was growth over the study period. Unique patients were defined as the number of patients served who are different as to reflect the reach and capacity of the safety-net system and represents the number of otherwise underserved patients who have obtained care (Cole, et al., 2017).

Health Care Costs. Sommers et al. (2015) found that inability to afford care declined from 35.5 percentage points to 33.1 percentage points in Medicaid expansion states, but it was not found to be statistically significant. Medicaid expansion was associated with a decrease in the report of the following outcome related to costs: delaying care due to cost (-18.2 percentage points (95% CI, [-25.4 to -11.1]), skipping medication due to cost (-11.6 percentage points, (95% CI, [-25.4 to -11.1]), and trouble paying medical bills (3.9 percentage points, (95% CI, [-4.0 to 11.9])) (Sommers et al., 2016).

Population Health: Disease Burden

Prevention and Detection of Undiagnosed Diabetes. Once the uninsured gained access to coverage, screening and the detection and diagnosis of diabetes also improved. Sommers et al. (2016) found that Medicaid expansion was associated with increased preventive care (i.e. check up in the past year, 16.1 percentage points [95% CI, (9.1 to 23), p<0.001] with higher diabetic glucose testing rates in a Medicaid expansion states compared to states that only had the private option available. In fact, in patients without diabetes, no statistical significance was found in obtaining a blood glucose check in the past year between Medicaid expansions and those states with only the private insurance option available. However, Medicaid expansion was associated with an increase of 10.7 percentage points (95% CI, [1.2 to 20.2]) in a patient with diabetes reporting a blood glucose check in 2015. Report of regular care for a chronic condition also increased by 12 percentage points (95% CI, [3.1 to 21]) by 2015 in Medicaid expansion states. Chronic conditions were limited to at least 1 of the following conditions: hypertension, coronary artery disease, stroke, asthma/chronic obstructive pulmonary disease (COPD), kidney disease, depression, cancer, substance abuse and diabetes (Sommers et al., 2016). Wherry & Miller (2016) found a significant increase in the diagnosis of diabetes (4.0 percentage points, [95% CI, (1.2 to 6.8)] 1-year post -ACA among Medicaid recipients in expansion states This was attributed to the increase seen in preventive care visits over the ACA period. However, by year 2, the slight increase of 1.8 percentage points in the increase of diabetes diagnosis was found to be statistically insignificant (Wherry & Miller, 2016).

Health/Functional Status. Wherry & Miller (2016) found no significant changes in health status or mental health between low-income adults in Medicaid expansion and non-expansion states. Sommers et al. (2015) also found null results for improvements in health or disability among Medicaid expansion and non-expansion groups; however nationally, the adjusted report of days with activities limited by poor health decreased by 1.7 percentage points (95% CI, -2.4 to -0.9. A limitation to finding significance between expansion and non-expansion states could be the unavailability of additional data post 2015 to measure changes in health and functional status.

Patient Experience

Quality of Care. In the Cole et al. (2017) study, one of the outcomes of interest was to assess the quality of care provided to low-income adults who utilized community health centers in Medicaid expansion and non-expansion states. Quality care was defined as a hemoglobin A1c less than 9% among the low-income adults who utilized the community health centers. No differences were found in the management of diabetes between Medicaid expansion versus non-expansion states, even among racial or ethnic minorities (Cole, et al., 2017). In year 2 post ACA, Wherry & Miller (2016) found a decrease of 2.7 percentage points (95% CI, (-6.0 to 0.5)] in the report of excellent or very good health, but it was found to not be statistically significant. However, Sommers et al. (2016) found that coverage expansion was associated with improved quality ratings of "excellent health" for individuals aged 19 to 64 years with incomes below 138% of the federal poverty level in Kentucky, Arkansas and Texas. Nationally, the adjusted report of fair/poor health decreased by 3.4 percentage points (95% CI, -4.6 to -2.2) (Sommers et al., 2015).

Additional Details. Appendices F and G have a summary of the literature reviewed with additional details.

Gap in the Literature

Through this review of literature, there was evidence that access to care improved as witnessed by dramatic drop in the rate of those who are uninsured, especially among the Hispanic population, with increased primary care access in Medicaid expansion states than in non-expansion states. Using the IHI Triple Aim as a guide, limited research was found on the impact of increased insurance coverage on diabetes preventive care. Only 7 articles were found to include diabetes in their analysis of ACA impacts. Commonly, diabetes was used as a control variable or outcome variable (i.e. newly diagnosed diabetes), rather than a predictor variable or sub-sample of interest. Current research has not focused on access to diabetes preventive care for high risk individuals, the effect of both the insurance subsidy and Medicaid expansion on high risk populations and the quality of the preventive services provided to high risk populations after ACA implementation. This is a novel area to explore as health care access and the quality of diabetes prevention among vulnerable populations continues to be a priority after ACA implementation. The recent literature primarily focused on identifying individuals with newly diagnosed diabetes and whether those with diabetes are receiving recommended diabetes care; which is important, but from population health perspective misses the opportunity to focus on primordial and primary prevention related research. Just as important to identifying diabetes, is identifying if the ACA led to (1) increased access to health insurance for individuals at high risk of diabetes, (2) increased access to health care services for individuals at high risk of diabetes and (3) the equitable delivery of diabetes prevention for minority adults (i.e. black and Hispanics) at high risk of developing diabetes.

Additionally, limited research focuses on the impact the ACA has on reducing racial/ethnic disparities in diabetes care. Ensuring access to health insurance is the first step to reducing racial/ethnic health disparities, as it ensures individuals have the ability to enter into the health care system to receive care. A limitation to the study of health disparities on this topic is that the time frame under examination is very short where population health changes may require additional years of analysis to detect improvements in diabetes preventive care for those at high risk. In addition, many of the studies relied on self-reported data. If we truly want to measure health care quality, data must reflect the perspective of the patient (survey-based data), as well as from the health care system (administrative data) that delivers the care interventions. Lastly, another limitation to the study of diabetes preventive care in the U.S., is the inability to control for is the "culture" (or context) of the U.S. health care system when using secondary data. It is well-known that the U.S. health care system undervalues preventive care, so an individual gaining access to the U.S. health care system may not be enough to change individual preventive care behaviors (such as knowing to make a preventive care visit with a physician), especially among minority groups of low socioeconomic status as such a short study period (~6 years) is under study. From a nursing perspective, one way to encourage behavior change is to focus on the delivery of prevention education, in addition to screening individuals at high-risk. This is why the study of the delivery of diabetes preventive care is also important to investigate when attempting to reduce the incidence of diabetes in the U.S.

CHAPTER 3

METHODOLOGY

In this chapter the datasets and methods used to conduct a secondary data analysis are presented. The research goal was to quantify the impact of the ACA, first, on the probability of having health care coverage, followed by quantifying the gain in health care access and the delivery of diabetes preventive care for low-income persons in the U.S. This initial analysis was run separately by race, then by diabetes risk status to determine the impact of the ACA's coverage expansion on the two sub-groups. This quantitative analysis was based on two national CDC datasets: The 2012-2017 Behavioral Risk Factor Surveillance System (BRFSS) and the 2012-2015 National Ambulatory Medical Care Survey (NAMCS). The state-based BRFSS dataset was chosen to study the impact of the ACAs coverage expansion on two specific outcomes: the likelihood of having health insurance coverage and the likelihood of having health care access (i.e. specific aims 1 and 2). This dataset was chosen over other national telephone surveys as it is the largest health-specific dataset focusing on health-related risk behaviors, chronic conditions and the use of preventive services (Centers for Disease Control and Prevention, 2018). In order to study the delivery of diabetes preventive care (specific aim 3), the NAMCS dataset was added to this analysis. NAMCS is unique in that it provides data on services ordered and provided, including treatments for patients within the ambulatory care setting (CDC, 2017). The use of both datasets for this analysis was instrumental in understanding the broader picture of how ACA impacts coverage, access and care delivery. Each dataset is described in greater detail in sub-sections 3.1 and 3.2 prior to the methods used to test relevant parts of the regression path model.

Conceptually Linking ACA to Health Care Coverage, Access and Delivery

Full Analytic Path Model

Understanding the relationship between socioeconomic status (SES), race and health is important to addressing health disparities in diabetes care in the U.S. The complete analytic path model is shown in **Figure 1**, which includes all variables used to address specific aims 1-3 using both BRFSS and NAMCS. Plus and minus signs in the figure indicate hypothesized correlations between variables used in the regression analyses described in sub-sections 3.1 and 3.2. To simplify the model, sections of the full path model were broken down by specific aim and described in the text that follows.

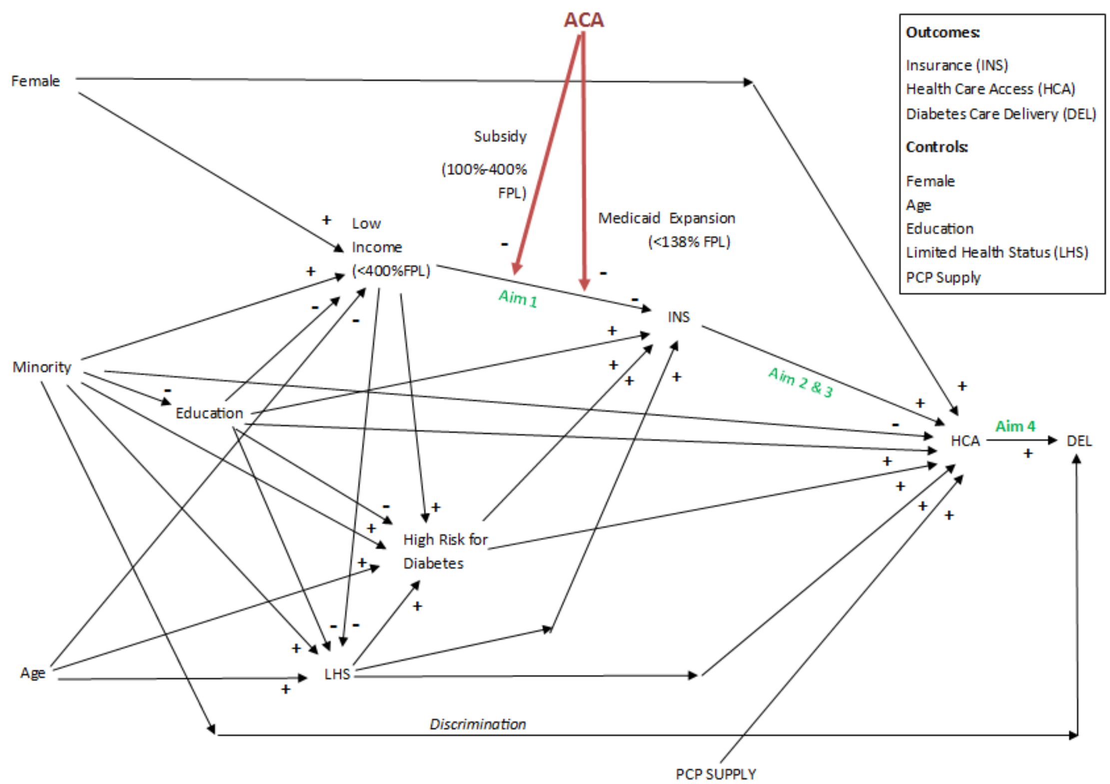

Figure 1. Analytic Path Model of the Impact of ACA on Reducing Disparities in the Coverage, Access and the Delivery of Diabetes Preventive Care to Adults aged 18 to 64 in the U.S.

SES is typically measured by educational level, income and occupation. It is expected that individuals with higher status occupations enjoy higher wages. One way to achieve a higher status occupation is to obtain advanced education. The association of SES with health becomes even more complex when race is added. Research has shown that even when income and educational levels are held constant, differences in health can be seen between blacks and whites (Barr, 2014). In the U.S., a long history of racism and discrimination has resulted in differences in health outcomes among racial and ethnic minorities (Isaacs & Schroeder, 2004). In fact, at any given income level, blacks die at a higher rate than whites and middle-income women. Discrimination is a form of social disadvantage that minorities face and has been found to be comparable with the disadvantage associated with being of low SES. An individual's race (i.e. racial/ethnic minority) coupled with their standing in the social hierarchy (i.e. low class) for prolonged periods of time leads to both low SES and poor health outcomes (Barr, 2014).

To simplify this otherwise complex relationship between race, SES and health, this analysis focused on education and income as an abridged proxy of SES. Race/Ethnicity (or minority status) is the central focus of this analysis, with age, gender, limited health status (described in the next section) and education being added to this model as controls. Additional relationships interacting with age, education, health status and being female exist but are not the central focus of this analysis. These four variables, including PCP supply, were removed from the figure and labeled as controls to narrow in on the path model of interest for each specific aim.

Female was added as a control since it is positively associated with being low-income; whereas age is negatively associated with lower income in the 18-64-year-old population.

Education was added as a control since black and Hispanic minorities in the U.S. tend to obtain lower levels of education when compared to non-Hispanic whites. This leads to a negative association between minority status and education. Higher education levels has two positive paths to higher insurance coverage. First, more education makes it less likely to have an income below 400% FPL primarily because of higher wages. Also, with higher wages comes employer-sponsored health insurance. Second, even holding a person's income constant, higher education should make an individual more aware of the benefits of having health insurance and a primary care provider.

Limited health status (LHS) plays a key role in the demand for health insurance as well as seeking a health care provider. Limited health status is an umbrella term and is represented by the following self-reported items in BRFSS: (1) chronic disease(s) and (2) self-reported health. These variables entered the model as control variables. Having limited health status is assumed to be positively correlated with age and minority status and negatively correlated with education level. Since high-risk for diabetes was one of the main predictor variables, it was studied separately from limited health status.

Specific Aims 1 & 2 BRFSS Path Model

Race/ethnicity is represented by the term *Minority* in this path model. Being of minority status is positively associated with being low-income (<400% FPL) as minorities tend to acquire lower wages when compared to non-Hispanic whites. Income level is an important variable within this model as the income to insurance path is interrupted by Medicaid expansion and the insurance subsidies through the ACA. Low-income is negatively associated with having health insurance as low-income individuals do not have the financial means to afford private insurance coverage and/or have employment that provides insurance benefits, or the educational level to know that having insurance is an asset for their well-being. However, a host of government programs have been implemented in the U.S. to provide coverage options for low-income and vulnerable populations. These government programs include: Medicare, Medicaid, the Indian Health Service and the Department of Veterans Affairs. Despite these programs, a coverage gap still remained through 2013, as witnessed by the 49 million Americans who were uninsured before ACA implementation. Among the uninsured, racial and ethnic minorities and individuals with low-incomes (including Non-Hispanic whites) were overrepresented. As a result, low-income status is important for this research as the ACA's subsidies and Medicaid coverage expansions substantially benefited those living within 100 to 400% of the Federal Poverty Level (FPL). The introduction of the ACA (in red) provided insurance subsidies and federal cost-sharing to states choosing to expand their Medicaid programs. The ACA is assumed to reduce the negative correlation between low income and insurance coverage. This might lead to zero correlation between the two variables post-ACA (**Figure 2**).

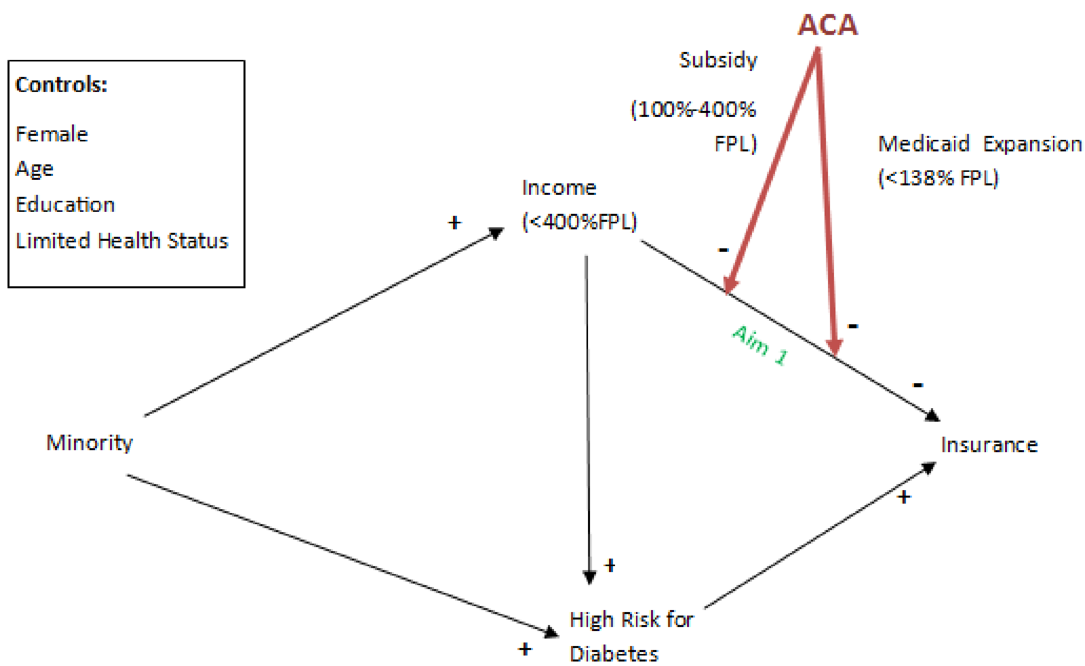

Figure 2. Specific Aim 1 Analytic Path Model of the Impact of the ACA on Reducing Disparities in Insurance Coverage.

Individuals at risk for diabetes tend to be overweight with one or more risk factors identified by the American Diabetes Association, placing them at higher risk of developing diabetes in their lifetime. More education should reduce the risk of diabetes by living healthier lifestyles, including regular exercise, access to nutritious foods and less habitual smoking. Because racial and ethnic minorities tend to have lower levels of education, and less healthier lifestyles, they are hypothesized to have a higher probability of developing pre-diabetes/diabetes. A counter-argument to this hypothesis is that having “pre-diabetes” is often asymptomatic and may not evoke a need for insurance or a health provider. Additionally, individuals who were previously uninsured prior to the ACA may have been unaware of their diabetes risk status due to the cost of accessing a health care provider, discrimination in availability, or a personal under-appreciation of primary care services.

Persons can have serious health conditions besides being pre-diabetic that encourage the purchase of health insurance and seeing a primary care provider. As a result, limited health status will be measured by the presence of chronic disease and self-reported health. Details on the chronic conditions controlled for in this analysis can be found within the BRFSS and NAMCS subsections that follow. Controlling for chronic disease is important because any of these conditions may "force" an individual to obtain health insurance that could lead to the "discovery" of their higher diabetes risk. Black and Hispanic minorities should exhibit greater health limitations, although they may be more likely to underreport or be unaware of their limitations which could produce an insignificant relationship. A limitation in this sense means individuals who report chronic disease.

Self-reported health was also included as an indicator of limited health status. Perceived health status reflects biological, psychological and social dimensions that are inaccessible to an external observer. Perceived health has been shown to correlate with the occurrence of chronic illness and physicians' ratings of health status in cross-sectional studies (Miilunpalo, Vuori, Oja, Pasanen & Urponen, 1997). In BRFSS, respondents rated their health as: (1) excellent, (2) very good, (3) good, (4) fair or (5) poor. To note, Zajacova & Dowd (2011) found measurement error in self-reported health among U.S. adults, specifically for those with less education and racial/ethnic minorities. Individuals with low levels of education and minorities made up greater numbers of the uninsured pre-ACA. Decker et al. (2013) found that uninsured adults with hypertension, hypercholesterolemia or diabetes were less likely to be aware of their health status and less likely to have these conditions controlled when compared to those enrolled in Medicaid.

The ACA's insurance subsidies and Medicaid coverage expansions should expand coverage to low-income minorities who are at higher risk for diabetes and, holding their age and education constant, who have experienced a limited health status more generally. We expected the ACA to show greater coverage to these two groups in "poorer" health, but without a casual link. Like with minorities in general, the ACA through its insurance features should "sweep up" those in poorer health by enhancing access to health insurance and health care. This would be an example of a (partially) intended spiller effect of public policy. Specific Aim 2 addresses this theory and is shown in **Figure 3**.

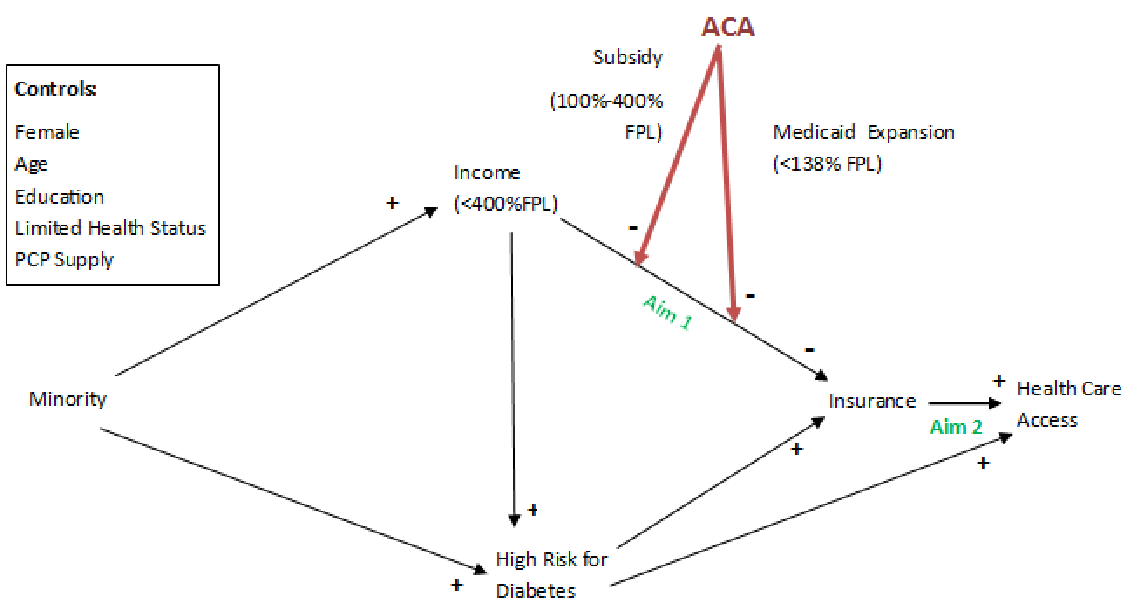

Figure 3. Specific Aim 2 Analytic Path Model of the Impact of ACA on Reducing Disparities in Health Care Access.

An important factor to consider in the Specific Aim 2 model is that BRFSS does not measure the primary care provider supply available within each state. Demographic, income, education, and health status measures were used to explain variation in a person's demand for insurance and access to primary care. But only with an adequate supply of health care providers (per capita in a state) can the primary care setting meet the demand for increased primary care services under expanded health insurance coverage. Health care access (or greater use of primary care services) will be measured two ways- by whether a BRFSS respondent has a primary care provider and/or had a routine checkup with a primary care provider within the last year. The National Center for Health Workforce Analysis, which is part of the U.S. Department of Health and Human Services (HHS) and the U.S. Health Resources and Services Administration (HRSA), provides updated projections of supply and demand for health workers (U.S. Department of Health and Human Services, 2016).

Specific Aims 3 NAMCS Path Model

BRFSS gives an estimate of the individuals who have access to the health care system. By adding NAMCS we go a step further to determine who is receiving diabetes preventive care. BRFSS and NAMCS, although separate analyses, conceptually are able to give a better understanding of how ACA impacts the delivery of diabetes preventive care for low-income adults (**Figure 4**). Diabetes preventive care was measured by receipt of diabetes screening or diabetes prevention education during a preventive care clinic visit. The ACA does not have a direct effect on the delivery of primary care services once a patient is at a clinic visit. In order to conceptually link ACA effects to the delivery of primary care, the BRFSS dataset was useful to understanding how the ACA worked through insurance coverage to health care access, leading to the likelihood that the patient would enter into a clinic to receive appropriate diabetes preventive care.

For the NAMCS analysis, the control variables included gender, age and chronic disease. Limited health status was updated to only reflect chronic disease as this is the only information available in NAMCS. Education level was not available in NAMCS, so was not used. PCP supply was not used in this analysis as individuals already have a visit and the supply of PCPs should have no effect on visit content. It is assumed that everyone in the NAMCS dataset has health care access since they have a clinic visit. It was not assumed that everyone in the NAMCS dataset had health insurance coverage, so an arrow is added from high-risk for diabetes to health care access to represent the uninsured. In the literature review it was apparent that many who were previously uninsured were unaware they had diabetes, a condition where patients exhibit symptoms. Therefore, for those individuals with pre-diabetes or at high risk for diabetes (a condition that tends to be asymptomatic) and without insurance coverage, they would be less likely to access the health care system unless another health problem was present.

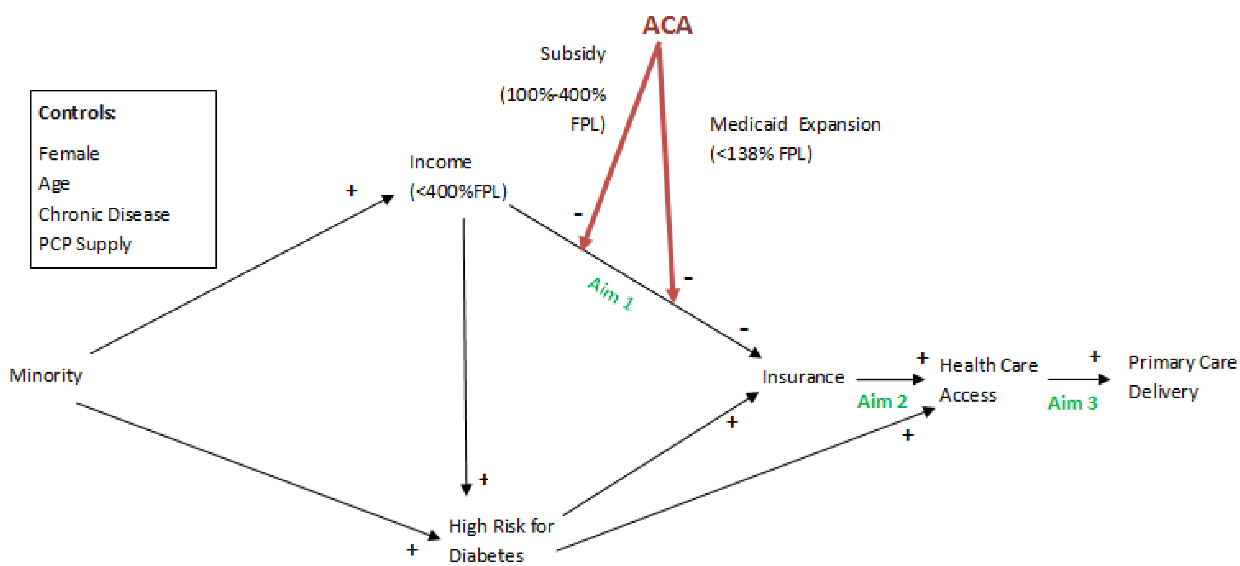

Figure 4. Specific Aim 3 Analytic Path Model of the Impact of ACA on Reducing Disparities in the Delivery of Diabetes Preventive Care.

An important factor to consider in the Specific Aim 3 path model is that NAMCS does not include a question on provider bias or a patient's perception of being treated unfairly, which is important to studying the delivery of health care services. Previous research has linked feelings of discrimination with minorities of higher SES status. If a patient is receiving or *feels* they are receiving different treatment than their white peers, then they will report discrimination which will decrease their trust with providers and/or with the health care system as a whole (Assari, et al., 2017). This may cause minority patients to forgo care leading to an increased probability of developing diabetes. Unfortunately, discrimination cannot be directly measured using the NAMCS dataset. For this analysis, focus was placed on determining if differences in the delivery of diabetes preventive care exist in the first place. Racial and ethnic disparities in diabetes screening or diabetes preventive education was measured by any statistically significant difference by at least 10% among each minority group versus non-Hispanics whites (LaVeist &Isaac, 2013), when controlling for other factors. This calculation will also be used to determine racial/ethnic health disparities in coverage and health care access. The description of these analyses will be presented in later sections.

Experimental Design

A Quasi-Experimental Design (QED) was chosen to estimate the impact of the ACA's subsidy and Medicaid coverage expansion on improving access to health insurance coverage, primary care services and the delivery of diabetes preventive care for low-income adults across the U.S. Research using cross-sectional secondary data is observational since the data was originally collected for purposes other than the current research questions. When studying Medicaid expansion (specifically, the pre/post, study-control design) this study was considered an ACA experiment within an experiment due to the fact that the Supreme Court ruling deemed Medicaid expansion optional for states, creating a natural experiment. Survey respondents naturally had no short-run control over where they lived.

A QED difference-in difference approach was proposed, including an interrupted cross-sectional time-series design with non-repetitive, independent annual samples. Cross-sectional data was merged for years 2012-2017 for BRFSS (for specific aims 1 and 2) and 2012-2015 for NAMCS (for specific aim 3). BRFSS and NAMCS are national federal datasets that do not follow the same individuals over time. The time-series was interrupted when the ACA introduced new coverage options for low-income adults at the end of 2013 (insurance subsidies) and the beginning of 2014 (Medicaid), which created an anticipated change in the trend line for the outcomes of interest by time.

In cross-sectional study designs, data is typically collected for a population at a single point in time in order to study the relationship between two or more variables of interest. This type of design is helpful in assessing the burden of disease or the health needs of a given population. Since all variables are measured at roughly the same time through questionnaires, challenges arise when drawing conclusions about causality because it is difficult to tell which variable came first (Barratt & Kirwan, 2009). In order to overcome this, each database (BRFSS or NAMCS) was merged to itself over time by state to make comparisons before and after the ACA took effect. In addition, theory (using the analytic path models described above) was used to identify causality. For example, a person’s level of education was determined before they buy insurance and find a primary care provider.

A limitation in using BRFSS and NAMCS samples is the inability to measure changes over time at the individual level. Admittedly, conducting a secondary data analysis using each of the two samples has weaker internal validity when compared to a study conducted using a randomized control trial. This happens because characteristics of individual respondents can change from year to year. While incomparability should be relatively small given very large samples sizes, minor individual differences may still remain. Internal validity (the strength of the causal evidence) can be increased by restricting the inclusion criteria (Gurwitz, Sykora, Mamdani, Streiner, Garfinkel, Normand, Anderson & Rochon, 2005). This research was restricted to Non-Hispanic white, black and Hispanic individuals aged 18 to 64 years. In addition, potential confounders such as gender and age were controlled for to increase the validity of the study (Polit & Beck, 2017). Education level and health status to isolate race/ethnicity changes due to the ACA were also controlled for.

The ACA's impact on insurance coverage and primary care access worked through Medicaid expansion and the insurance subsidies of lower income persons. Systematic bias was expected when comparing results for Medicaid expansion and non-expansion states. Every state had an insurance exchange with financial subsidies available. However, only 34 states (including D.C.) expanded Medicaid as of 2018 (Kaiser Family Foundation, 2018). Because expansion and non-expansion states vary systematically by standard of living, reported incomes were converted to a percentage of the federal poverty level (FPL), which is a nationally determined figure varying only by household size. Because respondents in "non-expansion" states such as Tennessee are poorer on average than persons living in California, we expect more of the former to be eligible for larger subsidies. Thus, the ACA may show greater percent changes in income groups between 138% and 400% in non-expansion states. We predicted larger changes for race/ethnic groups in the former states. Because of disproportionate sampling and missing item responses (see next sections for details), all tabular and regression data were weighted to reflect national totals.

Figure 4 provides a summary graphical structure that generated the hypothesized effects of the ACA's coverage expansion on increasing health insurance coverage and access to primary care in general; and the delivery of diabetes preventive care for individuals at high-risk of diabetes, in particular. The full QED model can be referred to in the statistical analysis sections 3.2 and 3.3.

Analysis using BRFSS

BRFSS Dataset Overview

The CDC initiated the BRFSS, a cross-sectional telephone survey conducted monthly by state health departments. This dataset was established in 1984 and collects data in all 50 states, the District of Columbia and three U.S. territories. In total, over 400,000 adult interviews are conducted each year making this dataset the largest continuously conducted health survey system in the world. BRFSS contains prevalence data on risk behaviors and preventive health practices among adult U.S. residents. The BRFSS questionnaire consists of a standard core (yearly survey asked by all states), rotating core (portion of survey asked by all states on every other year basis), optional modules (standardized questions on various topics that each state may select) and state-added questions. (Centers for Disease Control and Prevention, 2013). BRFSS does not include any questions related to immigration status (State Health Access Data Assistance Center, 2009).

BRFSS Sample Design

The BRFSS sample consists of landline and cellular telephone users. The landline sample is drawn using disproportionate stratified sampling (DDS) where telephone numbers are classified into high density (listed) or medium density (not listed) numbers, with high density stratum being sampled at a higher rate, a ratio of 1:1.5 (Centers for Disease Control and Prevention, 2013). The landline sample consists of household sampling where individual respondents are selected randomly from all adults aged 18 years and older living within the household. Cellular telephone respondents are weighted as a single adult household although geographic specificity is less reliable for cellular than landline numbers. In addition, persons in college housing are considered single households. A household is defined as a housing unit with a separate entrance, where residents eat separately and the household is the principal or secondary place of residence. Eligible household members include all adults aged 18 years or older who consider the household their home. Non-eligible households include: unoccupied vacation homes for more than 30 days per year, group homes, institutions and households in an outside state (for the landline sample) (Centers for Disease Control and Prevention, 2013).

As of 2011, the sample design was updated to reflect the growing number of U.S. households relying solely on cellular telephones and the declining response rates. By adding cellular telephone-only households, greater representation of individuals with lower incomes, lower educational levels and younger age groups was expected. The CDC adopted a sophisticated weighting method known as “raking” or iterative proportional fitting. In raking, non-response adjustments for each variable are made individually and weights are re-adjusted as each variable is included until the sample weights are representative of the whole population (Centers for Disease Control and Prevention, 2012).

The raking methodology is composed of two sections: design weight and raking. The design weight is adjusted to take into account the overlapping sample frames (i.e. cellular respondents and landline respondents) (Centers for Disease Control and Prevention, 2016). This weighting method updated the previous method of “poststratification”. Before 2011, post-stratification adjusted survey response data to known proportions of age, race, sex, geographic region or other characteristics of the population taken from U.S. Census data. A limitation to this method was access to information on specific regions or areas. As a result, the CDC transitioned to raking which does not require demographic data for small geographical areas (Centers for Disease Control and Prevention, 2012).

National Sample

The national sample consisted of 2,810,525 observations when years 2012 to 2017 were concatenated. Once Guam, Puerto Rico and the Virgin Islands were dropped, the national U.S. sample consisted of 2,764,052 observations. Income was the variable with the most "missing" observations, with about 15.58% of respondents reporting "don't know/not sure" (7.19%), "refused" (8.07%) or missing data (0.58%). The observations without an income reported were dropped, leading to a national sample of 2,327,106 observations. Missing incomes were dropped instead of imputing since imputation is already being used to identify those with incomes greater than $75,000 (refer to page 70 for additional details). Additionally, income is an important variable in this analysis since ACA effects are directly tied to income levels, so imputing a variable twice could result in greater biases.

The following missing data was dropped from the national sample before reducing the national sample to the analytic sample: age (0.60% missing), sex (0.01% missing), education (0.13% missing), body mass index (BMI) (4.4% missing), and self-reported health (0.26% missing). In instances where missing variables were recoded, the recoding will be described in detail in the sections that follow. The final national sample consisted of 2,207,012 observations. The national sample was used for descriptive statistics and to validate the study data to known national trends.

Analytic Sample

The analytic sample was restricted to: non-Hispanic whites, non-Hispanic blacks and Hispanic adults between the ages of 18-64 living in 28 Medicaid expansion and 19 non-expansion states, leading to a sample size of 1,283,537 observations. The minority sample is restricted to blacks and Hispanics as these are the two largest minority groups in the U.S. and have been known to be disproportionately at higher risk of developing diabetes, when compared to non-Hispanic whites. Adults over 65 years old were excluded as they are eligible for Medicare and thus do not rely solely on Medicaid or insurance subsidies for insurance coverage. All adults, regardless of health status were included in order to identify those at *high risk* of diabetes.

Given that pre-ACA Medicaid expansion %FPL levels were highly variable among states (refer to Appendix U), only Medicaid expansions that did not expand beyond 138% FPL in the pre-ACA period and non-expansion states as of 2017 were included in the analytic sample. Therefore, Medicaid expansion states: Hawaii, Massachusetts, Vermont, and Washington, DC were not included. See Appendix U for Table U-1 of states with their expansion dates, if applicable. Sensitivity analysis was conducted by including all states and D.C, with a sample size of approximately 1.3 million observations.

Outcome Variables

The outcome variables of interest include: (1) having health insurance coverage; and (2) having health care access. These outcomes were derived from questions located within the section titled "Health Care Access" in the BRFSS Questionnaire.

INSURANCE COVERAGE. For access to insurance coverage, BRFSS measures access with the question, *"Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, government plans such as Medicare, or Indian Health Service?"* (Appendix I).

The insurance coverage variable (INS) measures the likelihood of having health insurance and was recoded to: (0) no insurance coverage and (1) yes to any kind of health care coverage. The responses of "don't know/not sure" and "refused" were recoded to (0). This is the only question in BRFSS that asks about health insurance coverage.

A limitation to this question is the inability to differentiate between different types of health care coverage, especially between government programs (i.e. Medicare, Medicaid, Indian Health Service and the VA) and private insurance. Deleting individuals over age 65 removes the Medicare population (over 40 million nationally) who should be relatively unaffected by the ACA. Still, a few individuals in the study sample may be covered by Medicare due to disability-related eligibility. They would also have Medicaid coverage for uncovered or unpaid Medicare bills. Including them in the study sample creates a very minor bias towards null findings with regard to the ACA.

HEALTH CARE ACCESS. Health care access is measured via two BRFSS questions. The first question asks,

"Do you have one person that you think of as your personal doctor or health care provider? If "No", is there more than one, or is there no person who you think of as your personal doctor or health care provider?" (Appendix I).

The second question asks,

"About how long has it been since you last visited a doctor for a routine checkup? A routine checkup is a general physical exam, not an exam for a specific injury, illness or condition." (Appendix I).

The second question overlaps the first question as it demonstrates that a participant visited a care provider, but also received a routine visit. Both questions were used as alternative measures for determining health care access in specific aim 2 post ACA implementation (Figure 7). Health care access was measured two different ways- either by having a health care provider, or having a clinic visit with a health care provider- both of which give valuable insight to how individuals have access to the health care system. Therefore, for the first question, the likelihood of having access to a primary care provider will be labeled PCP where the dichotomous variable was coded to (0) for no provider and (1) yes, has provider. The responses of "don't know/not sure" and "refused" were recoded to (0) since the respondent is not aware of their PCP or did not answer "yes", which demonstrates a weak relationship with the health care system.

A limitation to the PCP variable is that- just because a patient-provider relationship has been established, does not necessarily mean that the patient has accessed the health care system to see their provider for preventive care. Preventive care typically occurs during the routine checkup as the patient is not there for an acute injury or condition, and time is available for preventive purposes.

The second variable was labeled "primary care access" (PCA_1yr) and focuses on the last time a patient visited a physician and received a routine checkup. Appendix I has the BRFSS question with the 7 options available for the participant. The PCA_1yr variable was recoded to (0) routine checkup beyond 1 year and (1) checkup in the last year. The responses of "refused" and “don’t know” were recoded to (0) since the respondent is not aware of their last checkup, which demonstrates a weak relationship with the health care system.

This question has limitations as it specifically states the word “doctor” instead of the word “health care provider” and may prompt respondents to under report routine primary care visits to providers who are not physicians. Another limitation is that this question does not make known if the participant received preventive care related to diabetes prevention. This is why the NAMCS dataset is important to add for this study. However, this second question gives valuable information that NAMCS does not. This question provides critical information on the proportion of individuals living within below 400% FPL who have a primary care provider and have not utilized primary care services.

Predictor Variables.

The predictor variables included: race, income, being at high risk for diabetes, and state Medicaid expansion status (See Appendix H).

RACE. In the initial analyses using the full study sample, we are interested in ACA effects for all groups regardless of race; but in the analyses that follow, we were interested in ACA effects on blacks and Hispanics versus whites in order to determine if racial/ethnic disparities decreased in the outcomes of interest. BRFSS captures race/ethnicity in three questions. All questions are included in Appendix I. The first question focuses on whether a respondent reports being Hispanic or Latino; whereas, the second question allows respondents to check all that apply to a set of five race-based categories and an “other” option. If a respondent choses more than one race, he/she was asked in the third question to select the group that best represents their race. For simplification, the data from the three questions was reduced to two race-based variables labeled: Black and Hispanic. The black and Hispanic variables were generated from the BRFSS variables _racegr2 (2012) and _racegr3 (2013-2017). In these computed variables, BRFSS recategorized race into mutually exclusive groups of whites, blacks and Hispanics (Appendix I). The dichotomous black variable was coded to (0) Non-Hispanic white and (1) Non-Hispanic black. The dichotomous Hispanic variable was coded to: (1) Hispanic and (0) Non-Hispanic white. For descriptive purposes a third variable was created which included all three racial/ethnic groups: (0) whites, (1) blacks and (2) Hispanics.

INCOME. The four income categories (INC_yearly) that were created represent the following percent of federal poverty level (FPL) groups:

1. $INC_h < 1.00 * FPL_{hsize;}$

2. $1.00 * FPL_{hsize} \leq INC_h \leq 1.38 * FPL_{hsize}$;

3. $1.39 * FPL_{hsize} \leq INC_h \leq 4.0 * FPL_{hsize}$;

4. $INC_h > 4.0 * FPL_{hsize}$

Percent of FPL groups were constructed using respondents' reported income, household size and 2012-2017 Department of Health and Human Services (HHS) Poverty Guidelines. The following formula was used to calculate percent of federal poverty level (%FPL):

% FPL= (incomecat/PGHSIZE)*100

Incomecat. For the income variable, BRFSS has one question for household income from all sources. Refer to Appendix I for the question. Eight income options are provided with "1" representing less than $10,000 and "8" representing $75,000 dollars or more. Since income categories do not exactly conform to ACA effects related to Medicaid and the insurance subsidies, household size and federal poverty guidelines (FPL_{hzize}) were used to determine to which of the four income categories (i.e. <100% FPL, 100-138% FPL, 139-400% FPL, or >400% FPL) the respondent belonged to. Respondents who answered "don't know/not sure or refused" to the income question were dropped, as stated in the beginning of this section.

First, each income category was converted to a dollar term by taking the median value as done in Sommers et al. (2015). For example, the less than $10,000 category was converted to $5,000 dollars (and so forth). The dollar term variable for income was given the label "incomecat". These income levels were used to isolate income groups that were hypothesized to have benefited the most from the Medicaid coverage expansion (100-138% FPL) or the ACA's subsidy (100-400% FPL).

To calculate the dollar term for the last category (greater than $75,000), the following formula was used:

Calculation of Mean Income for >$75,000 Group

(1) $HINC_{g,t} = \Sigma p_{j,g,t} \bullet Y_{j,g,t} + p_{>75,g,t} \bullet Y_{>75,g,t}$

- $HINC_{g,t}$ = mean income for households in the g-th group (eg., race) in year t (2012-2017)
- $p_{j,g,t}$ = proportion of households in g-th group in year t in j-th income category <$75,000
- $p_{>75,g,t}$ = proportion of households in g-th group in year t in income category >$75,000
- $Y_{j,g,t}$, $Y_{>75,g,t}$ = mean income in g-th group in year t with incomes <$75,000 or >$75,000.

Solving for the mean income of the top end group:

(2) $Y_{>75,g,t} = \{HINC_{g,t} - \Sigma p_{j,g,t} \bullet Y_{j,g,t}\} / p_{>75,g,t}$

(3)

The mean income for the last category was adjusted by year and race/ethnicity. See Appendix V for details on the calculation of mean income by race and year for the greater than $75,000 income category.

PGHSIZE. The 2012-2017 Poverty Guidelines were used to create a variable that assigned a poverty guideline dollar term dependent on the household number (PGHSIZE). The poverty guidelines are based on household size and are issued on a yearly basis. These guidelines are used for determining financial eligibility for federal programs. To note, Alaska and Hawaii have their own set of poverty guidelines and were adjusted accordingly (Office of the Assistant Secretary for Planning and Evaluation, U.S. Department of Health & Human Services, n.d.). See Appendix AD for the 2012-2017 poverty guidelines used in this analysis.

The BRFSS dataset has two variables that together, give household size, i.e. number of adults (numadult) plus number of children (children). Total household was calculated by adding the number of adults and number of children reported by the survey respondent. Calculating household size is important to calculate the percentages of FPL of study interest. The cutoff for household size was 14 as the percentage of the population at 14 in the analytic sample was 0.0056%. Therefore, the dollar term for households over 14 was given the same dollar term as those at 14 (i.e. Household size last category was 14+). In 2010, the average household size was 2.58 people per household, declining to 2.54 people per household in 2017 (Lofquist, Lugaila, O'Connell & Feliz, 2012; Statista, n.d.).

The study design which consists of landline and cellular calls is a limitation to calculating household size because cellular calls are counted as single adult households. In the national sample, 38.53% (n=850,461) were cellular calls, compared to 47.28% (n=645,078) in the analytic sample. To overcome this, the martial status variable was used to convert single adult households to two adult households if the survey respondent reported being "married". In the analytic sample, 51.27% (n=330,701) of cellular respondents (n=645,078) reported being married and were converted to two adult households. Fewer than 0.01% (n=8) of cellular respondents had their marital status "missing".

HIGH RISK OF DIABETES. To create the "high risk for diabetes" variable, an algorithm was created which consisted of the following BRFSS questions: (1) if the respondent was ever told they had diabetes, (2) participant calculated body mass index (BMI) and (3) if the respondent participated in any exercise in the past month. The algorithm classified each respondent into one of two diabetes risk categories or diabetes: (0) no/low risk for diabetes, (1) high risk for developing diabetes, and (2) diabetes. The following paragraphs describe how the algorithm was created. Figure 9 provides a detailed flow diagram leading to the creation of the *high risk for diabetes* (HRD_wDIA) variable. Diabetes was included in the algorithm

The high risk for diabetes algorithm begins with a self-report question on diabetes. The actual question from the BRFSS codebook reads,

"(Ever told) you have diabetes? If "Yes" and respondent is female, ask: *"Was this only when you were pregnant?"* If respondent says pre-diabetes or borderline diabetes, use response code 4.

The available answers to this question include: (1) Yes; (2) Yes, but female told only during pregnancy, (3) No; (4) No, pre-diabetes or borderline diabetes, (7) Don't know/Not sure; or (9) Refused. Respondents who answer "yes" were not included in the high-risk variable since they have diabetes. Respondents who responded with "told borderline/pre-diabetic" or "only during pregnancy" were labeled "1" for high risk; and those who responded "don't know"; or "refused" were moved onto the second step of the algorithm.

BMI5cat. Body Mass Index (BMI) is an important variable to determine diabetes risk status. This categorical variable was created using the BRFSS calculated variable for BMI (_bmi5). In this calculated variable, BRFSS provides the calculated BMI of respondents from the self-reported height and weight questions:

"About how much do you weight without shoes?"

"About how tall are you without shoes?"

Weight was reported in pounds (lbs.) and kilograms (kgs). In order to differentiate between the two, metrics were reported with a "9" in column 118 in the dataset. All weights were converted to kilograms (kg) using the standard conversion of 1kg= 2.20 lbs. Height was reported in feet/inches or meters/centimeters. In order to differentiate between the two, metrics were reported with a "9" in column 122 in the dataset. All heights were converted to meters (m) using the standard conversion of 1 meter= 39.37 inches. The standard formula for BMI is:

BMI Formula = weight (kg) /height (m^2)

Using the BMI calculations, obesity prevalence was calculated using the formula below:

$$\text{Prevalence} = \frac{\text{Number of people with obesity}}{\text{Number of people measured}} \text{ X } 100$$

A systematic review assessing reliability and validity of BRFSS 2004-2011 found that self-reported physical measures were compromised, especially when reporting measures of height and weight (Pierannunzi, Hu & Balluz, 2013). The BRFSS dataset only has self-reported data, which research has found adults tend to under-report weight and over-report height, with obese adults tending to under-report weight, resulting in artificially lower obesity prevalence rates (Elgar & Stewart, 2008; Lin, DeRoo, Jacobs & Sandler, 2012; Gildner, Barrett, Liebert, Kowal & Snodgrass, 2015). Although this information is self-reported, it provides an estimated height and weight for each individual since the measured weight and height are not available. If an individual in this algorithm reports a high BMI, we can expect this high BMI to be true.

A BMI dummy variable was created where (0) BMI < 25; (1) 25 ≤ BMI <30; and (2) BMI => 30. Individuals who did not report diabetes, borderline diabetes/pre-diabetes or only during pregnancy and report a BMI < 25 (normal BMI) were considered no/low risk for diabetes and coded "0". Individuals who did not report diabetes, borderline diabetes/pre-diabetes or only during pregnancy and report a BMI > 30 (obese) were considered high-risk for diabetes and coded "1". Individuals who did not report diabetes, pre-diabetes or diabetes during pregnancy and had missing data on BMI were coded "0" no/low risk. Individuals who did not report diabetes, borderline diabetes/pre-diabetes or only during pregnancy and reported a BMI of 25 to 30 moved onto the next step of the algorithm.

The third and last step of the algorithm incorporated the only BRFSS question on exercise. Exercise was added to this algorithm because a growing literature indicates that exercise alone is the best predictor of self-rated health when compared to the BRFSS variables tobacco use or diagnosis of diabetes (Larson & Winn, 2010). The benefits of regular physical activity are well accepted (Brown, Balluz, Heath, Moriarty, Ford, Giles & Mokdad, 2003); however, it is important to note that this question focuses only on a month's timeframe and does not mean exercise is practiced habitually. In an attempt to not oversample those "at high risk", exercise will be used to filter through the "overweight" BMI category since being "overweight" could misclassify someone with excess muscle mass instead of adipose tissue. The question reads, *"During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?*

The available answers to this question included: (1) Yes; (2) No; (7) Don't know/ Not Sure; and (9) Refused. In this last step, a respondent that reports "yes' to exercise in the last month will be categorized as "0", no/low risk for diabetes. All other respondents will be categorized as "1", high risk for diabetes. This is a crude measure for exercise.

To summarize, individuals were added to the "1" high risk for diabetes category if they: (1) had self-reported pre-diabetes or borderline diabetes; or if they (2) had diabetes only during pregnancy or didn't know if they were pre-diabetic and had a BMI > 30; or had a BMI ≥ 25 with report of no exercise in the past month. Since persons with diabetes cannot be categorized as "pre-diabetic" or at high risk of developing diabetes, they were identified separately as individuals with diabetes. Although race/ethnicity was an important part of this analysis, race/ethnicity was not considered a diabetes risk factor since race/ethnicity is a predictor of interest and cannot be evaluated if it is included as part of the high-risk definition. This survey-based variable for high risk does not mean an individual has "pre-diabetes". There are individuals at high risk who would not be considered pre-diabetic due to a blood glucose level within normal range. By creating this "high risk" variable, an approximation of individuals at higher risk of developing pre-diabetes or diabetes when compared to those at low/no risk was available. This algorithm could potentially underestimate the number of individuals at high risk for diabetes due to the reliance on critical self-reported information, such as height, weight and exercise routine; but allowed us to identify a population that requires adequate access to diabetes preventive care.

For descriptive statistics purposes, dichotomous variables for diabetes (DIA) and prediabetes (preDIA) were also created, where (1) is the report of the respective diagnosis for each variable. Although people with diabetes are not the focus of this study, this information provides context for our analysis.

MEDICAID EXPANSION STATUS. A dichotomous dummy variable was created to determine Medicaid coverage expansion status (EXP) as follows: (0) non-expansion state; and (1) Medicaid expansion state. Medicaid expansion will equal "1" for states that went into effect after ACA implementation. Expansion status was coded "0" or "1" for the full year, regardless of when (which month) the state expanded coverage. Appendix U displays all the states in each category and if excluded, why they were dropped.

Control Variables

DEMOGRAPHICS. The demographic control variables included age, sex, and education (Appendix K). Age was a continuous variable; whereas, sex was a dichotomous variable (FEM) recoded to (0) is male and (1) is female. BRFSS had one question in the demographic section related to educational level. The full question is in Appendix I and offers six options of increasing levels of educational attainment, from "1": never attended school to "6": college graduate. Education level was updated to reflect milestones in academic progression that are more likely to lead to better health behaviors, when compared to not having completed high school (HS). The education variable was recoded to: (0) Less than HS; (1) HS grad; (2) Some college; and (3) College grad. The option for "some college" was included since the focus was on racial and ethnic minorities who are less likely to be college graduates when compared to non-Hispanic whites who have some college (Krogstad & Fry, 2014).

LIMITED HEALTH STATUS. Limited Health status (LHS) refers to the report of chronic disease and the self-report of health status (Appendix I). Questions about ten health conditions (i.e. myocardial infarction, congestive heart disease, stroke, asthma, skin cancer, cancer, COPD/emphysema/chronic bronchitis, arthritis, depression and diabetes) were included in the BRFSS (Appendix L). Each question asks if the respondent was ever told they had an MI, coronary heart disease, cancer or a stroke, for example. The four responses were (1) yes, (2) no, (3) don't know/not sure and (9) refused. The question on asthma was the only condition that has two separate questions for one condition. The first question asks if the respondent was ever told they had asthma; whereas the second question asks if they currently have asthma. Only the second question will be considered in the creation of the chronic disease variable since we are interested in those with chronic conditions. For this study, only the major chronic conditions (i.e. cancer, COPD, asthma, heart disease, MI, kidney disease and stroke) were included in this analysis and used to create the chronic disease count variable.

First, a dichotomous variable was created for each chronic disease, where (0) was no disease and (1) was yes, condition present. Asthma and COPD were combined as were heart disease and MI. Five chronic disease variables resulted: (1) cardiovascular, (2) respiratory, (3) cancer, (4) kidney and (5) stroke. Myocardial infarction and heart disease were recoded to the cardiovascular grouping of (0) no disease or (1) yes, disease present. Asthma and COPD were recoded to the respiratory grouping of (0) no disease or (1) yes, disease present. Cancer, kidney and stoke were recoded to their own grouping of (0) no disease or (1) yes, disease present. Each chronic condition grouping was included in a count variable (CDcount) numbered 0 through 5. Diabetes was not included as this is the health condition of interest. Reliability of self-reported diagnoses of chronic disease was found to be high for BRFSS (Pierannuzi et al., 2013).

The question on self-reported health asks respondents to rate their general health as (1) excellent, (2) very good, (3) good, (4) fair, or (5) poor. Previous studies have shown that a majority of respondents report their health as good to excellent, leading to a skewed distribution; however, those who report being fair or poor health actually have some sort of health limitation (Van Doorslaer & Jones, 2003). Self-reported health was recoded to a dichotomous variable with a healthy/non-healthy distinction, where (0) was healthy and (1) was not healthy. If a respondent answered 1-3, they were categorized as healthy; whereas respondents answering 4 or 5 were categorized as unhealthy. Respondents answering “don’t know/not sure” or “refused” were added to the (1) not healthy category since they were either unaware of their health status or do not want to report poor health.

PRIMARY CARE PROVIDER SUPPLY. Lastly, the PCP supply variable was constructed using data from the 20011 Center for Studying Health System Change which measured state variation in primary care physician supply pre-ACA. The states classified as low, medium and high PCP based on the ratio of PCPs to the nonelderly U.S. population in 2008. Supply was measured using data was from the Health Resources and Services Administration (HRSA) where PCP supply was measured by the number of PCPs per 10,000 persons. Low supply was less than 11.5 PCPs per 10,000 persons; medium supply was 11.5-15 PCPs per 10,000 persons and high supply was greater than 15 PCPs per 10,000 persons (Cunningham, 2011). The dichotomous variable (SUPP) where (0) was adequate supply and (1) was low supply was created as a control variable for this study. Medium and high supply states were coded as (0) adequate supply, with low supply being coded as (1). The PCP supply dummy variable was not introduced into the regression model until specific aim 3 which measures the likelihood of a respondent having health care access.

Statistical Regression Analysis

Statistical analyses were conducted by concatenating the 2012 to 2017 cross-sectional BRFSS datasets. The years 2012 to 2017 were selected to conduct a pre/post, difference-in-difference analysis using STATA 15.0. The intervention year was 2014 with years 2012 to 2013 were “pre-ACA” and 2014 to 2017 were “post-ACA”. To measure changes over time, a dummy variable for ACA effects (**ACA**) was created where “0” was before ACA implementation and “1” after ACA implementation. The time variable “year” captured the year of the data (i.e. year 1-6 for years 2012-2017).

To test ACA effects on the main outcomes of interest, multivariate logistic regressions were used to determine the likelihood of a given event (e.g., having insurance). The main assumption with this type of study design was that trends in outcomes would not differ before and after the ACA or between expansion and non-expansion states if the ACA was not present (Decker, Brandy & Sommers, 2017). The outcomes of interest are typically dichotomous variables where “0” is equal to the probability that event will not occur, and “1” is equal to the probability that an event will occur (Angrist & Pischke, 2009).

Two regression approaches existed for testing ACA effects on race/ethnic groups and those with pre-diabetes. A fully-interacted model could be estimated that includes race/ethnic group and pre-diabetes indicators in a single equation. This is quite cumbersome, especially when we wish to account for state Medicaid expansion status. The alternative is to specify a simpler (but not simple) model that does not distinguish between these groups then subset the models in certain ways and test for coefficient differences across models. We intend to use a sub-sample approach and compare ACA-related race-ethnic and pre-diabetes coefficients post-stratification.

Specific Aim #1. To capture the broad effects of the ACA on insurance, Specific Aim1 provides baseline information by including all adults in the sample, regardless of race or diabetes risk status. This aim set the foundation for subsequent analyses focused on health care access and preventive care delivery. We began the modeling process by proposing a two-step model that isolates ACA effects on the likelihood of having insurance coverage. This model gave the global effects of the ACA on health insurance (INS) in the U.S. and provided a baseline to which additional analyses were conducted. If the ACA had differential effects on blacks and Hispanics or pre-diabetics, it must do so by (a) increasing insurance coverage, in lower income groups, and (b) the race and pre-diabetic groups of interest must be inversely correlated with income levels. Once the basic model was estimated, separate models were run by race, resulting in ACA impact coefficients comparisons. The same was done for individuals by diabetes risk. It was important to show a statistically significant link between ACA and insurance, in order to move onto further analyses outlined in aims 2-3.

Aim 1a. To determine the impact of the ACA's coverage expansion on the likelihood that an adult aged 18 to 64 has health insurance coverage in the U.S. by income category.

- ***Hypothesis #1a:*** When compared to the pre-ACA period, ACA's subsidy and Medicaid expansions will lead to not only to an increase in the percentage of lower income adults gaining health insurance coverage, but at a faster rate than for higher income adults post-ACA implementation.

Aim 1b. To determine the differential impact of the ACA's coverage expansion on the likelihood that an adult aged 18 to 64 has health care coverage between Medicaid expansion versus non-expansion states by income category.[1]

- ***Hypothesis #1b:*** When compared to the pre-ACA period, ACA's subsidy and Medicaid expansions will lead not only to an increase in the percentage of lower income adults gaining health care coverage, but at a faster rate within Medicaid expansion states than non-expansion states post-ACA implementation.

(1) $Pb[INS]_{it}$=

(Aim 1a., Step 1)

$$\alpha + \Sigma_m \phi_m X_{mit} + \Sigma_j \beta_j INC_{jit} + \mu T_t + \Sigma_j \nu_j INC_{jit} * T_t \qquad \text{(Line 1)}$$

(Aim 1b, Step 2)

$$+ \rho EXP_i + \psi EXP_i * T_t + \varepsilon_{it} \qquad \text{(Line 2)}$$

While this model requires estimation of numerous main and interaction coefficients, the dataset contained well over 2 million observations (+ 400,000 persons for each of the 5 years). The basic model was estimated in two steps. Step 1 estimated ACA effects on the level and trend in insurance coverage for the four income groups. Step 2 then differentiated the Step 1 effects between expansion and non-expansion states. The variable "T" in the regression model was measured two ways (1) pre vs. post ACA and (2) pre vs. each year (i.e. 2014, 2015, 2016 and 2017). With pre vs. post, we measured aggregate changes, whereas with the year by year variable, time trends were measured.

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[1] For a more detailed discussion of Difference-in-Difference regression methods for program evaluation, see J. Cromwell, et al. Pay for Performance in Health Care: Methods and Approaches, Ch. 10, RTI Press, March 2011; A. Gelman, J. Hill. Data Analysis: Using Regression and Multilevel/Hierarchical Models, Ch.11, Cambridge University Press, 2007.

For specific sub aim #1a, step 1 represents the probability of the i-th adult aged 18 to 64 having health insurance coverage (INS) in year T (pre vs. post ACA). This probability is a function of the following variables included in the X-vector: (1) the sum (Σ) of the independent variables: income, education, Limited Health Status (LHS), high risk for diabetes (HRD) and the covariates: chronic disease, age and gender, (2) the sum (Σ) of j=1-3 low-income levels (INC), (3) the annual T_t time counter variable (1-5), and (4) the new ACA coverage expansion policies (ACA). For clarification, the subscripts (m) and (j) represent a different independent variable within the summation (Σ) sign.

Step 1, Line 1 (Specific Aim 1a). For the basic model, the alpha (α) intercept and represents the probability of having insurance for an adult male age 18 with a household income >400% of the FPL, without a high school diploma, and no disabilities or chronic disease in base year 2012. Because the annual time trend and ACA variables are included in Step 1, the beta (β) coefficients for the three lower-income variables should be less than 1.0 indicating less insurance coverage, relative to persons with incomes >400% of the FPL.[2] The mu (μ) coefficient represents a time trend slope in coverage that is common to all persons in the X-vector during the two-year baseline period. The three nu (ν) coefficients quantify the deviation in the mu (μ) baseline trend line of μ for each of the three lower income groups- again relative to incomes > 400% FPL. While we predict that insurance coverage was less in lower-income groups prior to the ACA, no hypotheses are suggested regarding differences in trends in coverage within income groups. Given only five years of data, it is quite possible for some or all of the T-interaction coefficients

[2] Inspection of base year income coefficients provides a desirable check on the logic of our model. If any of the low-income logistic coefficients were >1.0, we likely have a mis-specification of some sort. On the other hand, education, health status, age, and sex are held constant. Some of these variables are correlated with income, in which case, it is not certain that lower-income persons with each of these interacted cells would have less insurance than those in the wealthiest group.

to be insignificant, but if they are, then one or more of the ACA shift coefficients must be significantly less than 1.0.

Step 2, Line 2 (Specific Aim 1b). For specific sub aim 1b, multiple indicators for expansion state status (EXP) are introduced into the logistic regression model. Line 2 replaces the interaction term in Line 1. The EXP interaction term tests for differences in the levels and trends between expansion and non-expansion states. The rho (ρ) and psi (ψ), coefficients for EXP represent the *difference* (in any) in the level and trend slope of insurance coverage, on average, in expansion vs. non-expansion states for the highest income group prior to ACA implementation.

Specific Aim #2: PCP Provider. A similar regression model was run for aim 2, with the outcome variable changing to the likelihood of having a primary care provider or the likelihood using primary care services (in order to measure health care access) by race, then by diabetes risk status (instead of by income levels in Specific Aim 1). The three income group variables were replaced by the insurance (INS) variable in the regression models that follow as income effects should be captured by the change in ACA level of insurance. In the following models, income has no added effect on having a PCP once insured, controlling for all other variables. The predictor variable PCP supply (SUPP) was added to model 2 via the X-vector since the state PCP supply impacts the availability and access to primary care providers and services within a given geographic location or state.

Aim 2a. To determine the impact of the ACA's coverage expansion on the likelihood that an adult aged 18 to 64 has health care access (i.e. a primary care provider or visited a physician for a routine visit) in the U.S. by race, then by diabetes risk status.

- ***Hypothesis #2a:*** When compared to the pre-ACA period, ACA's subsidy and Medicaid expansions will lead to an overall increase in health care access among racial/ethnic minority adults and adults at high risk of developing diabetes when compared to non-Hispanic whites and those at low risk respectively, post ACA implementation.

Aim 2b. To determine the differential impacts of the ACA's coverage expansion on the likelihood that an adult aged 18 to 64 has health care access (i.e. a primary care provider or visited a physician for a routine visit) in a Medicaid expansion versus non-expansion states by race, then by diabetes risk status.

- ***Hypothesis #2b:*** When compared to the pre-ACA period, ACA's subsidy and Medicaid coverage expansions will lead to an overall increase in the reporting of health care access among racial/ethnic minority adults and adults at high risk of developing diabetes when compared to non-Hispanic whites and those at low risk respectively within Medicaid expansion states than non-expansion states.

Pb[PCP}$_{it}$=

(Aim 2a, Step 1)

$$\alpha + \Sigma_m \phi_m X_{mit} + \beta INS_{it} + \mu T_t + \nu INS_{it} * T_t \qquad \text{(Line 1)}$$

(Aim 2b, Step 2)

$$+ \rho EXP_i + \psi EXP_i * T_t + \varepsilon_{it} \qquad \text{(Line 2)}$$

Full Model (Steps 1 & 2, Aim 2). For specific aim 2, step 1 represents the probability of the i-th adult aged 18 to 64 having a primary care provider (PCP) in year T. This probability is a function of the following variables: (1) the sum (Σ) of the independent variables: PCP supply, education, LHS and the covariates: chronic disease, age and gender (all represented by the X-vector), (2) the likelihood of having insurance (INS), and (3) the T_t time variable (1-5, or pre vs.

post ACA). The alpha in the global model is the intercept and represents the probability of having a primary care provider for an uninsured, adult male age 18, living within a non-expansion state with an adequate supply of primary care providers in 2012. Runs were run by race, then by diabetes risk status.

It was hypothesized that the beta (β) coefficient on INS will be highly significant in the pre-ACA years. The nu (ν) coefficient measures any change in the INS effect over the base years. The zeta (ζ) and lambda (λ) coefficients now quantify changes in the level or trend of having insurance coverage on primary care access during the ACA period. Neither of these coefficients must be significant for the ACA to have a significant effect on gaining a PCP so long as beta (β) is significant, and we have shown that the ACA significantly increased INS. If being in an expansion state has even different effects of insurance on PCP, at least some of the EXP-INS coefficients in lines 3-5 will be statistically significant.

A more immediate test of ACA effects on PCP was available by simply dropping all INS main and interaction effects- and this was done. But it was important to quantify the logical two-step path of the ACA through insurance to gaining PCP access. As noted earlier, if the ACA had no effect on insurance coverage, then how could it affect PCP access? And, if it did increase coverage, how important, quantitatively, was broader insurance to gaining access to primary care?

Sub-sample Analysis

Race/ethnicity and diabetes health risk sub-sample analyses were introduced via specific aims 2. To conduct the analysis by race, two separate regressions were run, (using the basic regression model shown above). It was anticipated that running separate models for race/ethnicity would lead to cleaner models to estimate and interpret. An F-test was conducted on the coefficients to test for differences in the R^2 of the regression models between the two race/ethnicity samples. The same method will be used for diabetes risk status, where the basic model was run for those at high-risk of diabetes.

Specific Aim #2 Clinic Visit. In specific aim 2, a possibly more meaningful way to measure health care access by predicting if a clinic visit with a health care provider for a routine checkup (PCA_1yr) occurred was proposed; instead of simply knowing if a respondent had a PCP. This outcome variable used the same regression model for the likelihood of a having a PCP but allowed for the measurement of health care access in a different manner. With the first outcome variable (PCP), an individual may report having a primary care provider, but may not actually see their provider for primary care services. Therefore, this alternative health care access outcome, labeled Primary Care Access (PCA_1yr) speaks to an actual visit with a physician, which would be the first step to receiving recommended prevention interventions, leading to our specific aim 3 NAMCS analysis. The regression model used to test for the "use" of primary care services was the same as for "having a primary care provider". The only change was the outcome variable in the equation (i.e. $Pb\,[PCP]_{it}$ to $Pb[PCA\_1yr]_{it}$)

Regression Weighting

Sample weighting (via design and raking) was used to adjust for characteristics in the population as unweighted sample statistics may be biased. Design weighting takes into account the number of phones and number of adults in each household; whereas raking weighting allows for the introduction of more demographic variables. To remove bias from the sample, BRFSS included the variable _LLCPWT, which is a final weight assigned to each respondent for the landline and cellular telephone combined data (Centers for Disease Control and Prevention, 2013). To survey weight the data in STATA, the following command was used: svyset _psu [pweight = _llcpwt], strata(_ststr) singleunit(scaled).

Missing Data

Unless otherwise noted in the text, any variable containing <5% missing data was dropped.

Analysis using NAMCS

BRFSS allowed us to quantify the impact of the ACA, first, on the probability of having health care coverage, followed by the gain in health care access overall, and for 2 sub-groups in the U.S. Since we are interested in studying the delivery of diabetes preventive care, the NAMCS dataset allows us to study the ultimate outcome in this multi-stage analysis (Figure 8). The two outcomes of interest in this section were: (1) the probability of receiving diabetes screening (SCR), and (2) the probability of receiving diabetes prevention education (DPE) during a preventive care clinic visit. Logically, the two outcomes of interest are a long way from the implementation of ACA and whether the two sub-groups of interest (i.e. high risk and minorities) are getting screened or receiving diabetes prevention education. This why the BRFSS analysis (Specific Aims 1 & 2) was instrumental to setting up the NAMCS analysis.

Analysis proposed using the BRFSS addresses the likelihood that the ACA increases insurance coverage which, in turn, increased the likelihood of having a PCP. The probability of having a clinic visit is dependent on having a PCP and how often a person sees their PCP. This ratio does not equal 1.0 for an insured population over a specified time period for example in the first ACA year. This produces a "loss" in linkage between the ACA and diabetes preventive care through broader insurance coverage. Finally, having a visit does not mean that high-risk persons or minorities are actually screened or provided education for diabetes- another loss. Therefore, the ACA does <u>not</u> guarantee that newly covered persons will now have a PCP or receive diabetes preventive care (even for those that do have a provider).

NAMCS Dataset Overview. The National Center for Health Statistics (NCHS) within The Centers for Disease Control and Prevention (CDC) has collected ambulatory health care data annually since 1989 through the National Ambulatory Medical Care Survey (NAMCS) and the

National Hospital Ambulatory Medical Care Survey (NHAMCS) since 1992. NAMCS is a national survey (Figures 7 and 8) based on a sample of visits to non-federally employed office-based physicians; whereas NHAMCS focuses on ambulatory care services in hospital emergency and outpatient departments. In 2006, a separate sample of community health centers (CHCs) was added to the survey. In the NAMCS dataset, data is collected from the physician via an automated laptop-assisted data collection method. Each physician is assigned to a 1-week reporting period. Data includes both patient characteristics, as well as physician and practice characteristics (Centers for Disease Control and Prevention, 2017).

There were two data collection forms, the Patient Log and the Patient Record. The Patient Log is a sequential list of patients expected to visit throughout the survey week and determines which visit should be recorded. The Patient Record is an encounter form which captures 12 items of data about the visit. These 12 items include: date and length of visit; patient's date of birth, sex, color, and primary problem; physician's estimate of the seriousness of the problem, and whether the patient has been seen for the problem before, major categorical reasons for visit; diagnoses; treatment or services; and disposition. The forms filled out by physicians requires 1-2 minutes to complete, or about 15 minutes per day. At the end of the survey week, participating physicians mail the Patient Records to interviewers who review the forms for completeness, before transmitting them for processing. If there is missing information, interviewer contacts physician's office and information is obtained from the patient's medical record by staff or from memory by the physician (National Center for Health Statistics, 1974).

In 2012, the overall response rate for physician's induction into the study was 59.7%, whereas the response rate for the Patient Record Forms was 37.4% unweighted (38.4% weighted) or 3,583 physicians completing the form. In general, rates have been declining from

2002 to 2012 for both physician induction interview and the completion of Patient Record Forms. As a result, survey weights were adjusted for nonresponse to produce final physician-level estimates based on (1) induction interview respondents and (2) completion of the Patient Record Form. Implementation of a new computerized survey instrument in 2012 may have influenced lower than usual physician completion rates than in 2010 and 2011. After adjusting for nonresponse among sample visits, no or minimal biases (<2.0 percentage points) were observed by MSA status, Census division or targeted state, and physician specialty categories (Hhing, Shimizu & Talwalkar, 2012).

Including the NAMCS dataset in this research was advantageous for the study of diabetes preventive care delivery. Since the unit of analysis was a patient visit, a focus was placed on the interventions delivered from provider to patient. In addition, there were variables included in this dataset that were not available within BRFSS, including: lab data, diagnoses, visit type and the type of insurance the patient is enrolled in. The lab data that was useful for this study includes tests such as Glycohemoglobin (HbA1c) and fasting blood glucose (FBG). The Patient Record Form captures a patient's diagnoses, including diabetes, which was helpful in identifying the high-risk group. The form also captured the visit type which allowed for the selection of preventive care visits; but also allowed us to distinguish between established versus new patients. Lastly, the form allowed us to differentiate between insurance types, a helpful piece of descriptive data that was not available in BRFSS.

NAMCS Sample Design

The NAMCS sample consisted of all physician-patient visits in a physician's office throughout the U.S. Only office visits to non-federally employed physicians classified by the

AMA or AOA as “office-based, patient care” are included. The visit must have been made within the physician’s office, face to face. Since the patient load may vary, physicians were assigned to use an “every-patient” or “patient-sampling” procedure. It is expected that sites completed approximately 10 patient visits per day. Physicians who anticpated 10 or fewer visits daily recorded data on all the visits; whereas physicians expecting 10 visits or more recorded data after every second, or third, or fifth visit, maintaining the same predetermined sampling interval at all times. The target was to have a sample of 30 visits per provider over a 1-week period. The visits that were excluded from the sample included: visits to specialists in anesthesiology, clinical pathology, forensic pathology, radiology, diagnostic radiology, pediatric radiology, and therapeutic radiology; visits to providers in federal service; and visits to all providers not practicing in an office-based practice. The exclusion criterion was focused on a provider’s practice characteristics rather than on specific patient characteristics (National Center for Health Statistics, 1988; National Center for Health Statistics, 2015).

The NAMCS dataset was set up as a multistage probability sampling design involving probability samples of primary sampling units (PSUs), physician practices within PSUs, and patient visits within practices. The sampling frame consisted of a list of licensed physicians classified as office-based and non-federally employed in the master files of the American Medical Association (AMA) and the American Osteopathic Association (AOA). These files were frequently updated, making them current at the time of the sample selection (National Center for Health Statistics, 1988).

In the first-stage sample, metropolitan statistical areas (SMSA’s) and nonmetropolitan counties were sorted and stratified by size, region and demographic characteristics- and then each frame was divided into sequential zones of 1 million residents. A random number was drawn to determine which primary sampling unit (PSU) came into the sample from each zone (National Center for Health Statistics, 1974). The first stage sample included 112 PSUs. PSUs are geographic segments composed of counties, group of counties or towns across the U.S. (National Center for Health Statistics, 2015).

The second stage consisted of a probability sample of practicing physicians selected from a list of physicians located in the sample PSU's, which were ordered by major specialty categories. This list came from the master files maintained by the AMA and the AOA. In this method, the overall probability for including any individual was the reciprocal of the number of physicians in the frame at the time of selection. Within each PSU, all eligible physicians were stratified by 15 groups by specialty (National Center for Health Statistics, 1974; National Center for Health Statistics, 2015).

The third stage was the selection of patient visits within the annual practices of sample physicians, which involves two steps. First, the total physician sample was divided into 52 random subsamples of approximately equal size. Then, each subsample was randomly assigned to 1 of the 52 weeks in the survey year. The second step involves the physician selecting a random sample of visits from the reporting week. The sampling rate varies from a 100 percent sample for very small practices, to a 20 percent sample for very large practices in this final step (National Center for Health Statistics, 2015).

NAMCS Analytic Sample

The NAMCS study sample focused on patient visits. The total sample sizes for each year was: 76,330 visits/year (2012), 54,873 visits/year (2013), 45,710 visits/year (2014), and 28,332 visits/year (2015). The type of visit was restricted to new and established patients who had a preventive care visit in 2012-2015. Like the BRFSS sample, the NAMCS sample was restricted to patients who were: Non-Hispanic whites, Non-Hispanic blacks and Hispanic adults aged 18-64. All adults, regardless of health status were included in order to identify those at *high risk* of diabetes. Only 16 states were identified in 2015 and were included in the sample: Arizona, California, Florida, Georgia, Illinois, Indiana, Massachusetts, Michigan, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Texas, Virginia and Washington. Following BRFSS eligibility requirements, Massachusetts was excluded from the analysis due to expanding Medicaid above 138% FPL in the pre-ACA period. The cut off year to be included as a Medicaid expansion state was 2015. Refer to Appendix Y for a list of states with their expansion dates, if applicable. Once the study sample was limited to preventive visits by white, black, or Hispanic adults aged 18-64 in one of the 15 states, the sample size was reduced to 8,974 visits from 2012-2015.

Outcome Variables

As primary care outcome measures for high-risk or pre-diabetes do not exist, adherence to clinical guidelines was used as a proxy to determine if appropriate diabetes interventions were delivered. The outcome variables of interest focus on health care delivery, specifically the delivery of diabetes prevention via (1) diabetes screening (SCR) and (2) diabetes prevention education (DPE) during a preventive care visit (Appendix U). The two variables were taken from the NAMCS Patient Record found in the section labeled “tests” for screening and “services” for counseling (Refer to Appendices N & O).

DIABETES SCREENING. To determine if diabetes screening was performed during a visit, a dichotomous variable was created where (0) was no screening and (1) was yes, blood glucose or HgA1c performed during visit. The diabetes screening came from 2 fields in the Patient Record From: (1) Hemoglobin A1c level and/or (2) glucose drawn during the preventive care visit in years 2012-2015. Sensitivity analysis was conducted where 4 fields in the Patient Record Form were included for years 2012-2014: (1) Hemoglobin A1c level drawn during visit, (2) glucose drawn during visit (3) fasting blood glucose in the past year, or (4) A1c in the past year. Year 2015 was dropped due to no entries in HgA1c or fasting blood glucose in the past year. The screening variable for the sensitivity analysis will be coded (0) was no screening and (1) was yes, blood glucose or HgA1c performed during visit or within the past year. To compare the sensitivity analysis to the main analysis, the 2 tests from the main analysis were also run using 2012-2014 data only.

DIABETES PREVENTION EDUCATION. Similarly, a dichotomous variable was created for diabetes prevention education where (0) was no diabetes prevention education and (1) was yes, at least one form of diabetes prevention education was provided during the clinic visit (i.e., diet/nutrition, exercise, or weight reduction). To note, survey years 2014 and 2015 have the option for diabetes education so this type of education was included in the variable for sensitivity analysis purposes.

Predictor Variables

The predictors (Appendix V) for this analysis included: race/ethnicity, diabetes risk status, and state Medicaid expansion status. PCP supply was not used in this analysis as the supply of PCPs should have no effect on visit content.

RACE/ETHNICITY. NAMCS has five race categories: (1) white, (2) black, (3) Asian, (4) Native Hawaiian or another Pacific Islander and (5) American Indian or Alaska Native.

Ethnicity has two options: (1) Hispanic or Latino and (2) Not Hispanic or Latino. As with the BRFSS analysis, race/ethnicity will be represented by two variables (i.e. black and Hispanic). The black variable was generated from the race section on the Patient Record From and was coded to (0) Non-Hispanic white and (1) Non-Hispanic black. The Hispanic variable was recoded to: (0) Not Hispanic or Latino and (1) Hispanic or Latino. Refer to Appendix V.

HIGH RISK FOR DIABETES. A separate algorithm was developed to determine diabetes risk. A variable labeled, "high risk for diabetes" (HRD) was constructed where (0) was no/low risk and (1) was high-risk (2) diabetes and (3) unknown risk. Individuals identified at higher risk for diabetes were more accurate than in BRFSS since the NAMCS data is not self-reported; rather the provider enters all the data for each patient.

Any patient with a diagnosis of diabetes was recoded to a (2) and not considered at risk since they already had a diagnosis of diabetes. Diabetes diagnosis was determined by information entered by the provider on the front side of the Patient Record Form (Appendix R). The NAMCS dataset includes a calculated BMI for each patient. Patients with a BMI > 25 and no diabetes diagnosis were placed in the (1) high risk category; whereas patients with no diabetes diagnosis and a BMI < 25 were coded (0) no/low risk. Almost half of the BMI values were missing in the sample and were coded a (3) unknown risk. Missing BMI values with a diagnosis of obesity were recoded to (1) high-risk. Figure P-1 displays the algorithm that determines diabetes risk.

MEDICAID EXPANSION STATUS. Lastly, a dichotomous variable was created for expansion status as follows: (0) non-expansion state; and (1) Medicaid expansion state. Medicaid expansion will equal “1” for states that went into effect after ACA implementation in 2015. Refer to Appendix AD for the map of Medicaid expansion states.

Control Variables

Covariate controls included age, gender and the presence of chronic disease (Appendix S-1). The covariates of interest included the continuous variable for age as well as the dichotomous variable for gender where gender was recoded to (0) male and (1) female. Chronic disease was simplified to one dichotomous variable representing chronic disease, labeled CDV. The chronic disease variables from BRFSS were different from those recorded on the NAMCS Patient Record Form. The chronic diseases available in the NAMCS Patient Record Form included: arthritis, asthma, cancer, cerebrovascular disease (stroke), COPD, chronic renal failure, depression, and ischemic heart disease. The chronic disease variable was reduced to 6 conditions: asthma, stroke, COPD, depression, CAD and CHF. Diabetes is also captured on the Patient Record Form but will not be included. The physician reported each of these diagnoses by checking off a checkbox on the front side of the NAMCS form (Appendix N). To account for chronic disease, a patient must have had at least one of the six chronic diseases checked off during their visit. The CDV variable was coded to: (0) no chronic disease and (1) at least one chronic disease or more.

Statistical Regression Analysis: Tabular and multivariate

Statistical analyses were conducted by concatenating the 2012 to 2015 cross-sectional NAMCS datasets. The years 2012 to 2015 were selected as these years cover the timeframe of interest. The 2016 data was not available by state. As with the BRFSS, a pre/post, difference in difference analysis was conducted. The intervention year was 2014, with 2012 to 2013 being pre-

ACA and 2014 to 2015 being post-ACA. The time trend (T) was not included in the model due to the shorter pre/post time period (2012-2015), when compared to BRFSS (2012-2017). As with the BRFSS analysis, Massachusetts was excluded from the analysis due to expanding Medicaid before 2014.

Descriptive Statistics

Descriptive statistics were calculated using the chi square test to compare results. Insurance status was included in the descriptive data. The Patient Record form captures if a patient had some form of health insurance coverage for their visit. The options included: (1) private insurance, (2) Medicare, (3) Medicaid or CHIP, (4) Worker's Compensation, (5) Self-pay, (6) No Charge, (7) Other or (8) Unknown. The options for Medicare and Worker's Compensation were dropped as these options were not applicable to the study. Even though insurance status was not relevant for the analysis, this information was valuable to the overall study to show how many individuals with a given insurance type visited a provider for preventative services.

Statistical Regression Analysis

Multivariate logistic difference-in-difference regression models were estimated to determine whether the ACA coverage expansion was associated with the odds of receiving diabetes prevention intervention. Two regression models were used to determine first, the likelihood that an adult received diabetes screening by expansion status and second, the likelihood that an adult received diabetes prevention education during a clinic visit by expansion status. These two outcomes are the main objectives of Specific Aim 3. After the Aim 3 is described, each model will be described in greater detail in the sections that follow.

Specific Aim #3:

Aim 3a. To determine if the ACA's coverage expansion increased the rate of diabetes screening and diabetes prevention education for adults within Medicaid expansion versus non-expansion states.

- ***Hypothesis #3a.1:*** When compared to the pre-ACA period, ACA's subsidies and Medicaid expansions led to an increase in the rate of diabetes screening and counseling overall, with greater proportions of adults receiving diabetes prevention within Medicaid expansion states than in non-expansion states post-ACA implementation.

Aim 3b. To determine if the ACA's coverage expansion increased the rate of diabetes screening and diabetes prevention education within Medicaid expansion versus non-expansion states by race/ethnicity, then by diabetes risk status.

- ***Hypothesis #3b.1:*** When compared to the pre-ACA period, ACA's subsidies and Medicaid expansions will lead to increased rate of diabetes screening and counseling overall, with greater proportions of black, Hispanic and high-risk adults receiving diabetes prevention within Medicaid expansion states than in non-expansion states post-ACA implementation.

DIABETES SCREENING. The following 2-step model for diabetes screening was proposed based on v-visits over the t=2012-2015 period. The probability was a function of the following variables: (1) the new ACA coverage expansion policies (ACA), and (2) expansion state status (EXP).

Model 1.

Pb[SCR}$_{vt}$=

(Aim 4a)

$\alpha + \beta ACA_t + \gamma EXP_v + \delta ACA{*}EXP_{vt}$ (Step 1)

(Aim 4b)

$+ \kappa AGE_{vt} + \psi FEM_{vt} + \omega RH_{vt}$ +-$\theta RH{*}ACA_{vt}$ +$\pi RH{*}ACA{*}EXP_{vt}$+ ε_{vt} (Step 2)

Step 1, Aim 4a. The alpha (α) is the average screening rate at the base period in non-expansion states. The beta (β) coefficient for ACA is interpreted as the average difference in screening rates during the two ACA years (2014-2015) for visits in non-expansion states. They gamma (γ) coefficient tests for any difference in visit screening rates in expansion versus non-expansion states in the base period. The interactive delta (δ) coefficient tests for larger (smaller) ACA effects for expansion versus non-expansion states. If the ACA increased insurance coverage, leading to a higher PC office visit rate, then the ACA should also show a higher screening rate for diabetes in the ACA period. An even higher screening rate may be observed in expansion states after the ACA went into effect. Since the ACA targeted Medicaid and lower-income groups, we can assume that the ACA disproportionately favored lower-income individuals in screening for diabetes.

Step 2, Aim 4b by RACE. In Step 1, the model does not adjust for age, sex or race/ethnicity. These patient characteristics were included in Step 2 of this model. Now that age (AGE) and being female (FEM) were controlled for, the pre/post-ACA visit samples should be fairly "balanced". Now, the alpha (α) coefficient is interpreted for males for a specific age. If the large samples were already well-balanced, then the ACA-related coefficients on line 1 should not change significantly.

Race/ethnicity (RH) had also been specified with both main and interactive coefficients. (The omega (ω) coefficient is interpreted as the average difference in screening rates for blacks (or Hispanics) in the base period within age-gender groups in non-expansion states. The theta (θ) coefficient tests for the change in screening rates for black (or Hispanics) during the ACA period in non-expansion states. Finally, pi (π) coefficient tests for a different rate of change of minorities for expansion states once ACA insurance coverage was implemented. Both the theta (θ) and pi (π) coefficients test hypotheses that ACA effects were greater for minorities. If both are insignificant but either or both beta (β) and delta (δ) coefficients are significant, then we can conclude that minorities shared equally with lower-income whites in higher ACA screening rates. Conversely, the two ACA coefficients in Step 2 may become insignificant if ACA effects were concentrated among minorities.

Step 2, Aim 4b by Diabetes Risk. Lastly, a separate analysis was conducted using the 2-Step Model 1 to test whether the ACA disproportionately affected screening for persons considered high risk of diabetes. It may be that a patient or clinician was aware of the patient's high-risk status prompting the clinician to recommend clinical screening for diabetes during the visit. Assuming the "high-risk" status was determined upon entering the clinic, this "pathway" to screening can be tested by replacing the race/ethnicity (RH) variable in the 2-Step Model 1 with the high risk for diabetes (HRD) variable. By dropping the race/ethnicity variable, any measure associated with being at high risk for diabetes cannot be interpreted separately for minorities.

When interpreting ACA effect on diabetes screening, it must be remembered that visits will represent both new and established patients to the clinic. Established patients with previous visits may have been screened for diabetes already and found to be negative or positive. To obtain a sharper estimate of ACA screening effects, we suggested dropping visits with a previous diagnosis of diabetes since we are most interested in whether the ACA enhanced screening rates for patients most at risk of incurring diabetes in the future. However a sensitivity analysis of the descriptive data will be done to compare differences in measurement for screening.

DIABETES PREVENTION EDUCATION. While it would be ideal for clinicians to educate patients on diet, exercise and weight reduction on each visit, this does not happen in many cases as more pressing health issues take precedence. Diabetes prevention education, however, should be triggered more often when the patient is at high risk of developing diabetes, as determined by their high BMI or elevated blood glucose levels- two major observable characteristics known to be a risk factor. Assuming this leads to screening during the visit, we should be able to test whether high risk individuals are not only screened more often during the ACA period because their visit rates have increased, they should also be receiving more diabetes prevention education in order to raise awareness of their health risk. The analysis involved replacing the screening (SCR) outcome in Model 1 with diabetes prevention education (DPE) in Model 2.

The following 2-Step model for diabetes prevention education was proposed based on v-visits over the t=2012-2015 period:

Model 2.

Pb[EDU}$_{it}$=

$\alpha + \beta ACA_t + \gamma EXP_v + \delta ACA{*}EXP_{vt}$ (Step 1)

$+ \kappa AGE_{vt} + \psi FEM_{vt} + \omega HRD_{vt} + \theta HRD{*}ACA_{vt} + \pi HRD{*}ACA{*}EXP_{vt} + \varepsilon_{vt}$ (Step 2)

Step 1, Aim 4a. Refer to pg. 91 for explanation of coefficients. Only difference is the outcome of interest changing from screening to diabetes prevention education.

Step 2, Aim 4 by Diabetes Risk. In Model 2, the omega (ω) coefficient is interpreted as the average difference in diabetes prevention education rates for those at high risk in the base period within age-sex groups in non-expansion states. The theta (θ) coefficient tests for the change in education rates for those at high risk during the ACA period in non-expansion states. Both the theta (θ) and pi (π) coefficients test hypotheses that ACA effects were greater for those at high risk of diabetes. If both are insignificant but either or both beta (β) and delta (δ) coefficients are significant, then we can conclude that those at high risk of diabetes shared equally with those with no/low risk for diabetes in receiving higher diabetes prevention education. Conversely, the two ACA coefficients in Model 2 Step 2 may become insignificant if ACA effects were concentrated among those at high risk of diabetes.

Step 2, Aim 4 by RACE. Lastly, a separate analysis will be conducted using the 2-Step Model 2 to test whether the ACA disproportionately affected diabetes prevention education for black and Hispanic minorities. In Step 2, the HRD variable will be replaced by RH variable representing race/ethnicity. Separate versions of Model 2 will be run for blacks (or Hispanics) versus whites. Refer to pg. 91 for discussion on regression coefficients. The only difference is the outcome of interest changing from screening to diabetes prevention education.

Regression Weighting

Sample weighting was used to adjust for national estimates. In order to remove bias from the sample, NAMCS included the variable PATWT, which is the patient visit weight used for national, regional, and divisional estimates and PATWTST for patient visit weight for state level estimates. The visit weight was calculated from the physician and visit-sampling rates, adjusting for non-response (Meigs & Stafford, 2000). The final weight used in STATA for the analytic sample was: svyset PHYCODE [pweight=PATWTST], stata(CSTRATUM) singleunit (scaled).

Missing Data

Unless otherwise noted in the text, any variable containing <5% missing was dropped.

CHAPTER 4

RESULTS

Chapter 4 is presented in two sections: Section 1: BRFSS Results and Section 2: NAMCS Results. Section 1 is sub-divided into Parts I-VI. Part I includes descriptive statistics displayed in the following format: (1) demographic data, (2) health status data, (3) state-specific data and (4) outcomes. Data from the full national BRFSS sample will be discussed in Part I to provide context, but the main datasets of interest are the two analytic BRFSS samples (i.e. 50 states and D.C. vs. 47 states). In Part II, more complex analytic tables are be presented that differentiate between Medicaid expansion and non-expansion states. In Part III, pre/post ACA changes in outcomes are presented. Parts IV-VI consist of multivariate regression results on insurance coverage, access to primary care providers (PCPs) and primary care checkups. All descriptive statistics and analyses are discussed using sample-weighted data. Data weights were provided by BRFSS documentation found on the BRFSS website; except when accounting for single sampling units within a stratum. Refer to Appendix X for additional details on how single sampling units were handled for this analysis.

BRFSS National and Analytic Sample Descriptive Statistics

We begin by reporting general results using the entire national BRFSS concatenated samples spanning years 2012-2017. This dataset includes all adult respondents 18 years and older in all U.S. states (and D.C.) for all race/ethnic groups with one major exclusion. Respondents not reporting household income (approximately 16%) were deleted, as described in Chapter 3 Methods Section 3.2. This was necessary given the study's focus on ACA effects across income groups. It was necessary to compare national BRFSS estimates to known U.S. population estimates in order to validate that any study findings could be generalizable to the U.S. population.

From the national BRFSS sample, two key analytic files were created. They differ from the national sample in two substantive ways: (a) all persons over age 64 and (2) race/ethnic groups besides whites, blacks, and Hispanics were deleted. Comparing ACA effects on the two largest minority groups versus whites was a goal of this study. The two analytic files differ from each other in the number of states included. The first analytic sample included all 50 states and the District of Columbia (DC); compared to the second analytic sample which consisted of 47 states. In the second analytic sample, three states (Hawaii, Massachusetts and Vermont) and D.C. were dropped when studying ACA effects as they materially expanded Medicaid (>138% FPL) prior to the ACA's implementation of 2014.

National BRFSS Sample

The total sample sizes for each year in BRFSS are shown below (total sample size, n=2,809,505):

Table 1

BRFSS Sample Sizes for Years 2012-2017.

2012-2017 BRFSS Sample Sizes					
2012	**2013**	**2014**	**2015**	**2016**	**2017**
475,687	491,773	464,644	441,456	486,303	450,642

Non-reported incomes were dropped as described in Chapter 3 Methods Section 3.2, leading to a sample size shown in Table 2. A breakdown of non-reported incomes by race and education can be seen in Appendix Y.

Table 2.

All BRFSS Respondents Aged 18 and Over with Income Non-reporters Dropped.

National BRFSS Sample 2012-2017		
	Unweighted	**Weighted**
Sample Size	2,207,012	1,240,231,044
Sample Size, mean per year	367,835	206,705,174

The unweighted national BRFSS sample size over six years was 2,207,012. This produced a mean annual national sample size of 367,835 that resulted in a weighted U.S. population of 206,705,174. As of 2010, the number of U.S. adults aged 18 and over was 234,564,071 million people (Howden & Meyer, 2011). Hence, the national sample (minus non-income reporters) currently accounts for approximately 88% of the U.S. adult population.

Analytic BRFSS Samples

The analytic samples were restricted to adults aged 18 to 64 who were either white only; black only; or Hispanic (all races). This produced an unweighted mean sample size of 227,376 and a corresponding U.S. population of 144,603,548 (displayed in Table 3). As of 2010, the number of U.S. adults aged 18 to 64 was 194,296,087 (Howden & Meyer, 2011). The analytic sample accounts for approximately 74% (144/194) of the U.S. adult population between the ages of 18-64 after deleting income non-responders and other races/ethnicities. A second, smaller sample dropping three states and D.C. reduced the analytic sample by a trivial amount.

Table 3

Analytic Samples of all BRFSS Respondents Aged 18 to 64 who are White, Black, or Hispanic in 50 states and D.C. versus 47 states and D.C., excluding 3 pre-ACA States (2012-2017).

BRFSS Analytic Sample 2012-2017				
	ALL 50 STATES & D.C.		47 STATES	
	Unweighted	Weighted	Unweighted	Weighted
Sample Size	1,364,254	867,621,289	1,283,537	844,741,467
Sample Size, mean per year	227,376	144,603,548	213,923	140,790,245

Demographic Variables. Tables 4 and 5 display data on demographic variables within the BRFSS national sample and the analytic sample with all states.

Table 4.

Demographic Variables for National Sample: All BRFSS Respondents Aged 18 and Over, Unweighted or Weighted by Sampling Fractions (2012-2017).

National BRFSS Sample 2012-2017		
	Unweighted	**Weighted**
Sample Size	2,207,012	1,240,231,044
Sample Size, mean per year	367,835	206,705,174
Income, mean (95% CI)	$80,160.66 ($80,067.73-$80,253.59)	$81,003.06 ($80,807.17-$81,198.96)
	Unweighted, %	**Weighted, %**
FPL		
<100% FPL	10.52	14.53
100-138% FPL	7.97	8.25
139-400% FPL	44.61	40.39
>400% FPL	36.91	36.84
Age Group		
18 to 24	4.74	11.28
25 to 29	4.67	8.45
30 to 34	5.55	9.67
35 to 39	6.02	8.37
40 to 44	6.51	9.02
45 to 49	7.58	8.14
50 to 54	9.68	10.02
55 to 59	11.02	8.58
60 to 64	11.59	8.21
65 to 69	10.91	6.29
70 to 74	8.41	4.64
75 to 79	5.98	3.52
80+	7.34	3.82
Sex		
Men	44.94	49.84
Women	55.06	50.16
Race/Ethnicity		
Non-Hispanic White	78.37	64.14
Black	7.98	11.59
Hispanic	6.37	15.32
Other	7.29	8.96
Education		
Less than HS	7.06	13.49
HS Grad	27.55	27.61
Some College	27.67	31.35
College Grad	37.72	27.55

Table 5.

Demographic Variables for Analytic Sample: White, Black and Hispanic BRFSS Respondents Aged 18-64 in 50 States and D.C., Unweighted or Weighted by Sampling Fractions (2012-2017).

BRFSS Analytic Sample 2012-2017		
	ALL 50 STATES & D.C.	
	Unweighted	**Weighted**
Sample Size	1,364,254	867,621,289
Sample Size, mean per year	227,376	144,603,548
Income (year), mean (95% CI)	$86,360.63 ($86,243.79-$86,477.47)	$82,663.57 ($82,426.04-$82,901.10)
	Unweighted, %	**Weighted, %**
FPL		
<100% FPL	11.78	15.79
100-138% FPL	7.3	8.1
139-400% FPL	38.6	37.4
>400% FPL	42.31	38.71
Age Group		
18 to 24	6.74	13.41
25 to 29	6.67	9.93
30 to 34	8.06	11.51
35 to 39	8.8	9.96
40 to 44	9.62	11
45 to 49	11.3	10.13
50 to 54	14.53	12.71
55 to 59	16.67	10.87
60 to 64	17.61	10.48
Sex (Fem)		
Men	45.88	51.85
Women	54.12	48.15
Race/Ethnicity		
Non-Hispanic White	81.57	68.35
Black	9.59	13.49
Hispanic	8.84	18.16
Education		
Less than HS	6.26	12.88
HS Grad	26.11	27.68
Some College	28.47	32.34
College Grad	39.15	27.1

Household Incomes. Mean household income for the analytic sample was $86,306.63 ($86,243.79- $86,577.47, CI) averaged over 2012-2017. In comparison, the national BRFSS sample's mean household income was $81,003.06 ($80,807.17- $81,198.96, CI). According to Census data found in Table V-1, the mean household income for all races from 2012-2017 was $91,618.17, about $10,00 more than the full national sample. A modest amount of the difference is likely due to the way we have imputed a continuous income figure using BRFSS categories. The analytic sample's mean income was about $5,000 dollars higher than the national BRFSS sample since it is restricted to working-age adults who generally earn higher incomes than older adults (65+). As of 2016, the median annual household income of the 65+ population was $39,823 dollars from all sources (Pension Rights Center, n.d.).

ACA Federal Poverty Level (FPL) Groups. The ACA coverage expansion provisions were expected to benefit the uninsured living between 100-400% FPL, which nationally represents 48% of the U.S. population (KFF, 2018). In our national BRFSS sample, 48.64% of respondents live between 100-400% FPL, which is very close to national population estimates. In the BRFSS national sample, 63% of individuals had incomes below 400% of the FPL. In the analytic sample, the percentage of respondents living between 100-400% FPL was only slightly smaller (45.5%). This reduction may be because whites and younger adults are a greater proportion of the analytic sample.

Age Groups. In the BRFSS unweighted survey responses, those under age 54 were underrepresented. Survey respondents tend to be older and more likely to participate in telephone surveys. By weighting the sample, the fraction of younger adults increased and older adults decreased, making the estimates closer to population estimates: 9% for adults 19-25; 12% for adults 26-34; 26% for adults 35-54; 13% for 55-64 and 16% for those 65+ as of 2017 (Kaiser

Family Foundation, 2018). Table 4 displays BRFSS national sample age estimates that differ slightly from population estimates due to different age groupings. In the analytic sample, the 65+ category is dropped, leading to greater representation of younger age groups.

Gender Groups. Representation of men and women in the BRFSS national sample was 49.84% and 50.16%, respectively. Using Census data, as of 2017, this ratio was 49% men to 51% women (KFF, 2018). Before dropping the non-reported incomes, the ratio of men to women in the BRFSS dataset was 48.66% to 51.34%, respectively.

Race/Ethnic Groups. According to KFF reports compared with BRFSS, the national and analytic population distributions by race/ethnicity as of 2017 were:

Table 6.

Racial/Ethnic Population Distributions by Data Source.

Data Source	White	Black	Hispanic	Other
KFF	61.0%	12.0%	18.0%	9.0%
BRFSS (national)	64.1%	11.6%	15.3%	9.0%
BRFSS (analytic)	68.3%	13.5%	18.2%	n/a

Greater proportions of minority populations are expected in the analytic sample as respondents aged 65+ were dropped- which consisted of a larger proportion of whites. Blacks and Hispanics tend to be younger populations. Weighting the analytic sample appears to reallocate most of the other race/ethnic groups to whites.

Education Groups. According to the U.S. Census Bureau's 2011 Current Population Survey, 12% of adults aged 25 years and older did not complete high school; whereas, 31% completed high school, 26% completed some college or an associate degree and 30% completed a bachelor's degree or higher (U.S. Census Bureau, n.d.). In the national BRFSS sample, 13.49%

of adults aged 18 and older did not complete high school; 27.61% completed high school; 31.31% completed some college; whereas, 27.55% completed a bachelor's degree or higher. The completion of degrees, especially in the bachelor's degree category (or higher) was slightly higher given the BRFSS sample includes years post 2011 and over time, data from the Census Bureau has shown that young workers in the U.S. are more likely than ever, to be college graduates. In fact, 40% of employed millennials, aged 25 to 29, have a bachelor's degree or higher (Graf, 2017).

Health Status Data. Tables 7 and 8 display results on health status variables for the national BRFSS and analytic samples.

Table 7.

Health Status Variables for National Sample: All BRFSS Respondents Aged 18 and Over, Unweighted or Weighted by Sampling Fractions (2012-2017).

National BRFSS Sample 2012-2017		
	Unweighted	**Weighted**
Sample Size	2,207,012	1,240,231,044
Sample Size, mean per year	367,835	206,705,174
BMI, mean (95% CI)	28.08 (28.07-28.09)	27.92 (27.91-27.94)
	Unweighted, %	**Weighted, %**
BMI		
Normal Weight (<25)	33.25	32.86
Overweight (25-29.9)	36.36	34.05
Obesity Class 1 (30-34.9)	18.62	17.18
Obesity Class 2 (35-39.9)	7.16	6.63
Obesity Class 3 (>40)	4.61	9.28
Exercise in last 30 days		
No	26.89	27.66
Yes	73.11	72.34
Diabetes Risk		
No/Low Risk	54.98	53.68
High Risk	32.13	35.86
Diabetes	12.89	10.47
Gestational Diabetes		
No	99.19	99.09
Yes	0.81	0.91
Pre-diabetes Diagnosis		
No	98.3	98.39
Yes	1.7	1.61
Diabetes Diagnosis		
No	87.11	89.53
Yes	12.89	10.47
Self-Reported Health		
Healthy	81.45	82.22
Not Healthy	18.55	17.78
Chronic Disease Count		
0	69.48	75.31
1	22.39	18.9
2	6.16	4.44
3	1.62	1.11
4	0.32	0.22
5	0.03	0.02

Table 8.

Health Status Variables for Analytic Sample: All White, Black and Hispanic BRFSS Respondents Aged 18-64, Unweighted or Weighted by Sampling Fractions (2012-2017).

BRFSS Analytic Sample 2012-2017		
	ALL 50 STATES & D.C.	
	Unweighted	**Weighted**
Sample Size	1,364,254	867,621,289
Sample Size, mean per year	227,376	144,603,548
BMI, mean (95% CI)	28.33 (28.32-28.34)	28.14 (28.12-28.16)
	Unweighted, %	**Weighted, %**
BMI		
Normal Weight (<25)	32.81	33.78
Overweight (25-29.9)	35.25	35.28
Obesity Class 1 (30-34.9)	18.87	18.48
Obesity Class 2 (35-39.9)	7.69	7.4
Obesity Class 3 (>40)	5.38	5.05
Exercise in last 30 days		
No	24.4	25.62
Yes	75.6	74.38
Diabetes Risk		
No/Low Risk	56.66	57.31
High Risk	34.38	34.95
Diabetes	8.96	7.75
Gestational Diabetes		
No	99.00	98.97
Yes	1.00	1.03
Pre-diabetes Diagnosis		
No	98.7	98.68
Yes	1.3	1.32
Diabetes Diagnosis		
No	91.04	92.25
Yes	8.96	7.75
Self-Reported Health		
Healthy	84.15	83.84
Not Healthy	15.85	16.16
Chronic Disease Count		
0	77.45	80.08
1	17.99	16.29
2	3.58	2.87
3	0.82	0.63
4	0.16	0.12
5	0.02	0.02

BMI. Weighted 6-year mean BMI in the national BRFSS sample was 27.92kg/m^2. According to the National Health and Nutrition Examination Survey (NHANES), the average BMI of an adult male in 2010 was 26.6kg/m^2, almost identical to that for females (Centers for Disease Control and Prevention, n.d.) This estimate was 5% less than the BRFSS national estimate which may be due to rising BMIs among the population over the 2010-2017 period. Another consideration was that NHAMES BMI was measured by a well-defined protocol; whereas BRFSS was self-reported, leading to variation. In the analytic sample, the average BMI was 28.14kg/m^2. BMI also is presented in 5 categories with the majority of respondents in the national BRFSS sample in the 25-29.9 kg/m^2 range. One third in the national BRFSS sample and 30% in the analytic sample were obese with BMIs greater than 30 g/m^2.

Exercise. In both the national and analytic samples, almost 3/4^{ths} of respondents reported exercise in the last 30 days. To note, the 2008 federal physical activity guidelines recommended that adults participate in either 150 minutes of moderate-intensity aerobic exercise or 75 minutes of vigorous exercise each week. Unfortunately, the BRFSS does not provide this kind of detail regarding exercise. A recent study found that only 23% U.S. adults aged 18-64 met the guidelines in 2010-2015 (Blackwell & Clarke, 2018). The exercise variable was used in this analysis as a second filter besides BMI to identify someone as high risk for diabetes. Almost one-quarter of individuals reported no exercise. As exercise tends to be overreported, it is possible that our estimate of the high-risk group is not well measured.

Diabetes. According to the American Diabetes Association (ADA), in 2015, 84.1 million Americans aged 18 and older had prediabetes (ADA, 2018). This number, divided by the 2010 U.S. adult population, gives a rough estimate of 36% of adults aged 18 and older who have pre-diabetes. This is a low estimate as there has been growth in the population since 2010. In the national BRFSS sample, the percentage identified at high risk for diabetes was nearly identical (35.86%). In the national BRFSS sample, those with diabetes accounted for 10.47% of the sample, compared with 9.4% reported by the ADA in 2015 (ADA, 2018). In the analytic sample, the high-risk group accounted for 34.95% of the high-risk population, and people with diabetes accounted for 7.75% of the population. The high-risk group included individuals who were obese, individuals who reported gestational diabetes, individuals who are overweight and did not exercise and individuals with self-reported prediabetes. Of all high-risk subgroups, those with prediabetes are of great interest as these adults have blood glucose levels nearing a diabetes diagnosis.

The potential for underreporting prediabetes using a specific BRFSS question is severe. In the BRFSS national sample, only 1.61% of individuals reported being told they had prediabetes. According to the ADA, this percentage should be about 36% of the adult population (based primarily on elevated blood glucose or A1c levels). Yet, the report of an actual diabetes diagnosis in the BRFSS national sample is close to national estimates. This discrepancy may be a sign that providers are not frequently warning patients of their high-risk status.

Self-Reported Health. In the national BRFSS sample, 82.22% of respondents reported being healthy (good, very good, or excellent health), compared to 83.84% of respondents in the analytic sample. The slightly higher report of being healthy among those in the analytic sample was most likely due to the sample being younger and offset to some unknown degree by greater minority representation.

Chronic Conditions. In the national BRFSS dataset, a majority of respondents (75.3%) reported no chronic disease, with the percentage of respondents who reported additional chronic diseases quickly declining after reports of 2 chronic diseases (4.4%). These proportions were less than national rates (45%) of all Americans have at least one chronic disease (National Association of Chronic Disease Directors, n.d.) since BRFSS reports on a limited number of chronic conditions. The analytic sample showed a slightly lower percentage with two-or-more chronic conditions than in the national BRFSS sample (2.87% vs. 4.4%), which was expected given the exclusion of the over-65 population in the former and limiting the variable to more serious conditions that might lead to insurance and a PCP visit.

State ACA Expansion Status & PCP Supply. Tables 9 and 10 display the distribution of the national BRFSS and analytic samples regarding Medicaid expansion and per capita primary care supply (PCP) over 6 years.

Table 9.

State-Specific Variables for National Sample: All BRFSS Respondents Aged 18 and Older, Unweighted or Weighted by Sampling Fractions (2012-2017).

National BRFSS Sample 2012-2017		
	Unweighted	**Weighted**
Sample Size	2,207,012	1,240,231,044
Sample Size, mean per year	367,835	206,705,174
	Unweighted, %	**Weighted, %**
Expansion Status		
Non-expansion	39.51	37.76
Medicaid Expansion	60.49	62.24
PCP Supply 2008		
Adequate Supply	71.77	70.27
Low Supply	28.23	29.73

Table 10.

State-Specific Variables for Analytic Sample: All White, Black and Hispanic BRFSS Respondents Aged 18-64, Unweighted or Weighted by Sampling Fractions (2012-2017).

BRFSS Analytic Sample 2012-2017		
	ALL 50 STATES & D.C.	
	Unweighted	**Weighted**
Sample Size	1,364,254	867,621,289
Sample Size, mean per year	227,376	144,603,548
	Unweighted, %	**Weighted, %**
Expansion Status		
Non-Expansion	39.88	38.77
Medicaid Expansion	60.12	61.23
PCP Supply 2008		
Adequate Supply	71.67	69.17
Low Supply	28.33	30.83

Expansion states were classified as states that expanded Medicaid by 2017 (Figure 5). Refer to Appendix U for a list of Medicaid expansion and non-expansion states included in this analysis. Respondents living in Medicaid expansion states accounted for 62.24% of the weighted national sample and 60.12% in the analytic sample. Roughly 7-in-10 respondents in both samples lived within a state that had an adequate supply of primary care providers. Ten out of 19 non-expansion states were classified as low supply: Alabama, Georgia, Idaho, Mississippi, North Carolina, Oklahoma, South Carolina, Texas, Utah and Wyoming. Seven out of 31 Medicaid expansion states and D.C. were classified as low supply: Alaska, Arizona, Arkansas, Indiana, Kentucky, Louisiana, and Nevada (Cunningham, 2011). Figure 6 is a U.S. map demonstrating PCP supply status. Table with expansion dates found in Table U-1. Table with PCP supply and expansion status data in Table U-1.

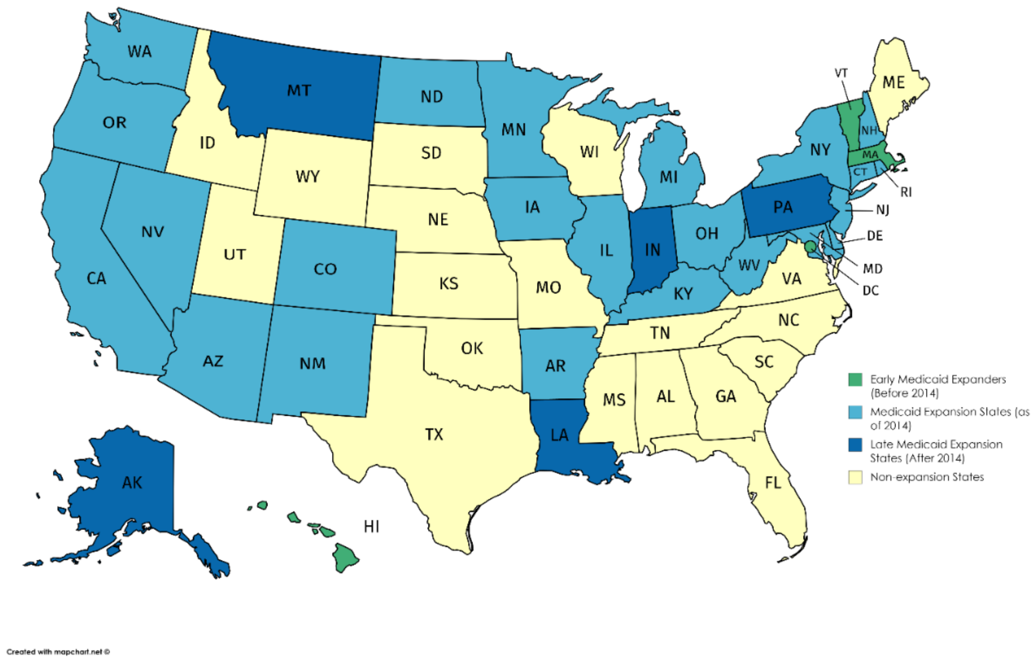

Figure 5. BRFSS Map of U.S. 50 states and D.C. included in the Analysis as Medicaid Expansion and Non-expansion States.

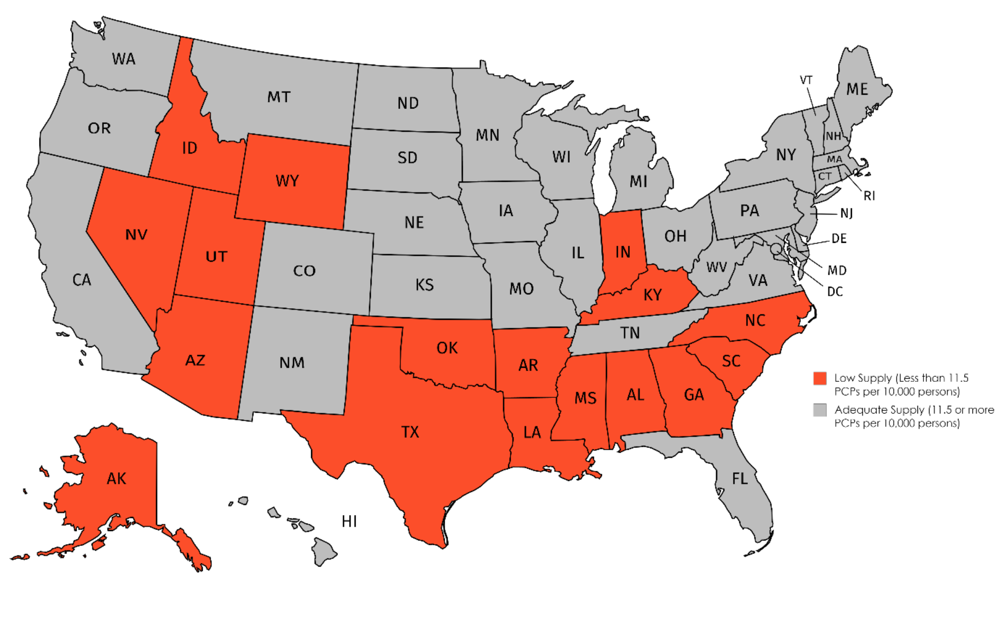

Figure 6. BRFSS Map of U.S. 50 States and D.C. Demonstrating PCP Supply Status.

Outcomes. Tables 11 and 12 display the distribution of the national BRFSS and analytic samples.

Table 11.

Outcome Variables for National Sample: All BRFSS Respondents Aged 18 and Older, Unweighted or Weighted by Sampling Fractions (2012-2017).

National BRFSS Sample 2012-2017		
	Unweighted	**Weighted**
Sample Size	2,207,012	1,240,231,044
Sample Size, mean per year	367,835	206,705,174
	Unweighted, %	**Weighted, %**
Insurance		
No insurance	8.89	14.27
Yes, has insurance	91.11	85.73
Provider		
No provider	15.44	22.45
Yes, has provider	84.56	77.55
Check up 1 year		
No checkup in past year	27.01	31.38
Yes, checkup in past year	72.99	68.62

Table 12.

Outcome Variables for Analytic Sample: All White, Black and Hispanic BRFSS Respondents Aged 18-64, Unweighted or Weighted by Sampling Fractions (2012-2017).

BRFSS Analytic Sample 2012-2017		
	ALL 50 STATES & D.C.	
	Unweighted	**Weighted**
Sample Size	1,364,254	867,621,289
Sample Size, mean per year	227,376	144,603,548
BMI, mean (95% CI)	28.33 (28.32-28.34)	28.14 (28.12-28.16)
	Unweighted, %	**Weighted, %**
Insurance		
No insurance	12.44	16.84
Yes, has insurance	87.56	83.16
Provider		
No provider	19.62	25.65
Yes, has provider	80.38	74.35
Check up 1 year		
No checkup in past year	32.9	35.38
Yes, checkup in past year	67.1	64.62

Insurance Coverage. The uninsured accounted for 14.27% of the BRFSS national sample and 16.84% of the analytic sample.

Primary Care Access. The last two outcomes variables, primary care provider and checkup in the past year are two variables that are used to measure health care access. In the national sample, 22.45% of respondents reported no health care provider; whereas 25.65% in the analytic sample reported no provider. In the national sample, 31.38% of respondents reported no checkup in the past year; whereas, 35.38% of respondents reported no checkup in the past year. According to CDC data from the 2016 National Health Interview Survey, 84.6% of adults reported they had contact with a health care professional in the past year (CDC, 2017), implying that 15% did not have contact with a PCP.

Descriptive Statistics of Medicaid Expansion vs. Non-expansion States

In non-expansion states, the insurance subsidy was available for those living between 100-400% FPL. In expansion states, not only was the insurance subsidy available to the same income groups, but Medicaid was also available to those living between 100-138% FPL. In this section, more complex analytic tables are presented that differentiate among four income groups within Medicaid expansion and non-expansion states. The four income groups included: (1) <100% FPL; (2) 100-138% FPL; (3) 139-400% FPL; and (4) >400% FPL. These distinct income groups were chosen in order to differentiate where the greatest gains in insurance and health care access occurred among white, black and Hispanic individuals between the ages of 18-64. Separate tables for demographic variables, health status variables, states-specific variables and outcomes are presented- first for non-expansion states, then Medicaid expansion states- then by income and race/ethnicity within each state group. Pearson chi-squared tests (x^2) assess statistical differences in the distribution of multi-valued categorical variables and the independent groups of interest (i.e. expansion status and/or income groups). In addition, tests were run to test the population means between two groups (e.g., sex), as appropriate.

The weighted proportion of BRFSS respondents residing in the 19 non-expansion states as of 2017 was 56,057,274 white, black and Hispanic adults aged 18-64 (39% of the analytic sample). The weighted proportion of BRFSS respondents residing in the 32 states[3] that opted to expand Medicaid by the end of 2017 was 88,546,274 white, black and Hispanic adults aged 18 to 64 (or 60.79% of the analytic sample) (**Table 13**). As a geographic reference (Figure 5), 89% of adults living in non-expansion states as of 2017 resided in the South; with 7% in the Midwest;

[3] The 32 states include states that expanded after 2014 plus the 4 pre-ACA expanders that are dropped in subsequent analyses.

3% in the West and less than 1% in the Northeast region of the United States (Garfield, Damico & Orgera, 2018).

Table 13.

Demographic Variables in Analytic Sample by Expansion Status: All White, Black and Hispanic BRFSS Respondents Aged 18-64 Living in 19 Non-expansion Versus 32 Medicaid Expansion States, Weighted by Sampling Fractions (2012-2017).

BRFSS Analytic Sample 2012-2017				
	Non-expansion States	**Medicaid Expansion States**	**X^2 Value**	**P Value**
Sample Size (unweighted)	544,122	820,132		
Population Size (weighted)	336,343,646	531,277,643		
Population Size, mean	56,057,274	88,546,274		
FPL	**Weighted (%)**	**Weighted (%)**	4,451.01	<0.001
<100% FPL	16.03	15.63		
100-138% FPL	8.67	7.75		
139%-400% FPL	40.01	35.81		
>400% FPL	35.29	40.81		
Age Group			116.15	<0.001
18 to 34	34.92	34.81		
35 to 44	21.35	20.70		
45 to 54	22.70	22.93		
55 to 64	21.02	21.56		
Sex			3.1	0.3746
Male	51.76	51.91		
Female	48.24	48.09		
Race/Ethnicity			0.0001	<0.001
Non-Hispanic White	65.75	69.99		
Black	17.21	11.14		
Hispanic	17.04	18.86		
Education			476.66	<0.001
Less than HS	12.92	12.85		
HS Grad	28.11	27.41		
Some College	32.90	31.99		
College Grad	26.07	27.75		

Demographic Variables by Expansion Status

In this section we show expansion and non-expansion states by demographic characteristic. It should be remembered that the analytic sample runs across the entire 2012-2017 period and, therefore, masks to some extent any shifts in demographic variables after the ACA insurance policies came into effect.

Income groups, Overall. Overall, white, black and Hispanic adults aged 18 to 64 reported higher household incomes within Medicaid expansion states (40.81% in Medicaid expansion states living >400% FPL when compared to 35.29% in non-expansion states living >400% FPL) (**Table 13**). In non-expansion states, the ratio of blacks to Hispanics was almost 1:1; whereas in Medicaid expansion states, there were about 60% more Hispanics than blacks in the expansion group (**Table 13**).

Race/Ethnicity by Income Group. To gain a better understanding of race-income differences, separate tables were created by expansion status.

Theory predicts that most of the effect of the ACA in narrowing the gap between whites, blacks and Hispanics will come from the negative correlation between minority status and household income. Tables 14-21 present the BRFSS race-ethnic characteristics of expansion and non-expansion states within four ACA-related income groups. The row, Proportions by income group, %, gives the race percentages within each income group. For example, 31.82% Hispanics are of low-income in non-expansion states. The All Races column shows 16% of all non-expansion respondents were below 100% FPL, 9% were between 100-138% FPL 40% between 139-400% FPL and 35% of income above 400% FPL (**Table 14**). A higher proportion of high-income earners resided within Medicaid expansion states (41%), when compared to residents in non-expansion states (35%) (**Table 15**). The Proportions by race only, % row give the race percentages within an income group. For example, 29.94% of Hispanics in non-expansion states were in the low-income group versus only 18.52% in the high-income group. This means that a Hispanic person was 62% more likely to be in the low-than in the high-income group.

Percentages by income-race-characteristic within each cell beginning with Age Group sum to 100% by characteristic, e.g., age and education. For example, 40.81% of all low-income whites were aged 18-34, compared with 44.04% of all low-income Hispanics. Multiplying each cell percentage by the fraction of the sample in the income-race group converts the cell percents to shares in the All Races column. For example, 42.17% of low-income people in non-expansion states were aged 18-34 versus 14.79% aged 55-64. This distribution by age is similar in expansion states.

Table 14.

Demographic Variables by Percent of FPL (Income) and Race for BRFSS Respondents in Non-expansion States (2012-2017).

	NON-EXPANSION STATES															
	Low Income (<100% FPL)				Overlap Low Income (100-138% FPL)				Moderate Income (139-400% FPL)				High Income (>400% FPL)			
	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races
Sample Size, number	40,105	15,902	11,648	67,655	30,029	7,712	5,555	43,296	182,690	26,908	16,045	225,643	188,146	11,580	7,802	207,528
Population size, weighted	22,700,248	14,066,143	17,159,958	53,926,349	15,220,820	6,405,292	7,530,351	29,156,463	87,658,213	24,909,236	22,001,482	134,568,931	95,562,394	12,516,315	10,613,194	118,691,903
Population size, mean/yr	3,783,375	2,344,357	2,859,993	8,987,725	2,536,803	1,067,549	1,255,059	4,859,411	14,609,702	4,151,539	3,666,914	22,428,155	15,927,066	2,086,053	6,940	19,781,984
Proportions by income group, %	42.09	26.08	31.82	16.03	52.20	21.97	25.83	8.67	65.14	18.51	16.35	40.01	80.51	10.55	8.94	35.29
Proportions by race only, %	10.27	24.30	29.94		6.88	11.06	13.14		39.64	43.02	38.39		43.21	21.62	18.52	
Age Group																
18 to 34	40.81	42.08	44.04	42.17	37.73	36.25	40.57	38.14	36.51	37.37	46.41	38.29	25.76	28.15	37.17	27.03
35 to 44	21.18	22.67	27.45	23.57	19.42	20.44	25.88	21.31	17.23	20.41	20.03	18.28	22.97	28.08	26.66	23.84
45 to 54	20.69	20.34	17.15	19.47	20.42	21.47	19.58	20.43	20.83	22.13	18.96	20.76	27.45	26.55	22.55	26.92
55 to 64	17.31	14.92	11.35	14.79	22.43	21.85	13.97	20.12	25.43	20.09	14.60	22.67	23.82	17.22	13.62	22.21**
Sex																
Female	58.58	63.54	55.75	58.98	52.14	55.97	46.68	51.57	47.47	50.39	40.65	46.89	44.49	44.69	39.71	44.08**
Education																
Less than HS	26.88	25.96	52.02	34.64	17.81	16.94	39.20	23.14	8.18	8.56	24.48	10.92	2.57	2.47	5.46	2.82
HS Grad	34.82	40.59	28.15	34.20	37.28	39.91	32.43	36.60	32.50	33.98	31.00	32.62	18.26	16.24	19.30	18.14
Some College	30.91	27.99	16.06	25.42	34.66	34.80	22.21	31.47	38.11	38.85	30.58	37.01	31.59	32.80	34.56	31.99
College Grad	7.39	5.46	3.77	5.73	10.26	8.35	6.16	8.78	21.21	18.61	13.43	19.46	47.58	48.49	40.68	47.06**

NOTES

1. Analytic sample (unweighted n=544,122) : all BRFSS respondents aged 18-64 who are white, Hispanic or black living in the U.S. non-expansion states, variables weighted by sampling fractions
2. Non-expansion states: 19 states that did not expand Medicaid by end of 2017
3. Proportions for variables in first column (i.e. age group, etc.) have weighted proportions displayed for each racial/ethnic group. Adding each racial/ethnic column per category is equal to 100
4. Proportions are rounded and may not add up to 100
5. Pearson Chi-square tests performed to measure assess differences between income group means by characteristic in left column (** $p<0.001$)

Table 15.

Demographic Variables by Percent of FPL (Income) and Race for BRFSS and Respondents in Medicaid Expansion States (2012-2017).

	MEDICAID EXPANSION STATES															
	Low Income (<100% FPL)				Overlap Low Income (100-138% FPL)				Moderate Income (139-400% FPL)				High Income (>400% FPL)			
	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races
Sample Size, number	55,532	14,716	22,779	93,027	39,002	7,221	10,132	56,355	244,972	27,466	29,153	301,591	332,394	19,302	17,463	369,159
Population size, weighted	34,997,816	14,482,214	33,572,478	83,052,507	21,754,843	6,334,810	13,059,679	41,149,333	132,302,731	22,927,664	35,028,803	190,259,198	182,812,001	15,442,469	18,562,135	216,816,605
Population size, mean/yr	5,832,969	2,413,702	5,595,413	13,842,085	3,625,807	1,055,802	2,176,613	6,858,222	22,050,455	3,821,277	5,838,134	31,709,866	30,468,667	2,573,745	3,093,689	36,136,101
Proportions by income group, %	42.14	17.44	40.42	15.63	52.87	15.39	31.74	7.75	69.54	12.05	18.41	35.81	84.32	7.12	8.56	40.81
Proportions by race only, %	9.41	24.47	33.50		5.85	10.70	13.03		35.58	38.74	34.95		49.16	26.09	18.52	
Age Group																
18 to 34	43.49	42.47	45.35	44.06	38.39	37.82	41.92	39.42	35.63	36.70	45.76	37.62	26.60	27.29	41.51	27.92
35 to 44	19.09	21.96	26.45	22.57	18.82	21.24	25.44	21.30	16.69	20.35	20.46	17.82	21.97	24.75	24.71	22.40
45 to 54	20.47	19.48	16.94	18.87	20.19	20.28	19.11	19.86	21.16	21.89	19.58	20.96	27.39	27.14	20.69	26.80
55 to 64	16.95	16.10	11.26	14.50	22.59	20.66	13.54	19.42	26.52	21.05	14.20	23.59	24.04	20.82	13.09	22.88**
Sex																
Female	56.88	58.22	55.93	56.73	51.81	54.59	47.93	51.00	47.93	51.31	40.99	47.06	45.45	46.61	40.71	45.13**
Education																
Less than HS	23.11	26.72	55.31	36.75	15.62	17.56	45.50	25.40	7.26	9.28	27.17	11.17	2.43	2.76	6.23	2.78
HS Grad	36.18	39.67	26.17	32.74	37.35	39.12	29.41	35.10	34.21	32.37	31.19	33.43	18.50	16.98	21.38	18.64
Some College	32.05	28.04	15.69	24.74	35.55	34.17	20.82	30.66	37.08	40.95	30.48	36.33	30.37	34.46	36.87	31.21
College Grad	8.66	5.57	2.84	5.77	11.48	9.15	4.28	8.84	21.45	17.40	11.16	19.07	48.71	45.80	35.52	47.37**

NOTES

1. Analytic sample (unweighted n=820,132): all BRFSS respondents aged 18-64 who are white, Hispanic or black living in the U.S. Medicaid expansion states, weighted by sampling fractions
2. Expansion states: 32 states that opted to expand Medicaid by the end of 2017
3. Proportions for variables in first column (i.e. age group, etc.) have weighted proporitions displayed for each racial/ethnic group. Adding each racial/ethnic column per category is equal to 100
4. Proportions are rounded and may not add up to 100
5. Pearson Chi-square tests performed to measure assess differences between income group means by characteristic in left column (** p<0.001)

It is apparent that blacks and Hispanics made up greater proportions of the low-income groups. (See Proportions by race only rows in **Tables 14 and 15**). In the non-expansion group, Hispanics reported the lowest incomes, with 30% being of low-income, when compared to 10% of whites. These proportions are similar in the Medicaid expansion low-income group. In the moderate-income group, there are similar proportions of whites, blacks and Hispanics in the non-expansion and Medicaid expansion groups. In the high-income groups in both state groups, whites make up by far the largest percentage (~80%) when compared to blacks only (~9%) or Hispanics only (~9%).

The non-expansion group had greater proportions of blacks in the low income and overlap low income groups (35.35%) than Hispanics (15.50%).[4] Whereas, the Medicaid expansion group had a greater proportion of Hispanics (46.53%) in the low income and overlap income group than blacks (35.17%).[5] Whites make up the majority within all income groups in both non-expansion and Medicaid expansion states. Slightly more low-income whites were found within non-expansion states (17.15%) than Medicaid expansion states (15.26%).[6]

To summarize, greater proportions of blacks and Hispanics were found in the low-income non-expansion group and Medicaid expansion group. In both groups, higher proportions of Hispanics reported lower incomes (<400% FPL), 81% in both the non-expansion and Medicaid expansion group. Income distribution differences between Medicaid expansion and non-expansion states were found to be statistically significant (p<0.001) (**Table 13**).

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[4] Svy weighted: 3,411,906/9,649,498= 35.35% blacks in non-expansion states; 4,115,052/26,550,147=15.50% Hispanics in non-expansion states.

[5] Svy weighted: 3,469,504/9,864,526= 35.17% blacks in expansion states; 7,772,026/16,703,849= 46.53% Hispanics in expansion states.

[6] Svy weighted: 6,320,178/36,856,946= 17.15% whites in non-expansion states; 9,458,776/61,977,898 = 15.26% whites in expansion states.

Age group. Across income groups, young adults (18-34) in the non-expansion and Medicaid expansion groups made up the greatest proportions within all income groups, about 35% in each group (**Table 13**). The share of persons aged 18-34 declined systematically in higher income groups. Age distribution differences among the four income groups within non-expansion and Medicaid expansion states were found to be statistically significant ($p<0.001$) (**Tables 14 and 15**).

Between Medicaid expansion and non-expansion states, the number of young adults living 100-138% FPL was relatively similar (40% vs. 38%, respectively). Differences in the distribution of age between Medicaid expansion and non-expansion states was statistically significant ($p<0.001$) (**Table 13**).

Sex. Overall, males and females have equal proportions within each expansion group (**Table 13**). However, in the non-expansion states, women made up a greater proportion of the low-income groups for each race/ethnic group. A greater proportion of black women were low income when compared with white women and Hispanic women (**Table 14**). Black women also made up a greater proportion of low-income women in Medicaid expansion states, when compared to white or Hispanic women (**Table 15**). Interesting to note, Hispanic men made up the majority within the 100-138% FPL group in both non-expansion (53%) and Medicaid expansion states (52%). Sex differences between Medicaid expansion and non-expansion states were not statistically significant ($p=0.3746$) (**Table 13**). Sex distribution differences among the four income groups within non-expansion and Medicaid expansion states were found to be statistically significant ($p<0.001$) (**Tables 14** and **15**).

Education. The percentage of college graduates is nearly equal by expansion status, although expansion states have a higher percentage with incomes >400% FPL. Medicaid expansion states had slightly more college graduates than non-expansion states (**Table 13**). College graduates made up the largest proportions in the high-income group representing all races (47% in both non-expansion and Medicaid expansion states). Hispanics had the lowest level of educational attainment within the low-income groups, with 52% of Hispanics having less than a HS diploma in non-expansion states (**Table 14**) and 55% in Medicaid expansion states (**Table 15**). To note, Hispanics in Medicaid expansion states reported lower levels of education when compared to those living in non-expansion states- possibly due to a higher number of immigrants in the expansion states. The majority of low-income whites and blacks reported at least a high school degree or higher in the low-income non-expansion group. This was similar to the proportions in the Medicaid expansion group. Differences in the distribution of educational levels between expansion and non-expansion groups was statistically significant ($p<0.001$). Differences in education distributions among the four income groups within non-expansion and Medicaid expansion states were statistically significant ($p<0.001$) (**Tables 14** and **15**).

Health Status Variables

BMI. Overall, the Medicaid expansion group had a marginally greater proportion of adults (35% vs. 32%) who were of normal weight (BMI < 25) (**Table 16**).

Table 16.

Health Status Variables in Analytic Sample by Expansion Status: All White, Black and Hispanic BRFSS Respondents Aged 18-64 Living in Non-expansion versus Medicaid Expansion States, Weighted by Sampling Fractions (2012-2017).

BRFSS Analytic Sample 2012-2017				
	Non-expansion States	**Medicaid Expansion States**	**X^2 Value**	**P Value**
Sample Size (unweighted)	544,122	820,132		
Population Size (weighted)	336,343,646	531,277,643		
Population Size, mean	56,057,274	88,546,274		
BMI			1,244.14	<0.001
Normal Weight (<25)	32.46	34.62		
Overweight (25-29.9)	35.06	35.42		
Obesity Class 1 (30-34.9)	19.12	18.08		
Obesity Class 2 (35-39.9)	7.86	7.11		
Obesity Class 3 (>40)	5.50	4.77		
Diabetes Risk			1,181.17	<0.001
No/Low Risk	55.58	58.40		
High Risk	36.05	34.25		
Diabetes	8.37	7.35		
Pre-diabetes Diagnosis			22.77	<0.05
No	98.74	98.65		
Yes	1.26	1.35		
Self-Reported Health			340.17	<0.001
Healthy	83.11	84.31		
Not Healthy	16.89	15.69		
			T Value	**P Value**
No. Chronic Disease			-1.01	0.312
0	80.33	79.92		
1	15.79	16.60		
2	3.04	2.77		
3	0.66	0.60		
4	0.15	0.10		
5	0.05	0.01		

Across all races/ethnicities, there were low proportions of individuals at a normal weight. The prevalence of obesity in non-expansion states is 32.5 per 100 respondents for all races, compared to 30 per 100 respondents for all races in Medicaid expansion states (**Table 16**). Prevalence was calculated using the formula below:

$$\text{Prevalence} = \frac{\text{Number of people with obesity}}{\text{Number of people measured}} \times 100$$

Among racial/ethnic subgroups in the expansion groups, blacks and Hispanics had greater proportions of overweight or obese respondents in the low- and moderate-income groups in non-expansion and Medicaid expansion states (**Tables 17** and **18**). Even though there were lower proportions of respondents within the Obesity Class 2 or greater (BMI$\geq$ 35) groups than the other BMI categories, a higher proportion of blacks were found to have greater prevalence of obesity when compared to whites or Hispanics. However, as income increased, a reduction in the proportion of respondents with obesity declined. Differences in BMI among the four income groups within non-expansion and Medicaid expansion states were found to be statistically significant ($p<0.001$) (**Tables 17** and **18**).

Interesting to note, as income increased for blacks, the proportion of respondents that reported being obese (BMI 30 or greater) was consistently high for this demographic, when compared to whites and Hispanics. Generally speaking, as income levels increased, obesity levels decreased for all racial/ethnic groups. BMI differences between Medicaid expansion and non-expansion states were statistically significant ($p<0.001$) (**Table 16**).

Table 17.

Health Status Variables by Percent of FPL (Income) and Race for BRFSS Respondents in Non-expansion States (2012-2017)

	NON-EXPANSION STATES															
	Low Income (<100% FPL)				Overlap Low Income (100-138% FPL)				Moderate Income (139-400% FPL)				High Income (>400% FPL)			
	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races
Sample Size, unweighted	40,105	15,902	11,648	67,655	30,029	7,712	5,555	43,296	182,690	26,908	16,045	225,643	188,146	11,580	7,802	207,528
BMI																
Normal Weight (<25)	35.44	26.39	27.53	30.56	34.45	26.45	27.52	30.90	34.41	26.13	29.93	32.15	35.71	24.07	30.83	34.05
Overweight (25-29.9)	28.27	27.37	35.99	30.49	30.82	31.45	37.01	32.56	34.12	34.04	38.11	34.76	37.85	39.25	38.96	38.09
Obesity Class 1 (30-34.9)	17.83	21.02	22.20	20.05	17.70	21.20	22.02	19.59	18.55	21.64	20.85	19.50	17.39	22.82	19.50	18.15
Obesity Class 2 (35-39.9)	9.50	11.83	8.40	9.76	9.39	10.17	7.76	9.14	7.81	10.18	7.46	8.19	5.91	8.57	7.25	6.31
Obesity Class 3 (>40)	8.96	13.39	5.88	9.14	7.64	10.72	5.69	7.81	5.10	8.01	3.65	5.41	3.15	5.29	3.45	3.40**
Diabetes Risk																
No/Low Risk	49.12	39.25	44.83	45.18	51.09	43.10	45.37	47.86	57.01	46.60	53.20	54.46	65.22	52.99	60.11	63.48
High Risk	38.92	46.80	44.45	42.73	37.49	43.17	44.38	40.52	35.09	42.24	38.37	36.95	29.71	37.56	33.71	30.90
Diabetes	11.96	13.95	10.72	12.08	11.42	13.73	10.25	11.63	7.90	11.16	8.43	8.59	5.07	9.45	6.18	5.63**
Pre-diabetes Diagnosis																
Yes	1.93	1.62	1.68	1.77	1.64	1.56	1.45	1.57	1.29	1.51	1.21	1.32	0.87	1.07	0.71	0.88**
Self-Reported Health																
Not Healthy	38.08	33.21	32.17	34.93	30.57	27.99	28.54	29.48	15.24	16.88	19.61	16.25	5.91	7.93	8.03	6.31**
Chronic Disease Count																
0	63.30	70.50	85.05	72.10	67.97	72.92	84.35	73.29	78.83	80.00	86.89	80.37	85.42	85.98	88.44	85.75
1	25.44	22.09	11.58	20.16	23.15	20.70	12.60	19.89	17.05	16.62	11.30	16.03	12.89	11.86	10.20	12.54
2	8.03	5.65	2.44	5.63	6.33	4.77	2.64	5.03	3.33	2.80	1.46	2.93	1.48	1.95	1.27	1.51
3	2.52	1.41	0.67	1.64	2.00	1.34	0.28	1.41	0.64	0.47	0.27	0.55	0.18	0.15	0.04	0.17
4	0.65	0.34	0.10	0.43	0.41	0.27	0.13	0.30	0.14	0.10	0.06	0.12	0.03	0.01	0.02	0.03
5	0.06	0.10	0.05	0.04	0.14	0.00	0.00	0.08	0.01	0.02	0.00	0.01	0.00	0.00	0.03	0.01**

NOTES

1. Analytic sample (unweighted n=544,122): all BRFSS respondents aged 18-64 who are white, Hispanic or black living in the U.S. non-expansion states, variables weighted by sampling fractions
2. Non-expansion states: 19 states that did not expand Medicaid by end of 2017
3. Chronic diseases include: Cardiovascular, Respiratory, Stroke, Kidney and Cancer
4. Proportions for variables in first column (i.e. age group, etc.) have weighted proportions displayed for each racial/ethnic group. Adding each race value across income group is equal to 100
5. Proportions are rounded and may not add up to 100
6. Pearson Chi-square tests performed to measure assess differences between income group means by characteristic in left column (** p<0.001); T-test for chronic disease (**p<0.001)

Table 18.

Health Status Variables by Percent of FPL (Income) and Race for BRFSS Respondents in Medicaid Expansion States (2012-2017).

	MEDICAID EXPANSION STATES															
	Low Income (<100% FPL)				Overlap Low Income (100-138% FPL)				Moderate Income (139-400% FPL)				High Income (>400% FPL)			
	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races
Sample Size, unweighted	55,532	14,716	22,779	93,027	39,002	7,221	10,132	56,355	244,972	27,466	29,153	301,591	332,394	19,302	17,463	369,159
BMI																
Normal Weight (<25)	38.06	29.41	28.56	32.71	35.76	29.36	28.47	32.46	35.67	27.40	29.85	33.60	37.97	25.01	33.41	36.65
Overweight (25-29.9)	27.90	30.35	36.73	31.89	30.76	30.41	38.63	33.20	33.78	34.86	39.71	35.00	37.37	39.39	37.88	37.56
Obesity Class 1 (30-34.9)	16.99	19.12	21.12	19.03	17.42	20.86	21.32	19.19	17.90	20.81	19.67	18.58	16.44	22.42	18.85	17.07
Obesity Class 2 (35-39.9)	8.78	10.64	7.98	8.79	8.40	10.17	7.45	8.37	7.57	9.38	6.63	7.61	5.48	7.96	6.92	5.78
Obesity Class 3 (>40)	8.27	10.47	5.61	7.58	7.66	9.20	4.14	6.78	5.07	7.55	4.15	5.20	2.74	5.22	2.94	2.93**
Diabetes Risk																
No/Low Risk	52.51	43.33	45.12	47.92	52.91	44.33	48.10	50.07	58.57	48.05	53.18	56.31	67.38	53.42	60.84	65.83
High Risk	37.22	44.50	43.93	41.20	36.97	43.14	41.68	39.41	33.96	41.29	38.66	35.71	28.15	38.33	33.47	29.33
Diabetes	10.27	12.17	10.95	10.88	10.12	12.53	10.22	10.52	7.47	10.66	8.16	7.98	4.47	8.25	5.68	4.85**
Pre-diabetes Diagnosis																
Yes	1.69	2.16	2.33	2.03	1.45	2.09	2.73	1.95	1.24	1.63	2.35	1.49	0.76	1.39	1.38	0.86**
Self-Reported Health																
Not Healthy	33.22	30.86	35.15	33.59	27.76	27.06	29.93	28.34	14.74	17.38	20.03	16.03	5.66	8.60	8.82	6.14**
Chronic Disease Count																
0	64.51	68.75	82.59	72.56	69.19	70.72	83.25	73.89	78.47	78.07	85.48	79.71	83.97	83.84	85.34	84.08
1	26.00	24.20	14.24	20.94	22.53	22.22	13.79	19.71	17.62	18.04	12.49	16.73	14.32	14.12	13.44	14.23
2	7.08	5.37	2.51	4.93	6.19	5.57	2.25	4.84	3.16	2.99	1.52	2.83	1.51	1.67	1.05	1.48
3	1.97	1.42	0.56	1.30	1.76	1.23	0.59	1.30	0.65	0.76	0.46	0.63	0.17	0.32	0.14	0.18
4	0.38	0.24	0.08	0.24	0.30	0.26	0.09	0.22	0.10	0.14	0.03	0.09	0.03	0.04	0.02	0.03
5	0.06	0.01	0.02	0.03	0.03	0.01	0.04	0.03	0.01	0.00	0.02	0.01	0.00	0.00	0.01	0.00**

NOTES
1. Analytic sample (unweighted n=820,132): all BRFSS respondents aged 18-64 who are white, Hispanic or black living in the U.S. Medicaid expansion states, variables weighted by sampling fractions
2. Expansion states: 32 states that opted to expand Medicaid by the end of 2017
3. Chronic diseases include: Cardiovascular, Respiratory, Stroke, Kidney and Cancer
4. Proportions for variables in first column (i.e. age group, etc.) have weighted proporitions displayed for each racial/ethnic group. Adding each race value across income group is equal to 100
5. Proportions are rounded and may not add up to 100
6. Pearson Chi-square tests performed to measure assess differences between income group means by characteristic in left column (** p<0.001); T-test for chronic disease (**p<0.001)

Diabetes Risk. The prevalence of diabetes in non-expansion states was 8.37 per 100 respondents for all races, compared to 7.35 per 100 respondents in Medicaid expansion states (**Table 16**). Prevalence was calculated using the formula below:

$$\text{Prevalence} = \frac{\text{Number of people with diabetes}}{\text{Number of people measured}} \times 100$$

In non-expansion states, the income group with the highest report of diabetes was those living below 100% FPL (12.08%). The proportion of individuals reporting diabetes in the same group in expansion states was 10% less, but still was the income group with the highest report of diabetes (10.88%). Blacks had the greatest proportion of respondents with diabetes in all income groups in non-expansion and Medicaid expansion states when compared to whites and Hispanics (**Tables 17** and **18**).

Similarly, among all races, the income group with the highest proportion of respondents at high risk for developing diabetes in non-expansion states was individuals living below 100% FPL (42.73%). The same group of individuals in the Medicaid expansion group had a proportion 4% less than that of the non-expansion group, but remained the largest proportion of individuals at high risk across all income groups (41.22%) (**Table 18**). Respondents living in the overlap low income group (100-138% FPL) in non-expansion and Medicaid expansion states had slightly lower proportions of high-risk respondents than those living below 100% FPL.

In both non-expansion and Medicaid expansion states, blacks had the highest proportion of individuals at high risk. Across all income groups in both state groups, whites had the lowest proportions of those at high risk of diabetes. Differences in the distribution of diabetes risk between Medicaid expansion and non-expansion states was statistically significant ($p<0.001$)

(**Table 16**). Differences in distribution of diabetes risk among the four income groups within non-expansion and Medicaid expansion states was also statistically significant (p<0.001) (**Tables 17** and **18**).

Pre-diabetes. The prevalence of pre-diabetes in non-expansion states was 1.26 per 100 for all races, compared to 1.35 per 100 for all races in Medicaid expansion states (**Table 16**). In non-expansion states, respondents living <100% FPL reported greater proportions of prediabetes (1.77%), than those at higher incomes (e.g. 0.88% for >400% FPL). Their low-income counterparts in Medicaid expansion states reported 15% more prediabetes (2.03%). The greater report of prediabetes in Medicaid expansion states may be associated with expanded insurance options. Differences in in the report of prediabetes existed between all races. However, Hispanics within expansion states, across all income groups, had the highest report of prediabetes.

Within non-expansion states, whites in the two low income groups had the highest reporting of prediabetes, which was then surpassed by blacks in the moderate- and high-income groups. Differences in the distribution of prediabetes between states was statistically significant (x^2=22.88, p<0.05). Differences in the distribution of prediabetes among the four income groups within the two state groups was statistically significant (p<0.001) (**Tables 17** and **18**).

Self-reported Health. In non-expansion states, 17% of respondents reported being unhealthy, which was only a 1% difference compared to respondents in expansion states (16%) (**Table 16**). Low income whites living within non-expansion states had the highest report of being unhealthy (35%) (**Table 17**). Meanwhile, Hispanics in all income groups within Medicaid expansion states had the highest reports of being unhealthy, when compared to whites and blacks. The report of being unhealthy in non-expansion states is inconsistent with the report of pre-diabetes, where Medicaid expansion states had higher reports of pre-diabetes than non-expansion states (**Table 16**). Differences in the distribution of self-reported health was statistically significant between state groups ($p<0.001$). Differences in the distribution of self-reported health among the four income groups within state groups was statistically significant ($p<0.001$) (**Tables 17** and **18**), with high income earners reporting being healthier than lower income groups in both expansion groups.

Chronic Disease Count. Like the national BRFSS sample, the number of chronic diseases began to taper off after the report of two in both non-expansion and Medicaid expansion states. In both non-expansion and Medicaid expansion states, 80% of respondents reported no major chronic disease (**Table 16)**. The greatest disparity in the report of chronic disease was among Hispanics across all income groups in non-expansion and Medicaid expansion states. Hispanics had greater proportions of respondents reporting no chronic disease than blacks or whites. For example, Hispanics living below 100% FPL in non-expansion states had a report of no chronic disease at 85%, whereas blacks reported no chronic disease 71% and whites 63% (**Table 17**). In Medicaid expansion states, 83% of Hispanics living below 100% FPL reported no chronic disease (**Table 18**). Yet, low income racial/ethnic minorities tend to be at greater risk for many chronic conditions over whites. Overall, there was no difference in the report of chronic conditions between non-expansion and Medicaid expansion groups ($t= -1.01$, $p= 0.312$) (**Table 16**). Differences in the report of chronic disease among the four income groups within non-expansion and Medicaid expansion states was statistically significant ($p<0.001$), with more high-income earners reporting no chronic disease than earners in the lower income groups (**Tables 17** and **18**).

Primary Care Provider (PCP) Supply. A dummy variable for PCP Supply was created that classified states based on the supply of non-federal primary care physicians relative to the size of the non-elderly population pre-ACA; therefore, PCP supply states are based on the distribution of the U.S. population. Low supply was less than 11.5 PCPs per 10,000 persons and adequate supply was greater than 11.5 PCPs per 10,00 persons (Cunningham, 2011). Respondents living within Medicaid expansion states were found to live in a state with a greater proportion of primary care providers (85%), when compared to respondents living in non-expansion states (44%) (**Table 19**).

Table 19.

State-Level Variables in Analytic Sample by Expansion Status: All White, Black and Hispanic BRFSS Respondents Aged 18-64 Living in Non-expansion versus Medicaid Expansion States, Weighted by Sampling Fractions (2012-2017).

BRFSS Analytic Sample 2012-2017				
	Non-expansion States	**Medicaid Expansion States**	**X^2 Value**	**P Value**
Sample Size (unweighted)	544,122	820,132		
Population Size (weighted)	336,343,646	531,277,643		
Population Size, mean	56,057,274	88,546,274		
PCP Supply			0.00003	<0.001
Adequate Supply	43.91	85.17		
Low Supply	56.09	14.83		

The disparities in PCP supply between non-expansion and Medicaid expansion states became even more stark when comparing income-race differences (**Tables 20** and **21**). Even within non-expansion states, the low-income Hispanic population had higher proportions of respondents living in an area with a low PCP supply (71%), than whites (53%) or blacks (65%) in the same income group (**Table 20**). In the low-income Medicaid expansion group, whites and blacks had a greater proportion of respondents residing in an area with a low PCP supply (21%), when compared to Hispanics (10%) (**Table 21**) although at far lower rates than in non-expansion states. The differences in the supply of PCPs by race may be attributed to more blacks living in non-expansion states, and more Hispanics living in Medicaid expansion states. The distribution of PCP state supply between non-expansion and Medicaid expansion states was statistically significant (p=<0.001) (**Table 19**). Differences in the distribution of state level PCP supply for the four incomes within both expansion groups was statistically significant ($p<0.001$), with the low-income group living in areas with the lowest supply of PCPs, when compared to higher income groups (**Tables 20** and **21**).

Table 20.

State-level Variables by Percent of FPL (Income) and Race for BRFSS Respondents in Non-expansion States (2012-2017).

	NON-EXPANSION STATES															
	Low Income (<100% FPL)				Overlap Low Income (100-138% FPL)				Moderate Income (139-400% FPL)				High Income (>400% FPL)			
	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races
Sample Size, unweighted	40,105	15,902	11,648	67,655	30,029	7,712	5,555	43,296	182,690	26,908	16,045	225,643	188,146	11,580	7,802	207,528
PCP Supply																
Low Supply	52.58	65.08	70.65	61.59	51.26	65.04	68.63	58.77	50.11	63.63	64.31	54.93	52.66	62.58	58.48	54.23**

NOTES

1. Analytic sample (unweighted n=544,122): all BRFSS respondents aged 18-64 who are white, Hispanic or black living in the U.S. non-expansion states, weighted by sampling fractions
2. Non-expansion states: 19 states that did not expand Medicaid by end of 2017
3. Proportions for variables in first column have weighted proporitions displayed for each racial/ethnic group. Adding each race value across income group is equal to 100
4. Proportions are rounded and may not add up to 100
5. Pearson Chi-square tests performed to measure assess differences between income group means by characteristic in left column (** p<0.001)

Table 21.

State-level Variables by Percent of FPL (Income) and Race for BRFSS Respondents in Medicaid Expansion States (2012-2017).

	MEDICAID EXPANSION STATES															
	Low Income (<100% FPL)				Overlap Low Income (100-138% FPL)				Moderate Income (138-400% FPL)				High Income (>400% FPL)			
	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races
Sample Size, unweighted	55,532	14,716	22,779	93,027	39,002	7,221	10,132	56,355	244,972	27,466	29,153	301,591	332,394	19,302	17,463	369,159
PCP Supply																
Low Supply	21.22	20.70	10.19	16.67	19.71	20.16	9.91	16.67	17.66	17.98	11.69	16.60	12.51	12.1	9.6	12.23**

NOTES

1. Analytic sample (unweighted n=820,132): all BRFSS respondents aged 18-64 who are white, Hispanic or black living in the U.S. Medicaid expansion states, weighted by sampling fractions
2. Expansion states: 32 states that opted to expand Medicaid by the end of 2017
3. Proportions for variables in first column have weighted proporitions displayed for each racial/ethnic group. Adding each race value across income group is equal to 100
4. Proportions are rounded and may not add up to 100
5. Pearson Chi-square tests performed to measure assess differences between income group means by characteristic in left column (** p<0.001)

Outcome Variables

Insurance. A greater proportion of respondents in expansion states reported having insurance (86% vs. 79%) (**Table 22**). Had non-expansion states had the 86% expansion rate, 4.8 million more persons would be insured annually. It was expected that respondents living within Medicaid expansion states would have lower uninsured proportions as this group had more coverage options (i.e. Medicaid and subsidy options). Since the respondents living within 100-400% FPL were expected to benefit the most from the ACA's coverage expansion provisions, focus was placed on the overlap low income group and moderate-income groups within non-expansion and Medicaid expansion states.

Table 22.

Outcome Variables in Analytic Sample by Expansion Status: All White, Black and Hispanic BRFSS Respondents Aged 18-64 Living in Non-expansion versus Medicaid Expansion States, Weighted by Sampling Fractions (2012-2017).

BRFSS Analytic Sample 2012-2017				
	Non-expansion States	**Medicaid Expansion States**	**X^2 Value**	**P Value**
Sample Size (unweighted)	544,122	820,132		
Population Size (weighted)	336,343,646	531,277,643		
Population Size, mean	56,057,274	88,546,274		
Insurance			9,488.32	<0.001
Uninsured	20.76	14.36		
Insured	79.24	85.64		
Primary Care Provider			5,305.06	<0.001
No Provider	29.07	23.48		
Yes, Provider	70.93	76.52		
Checkup in Last Year			2.4675	0.435
No Checkup	35.30	35.43		
Yes, Checkup	64.70	64.57		

In non-expansion states, stark differences in the proportions of the uninsured can be seen between low- and high-income groups, which points to the need for subsidized insurance

(**Tables 23 and 24**). A greater proportion of low-income individuals were uninsured (46% in the <100% FPL group and 36% in the 100-138% FPL group) than in the moderate-income group (21%). Even the difference between the moderate-income group and high-income group is dramatic, with only 5% of high-income earners reporting being uninsured. Under the ACA, the lack of Medicaid expansion means that federal the insurance subsidies were instrumental in closing the insurance gap between high- and low-income groups. This will be examined in the next section when comparing pre-ACA and post-ACA statistics.

Although Medicaid expansion states had lower proportions of uninsured, stark differences in the proportion of uninsured still existed between high- and low-income groups (4% vs. 30%, respectively) (**Table 24**). As the literature has stated, many Hispanics, pre and post ACA remained uninsured. In both state groups, Hispanics had the largest proportions of uninsured; while whites had the lowest proportions of uninsured across all four income groups. Overall, differences in the distribution of insurance status were statistically significant ($p<0.001$) between non-expansion and Medicaid expansion states. Differences in insurance status among the four incomes within non-expansion and Medicaid expansion states were statistically significant ($p<0.001$), with high income earners far less likely to be uninsured (**Tables 23** and **24**).

Primary Care Provider. A greater proportion of BRFSS respondents within Medicaid expansion states reported having a primary care provider (77% vs. 71%) (**Table 22**). It is expected that respondents living within Medicaid expansion states would have lower proportions of respondents reporting no PCP as this group had more coverage options (i.e. Medicaid and subsidy options), leading to the selection of a provider. In addition, as shown in **Table 19**, Medicaid expansion states had a greater proportion of respondents living in an area with an adequate supply of PCPs when compared to respondents living in non-expansion states. Having an adequate supply of PCPs within a state increases the probability that an individual will have a provider (as shown later using multivariate regression).

In non-expansion states, 43% of respondents living below 100% FPL reported not having a provider, compared to only 35% of respondents in the Medicaid expansion low-income group (**Table 23**). As income increased, the overall proportion in the report of no provider decreased across all races. However, Hispanics had the highest proportions in the report of no provider across all income groups in non-expansion states and Medicaid expansion states. Although the proportion of Hispanics without a PCP was high in Medicaid expansion states, it was consistently lower than in non-expansion states. For example, 53% of Hispanics in the overlap low income group in non-expansion states reported no PCP versus 43% of Hispanics in the Medicaid expansion group. Distribution differences in the report of a PCP between the two state groups was statistically significant ($p<0.001$) (**Table 22**). Differences in the report of a PCP among the four incomes within both state groups was statistically significant ($p<0.001$), with high income earners having a greater proportion report having a PCP than the lower income group respondents (**Tables 23** and **24**).

Checkup in Last Year. The proportion of white, black and Hispanic adults aged 18 to 64 who had a preventive visit with a provider in the last year was similar between non-expansion and Medicaid expansion states, 65% (**Table 22**). In non-expansion states, the two lower income groups had the largest proportions of respondents who reported no provider, 43% vs. 41%, with the report of no provider decreasing as income increased (**Table 23**). As income increased in Medicaid expansion state, the report of no provider also decreased (**Table 24**). Interestingly, blacks within both expansion groups had the lowest proportions in the report of no checkup in the past year compared to whites and Hispanics. This may be related to more whites living in rural areas where geographic barriers to health care access exist. Overall differences in the report of a checkup in the past year between Medicaid expansion and non-expansion states were not statistically significant ($p=0.58$) (**Table 22)**. However, differences in the report of no checkup among the four incomes groups within state groups was statistically significant ($p<0.001$), with low income earners reporting no checkup in the past year at greater proportions than high income earners (**Tables 23** and **24**).

Table 23.

Outcome Variables by Percent of FPL (Income) and Race for BRFSS Respondents in Non-expansion States (2012-2017).

	NON-EXPANSION STATES															
	Low Income (<100% FPL)				Overlap Low Income (100-138% FPL)				Moderate Income (139-400% FPL)				High Income (>400% FPL)			
	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races
Sample Size, unweighted	40,105	15,902	11,648	67,655	30,029	7,712	5,555	43,296	182,690	26,908	16,045	225,643	188,146	11,580	7,802	207,528
Insurance																
Uninsured	37.65	39.34	62.87	46.12	30.79	31.86	51.15	36.28	16.78	21.22	36.73	20.86	4.45	7.02	11.09	5.32**
Primary Care Provider																
No Provider	34.71	37.66	57.29	42.66	32.23	32.25	52.80	37.55	27.60	29.26	45.89	30.90	18.27	17.23	24.78	18.74**
Checkup in Last Year																
No Checkup	46.02	30.87	47.88	42.66	43.67	27.34	47.68	41.12	38.54	25.26	41.79	36.61	30.30	18.67	29.88	29.03**

NOTES

1. Analytic sample (unweighted n=544,122): all BRFSS respondents aged 18-64 who are white, Hispanic or black living in the U.S. non-expansion states, weighted by sampling fractions
2. Non-expansion states: 19 states that did not expand Medicaid by end of 2017
3. Proportions for variables in first column (i.e. age group, etc.) have weighted proporitions displayed for each racial/ethnic group. Adding each race value across income group is equal to 100
4. Proportions are rounded and may not add up to 100
5. Pearson Chi-square tests performed to measure assess differences between income group means by characteristic in left column (** p<0.001)

Table 24.

Outcome Variables by Percent of FPL (Income) and Race for BRFSS Respondents in Medicaid Expansion States (2012-2017).

	MEDICAID EXPANSION STATES															
	Low Income (<100% FPL)				Overlap Low Income (100-138% FPL)				Moderate Income (138-400% FPL)				High Income (>400% FPL)			
	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races	White	Black	Hispanic	All Races
Sample Size, unweighted	55,532	14,716	22,779	93,027	39,002	7,221	10,132	56,355	244,972	27,466	29,153	301,591	332,394	19,302	17,463	369,159
Insurance																
Uninsured	22.35	24.24	41.56	30.44	21.46	21.46	36.30	26.17	13.82	16.73	26.57	16.52	3.50	5.44	8.38	4.06**
Primary Care Provider																
No Provider	27.19	29.18	45.16	34.80	26.65	26.41	42.87	31.76	23.74	24.04	36.48	26.12	14.89	13.15	20.61	15.26**
Checkup in Last Year																
No Checkup	41.00	26.99	43.53	39.58	41.28	24.49	41.53	38.78	38.61	24.39	39.67	37.09	32.51	20.48	33.59	31.75**

NOTES

1. Analytic sample (820,132): all BRFSS respondents aged 18-64 who are white, Hispanic or black living in the U.S. Medicaid expansion states, weighted by sampling fractions
2. Expansion states: 32 states that opted to expand Medicaid by the end of 2017
3. Proportions for variables in first column (i.e. age group, etc.) have weighted proporitions displayed for each racial/ethnic group. Adding each race value across income group is equal to 100
4. Proportions are rounded and may not add up to 100
5. Pearson Chi-square tests performed to measure assess differences between income group means by characteristic in left column (** p<0.001)

Pre/Post ACA Differences in Insurance Coverage and PCP Access

The focus for using BRFSS was to assess changes in insurance and health care access after the implementation of the ACA among racial/ethnic minorities and for individuals at high risk for diabetes living within non-expansion and Medicaid expansion states. In this section, pre/post descriptive statistics comparing changes in insurance status and health care access (i.e. PCP or a checkup in past year) by income, race, and diabetes health risk before and after ACA implementation were explored. Pearson Chi-square statistics were used to assess for differences in the sampling distributions between variables and outcomes of interest.

Until this point, expansion groups have been dichotomized into two groups: (1) non-expansion and (2) Medicaid expansion states based on whether the state expanded Medicaid by 2017. However, there are four different expansion types. Within our sample, we have identified:

- **Pre-ACA Expanders** (i.e. Massachusetts, Vermont, Hawaii and D.C.) which are states/districts that expanded Medicaid beyond the 138% FPL limit before 2014. The pre-ACA expanders will be known as the first expansion group and are highlighted green in the expansion map in Figure 5. The second state group is the
- **2014 Expanders**. These are the 23 states that expanded Medicaid up to 138% FPL during 2014. This group is highlighted light blue in the Medicaid expansion map in Figure 5. The third group is the
- **Late Expanders**, that includes 5 states that expanded Medicaid up to 138% FPL after 2014: Montana, Indiana, Pennsylvania, Louisiana and Alaska, highlighted dark blue in Figure 5. The last group

- **Never Expanders**, included 19 states that did not expand Medicaid by 2017. To note, there are a few states in this last group that have considered or expanded Medicaid post-2017 and have been identified in Table U-1.

This section shows any trends in the BRFSS analytic sample over the pre/post-ACA period. The next section will focus on positive gains in insurance and health care access and is organized around Specific Aims 1 and 2. The last section mathematically links trends in PCP access to ACA-related changes in insurance coverage using the descriptive results.

Pre-and Post-ACA Trends in Sample Population Characteristics

In the descriptive tables in this section, the focus was on changes on outcomes where control variables have not been introduced. In the beginning of Chapter 4, basic descriptive statistics were described but did not look at changes over time or pre/post ACA. To ensure major changes over time did not occur in the 47-state analytic sample, **Table 25** was included to show mean changes over time for the independent and control variables. The analytic sample did not show differences in the pre and post ACA periods for the time-invariable variables race and sex. In the time variant variables, income, education, age, health status and state level supply differences were found since our weighted sample is very large and small changes will be detected between groups. But, in review of the numbers, the relative changes between the pre and post ACA groups are small and consistent with what is occurring nationally.

For example, average household incomes have been increasing over time, which is consistent with the data shown in **Table 25.** Household incomes have been rising as noted by a

decrease in the <100% FPL income group from 18.36% in 2012 to 13.65% by 2017. Over time, education completion rates for high school and college have also increased. This was noted by a post-ACA decrease in the less than HS group of 7% and a gain in the college graduate group by 3%. Increases in age over time are expected. The 55 to 64 group increased by 4% and is the age group to have the greatest increase. Across the country there has been an increase in obesity rates, which had led to a growth in the high-risk group of about 4% in the post-ACA period. There was no difference in the pre and post ACA period in the reporting of chronic disease. This was probably due to the short time period under study in combination with the length of time it takes to have a condition classified as chronic. This was consistent with the finding that report of diabetes was not different in the pre and post ACA periods. Reports of being unhealthy decreased by 1.8%. PCP supply decreased by almost 2% in the post-ACA period. It may be a larger decrease considering this variable was created only using data from the pre-ACA period and was not adjusted to include changes over time. Changes in this table have not been controlled for.

The results from **Table 25** were consistent with the descriptive statistics for the independent and control variables stratified by expansion states in Appendix AB. Medicaid expansion states saw the greatest decline in the less than <100% FPL and the greatest increases in the completion of a college degree than in non-expansion states (3.88% vs. 2.73%, respectively). Non-expansion states saw the greatest increase in the high-risk group (4.54%, $p<0.001$), compared to 4.17% in expansion groups. Expansion states saw a decline in PCP supply in the post ACA period by 2%. Non-expansion states had no difference in PCP supply between the pre and post ACA periods. Refer to Tables AA-1 and AA-2 in Appendix AA to review non-expansion and expansion states descriptive data by time.

Table 25.

Mean Changes Over Time for Predictor and Control Variables in 47-state Analytic Sample.

Variables	2012 n=225,471	2013 n=233,074	2014 n=212,865	2015 n=191,162	2016 n=214,746	2017 n=206,219	Pre ACA n=458,545	Post ACA n=824,992	Growth Rate (Post/Pre ACA)	P Value X^2
Demographics										
Income										
>400% FPL	37.92	39.11	35.59	37.92	38.91	40.22	38.51	38.17	-0.88%	p<0.05
139-400% FPL	34.97	34.51	39.61	39.13	39.23	38.43	34.74	39.10	12.55%	p<0.001
100-138% FPL	8.75	8.51	8.18	8.09	7.74	7.70	8.63	7.93	-8.11%	p<0.001
<100% FPL	18.36	17.88	16.62	14.85	14.12	13.65	18.12	14.80	-18.32%	p<0.001
Race										
Whites	68.23	68.23	68.92	68.09	67.35	67.42	68.23	67.94	-0.43%	0.1215
Blacks	13.75	13.45	13.56	13.65	13.55	13.72	13.60	13.62	0.15%	0.8722
Hispanics	18.03	18.32	17.52	18.26	19.10	18.86	18.17	18.44	1.49%	0.1212
Education										
<HS	13.45	13.82	13.11	12.60	12.74	12.20	13.63	12.66	-7.12%	-
HS Grad	28.02	27.68	27.97	27.72	27.64	27.64	27.85	27.74	-0.39%	-
Some College	32.27	32.40	32.49	32.57	32.43	32.66	32.34	32.54	0.62%	-
College Grad	26.25	26.10	26.43	27.11	27.20	27.51	26.17	27.06	3.40%	p<0.001
Age										
18 to 34	34.55	34.48	34.60	34.95	35.59	34.99	34.51	35.03	1.51%	-
35 to 44	21.36	20.67	20.96	20.93	20.82	21.13	21.02	20.96	-0.29%	-
45 to 54	23.75	23.74	23.13	22.61	21.96	21.79	23.74	22.36	-5.81%	-
55 to 64	20.34	21.12	21.32	21.52	21.64	22.09	20.73	21.65	4.44%	p<0.001
Sex										
Male	51.79	51.63	51.73	52.00	52.18	51.82	51.71	51.93	0.43%	-
Female	48.21	48.37	48.27	48.00	47.82	48.18	48.29	48.07	-0.46%	0.2182
Health										
Diabetes Status										
No/Low Risk	59.74	56.58	58.27	55.63	57.67	54.65	58.16	56.56	-2.75%	p<0.001
High Risk	32.48	35.77	33.85	36.64	34.54	37.41	34.12	35.61	4.37%	p<0.001
Diabetes	7.79	7.65	7.88	7.72	7.79	7.94	7.72	7.83	1.42%	0.229
Chronic Disease										
0	80.33	79.82	79.85	80.54	80.11	79.94	80.08	80.10	0.02%	-
1	15.99	16.66	16.45	15.93	16.25	16.27	16.32	16.23	-0.55%	-
2	2.87	2.81	2.94	2.80	2.85	3.01	2.84	2.90	2.11%	-
3	0.67	0.60	0.65	0.61	0.66	0.60	0.63	0.63	0.00%	-
4	0.12	0.10	0.11	0.11	0.11	0.16	0.11	0.12	9.09%	-
5	0.03	0.02	0.01	0.01	0.01	0.01	0.02	0.01	-50.00%	0.1459
Self Reported Health										
Healthy	83.52	83.49	83.74	84.22	84.02	83.29	83.51	83.81	0.36%	
Unhealthy	16.48	16.51	16.26	15.78	15.98	16.71	16.49	16.19	-1.82%	p<0.05
State Level										
PCP Supply										
Adequate	68.7	68.79	68.17	68.43	68.14	68.14	68.74	68.13	-0.89%	-
Low	31.30	31.21	31.83	31.57	31.86	31.86	31.26	31.87	1.95%	p<0.001

Gains in Insurance Coverage & Access

Specific Aim 1- Insurance (INS)

Overall INS Trends by Expansion Status. In the first aim, focus was placed on determining the likelihood of an 18-64-year-old white, black or Hispanic individual gaining health insurance in the post ACA period. In **Table 26**, it is apparent that the Pre-ACA Expanders had the highest levels of insured persons (92.13%) when compared to the other state groups prior to 2014. Their growth in insurance was a modest 2.28% ($p<0.001$), which was expected given their very high levels of insurance in the pre-ACA period. Any gains in insurance for this group are attributed to uninsured Medicaid-eligible residents signing up for insurance in the post-ACA period or previously uninsured individuals living between the state's upper Medicaid threshold (i.e. 200% FPL for Massachusetts) and 400% FPL who gained access to affordable health care coverage through the insurance subsidies on the health insurance exchange.

Table 26.

Pre/Post Differences in the Report of Being Insured Among Expansion Groups in Full Analytic Sample.

Mean Insurance by Expansion Status and Time												
		2012		2013	2014	2015	2016	2017	Pre ACA	Post ACA	Growth Rate	P Value
Mean (INS)	**No. States**	**BRFSS Sample**	Weighted %	Weighted %	Weighted %	Weighted %	Weighted %	Weighted %	Weighted %	Weighted %	(Post/Pre ACA)	X^2
Expansion Status												
Pre-ACA Expanders	4	18,478	92.31	91.97	94.06	93.80	94.11	94.94	92.13	94.23	2.28%	<0.001
2014 Expanders	23	109,003	79.40	80.94	86.01	88.15	88.89	88.79	80.17	87.97	9.73%	<0.001
Late Expanders	5	26,519	80.86	81.66	84.20	87.34	88.80	89.96	81.26	87.58	7.78%	0.6203
Never Expanders	19	89,949	74.56	75.73	79.57	81.73	82.44	81.40	75.14	81.28	8.17%	<0.001
Analytic Sample												
All 50 States/DC	51	243,949	78.03	79.34	83.56	85.67	86.50	86.16	84.14	89.49	6.36%	<0.001

Notes:

1. Analtyic sample: All BRFSS respondents aged 18-64 who are white, black or Hispanic living in the U.S. who reported being insured, propprtions weighted by sampling fractions
2. Proportions are rounded and may not add up to 100
3. P value clumn: Pearson Chi-square tests performed to assess differences in sample distribution between expansion status and insurance by year (pre vs. post ACA)

During 2014, 23 states expanded Medicaid up to 138% FPL with 5 additional states expanding between 2015 and 2017. The 2014 Expanders and Late Expanders are similar with their pre-ACA percent insured being about 80%. The 2014 Expanders had a 9.73% insurance growth while the insurance growth of 7.78% ($p=0.6203$) in the Late Expanders group was nearly as high but statistically insignificant. This is related to their small sample size, already high coverage rates, and fewer years to sign up.

Lastly, the Never Expanders group had the lowest levels of percent insured in the pre-ACA period (75.14%, $p<0.001$). As a reminder, many of these states operated conservative programs with strict Medicaid eligibility levels that left many low-income adults without any affordable insurance options. The 8.17% insurance growth seen in this group in the post-ACA period is due to insurance subsidies available via the federal health insurance marketplace ($p<0.001$). Opportunities for increasing insurance levels exist by opting into Medicaid expansion for the Never Expanders. Had the Never Expanders expanded Medicaid, post ACA insurance levels could have reached 88% insured like in the 2014 Expanders and Late Expanders groups, instead of only 81% insured post-ACA.

Relationship between Pre and Post-ACA Insurance Rates. When the 50 states and D.C. are grouped into the 4 expansion groups, it was a challenge to identify which states made the greatest coverage gains post-ACA expansion. To derive an estimate of post-ACA insurance values for each state, a curvilinear function was estimated by plotting the change in insurance over time for each of the 50 states and D.C. Each dot in the Figures 7-10 is a state with its average pre-ACA insurance values are on the x-axis and post-ACA insurance values are on the y-axis. A 45° line is included to indicate post-ACA values that exceed or fall short of pre-ACA insurance rates. The range of the graph is 60-100 as no state had a pre-ACA rate less than 65. A curvilinear quadratic line has been estimated to fit the observations. (A linear line produces the same R^2). Taking the derivative,

$$dy/dx = 0.9419- 2*(0.0021x)= 0.9419-0.0042x$$

For every 10-percentage point increase in a state's pre-ACA coverage rate, the marginal increase fell by 0.042 points. At over 90%, the post-ACA gain becomes quite small as the ceiling rate approaches 100%. For example, setting x=92 gives a predicted post-ACA rate of 94.5%. At a pre-ACA value, the predicted post-ACA rate is 77.4% Surprisingly, the line doesn't become flat with no gain until a pre-ACA rate=224, clearly an impossible figure.[7]

It is important to remember that the estimated line was only capturing the rate of insurance growth beginning in the pre-ACA period, but the line begins many years before when insurance rates were much lower. The line without a doubt was more curvilinear over longer periods, but the short 2012-2017 period covers a time when the trend line is much flatter.

[7] The 224 figure is derived by setting the derivative equal to zero and solving for x.

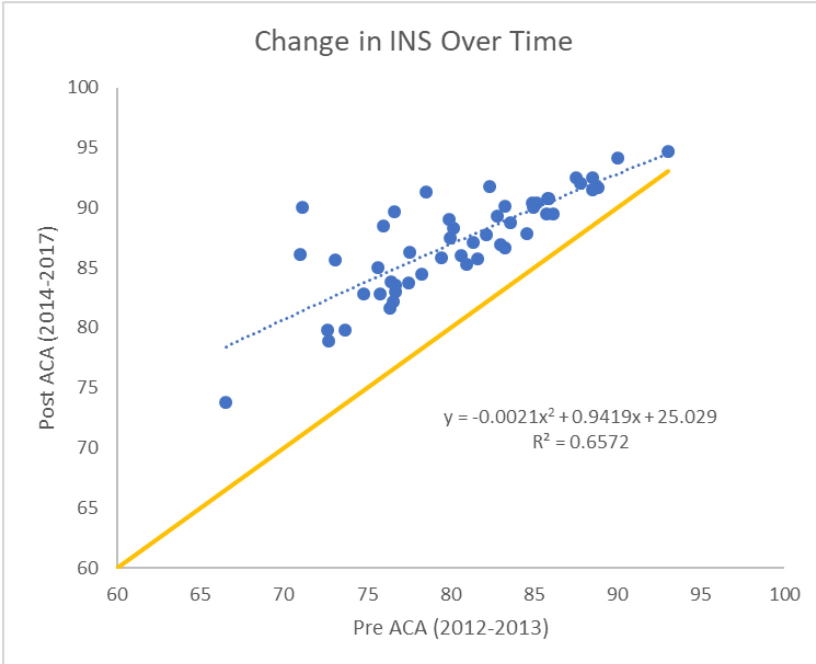

Figure 7. Changes in INS over time (Pre to Post-ACA) using all 50 states and D.C.

Since all points were above the 45˚ line in Figure 7, it was clear that no state experienced a decline in insurance coverage between the pre-ACA and post-ACA periods. (Figure 5 shows several interesting outlier states, which are discussed later in the text). States that have low initial levels of insurance pre-ACA have a large pool of uninsured to enroll, but once pre-ACA levels reach 85% or more, the pool of uninsured has narrowed considerably and includes many who are not interested in (or eligible for) ACA subsidies or enrolling in Medicaid.

Figure 7 demonstrates how difficult it would be for the ACA to increase insurance in expansion states that already had a high percentage of individuals insured before the ACA (i.e. Massachusetts). Starting at a lower percentage would give states the opportunity for greater coverage gains. Medicaid expansion states with lower levels of insurance in the pre-period should show the greatest benefit as both the Medicaid expansion and the insurance subsidy policies would in effect. Similarly, we would expect to see a higher insured rate in the non-expansion states had they expanded like expansion states.

Figures 8 and 9 estimated the pre/post relationship, separately, for non-expansion vs. expansion states. When non-expansion states are separated from expansion states, it becomes clear that the negative (slight) curve that is seen in Figure 7, is due to the non-expansion states. The intercept implies that the post-ACA insurance coverage rate is not positive until the pre rate exceeds 21.1- at least for the censored rage 2012-2017. The non-expansion line shows a slope equal to 1.91-0.0146x with an extremely high R^2.

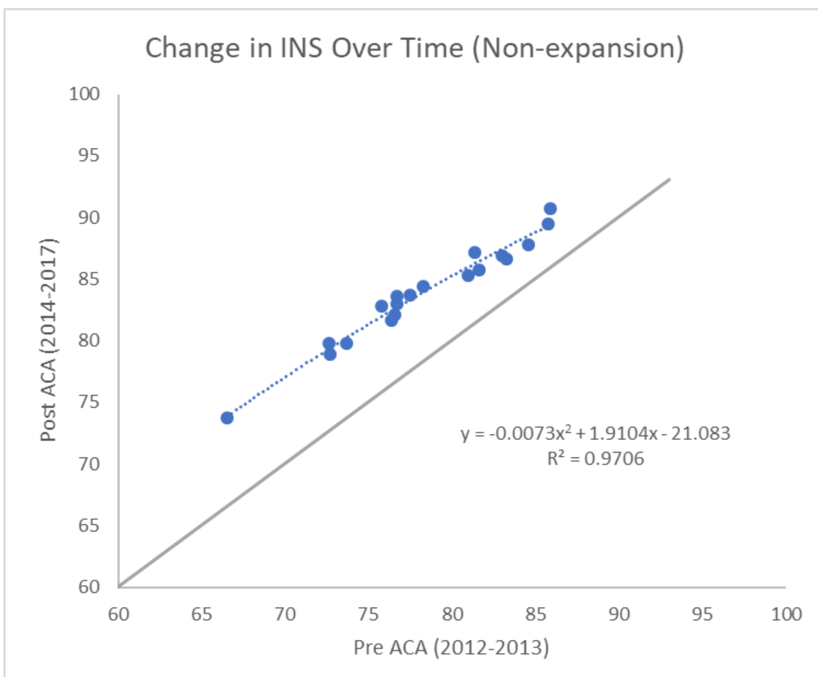

Figure 8. Changes in INS over time (Pre to Post-ACA) using 19 Non-expansion States.

In Figure 9, the curve for expansion states was positive, not negative, with greater growth in insurance being shown in Figure 10 when the 4 states that expanded Medicaid pre-ACA were dropped out. The expansion line had a positive, not negative, squared coefficient and a large positive intercept term. This was due to Arkansas and Nevada, expansion states who had actual post-ACA rates show extraordinary increases in coverage even for their low initial levels (see **Table 26**). Other expansion states were not able to reproduce these gains; hence, the negative 2.78 term associated with x in Figure 9.

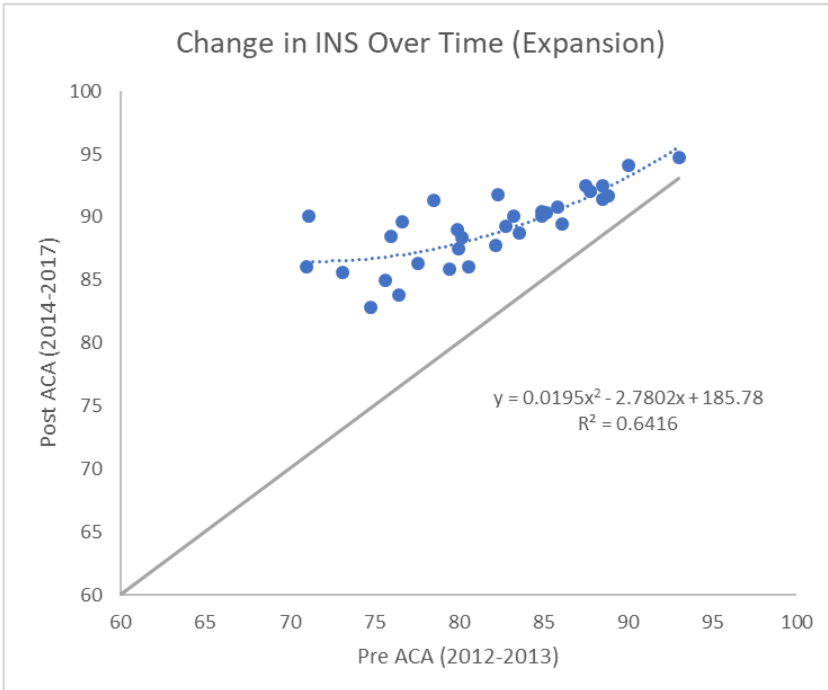

Figure 9. Changes in INS over time (Pre to Post-ACA**)** using all 32 Expansion States as of 2017.

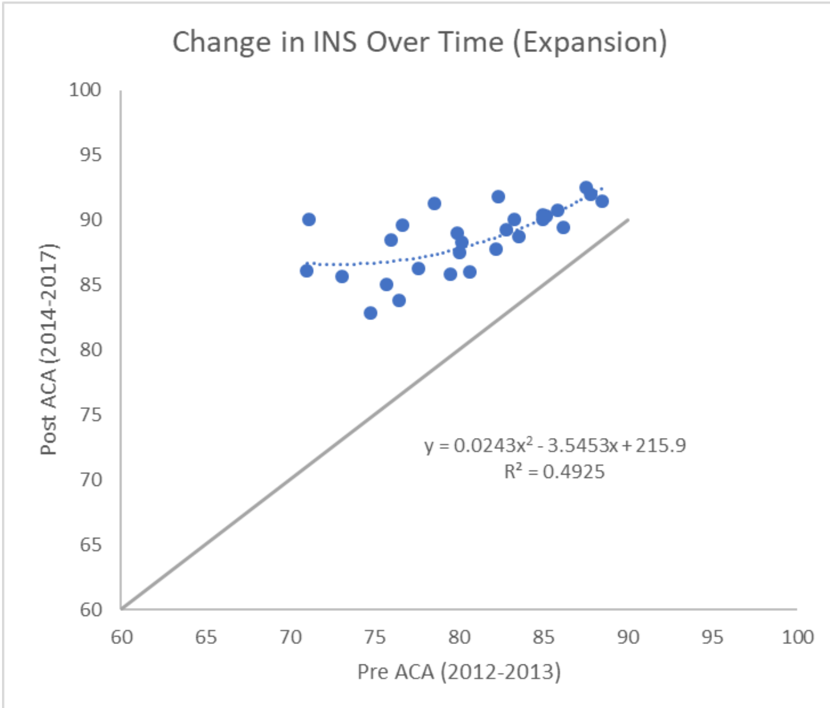

Figure 10. Changes in INS over time (Pre to Post-ACA) using 28 Expansion States as of 2017.

Curvilinear Function Goodness of Fit. Figure 7 shows several low and high outlier states at very low pre-ACA coverage rates. The five states with the lowest pre-ACA percent insured are displayed below in **Table 27**.

Table 27.

The Five States with Lowest Pre-ACA Percent Insured (2012-2013).

LOWEST 5 STATES (%)	STATE	ACTUAL PRE-ACA INS RATE (%)	ACTUAL POST-ACA INS RATE (%)	PREDICTED RATE (%)	EXPANSION STATUS
1	TEXAS	66.53	73.75	78.40	Non-expansion
2	ARKANSAS	70.99	86.06	81.32	Expansion
3	NEVADA	71.14	90.04	82.81	Expansion
4	FLORIDA	72.63	79.82	82.36	Non-expansion
5	MISSISSIPPI	72.72	78.88	82.41	Non-expansion

Notes:

1. Predicted INS Rate based on eq: 25.03+0.9419xPre-ACA- 0.0021x(pre-ACA)^2
2. Source: BRFSS Analtyic File, including all states, 2012/13 vs. 2014/17

It became apparent that non-expansion states did not reach their predicted post-ACA insurance values. For example, Texas, a non-expansion stated achieved 73.75% insured in the post-ACA period, an increase of about 7 points. Had the state expanded Medicaid, it could have achieved 78% insured had it performed like other states. This also was true for both Florida and Mississippi (non-expansion states) where their post-ACA values were several points under their predicted values. By comparison, Arkansas, a state that had 70.99% insured in the pre-ACA period, expanded Medicaid and had 86.06% insured post-ACA. The predicted value post-ACA using the curvilinear function was only 81%. Nevada, also an expansion state, performed better than predicted with 90.04% insured in the post-ACA period compared to 82% predicted. Full calculations for predicted insurance values for the states in **Table 27** can be found in Appendix Z. These calculations are helpful in showing the impact Medicaid expansion has in increasing insurance coverage, even in states with very low levels of insurance and within a short period of time.

Changes in INS by Income and Expansion Status. The ACA's coverage expansion provisions worked through income (eligibility by %FPL) to provide access to insurance. For Specific Aim 1, the interest was on determining what changes in insurance levels occurred by income group. It was hypothesized that lower income groups would benefit the most from coverage expansion. Overall changes in insurance levels by income for the full analytic sample (50 state and DC), the 47-state analytic sample, non-expansion sample and expansion sample are provided in Tables 27-30. Considering that only 4 states (i.e. pre-ACA expansion states) were removed in the later analytic sample, the percentage changes are not too different over time between both analytic samples, which include over 1 million observations unweighted.

Overall, without adjusting for other variables and including the 4 pre-ACA early expanders, the income group to benefit the most from the ACA's coverage expansion provisions was the less than 100% FPL income group (23.19% increase, p<0.001), which was mainly driven by increases in Medicaid enrollment. The next income group with the greatest insurance growth was the 100-138% FPL group, with a growth of 19.96%, but this increase was not statistically significant (p=0.4793). The 139-400% FPL income group had a 9.19% (p<0.001) growth in insurance that was mainly driven by federally subsidized insurance (**Table 28**). Percentages for the 50-and 47-state samples were similar over time. Refer to Appendix AB for 50-state tables.

Table 28.

Percent Insured by Income Group and Time (47-state Analytic Sample).

Mean INS by Income and Time (47 States)											
		2012	2013	2014	2015	2016	2017	Pre ACA	Post ACA	Growth Rate	P Value
Mean (INS)	BRFSS Sample	Weighted %								(Post/Pre ACA)	X^2
U.S. Income Groups											
>400% FPL	96,601	94.45	94.82	95.89	95.90	95.97	95.58	94.64	95.83	1.26%	p<0.001
139-400% FPL	81,414	76.43	76.73	82.51	84.16	85.00	83.34	76.58	83.75	9.36%	p<0.001
100-138% FPL	17,460	60.05	62.87	71.28	74.97	73.08	75.52	61.43	73.69	19.96%	0.4114
<100% FPL	29,996	53.58	56.39	63.89	67.87	70.59	70.65	54.96	68.05	23.82%	p<0.001
Analtyic Sub Sample											
47 States	224,441	77.63	78.99	83.26	85.45	86.31	85.93	78.31	85.24	8.85%	p<0.001

In the pre-ACA period for Medicaid expansion states, the insurance rate was only 59.30% for the <100% FPL group (**Table 30**). This was surprising considering Medicaid was available in many states up to 100% FPL for specific adult populations. The 27.17% (p<0.001) increases in coverage for the lowest income group in Medicaid expansion states led to an overall insurance growth of 24% for the 47-state analytic sample (**Table 28**). Even with limited availability of Medicaid in non-expansion states, the 100-138% FPL group and the 139-400% FPL group mean INS increased in the post-ACA period (17.62% and 18.94%, respectively)

(**Table 29**). However, the 100-138% FPL groups in both expansion states did not show increases that were statistically significant. The insurance increases seen within the 139-400% FPL income group within non-expansion states shows the value the federal marketplace had on increasing coverage for many low-income adults without access to Medicaid. Had Medicaid expanded in non-expansion states, greater gains could have been actualized for many low-income adults.

Table 29.

Percent Insured by Income Group and Time for the Non-expansion Group.

Mean INS by Income and Time (19 Non-expansion States)												
		2012	2013	2014	2015	2016	2017	Pre ACA	Post ACA	Growth Rate	P Value
Mean (INS)	BRFSS Sample	Weighted %								(Post/Pre ACA)	X^2
U.S. Income Groups											
>400% FPL	35,847	93.82	94.13	95.37	95.45	95.11	94.32	93.98	95.04	1.13%	p<0.001
139-400% FPL	34,090	74.56	74.77	80.14	81.71	82.81	79.81	74.66	81.11	8.64%	p<0.001
100-138% FPL	7,526	56.36	58.06	66.27	69.37	64.94	68.58	57.20	67.28	17.62%	0.6981
<100% FPL	12,486	47.07	49.38	53.85	57.87	58.85	59.42	48.20	57.33	18.94%	p<0.001
Non-Expansion States											
19 States	89,949	74.56	75.73	79.56	81.73	82.44	81.40	75.14	81.28	8.17%	p<0.001

Table 30.

Percent Insured by Income Group and Time for Medicaid Expansion Group.

Mean INS by Income and Time (28 Expansion States)											
		2012	2013	2014	2015	2016	2017	Pre ACA	Post ACA	Growth Rate	P Value
Mean (INS)	BRFSS Sample	Weighted %								(Post/Pre ACA)	X^2
U.S. Income Groups											
>400% FPL	60,754	94.80	95.21	96.20	96.17	96.48	96.31	95.01	96.30	1.36%	p<0.001
139-400% FPL	47,324	77.75	78.09	84.23	86.06	86.63	86.01	77.92	85.72	10.01%	p<0.001
100-138% FPL	9,934	62.67	66.28	75.04	79.23	79.10	80.59	64.44	78.45	21.74%	0.1877
<100% FPL	17,510	57.81	60.81	70.74	75.21	78.13	78.38	59.30	75.41	27.17%	p<0.001
Expansion States											
28 States	135,522	79.61	81.05	85.74	88.03	88.88	88.96	80.33	87.91	9.44%	p<0.001

Specific Aim 2-Primary Care Provider (PCP) and Checkup

In the second aim, focus was placed on determining the likelihood of an 18 to 64-year-old white, black or Hispanic individual having health care access in the post-ACA period, as measured by having a PCP or receiving a checkup in the past year. It was notable that large gains in insurance did not yield gains in having a PCP for any of the four expansion groups (**Table 31**). Very small percentage increases occurred even within states that expanded Medicaid: Pre-ACA Expanders (0.22%); 2014 Expanders (1.89%) with both being statistically significant (p<0.001). A trivial decline of 0.07% (p<0.001) was seen even within the Never Expanders group.

Table 31.

Pre/Post Differences in the Report of having a PCP Overall, and Among Expansion Groups in Full Analytic Sample.

Mean PCP by Expansion Status and Time												
		2012		2013	2014	2015	2016	2017	Pre ACA	Post ACA	Growth Rate	P Value
Mean (PCP)	No. States	BRFSS Sample	Weighted %	Weighted %	Weighted %	Weighted %	Weighted %	Weighted %	Weighted %	Weighted %	(Post/Pre ACA)	X^2
Expansion Status												
Pre-ACA Expanders	4	18,478	85.83	85.29	86.23	85.92	86.90	83.99	85.56	85.75	0.22%	<0.001
2014 Expanders	23	109,003	75.57	73.78	75.50	76.82	76.15	75.93	74.68	76.09	1.89%	<0.001
Late Expanders	5	26,519	79.94	78.07	78.14	80.19	79.15	79.09	79.00	79.12	0.15%	0.5661
Never Expanders	19	89,949	71.60	70.32	70.93	71.56	71.27	69.91	70.96	70.91	-0.07%	<0.001
Analytic Sample												
All 50 States/DC	51	243,949	74.70	73.16	74.23	75.24	74.77	74.06	73.93	74.57	0.87%	<0.001

Notes:

1. Analtyic sample: All BRFSS respondents aged 18-64 who are white, black or Hispanic living in the U.S. who reported having a PCP, propprtions weighted by sampling fractions
2. Proportions are rounded and may not add up to 100
3. P value clumn: Pearson Chi-square tests performed to assess differences in sample distribution between expansion status and report of PCP by year (pre vs. post ACA)

Within the same aim, the likelihood of an 18 to 64-year old white, black or Hispanic individual reporting a checkup in the past year was used as another measure of primary care health care access which focuses more on the primary care utilization. Overall, there were greater increases seen in the report of having a checkup than in the report of having a PCP across all expansion groups (**Table 32**). Yet, the gains in insurance did not yield similar proportions in the report of a checkup in the past year in the post-ACA period. The 2014 Expanders had the greatest gains in having a checkup in the past year (4.41%, p<0.001) which was expected as this group had the greatest gains in insurance coverage.

Table 32.

Pre/Post Differences in the Report of having a Checkup in the Past year, Overall and Among Expansion Groups in the Full Analytic Sample.

Mean Checkup by Expansion Status and Time													
		2012		2013	2014	2015	2016	2017	Pre ACA	Post ACA	Growth Rate	P Value
Mean (PCA_1YR)	**No. States**	**BRFSS Sample**	Weighted %	Weighted %	Weighted %	Weighted %	Weighted %	Weighted %	Weighted %	Weighted %	(Post/Pre ACA)	X^2
Expansion Status												
Pre-ACA Expanders	4	18,478	72.22	71.30	72.25	72.43	72.71	71.32	71.76	72.17	0.57%	<0.001
2014 Expanders	23	109,003	61.84	62.90	64.89	64.69	65.82	65.05	62.37	65.12	4.41%	<0.001
Late Expanders	5	26,519	63.08	64.36	65.28	64.38	65.30	65.47	63.72	65.12	2.20%	0.958
Never Expanders	19	89,949	63.00	64.31	65.26	65.22	66.00	64.44	63.65	65.23	2.48%	<0.001
Analytic Sample												
All 50 States/DC	51	243,949	62.67	63.78	65.27	65.08	66.02	65.00	63.23	65.34	3.34%	<0.001

Notes:
1. Analtyic sample: All BRFSS respondents aged 18-64 who are white, black or Hispanic living in the U.S. who reported having a checkup, propprtions weighted by sampling fractions
2. Proportions are rounded and may not add up to 100
3. P value clumn: Pearson Chi-square tests performed to assess differences in sample distribution between expansion status and report of a checkup by year (pre vs. post ACA)

Changes in Health Care Access by Race and Expansion Status. In Specific Aim 2, one of the objectives was to assess for changes in health care access by race and expansion status. In the analytic sample, there was only a 1% growth in having a PCP. The greatest PCP growth occurred among Hispanics (4.24%, p<0.001). One would expect with access to a PCP and regular preventive care, a yearly checkup would be reported at a similar rate as the PCP rate. However, whites had a greater number of respondents with a PCP pre-ACA (78.18%) than blacks (72.12%) or Hispanics (57.54%). The PCP percentage for whites was much greater than the percentage for having a checkup (62.51%). Post-ACA, blacks and Hispanics had relatively similar PCP and checkup rates; however, a greater proportion of whites reported having a PCP (78%) than having a checkup (64%) post-ACA **(Table 33**). The percentages for PCP and checkup found in the 50-state analytic sample were similar to those found in **Table 33**. The 50-state analytic sample can be found in Appendix AB.

Table 33.

Mean PCP or Checkup in Past Year by Race and Time (47-state Analytic Sample).

Mean Health Care Access by Race and Time (47 States)											
	2012		2013	2014	2015	2016	2017	Pre ACA	Post ACA	Growth Rate	P Value
	BRFSS Sample	Weighted %								(Post/Pre ACA)	X^2
Mean (PCP)											
U.S. Race/Ethnic Groups											
Whites	184,347	78.99	77.37	77.78	78.69	78.29	77.28	78.18	78.00	-0.23%	p<0.001
Blacks	23,178	72.54	71.69	74.44	74.91	75.51	75.13	72.12	75.00	3.99%	p<0.05
Hispanics	17,946	58.39	56.69	58.17	61.04	60.25	60.39	57.54	59.98	4.24%	p<0.001
Analtyic Sub Sample											
47 States	225,471	74.39	72.82	73.90	74.95	74.47	73.80	73.61	74.27	0.90%	p<0.001
Mean (Checkup)											
U.S. Race/Ethnic Groups											
Whites	184,347	62.02	62.99	64.32	64.22	65.14	63.85	62.51	64.38	2.99%	p<0.05
Blacks	23,178	73.06	73.85	75.96	75.37	76.47	76.55	73.45	76.10	3.61%	0.7788
Hispanics	17,946	55.74	58.18	59.62	59.50	60.80	59.87	56.97	59.96	5.25%	p<0.05
Analtyic Sub Sample											
47 States	225,471	62.40	63.57	65.07	64.88	65.85	64.84	62.99	65.16	3.44%	p<0.001

Overall, whites in <u>expansion</u> states had the highest percentage of having a PCP in the pre-ACA period (79.62%), with Hispanics in non-expansion states having the lowest (55.91%). In non-expansion states, there was a decrease of -0.07% in the report of a PCP after the ACA (**Table 34**), but an increase of 1.66% in expansions states (**Table 35**). Only blacks (5.75%, p<0.001) and Hispanics (5.85%, 0<0.001) saw increases in the proportions reporting having a PCP in the post-ACA period, compared to the pre-ACA period. In non-expansion states, Hispanics were the only racial/ethnic group to benefit from the ACA in obtaining a provider, a growth of 1.85% (p<0.05). Whites reported a decline in having a PCP in non-expansion states, a decline of 0.82%, p<0.05; whereas blacks did not have any statistically significant changes.

Table 34.

Mean PCP or Checkup in the Past Year by Race and Time for Non-expansion States.

Mean Health Care Access by Race and Time (19 States)											
	2012		2013	2014	2015	2016	2017	Pre ACA	Post ACA	Growth Rate	P Value
	BRFSS Sample	Weighted %								(Post/Pre ACA)	X^2
Mean (PCP)											
U.S. Race/Ethnic Groups											
Whites	73,146	76.69	74.88	75.38	75.77	75.58	74.00	75.80	75.18	-0.82%	p<0.05
Blacks	11,347	69.72	70.07	71.49	70.89	72.71	70.99	69.89	71.51	2.32%	0.4464
Hispanics	5,456	53.15	52.94	52.44	56.22	53.83	53.58	53.04	54.02	1.85%	p<0.05
Non-Expansion States											
19 States	89,949	71.60	70.32	70.93	71.56	71.27	69.91	70.96	70.91	-0.07%	p<0.001
Mean (Checkup)											
U.S. Race/Ethnic Groups											
Whites	73,146	62.52	63.67	64.58	64.44	65.08	63.15	63.09	64.31	1.93%	0.1165
Blacks	11,347	72.96	73.58	75.38	74.37	75.51	75.66	73.26	75.23	2.69%	0.5276
Hispanics	5,456	54.45	57.35	57.51	58.95	60.29	58.19	55.91	58.75	5.08%	p<0.05
Non-Expansion States											
19 States	89,949	63.01	64.31	65.26	65.22	66.00	64.44	63.65	65.23	2.48%	p<0.001

Table 35.

Mean PCP or Checkup in the Past Year by Race and Time for Expansion States.

Mean Health Care Access by Race and Time (28 States)											
	2012		2013	2014	2015	2016	2017	Pre ACA	Post ACA	Growth Rate	P Value
	BRFSS Sample	Weighted %								(Post/Pre ACA)	X^2
Mean (PCP)											
U.S. Race/Ethnic Groups											
Whites	111,201	80.40	78.85	79.30	80.59	80.01	79.36	79.62	79.80	0.23%	p<0.001
Blacks	11,831	75.32	73.29	77.49	79.29	78.29	79.31	74.32	78.59	5.75%	p<0.01
Hispanics	12,490	61.32	58.78	61.67	64.07	63.96	64.43	60.05	63.56	5.85%	p<0.001
Expansion States											
28 States	135,522	76.19	74.39	75.89	77.31	76.59	76.40	75.29	76.54	1.66%	p<0.001
Mean (Checkup)											
U.S. Race/Ethnic Groups											
Whites	111,201	61.72	62.59	64.15	64.08	65.18	64.29	62.16	64.42	3.64%	0.0755
Blacks	11,831	73.15	74.12	76.56	76.45	77.42	77.45	73.63	76.98	4.55%	0.6403
Hispanics	12,490	56.46	58.65	60.91	59.84	61.10	60.86	57.56	60.70	5.46%	0.1161
Expansion States											
28 states	135,522	62.02	63.11	64.94	64.64	65.74	65.11	62.56	65.12	4.09%	p<0.001

Changes in Health Care Access by Diabetes Risk and Expansion Status. The second objective for Specific Aim 2 was to assess for changes in health care access by diabetes risk. In the full analytic sample, there was an overall increase in the report of a PCP among low risk (0.22%, p<0.001), high risk (1.26%, p<0.001) and individuals with diabetes (p<0.01), with individuals with diabetes having the highest PCP rate at 90.79% post-ACA (**Table 36**). (Refer to Appendix AB for 50-state analytic sample).

Table 36.

Mean PCP or Checkup in the Past Year by Diabetes Risk and Time (47-state Sample).

Mean Health Care Access by Diabetes Risk and Time (47 States)											
		2012	2013	2014	2015	2016	2017	Pre ACA	Post ACA	Growth Rate	P Value
	BRFSS Sample	Weighted %								(Post/Pre ACA)	X^2
Mean (PCP)											
U.S. Diabetes Risk											
No/Low Risk	132,297	72.63	71.04	71.66	72.95	72.09	71.49	71.86	72.04	0.25%	p<0.001
High Risk	72,771	74.17	72.36	74.04	74.53	74.74	73.57	73.22	74.21	1.35%	p<0.001
Diabetes	20,403	88.86	88.10	89.79	91.35	90.89	90.75	88.49	90.69	2.49%	p<0.05
Analtyic Sub Sample											
47 States	225,471	74.39	72.82	73.90	74.95	74.47	73.80	73.61	74.27	0.90%	p<0.001
Mean (Checkup)											
U.S. Diabetes Risk											
No/Low Risk	132,297	60.06	61.34	62.55	62.54	63.28	62.13	60.68	62.63	3.21%	p<0.001
High Risk	72,771	62.44	63.16	65.07	64.32	65.91	64.79	62.81	65.01	3.50%	p<0.001
Diabetes	20,403	80.28	81.98	83.71	84.39	84.60	83.78	81.12	84.11	3.69%	0.1945
Analtyic Sub Sample											
47 States	225,471	62.40	63.57	65.07	64.88	65.85	64.84	62.99	65.16	3.44%	p<0.001

Across all diabetes risk groups, the report of a PCP was higher than the report of a checkup, with the low risk group having the lowest report of a checkup (62.85%) in the post-ACA period. Interesting to note, changes in the report of a checkup from pre-to-post-ACA among the diabetes group was not statistically significant. The group that would benefit the most from preventive care is the high-risk group, yet their PCP and checkup means pre and post-ACA were similar to those of the low risk groups.

Within non-expansion states, there was a 0.07% decline in having a PCP, which is attributed to those at low risk (-0.71%, p<0.001). Any PCP increases in the non-expansion states are mainly due to the diabetes group (2.12%, p=0.05). The high-risk group living within non-expansion states had mean PCPs 6 percentage-points lower than those living in expansion states. For both state groups, the mean PCP levels for each diabetes risk group was higher than the mean Checkups. Although the diabetes group had the highest means for checkups in both state groups, these were not statistically significant. The mean Checkups for both the low and high-risk groups were similar in the post-ACA period in expansion and non-expansion states.

Table 37.

Mean PCP or Checkup in the Past Year by Diabetes Risk and Time for Non-expansion States.

Mean Health Care Access by Diabetes Risk and Time (19 States)											
		2012	2013	2014	2015	2016	2017	Pre ACA	Post ACA	Growth Rate	P Value
	BRFSS Sample	Weighted %								(Post/Pre ACA)	X^2
Mean (PCP)											
U.S. Diabetes Risk											
No/Low Risk	51,529	69.38	68.28	68.53	69.20	68.79	66.96	68.86	68.37	-0.71%	p<0.001
High Risk	29,924	71.47	69.68	70.77	70.92	70.79	69.79	70.53	70.55	0.03%	p<0.001
Diabetes	8,496	87.88	86.57	87.93	89.72	89.86	88.85	87.23	89.08	2.12%	0.0502
Non-Expansion States											
19 States	89,949	71.60	70.32	70.93	71.56	71.27	69.91	70.96	70.91	-0.07%	p<0.001
Mean (Checkup)											
U.S. Diabetes Risk											
No/Low Risk	51,529	60.73	62.18	62.73	63.03	63.59	61.78	61.42	62.78	2.21%	p<0.001
High Risk	29,924	62.76	63.43	65.08	64.11	65.47	63.96	63.11	64.63	2.41%	p<0.001
Diabetes	8,496	80.21	82.25	83.33	84.45	84.36	83.07	81.23	83.79	3.15%	0.253
Non-Expansion States											
19 States	89,949	63.00	64.31	65.26	65.22	66.00	64.44	63.65	65.23	2.48%	p<0.001

Table 38.

Mean PCP or Checkup in the Past Year by Diabetes Risk and Time for Medicaid Expansion States.

Mean Health Care Access by Diabetes Risk and Time (28 States)											
		2012	2013	2014	2015	2016	2017	Pre ACA	Post ACA	Growth Rate	P Value
	BRFSS Sample	Weighted %								(Post/Pre ACA)	X^2
Mean (PCP)											
U.S. Diabetes Risk											
No/Low Risk	80,768	74.66	72.68	73.71	75.41	74.16	74.38	73.69	74.40	0.96%	p<0.001
High Risk	42,847	75.96	74.14	76.28	77.20	77.52	76.22	75.01	76.79	2.37%	p<0.001
Diabetes	11,907	87.88	86.57	87.93	89.72	89.86	88.85	89.39	91.91	2.82%	0.1812
Expansion States											
28 States	135,522	76.19	74.39	75.89	77.31	76.59	76.40	75.29	76.54	1.66%	p<0.001
Mean (Checkup)											
U.S. Diabetes Risk											
No/Low Risk	80,768	59.64	60.85	62.44	62.23	63.08	62.35	60.23	62.53	3.82%	p<0.001
High Risk	42,847	62.22	62.98	65.06	64.48	66.21	65.36	62.62	65.28	4.25%	p<0.001
Diabetes	11,907	80.33	81.78	84.00	84.34	84.79	84.31	81.04	84.36	4.10%	0.5491
Expansion States											
28 States	135,522	62.02	63.11	64.94	64.64	65.74	65.11	62.56	65.12	4.09%	p<0.001

Relationship between Specific Aims 1 & 2

In the previous sections, it became apparent that gains in insurance across the expansion groups led to minor effects on having a PCP or checkup. In this section, the relationship between PCP and INS will be explored via a PCP to INS ratio which effectively controls for growth in coverage. PCP is used instead of Checkup because Checkup was a secondary measure for primary care health care access. This INS to PCP link is important as conceptually we hypothesized that the ACA worked primarily through higher INS rates to increase the number of individuals with a PCP. The PCP/INS ratio is stratified by variables of interest that identify where disparities in having a PCP or INS exist among subgroups.

It is anticipated that the ratio of PCP to INS for most demographic variables will be less than 1.0. However, a PCP to INS ratio greater than 1.0 is possible if some uninsured persons actually report having a PCP. The ratio can be thought of as a simple count of sample numbers reporting having a PCP and/or having insurance. It is actually constructed as a ratio of two percentages with identical total (or sub-sample) denominators. As the ratio of two percentages, changes are expected to be inelastic, or less than 1.0 when access to a PCP does not change commensurate with increases in insurance.

Stratification of PCP/INS Ratio

When focusing on race, whites had the highest levels of insurance in the pre-ACA period yet the lowest PCP/INS ratio (0.9266) when compared to blacks (0.9767) or Hispanics (0.9771) (**Table 39**). In the post-ACA period, as insurance coverage increased for all racial/ethnic groups, increases in having a PCP did not occur at the same rate. In fact, for whites, the percent reporting a PCP remained relatively unchanged in the post-ACA period (from 78.18% pre-ACA to 78%

post-ACA). Blacks had the highest PCP to INS ratio in the post-ACA period (0.9025) and is primarily attributed to the almost 3% gain in having a PCP from the pre-to post-ACA period. Nonetheless, their PCP/INS ratio fell over 7 percentage points. Hispanics actually had a PCP/INS ratio of 1.03 in the pre-ACA period within non-expansion states. Some uninsured Hispanics in both must be reporting having a PCP. But as insurance levels increased in the post-ACA period for Hispanics in both expansion and non-expansion states, they saw the greatest decline in the PCP/INS ratio of 11 percentage points. This suggests many newly insured Hispanics are not accessing a PCP for some reason.

Individuals living below 100% FPL and between 100-138% FPL had the lowest levels of insurance in the pre-ACA period and even lower PCP rates reported. This led to PCP/INS ratios above 1.0 for these two low income groups. This must be due to low-income earners who are uninsured being eligible for care at no cost. Even in the post-ACA period, the two lower income groups had the highest PCP/INS ratios, and the 100-138% FPL group experienced the largest decline (13 percentage points). Even though the ACA did not directly target the high-income group, small increases in insurance coverage did not lead to equal increases in obtaining a PCP.

The highest income group (>400% FPL) had the lowest PCP/INS ratio in the pre-ACA period (0.897) but only a slight decline relative to the lower-income groups. In part this must be due to less access to free PCP care and voluntarily deciding not to have a regular PCP.

As with income, lower levels of education resulted in lower levels of being insured, which resulted in a PCP/INS ratio above 1.0 in the pre-ACA period for those with less than a high school diploma. As the mean INS increased in the post-ACA period, levels of PCP did not steadily increase at the same rate. Individuals with less than a high school education saw the greatest decrease in the PCP/INS ratio, a decrease of 12 percentage points. This is due to a 10-point increase in coverage with only a 2-point increase in PCP. Individuals with less than a high school diploma in non-expansion states had the lowest levels of insurance (47.15%). For individuals with college degrees, as with the >400% FPL group, there were insured adults who did not subsequently obtain a PCP, leading to a PCP/INS ratio below the average of 0.8713. Although the ratio is low, this income group would not expect to have large gains in having a PCP since pre-ACA insurance levels were the highest (94.64%).

Table 39.

PCP/INS Ratio Stratified by ACA, Expansion Status and Key Demographic/Health Status Variables.

		PRE-ACA									POST-ACA								
		INS			PCP			PCP/INS			INS			PCP			PCP/INS		
RACE	**SAMPLE**	NEXP	EXP	TOTAL	NEXP	EXP	TOTAL	NEXP	EXP	TOTAL	NEXP	EXP	TOTAL	NEXP	EXP	TOTAL	NEXP	EXP	TOTAL
WHITES	1,048,152	0.8230	0.8562	0.8437	0.7580	0.7962	0.7818	0.9210	0.9299	0.9266	0.8701	0.9194	0.9002	0.7518	0.7980	0.7800	0.8640	0.8680	0.8665
BLACKS	121,844	0.7074	0.7688	0.7384	0.6989	0.7432	0.7212	0.9880	0.9667	0.9767	0.7906	0.8725	0.8310	0.7151	0.7859	0.7500	0.9045	0.9007	0.9025
HISPANICS	113,541	0.5148	0.6302	0.5889	0.5304	0.6005	0.5754	1.0303	0.9529	0.9771	0.6160	0.7378	0.6921	0.5402	0.6356	0.5998	0.8769	0.8615	0.8666
TOTAL	1,283,537	0.7514	0.8033	0.7831	0.7096	0.7529	0.7361	0.9444	0.9373	0.9400	0.8128	0.8791	0.8524	0.7091	0.7654	0.7427	0.8724	0.8707	0.8713
INCOME																			
<100%FPL	152,358	0.4820	0.5930	0.5496	0.5587	0.6093	0.5895	1.1591	1.0275	1.0726	0.5733	0.7541	0.6805	0.5823	0.6734	0.6363	1.0157	0.8930	0.9350
100-138%FPL	94,446	0.5720	0.6444	0.6143	0.6190	0.6482	0.6351	1.0822	1.0059	1.0339	0.6728	0.7845	0.7369	0.6275	0.6956	0.6666	0.9327	0.8867	0.9046
138-400%FPL	500,262	0.7466	0.7792	0.7658	0.6883	0.7292	0.7123	0.9219	0.9358	0.9301	0.8111	0.8572	0.8375	0.6922	0.7386	0.7187	0.8534	0.8616	0.8581
>400%FPL	536,451	0.9398	0.9501	0.9464	0.8319	0.8585	0.8489	0.8852	0.9036	0.8970	0.9504	0.9630	0.9583	0.8028	0.8370	0.8243	0.8447	0.8692	0.8602
TOTAL	1,283,517	0.7514	0.8033	0.7831	0.7096	0.7529	0.7361	0.9444	0.9373	0.9400	0.8128	0.8791	0.8524	0.7091	0.7654	0.7427	0.8724	0.8707	0.8713
EDUCATION																			
<HS	81,864	0.4715	0.5795	0.5377	0.5310	0.5917	0.5683	1.1262	1.0211	1.0569	0.5602	0.6924	0.6393	0.5486	0.6373	0.6017	0.9793	0.9204	0.9412
HS GRAD	338,187	0.7017	0.7677	0.7416	0.6803	0.7325	0.7119	0.9695	0.9541	0.9600	0.7646	0.8523	0.8166	0.6704	0.7429	0.7134	0.8768	0.8716	0.8736
SOME COLLEGE	369,710	0.7865	0.8253	0.8101	0.7358	0.7712	0.7573	0.9355	0.9344	0.9348	0.8480	0.9063	0.8824	0.7342	0.7814	0.7621	0.8658	0.8622	0.8637
COLLEGE GRAD	493,776	0.9099	0.9289	0.9216	0.8033	0.8350	0.8229	0.8828	0.8989	0.8929	0.9410	0.9601	0.9526	0.7957	0.8280	0.8154	0.8456	0.8624	0.8560
TOTAL	1,283,517	0.7514	0.8033	0.7831	0.7096	0.7529	0.7361	0.9444	0.9373	0.9400	0.8128	0.8791	0.8524	0.7091	0.7654	0.7427	0.8724	0.8707	0.8713
SEX																			
MALE	558,505	0.7360	0.7809	0.7635	0.6455	0.6913	0.6736	0.8770	0.8853	0.8823	0.7984	0.8604	0.8355	0.6470	0.7059	0.6822	0.8104	0.8204	0.8165
FEMALE	695,032	0.7677	0.8273	0.8041	0.7779	0.8191	0.8030	1.0133	0.9901	0.9986	0.8283	0.8993	0.8706	0.7760	0.8298	0.8081	0.9369	0.9227	0.9282
TOTAL	1,283,517	0.7514	0.8033	0.7831	0.7096	0.7529	0.7361	0.9444	0.9373	0.9400	0.8128	0.8791	0.8524	0.7091	0.7654	0.7427	0.8724	0.8707	0.8713
AGE																			
18 to 34	276,428	0.6827	0.7427	0.7194	0.5617	0.6254	0.6007	0.8228	0.8421	0.8350	0.7639	0.8427	0.8108	0.5662	0.6437	0.6123	0.7412	0.7639	0.7552
35 to 44	336,476	0.7462	0.7982	0.7776	0.7122	0.7513	0.7358	0.9544	0.9412	0.9462	0.7985	0.8648	0.8377	0.7030	0.7550	0.7337	0.8804	0.8730	0.8759
45 to 54	330,682	0.7831	0.8375	0.8164	0.7897	0.8245	0.8110	1.0084	0.9845	0.9934	0.8380	0.9001	0.8753	0.7968	0.8393	0.8222	0.9508	0.9325	0.9393
55 to 64	439,951	0.8357	0.8695	0.8566	0.8634	0.8838	0.8760	1.0331	1.0164	1.0226	0.8815	0.9291	0.9102	0.8597	0.8937	0.8802	0.9753	0.9619	0.9670
TOTAL	1,283,517	0.7514	0.8033	0.7831	0.7096	0.7529	0.7361	0.9444	0.9373	0.9400	0.8128	0.8791	0.8524	0.7091	0.7654	0.7427	0.8724	0.8707	0.8713
DIABETES RISK																			
LOW RISK	721,552	0.7657	0.8103	0.7934	0.6886	0.7369	0.7186	0.8993	0.9094	0.9057	0.8226	0.8827	0.8363	0.6837	0.7440	0.7204	0.8311	0.8429	0.8614
HIGH RISK	445,547	0.7226	0.7834	0.7591	0.7053	0.7501	0.7322	0.9761	0.9575	0.9646	0.7918	0.8673	0.8106	0.7055	0.7679	0.7421	0.8910	0.8854	0.9155
DIABETES	116,438	0.7749	0.8378	0.8117	0.8723	0.8939	0.8849	1.1257	1.0670	1.0902	0.8402	0.9069	0.8556	0.8908	0.9191	0.9069	1.0602	1.0135	1.0600
TOTAL	1,283,537	0.7514	0.8033	0.7831	0.7096	0.7529	0.7361	0.9444	0.9373	0.9400	0.8128	0.8791	0.8524	0.7091	0.7654	0.7427	0.8724	0.8707	0.8713

In the pre-ACA period, the PCP/INS ratio for females was 0.9986 compared to 0.8823 for males, a difference of about 12 percentage points. This difference remained unchanged from the pre to the post ACA period.

Young adults (18-34) in the pre-ACA period had the lowest levels of insurance and having a PCP leading to the lowest PCP/INS ratio by age category of 0.8350. Yet, this age demographic had the greatest gains in insurance (9 percentage points) in the post-ACA period, but only a 1 percentage point increase in reporting a PCP **(Table 39**). The 55 to 64-year-old group were more likely to have a PCP in the pre-ACA period than insurance, leading to a PCP/INS ratio of 1.02. Like other age groups, gains in INS during the ACA period did not translate to rapid gains in having a PCP, which led to declines in their PCP/INS ratios.

For diabetes risk in the pre-ACA period, individuals with a diagnosis of diabetes had a PCP/INS ratio of 1.0902, which is expected given their increased demand for health care services when compared to individuals at high or low risk of diabetes. In the post-ACA period, there was a 1% increase in having a PCP for the diabetes group. Individuals at high risk also saw a 1% increase in having a PCP in the post-ACA period, but an overall decline in the INS/PCP ratio by 5 percentage points. Generally speaking, increases in insurance did not translate to equal increases in having a PCP across various subgroups.

Elasticity of PCP

Before any stratification, the overall average PCP to INS ratio was 0.94 in the pre-ACA period and 0.87 in the post-ACA period, a decline of 7 percentage points. An elasticity was calculated by dividing the percent change in PCP between the pre and post-ACA periods by the percent change in INS. To calculate the overall average elasticity of PCP with regards to INS using data from **Table 39**:

Elasticity (PCP wrt INS)= $\%\Delta PCP/\%\Delta INS$

$((0.7427/0.7361)-1)/((0.8524/0.7831)-1) = 0.102.$

For every 10% increase in the INS rate (that increased 8.85% post-ACA), a 1% increase in having a PCP resulted. This PCP-INS link assumes that changes were a result of the ACA. This assumption will be strengthened when other variables are controlled for within the multivariate regression work in Part IV. Refer to Appendix AB for additional descriptive analyses on the uninsured.

Table 40 consolidates **Table 39** and displays changes in INS and PCPs for each demographic variable of interest. In addition, the PCP/INS elasticities are displayed in the last column. Using race as an example, whites were the only racial/ethnic group to see a decline in their PCP rate, however insignificant. Other groups that experienced a decrease in PCP for every 10% increase in INS included: >400% FPL (-2.28%), college graduates (-0.27%), and the 35 to 44 age group (-0.03%). No group was found to have PCP changes elastic to changes in INS.

Table 40.

Levels and Change in INS and PCP Rate, including Elasticity of PCP, Pre/Post-ACA.

Variables	INS-Pre	INS-Post	INS-Change	PCP-Pre	PCP-Post	PCP-Change	PCP/INS-Elasticity
RACE							
WHITES	0.8437	0.9002	0.0670	0.7818	0.7800	-0.0023	-0.0343808
BLACKS	0.7384	0.8310	0.1254	0.7212	0.7500	0.0399	0.3184326
HISPANICS	0.5889	0.6921	0.1752	0.5754	0.5998	0.0424	0.2419813
TOTAL	0.7831	0.8524	0.0885	0.7361	0.7427	0.0090	0.101319
INCOME							
<100%FPL	0.5496	0.6805	0.2382	0.5895	0.6363	0.0794	0.3333259
100-138%FPL	0.6143	0.7369	0.1996	0.6351	0.6666	0.0496	0.2485184
138-400%FPL	0.7658	0.8375	0.0936	0.7123	0.7187	0.0090	0.0959651
>400%FPL	0.9464	0.9583	0.0126	0.8489	0.8243	-0.0290	-2.3046572
TOTAL	0.7831	0.8524	0.0885	0.7361	0.7427	0.0090	0.101319
EDUCATION							
<HS	0.5377	0.6393	0.1890	0.5683	0.6017	0.0588	0.3110392
HS GRAD	0.7416	0.8166	0.1011	0.7119	0.7134	0.0021	0.0208344
SOME COLLEGE	0.8101	0.8824	0.0892	0.7573	0.7621	0.0063	0.0710188
COLLEGE GRAD	0.9216	0.9526	0.0336	0.8229	0.8154	-0.0091	-0.2709536
TOTAL	0.7831	0.8524	0.0885	0.7361	0.7427	0.0090	0.101319
SEX							
MALE	0.7635	0.8355	0.0943	0.6736	0.6822	0.0128	0.1353857
FEMALE	0.8041	0.8706	0.0827	0.8030	0.8081	0.0064	0.0767968
TOTAL	0.7831	0.8524	0.0885	0.7361	0.7427	0.0090	0.101319
AGE							
18 to 34	0.7194	0.8108	0.1271	0.6007	0.6123	0.0193	0.1519934
35 to 44	0.7776	0.8377	0.0773	0.7358	0.7337	-0.0029	-0.0369268
45 to 54	0.8164	0.8753	0.0721	0.8110	0.8222	0.0138	0.1914189
55 to 64	0.8566	0.9102	0.0626	0.8760	0.8802	0.0048	0.0766229
TOTAL	0.7831	0.8524	0.0885	0.7361	0.7427	0.0090	0.101319
DIABETES RISK							
LOW RISK	0.7934	0.8363	0.0541	0.7186	0.7204	0.0025	0.0463255
HIGH RISK	0.7591	0.8106	0.0678	0.7322	0.7421	0.0135	0.1992954
DIABETES	0.8117	0.8556	0.0541	0.8849	0.9069	0.0249	0.4596841
TOTAL	0.7831	0.8524	0.0885	0.7361	0.7427	0.0090	0.101319

Multiple Logistic Regression Analyses of Health Care Coverage and Access

In Part IV, logistic regression results are presented and discussed in two sections by aim:

- **Specific Aim 1** the impact of the ACA on the likelihood of having insurance by income group and expansion status;
- **Specific Aim 2:** the impact of the ACA on the likelihood of having a PCP, (or an annual checkup) by race and, by diabetes risk status.

Each aim consisted of two parts (a and b). For each aim, the policy effect of ACA was measured two ways: 1) an ACA indicator for pre/post changes or, 2) time dummy variables (2014-2017) to assess trends by year in the post-ACA period. The analyses using time dummy variables are referenced once within the text, with subsequent analyses provided in the Appendix. A difference-in-difference approach was used to quantify ACA effects between expansion and income groups. ACA interaction terms form the crucial difference-in-difference estimators.

Up to this point, two analytic datasets have been referenced: 1) the full 50 state and D.C. analytic sample; and 2) the 47-state analytic sample which excludes the 4 pre-ACA Medicaid expansion states. To isolate ACA effects alone, the 47-state sample will be used exclusively in Part IV. Regression methods were used to determine the statistical significance and size of the causal paths from the ACA to insurance coverage, and then to health care access. Sensitivity analysis was done using the full analytic sample which produced the same regression coefficients as in the 47-state sample.

Prior to running the multivariate logistic regressions, the correlations among the dependent and independent variables were reviewed to describe the association between random variables. Although the correlation matrix does not control for confounders, it is helpful in identifying the presence of causal relationships, which will be confirmed by regression results found later within this section.

When interpreting the correlation coefficients in **Table 41**, the coefficients include 6 years of data and reflect mean differences between the values of 0 or 1 as most variables are dichotomous or are represented by groups. All variables except income, education, diabetes risk, and chronic disease count are dichotomous variables; whereas chronic disease count was ordinal, with the rest of the variables being represented by groups. For variables that are not time-sensitive, (**Table 40)**, a single correlation is repeated 6 times, helping the power. For time-sensitive variables (such as ACA), the correlation coefficient gives an indication of how the variable means differ by time (pre vs. post ACA). Generally, the correlations with ACA will be quite low because the sample is weighted and the BRFSS mix changes are gradual.

Table 41.

Correlation Matrix for All Independent and Outcome Variables (47-state Analytic Sample).

	Income	Whites	Blacks	Hispanics	Education	Age	Female	D Risk	CDcount	SRH	Supply	Expansion	ACA	INS	PCP	Checkup
Income	1.0000															
Whites	0.3105*	1.0000														
Blacks	-0.1296*	-0.5792*	1.0000													
Hispanics	-0.2598*	-0.6917*	-0.1882*	1.0000												
Education	0.4420*	0.2454*	-0.0358*	-0.2640*	1.0000											
Age	0.1101*	0.1109*	-0.0203*	-0.1156*	-0.0022*	1.0000										
Female	-0.0879*	-0.0125*	0.0353*	-0.0162*	0.0654*	0.0158*	1.0000									
D Risk	-0.1391*	-0.1070*	0.0854*	0.0533*	-0.1565*	0.2164*	-0.0117*	1.0000								
CDcount	-0.1313*	0.0271*	0.0276*	-0.0571*	-0.0910*	0.1738*	0.0735*	0.1862*	1.0000							
SRH	-0.2730*	-0.1066*	0.0384*	0.0944*	-0.2406*	0.1304*	0.0211*	0.2720*	0.3161*	1.0000						
Supply	-0.0547*	-0.0547*	0.0806*	-0.0055*	-0.0404*	-0.0205*	0.0004	0.0391*	0.0064*	0.0294*	1.0000					
Expansion	0.0287*	0.0399*	-0.0854*	0.0275*	0.0072*	0.0072*	-0.0016	-0.0268*	-0.0017	-0.0131*	-0.4271*	1.0000				
ACA	0.0316*	-0.0029*	0.0003	0.0032*	0.0140*	-0.0044*	-0.0021*	0.0128*	0.0004	-0.0039*	0.0063*	-0.0134*	1.0000			
INS	0.3099*	0.2019*	-0.0309*	-0.2158*	0.2652*	0.1039*	0.0489*	-0.0092*	0.0267*	-0.0881*	-0.0824*	0.0787*	0.0872*	1.0000		
PCP	0.1765*	0.1338*	-0.0002	-0.1610*	0.1545*	0.2172*	0.1448*	0.0867*	0.1020*	0.0142*	0.0626*	0.0578*	0.0072*	0.3554*	1.0000	
Checkup	0.0770*	-0.0208*	0.0893*	-0.0541*	0.0604*	0.1417*	0.1054*	0.0939*	0.0818*	0.0274*	-0.0162*	-0.0048*	0.0215*	0.2383*	0.3599*	1.0000

Matrix results in **Table 41** weighted with [aweight=_llcpwt]. Statistically significant correlations at 0.05 marked with an (*).

Given the tremendous power in our analysis, standard biostatistics correlation guidelines are used with caution. For example, the variable pairs with moderate correlation coefficients (0.30-0.70) include: (1) education and income (0.4420*); (2) insurance and income (0.3099*); (3) expansion status and PCP supply (-0.4271*); (4) checkup and PCP (0.3599*); and (5) INS and PCP (0.3554*) (**Table 41**). There were no variable pairs in the matrix that were highly correlated (correlation coefficient > 0.70) using standard guidelines. But, given the large sample size, the variable pairs with "moderate" correlation coefficients are highly correlated in the positive direction. The negative correlation with expansion status and PCP supply is due to the coding of PCP supply as "1" for low supply, meaning expansion states are associated with an adequate supply of PCP, or a variable coding of "0". Generally, non-expansion states have been known to have less health care resources. Self-reported health or SRH is another variable that is coded with "1" being unhealthy.

The variables of great interest in the matrix include ACA, INS and PCP, as these variables cover our main research interest. The correlation between ACA and INS is a positive relationship of 0.0872 ($p<0.05$), meaning insurance coverage increases in the post-ACA period. The correlation between ACA and PCP is also positive (0.0072, $p<0.05$), with a coefficient that is much lower than ACA and INS. This suggests little ACA effect on PCP, which is consistent with descriptive statistic results. Yet, the correlation coefficient for ACA and PCP is still statistically significant which demonstrates the power available to detect very low effects.

In the next section, focus will be placed on the multivariate regression work conducted, where outside factors were adjusted to determine if changes in health care coverage and health care access post ACA carried policy significance. Additionally, by controlling for variables, disparities for the subgroups of interest (race or diabetes risk status) in the post-ACA period can be assessed. Typically, multicollinearity is an issue in regression analysis and the correlation matrix is helpful in identifying which variables are highly correlated to one another. Multicollinearity occurs when two highly correlated variables are placed within the same regression model, causing some variables to be statistically insignificant, when they are indeed significant. This phenomenon occurs because one variable can be predicted from another variable with a substantial degree of accuracy, leading to increased standard errors since partial regression coefficients cannot be estimated accurately. Given the large sample size in this analysis (>1.2 million observations) and weighting over six years, the standard errors are not affected due to the amount of power available to detect statistical significance.

Specific Aim 1- Odds of Insurance (INS)

In Specific Aim 1a, the purpose is to assess the impact of the ACA on enhanced access to U.S. health insurance coverage, overall and then stratified by ACA-related income groups. In Specific Aim 1b, the purpose is to determine if differences in insurance gains during the ACA existed among ACA-related income groups, adjusting for expansion status. Multiple logit and logistic regressions were run with findings displayed in **Tables 42-48**. **Table 42-45** address Specific Aim 1a and represent simple pre/post-ACA effects. **Tables 46-48** address Specific Aim 2b and stratify the odds of having insurance by income levels to test for pre/post ACA effects among ACA-related income groups, adjusting for expansion status. Appendix AD contains additional Specific Aim 1 regression models not included in the text.

Specific Aim 1a. Pre/Post-ACA Insurance Coverage Odds with ACA-Income Interactions. Model 1 only includes the predictor variable ACA, to give the overall gross correlation of the ACA period indicator with INS. The odds of having insurance in the post-ACA period (2014-2017) was 60% greater ($p<0.001$, 1.57-1.63 95% CI) than the odds of having insurance in the pre-ACA reference period (2012-2013). The constant term of 3.61 is the overall odds of being insured for a U.S. adult aged 18-64 in the pre-ACA period (**Table 42**). The overall average ACA-related INS gain in odds (60%) represents the rising INS probability from 78.31% (pre-ACA) to 85.27% (post-ACA).

Model 2 includes the addition of the ACA-related income groups. The ACA regression coefficient was relatively unchanged, with an odds ratio of 1.61 ($p<0.001$, 1.57-1.64 95% CI). This demonstrates the broad, strong effect of the ACA on INS. The constant term increased to an odds of 15.63 because the reference group narrowed to include only U.S. adults aged 18-64 living above 400% FPL in the pre-ACA period. The reference group, due to their high income, had a much higher odds of having insurance, than the groups living below 400% FPL. At this point in the regression process, the coefficients for each income level are percentage adjustments applied equally to both the pre-and post-ACA periods. Adjusting for the ACA, the <100% FPL group was the least likely to be insured (OR 0.08, $p<0.001$, 0.08-0.08 95% CI), when compared with the >400% FPL group. The 100-138% FPL group was 89% less likely to be insured than the >400% FPL group; whereas the 139-400% FPL group was 79% less likely to be insured than the >400% FPL group.

In Model 3, the ACA coefficient increased by 3.75% to an odds ratio of 1.66 ($p<0.001$, 1.62-1.70 95% CI) when demographic and health status variables were stepped in and adjusted for. This demonstrates that the ACA had a greater effect on INS when adjusting for race, education, age, sex, diabetes risk status, and chronic disease. As all coefficients are jointly estimated, the marginal increase in insurance to 15-28% odds for the 3 lower income groups shows that differences between the demographic and health status variables exist. Since lower income groups tend to have poorer health, less education and belong to a minority group, for example, by adjusting for these variables, the insurance gap closes (if even slightly) between the low-income groups and the high-income group. The constant in Model 3 reduced to an odds of 4.92 as the reference group became more specific. The constant represents U.S. white adult males aged 18-44 living above the 400% FPL with less than a high school education and were healthy and at low risk for diabetes with no chronic disease in the pre-ACA period.

Although the other coefficients were not the central focus for Specific Aim 1, it is interesting to note the following disparities in insurance coverage existed when adjusting for other factors:

- Blacks and Hispanics were 21-48% less likely to have insurance when compared to whites;
- Large gains for college graduates (3.66 times more likely than those with less than HS);
- Individuals aged 45 to 64 had increased odds (1.43) of having insurance when compared to those aged 18 to 44;
- Females had increased odds (1.42) of having insurance when compared to males;
- High Risk individuals were 8% more likely to have insurance than no/low risk individuals;
- Individuals with Diabetes were 60% more likely to have insurance than no/low risk individuals
- As the number of reported chronic diseases increased, the odds increased by 1.26, yet the individuals who reported being "unhealthy" were 14% less likely to have insurance than those who reported being "healthy".

The odds ratios for the demographic and health status variables listed above are percentage adjustments applied equally for the 6 years under study.

To differentiate between the pre-and post-ACA periods, an interaction term of ACA*Income was introduced in Model 4. Without an interaction term, the <100% FPL income group in Model 3 was 85% less likely (odds= 0.15) to have insurance in the pre-ACA period than those living above 400% FPL, when adjusting for other factors. With the addition of an ACA*Income<100% FPL interaction term in Model 4, a distinction between the pre-and post-ACA periods can be quantified. Once the main odds coefficient is “split”, between pre-and post-ACA periods, the less than 100% FPL group had a slightly lower percent insured in Model 4 (odds= 0.13), compared with Model 3’s odds of 0.15 because Model 3’s coefficient is averaged over 6 years. The odds ratio of 0.13 (relative to the >400% FPL) now represents solely the pre-ACA period. The post-ACA coefficient (1.34) is now limited to the >400% FPL income group, whites and other reference groups. It is not directly comparable to the 1.60 overall ACA effect.

With the addition of interaction terms, the marginal ACA effect on the 3 lower income groups was between 21-40% greater than for the >400% group of 34%. The lower income groups (<139% FPL) benefited more from the ACA considering Medicaid expansion was available. Since there were no changes in the odds for other demographic and health status variables, this implies that there was no change pre/post ACA.

Table 42.

Logistic Regression Models for the Odds of INS using Pre/Post ACA Indicator (47-state Sample).

Probability of Insurance (n=1,283,537)	**Model 1 Odds Ratio**	**Model 2 Odds Ratio**	**Model 3 Odds Ratio**	**Model 4 Odds Ratio**
Time				
ACA				
Pre-ACA	Ref	Ref	Ref	Ref
Post-ACA	1.60**	1.61**	1.66**	1.34**
Income				
>400% FPL		Ref	Ref	Ref
139-400% FPL		0.21**	0.28**	0.25**
100-138% FPL		0.11**	0.17**	0.14**
<100% FPL		0.08**	0.15**	0.13**
ACA*Income				
ACA* >400% FPL				Ref
ACA* 139-400% FPL				1.21**
ACA* 100-138% FPL				1.40**
ACA* <100% FPL				1.35**
Other Variables				
Race				
Whites			Ref	Ref
Blacks			0.79**	0.79**
Hispanics			0.52**	0.52**
Education				
Less than HS			Ref	Ref
HS Grad			1.61**	1.61**
Some College			2.13**	2.13**
College Grad			3.66**	3.67**
Age				
18 to 44			Ref	Ref
45 to 64			1.43**	1.43**
Sex				
Male			Ref	Ref
Female			1.42**	1.42**
Health Variables				
Diabetes Status				
No/Low Risk			Ref	Ref
High Risk			1.08**	1.08**
Diabetes			1.60**	1.60**
Chronic Disease				
Count 0-5			1.26**	1.26**
Self Reported Health				
Healthy			Ref	Ref
Unhealthy			0.88**	0.88**
Constant	3.61**	15.63**	4.92**	5.57**
F Statistic	2149**	5574**	2301**	1948**

Notes:
1. Contains odds ratio for 47-state analtyic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Refer to Appendix AD, Table AD-1 for 95% CI's for **Table 42**.

To gain a better understanding of key ACA regression coefficients in Specific Aim 1a, **Table 43** provides a summary and was created from regression coefficients in **Table 42**. Columns 1, 2 and 3 were directly taken from **Table 42.** The values for Post-ACA Income Odds (column 4) and the ACA Effect (column 5) were calculated and discussed below.

Table 43.

Summary of ACA Effects by Income Group.

INCOME GROUP	PRE-ACA ODDS	POST-ACA ODDS	ACA*INCOME ODDS	POST-ACA INCOME ODDS	ACA LOW vs HIGH INCOME EFFECT
COLUMN	**1**	**2**	**3**	**4**	**5**
<100% FPL	0.13	1.34	1.35	0.24	1.81
100-138% FPL	0.14	1.34	1.40	0.25	1.88
139-400% FPL	0.25	1.34	1.21	0.45	1.62
>400% FPL	1.00	-	-	-	-

Notes:
1. Pre-ACA Odds: Table 46, Specfic Aim 1a
2. Post-ACA Odds (Coefficient): Table 46, Specific Aim 1a
3. ACA*Income Odds (Interaction): Table 46, Specific Aim 1a
4. Post-ACA Income Odds: Calculation (Exp{ln(preACA) + ln(postACA) + ln(ACA*Income)})
5. ACA Low vs. High Income Effect: Calculation (Exp{ln(postACA)+ ln(ACA*Income)})

<u>Calculations:</u>

To derive a gross (total) estimate of the ACA effect (column 5 in **Table 43**) on the odds of having insurance coverage for the <100% FPL group, both ACA terms in Model 4 were used to produce a combined ACA effect:

<u>ACA Effect <100% FPL:</u> Exp {ln(1.34) + ln(1.35)= 0.293+0.297}= exp [0.590] = 1.809, or an 80% gain in insurance coverage relative odds versus the >400% FPL group over the pre-ACA period. The estimated total ACA effects on the odds of having insurance coverage for all four income groups when compared to the <400% FPL income group were:

- <100% FPL: 1.809
- 100-138% FPL: 1.876= Exp{ln(1.34)+ ln(1.4)= 0.293+ 0.336= 0.629}
- 138-400% FPL: 1.621= Exp{ln(1.34)+ ln(1.21)= 0.293+ 0.191= 0.484}
- >400% FPL: 1.34 (reference group).

To derive the regression-based post-ACA odds for the <100% FPL group (column 3 in **Table 47**), the group's own logit coefficient, ln(0.13) was added to the ACA effect:

<u><100% FPL Post-ACA Odds:</u> Exp {ln(0.13) + ln(1.34) + ln(1.35)= -2.04 +0.297+0.293} = exp[-1.47] = 0.235,

which also produced the same 80 percentage point difference from the baseline of 0.13 for the <100% FPL group in the pre-ACA period. The regression-based post ACA odds for all income groups were:

- <100% FPL: 0.235
- 100-138% FPL: 0.263 =Exp{ln(0.14) + ln(1.34) + ln(1.40) = -1.97 + 0.297 +0.336}= exp[-1.337]
- 138-400% FPL: 0.405 =Exp{ln(0.25) + ln(1.34) + ln(1.21)= -1.386 + 0.297+0.191}= exp[-0.902]
- >400% FPL: 7.46 (constant plus ACA)

Comparing Descriptive Results to Regression Results. For ease of interpretation, descriptive and regression results are summarized in **Table 44**. The pre/post INS percentages were taken from **Table 28,** with the change in the percentages being calculated under column 4 heading "change". The percent change for the less than 100% FPL group was 23.82% in the post-ACA without controlling for other variables. The greatest percentage change in having insurance after the ACA was seen among the <100% FPL group, followed by the 100-138% FPL group at 19.96%. Interestingly, using percentage changes only, the <100% FPL saw the greatest gains despite the legislation not directly targeting this income group.

Table 44.

Comparison of BRFSS Descriptive and Regression Results (47-state Sample).

DESCRIPTIVE STATISTICS									REGRESSION RESULTS		
INCOME GROUP	PRE-INS %	POST-INS %	PERCENT CHANGE	PRE-INS ODDS	POST-INS ODDS	CHANGE IN ODDS	PRE-ODDS >400%		PRE-ODDS	POST-ODDS	CHANGE IN ODDS
<100% FPL	0.55	0.68	23.82%	1.22	2.13	1.75	0.07		0.13	0.24	1.81
100-138% FPL	0.61	0.74	19.96%	1.59	2.80	1.76	0.09		0.14	0.26	1.88
139-400% FPL	0.77	0.84	9.36%	3.27	5.15	1.58	0.19		0.25	0.41	1.62
>400% FPL	0.95	0.96	1.31%	17.66	23.33	1.32	1.00		-	-	-

Notes:
Descriptive Results Source: Table 28, Percentages of INS by inccome group and time, 47 states
Regression Results Source: Table 46, Logistic Regression Models for Specific Aim 1a

Insurance percentages from the descriptive statistics were converted to odds ratios to compare them to the regression odds. The following calculations were used to convert the pre and post insurance percentages to pre/post insurance odds ratios:

<u>Pre INS Odds:</u> [Pre INS %/(1-Pre INS %)]

- Example (Pre INS Odds for <100% FPL): (0.5496/1-0.5496) = 1.2202

<u>Post INS odds:</u> [Post INS %/(1-Post INS %)]

- Example (Post INS Odds for <100% FPL): [0.6805/(1-0.6805)] =2.1299

When comparing the descriptive percentages and descriptive odds ratios, it's clear that the odds ratios are much larger than the percentage changes. This is because the percentages (or probabilities) are bound by 0 and 1, whereas odds are dependent upon the size of the denominator as it is a ratio of the probability of an event occurring divided by the probability of the event not occurring. Unless the event is a rare event, typically the odds ratio will be much higher than the probability for the same event.

The converted percentages to unadjusted odds ratios show the 100-138% FPL group having the greatest increase in the odds, of 76%. The unadjusted changes in the odds for the additional income groups are: 30% for the >400% FPL group, 58% for the 139-400% FPL group and 75% for <100% FPL group. The change in the odds for the descriptive statistics is less than in the regression model since the trends are unadjusted. Once adjusted for race and education, the pre-INS odds are greater in the regression results since more minorities and uneducated individuals are more likely to be uninsured. When compared to the >400% FPL income group, the very low-income groups were about 80% more likely to have insurance in the post-ACA period, when adjusting for demographic and health status variables. The reference group (>400% FPL) was 34% more likely to have insurance over the pre-ACA period.

Specific Aim 1a. Annual ACA Insurance Coverage Odds Ratios with ACA-Income Interactions. In the previous regression models, the ACA regression coefficient was averaged over 4 years, 2014-2017. When the post-ACA period was broken out by year, insurance coverage was rising from 2014-2016 (odds of 38%-75%), with a small decline by 2017 (odds of 69%) when compared to the pre-ACA period (**Table 45, Model 1**). When income, and other variables were adjusted for, the ACA effect increased (odds of 45-83%) as it did in the pre/post ACA models. However, by using dummy variables for the post ACA years (2014-2017), changes over time by income group were better understood. All pre/post ACA regressions were run using time series dummy variables, and after this section will be referenced in Appendix AD.

Table 45.

Logistic Regression Models for the Odds of Insurance using 2014-2017-Time Dummies; 47-state sample.

Probability of Insurance (n=1,283,537)	**Model 1 Odds Ratio**	**Model 2 Odds Ratio**	**Model 3 Odds Ratio**	**Model 4 Odds Ratio**
Time				
Year				
2012	Ref	Ref	Ref	Ref
2013	Ref	Ref	Ref	Ref
2014	1.38**	1.44**	1.45**	1.34**
2015	1.63**	1.64**	1.70**	1.36**
2016	1.75**	1.73**	1.83**	1.40**
2017	1.69**	1.64**	1.71**	1.27**
Income				
>400% FPL		Ref	Ref	Ref
139-400% FPL		0.21**	0.28**	0.25**
100-138% FPL		0.11**	0.17**	0.14**
<100% FPL		0.08**	0.15**	0.13**
Year*Income				
2014* >400% FPL				Ref
2014 * 139-400% FPL				1.08
2014* 100-138% FPL				1.21*
2014* <100% FPL				1.08
2015* >400% FPL				Ref
2015 * 139-400% FPL				1.22**
2015* 100-138% FPL				1.47**
2015* <100% FPL				1.32**
2016* >400% FPL				Ref
2016 * 139-400% FPL				1.30**
2016* 100-138% FPL				1.35**
2016* <100% FPL				1.49**
2017* >400% FPL				Ref
2017 * 139-400% FPL				1.26**
2017* 100-138% FPL				1.65**
2017* <100% FPL				1.62**
Other Variables				
Race				
Whites			Ref	Ref
Blacks			0.79**	0.79**
Hispanics			0.52**	0.52**
Education				
Less than HS			Ref	Ref
HS Grad			1.61**	1.61**
Some College			2.13**	2.14**
College Grad			3.66**	3.67**
Age				
18 to 44			Ref	Ref
45 to 64			1.43**	1.43**
Sex				
Male			Ref	Ref
Female			1.42**	1.42**
Diabetes Status				
No/Low Risk			Ref	Ref
High Risk			1.08**	1.08**
Diabetes			1.60**	1.60**
Chronic Disease				
Count 0-5			1.26**	1.26**
Self Reported Health				
Healthy			Ref	Ref
Unhealthy			0.88**	0.88**
Constant	3.61**	15.60**	4.91**	5.57**
F Statistic	574**	3192**	1918**	1175**

Notes:
1. Contains odds ratio for 47-state analtyic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Refer to Appendix AD, Table AD-2 for 95% CI’s for **Table 45**.

In 2014, the 100-138% FPL income group was the only income group to see increases in insurance coverage (21%, $p<0.05$), when compared to the >400% FPL income group post-ACA. Since 2014 was the 1st year post ACA implementation, it seems logical that the group that was impacted the most was the 100-138% FPL group as this group benefited from both Medicaid expansion and the insurance subsidies. By 2015, all lower income groups saw increases in the odds of having insurance (30-47%) in the post-ACA period, when compared to the >400% FPL group and controlling for other factors. During this time, the 100-138% FPL had the greatest likelihood of having insurance (47%, $p<0.001$). By 2016, interestingly, the <100% FPL was 49% ($p<0.001$) more likely to have insurance than the >400% FPL, when adjusting for other factors. The lowest income group now had the greatest likelihood of having insurance. The decline in the likelihood of having insurance by 2017, was due to the decline in the odds of having insurance in the post-ACA period by the >400% FPL group. Small increases (34-40%) were seen from 2014-2016 in the odds of insurance in the post-ACA period for the >400% FPL income group; however, a decline for this group took place by 2017.

The decline in the likelihood of having insurance in the post-ACA period for the >400% FPL group, lead to greater odds of insurance (62-65%) for the <100% FPL and 100-138% FPL income groups. The 139-400% FPL income group seemed to experience a marginal decline in the likelihood of having insurance (from 30% in 2016 to 26% in 2017), like the >400% FPL income group. The declines seen in the >139% FPL groups could be attributed to the rising costs of health insurance premiums, causing individuals to opt out of health insurance coverage post-ACA. According to a recent survey conducted by The Commonwealth Fund, individuals who receive insurance subsidies via the marketplace were significantly more likely than those with employer coverage or Medicaid to report health care as unaffordable (Collins, Gunja, Doty & Bhupal, 2018).

Specific Aim 1b. Pre/Post-ACA (and Annual) Insurance Coverage Odds Ratios Controlling for Expansion Status In Specific Aim 1b, the focus is to understand how expansion status influenced the odds of having insurance. **Tables AD-3 and AD-4**, the dichotomous expansion status variable (0=non-expansion and 1=expansion) was added to Specific Aim 1a's full model in order to assess pre/post-ACA changes in the odds of having insurance. **Table AD-3** shows logistic regression models using the pre/post ACA indicator; whereas **Table AD-4**, shows logistic regression models using the (2014-2017) time dummy variables. A brief write-up is presented along the models in Appendix AD. A limitation to running the full models, controlled by expansion status is that changes in the odds of insurance are relative to the >400% FPL income group. Alternatively, full models were run controlling for expansion status, by income group in order to compare changes across all groups. These models were helpful in understanding changes in regression coefficients for not only the low income groups, but for all income groups.

Specific Aim 1b. Pre/Post-ACA Insurance Coverage Odds Ratios Controlling for Expansion Status by Income Group. In **Table 50**, full regression models are presented, stratified by income, with the addition of an ACA*Expansion (EXP) interaction term to differentiate between pre/post differences in expansion groups. The constant represents the odds ratio for the combined set of reference groups in the regression. For example, the reference group within the <100% FPL group represents U.S. white male adults aged 18-44 with less than a high school education, reporting good health, who are at low risk for diabetes with no chronic disease in the pre-ACA period. This reference group is represented by the constant of 0.59 in the <100%

FPL group. When comparing the constant terms across income groups, the odds of having insurance for the baseline group was the lowest for the less than 100% FPL income group. This is consistent with the base percentages insured in the descriptive **Table 28** showing the <100% FPL income group having the lowest levels of insurance.

Table 46.

Logistic Regression Models for the Odds of Insurance by Income and Expansion Status Using Pre/Post-ACA Indicator (47-state Analytic Sample).

Probability of Insurance by Income Group	**Income <100% FPL Odds Ratio** (n=152,358)	**Income 100-138% FPL Odds Ratio** (n=94,466)	**Income 139-400% FPL Odds Ratio** (n=500,262)	**Income >400% FPL Odds Ratio** (n=576,687)
ACA				
Pre ACA	Ref	Ref	Ref	Ref
Post ACA	1.48**	1.62**	1.49**	1.27**
Expansion Status				
Non-expansion	Ref	Ref	Ref	Ref
Expansion	1.82**	1.50**	1.21**	1.21**
Interaction Term				
ACA*EXP	1.47**	1.31**	1.20**	1.12
Other Variables				
Race				
Whites	Ref	Ref	Ref	Ref
Blacks	0.94*	0.99	0.78**	0.64**
Hispanics	0.46**	0.56**	0.52**	0.49**
Sex				
Male	Ref	Ref	Ref	Ref
Female	1.40**	1.35**	1.39**	1.58**
Age				
18 to 44	Ref	Ref	Ref	Ref
45 to 64	1.17**	1.33**	1.50**	1.79**
Education				
Less than HS	Ref	Ref	Ref	Ref
HS Grad	1.34**	1.54**	2.05**	2.25**
Some College	1.66**	1.95**	2.75**	3.44**
College Grad	1.87**	2.35**	4.49**	7.75**
Diabetes Status				
No/Low Risk	Ref	Ref	Ref	Ref
High Risk	1.04	1.12**	1.11**	1.08*
Diabetes	1.66**	1.61**	1.67**	1.53**
Chronic Disease				
Count 0-5	1.36**	1.35**	1.18**	1.09*
Self Reported Health				
Healthy	Ref	Ref	Ref	Ref
Unhealthy	0.99	0.96	0.80**	0.77**
Constant	0.59**	0.63**	1.01	2.89**
F Statistic	286**	133**	499**	214**

Notes:
1. Contains odds ratio for 47-state analtyic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios
4. Separate model run per income level

Appendix AD includes regressions without interaction term and 95% CI's (Table AD-3).

The variables of interest in **Table 46** are the ACA, expansion (EXP) and ACA*EXP interaction terms. These terms provide critical information on how insurance levels changed by income and expansion groups over the ACA period. Even though the 100-138% FPL group saw the greatest gains in insurance coverage in the post-ACA period (ACA OR 1.62), the less than 100% FPL group in expansion states had greater odds of being insured in the post-ACA period (47%). The <100% FPL group was 3.96 times more likely to be insured post-ACA in expansion states, than in non-expansion states, when adjusting for other factors. (This was calculated by adding the logits of ACA, EXP and ACA*EXP). The overall odds of being insured for someone living in an expansion state and in the 100-138% FPL income group was 3.18; whereas the odds of someone in the 138-400% FPL was 2.16 and for those living at >400% FPL in expansion states the odds of being insured were 1.79, when adjusting for other factors. To note, the odds ratio of 1.12 for the ACA*EXP interaction term in the >400% FPL group had a p value of 0.068, which is very close to the cutoff point for statistical significance and is worth including in our analysis of ACA effects.

The post-ACA odds ratios for each income group are not representative of their own post-ACA values because covariates are introduced in the model causing the constant term to underestimate the pre-ACA insurance rate and odds ratio. When an odds ratio is adjusted for, as was done in the logistic regression analysis, there is no longer a shared baseline risk as the covariates take on different baseline values (Grant, 2014). However, since baseline insurance rates per income level are known from Part III, Tables 29 and 30, and the (estimated) change in the percent insured due to the ACA is known (per the regression odds ratios), these values were used as to calculate average odds ratios for persons living in expansion and non-expansion states by income group (**Table 51**). “Average” (odds) refers to the pre-ACA descriptive odds ratios that exist before any adjustments are made for race, income, etc. Then, marginal odds ratios are calculated for the post-ACA period. “Marginal” (odds) refers to creating post-ACA odds ratios based on regression-adjusted coefficients and then comparing them with the pre-ACA odds. In an ideal setting, mean pre-values for expansion and non-expansion states would be used.

First, the pre-ACA percentages by income and expansion status were converted to odds ratios using the following formula:

(1) OR= Percent insured/(1-percent insured)

- Example: OR= 0.931= 0.482/1-0.482.

The OR’s in Rows 1 and 2 in **Table 47** below become the base upon which logistic marginal effects are constructed. Rows 2 and 4 are reproduced in Rows 5 and 8 for comparison purposes in non-expansion and expansion states separately. Post-ACA ORs, or ACA effects, by expansion status (Rows 6 and 9) were calculated using the following formulas:

(2) OR[NEXP]= exp(LN(ACA OR) + LN(NEXP-pre))

- Example: 1.377= Exp{ln(1.48) + ln(0.931)}= Exp{0.392 -0.071=0.321}= 1.377

(3) OR[EXP] = exp((LN(ACA OR) + LN(ACA*EXP OR) + LN(EXP-pre))

- Example: 3.170= Exp{ln(1.48) + ln(1.47) + ln(1.457)}= Exp{1.153}=3.167.

The EXP coefficient is not included in calculating OR(EXP) because it is already included in the pre-ACA baseline insurance rate.

Then Rows 5 and 8 show the post-ACA insurance gains over the pre-ACA period.

Table 47.

Conversion of Marginal Odds Ratios for Insurance to Average Odds Ratio for Insurance in Non-expansion and Expansion States.

EXPANSION ODDS RATIOS W/ PRE-ACA %INS ODDS					
Row	**Odds**	**INC<100**	**INC100-138**	**INC138-400**	**INC>400**
1	**NEXP-pre**	0.931	1.336	2.953	15.667
2	**EXP-pre**	1.457	1.809	3.525	19.000
NEXP					
3	**Pre-ACA**	0.931	1.336	2.953	15.667
4	**Post-ACA**	1.377	2.165	4.399	19.897
5	**Post/Pre**	1.480	1.620	1.490	1.270
EXP					
6	**Pre-ACA**	1.457	1.809	3.525	19.000
7	**Post-ACA**	3.170	3.839	6.302	27.026
8	**Post/Pre**	2.176	2.122	1.788	1.422

The greatest relative gains in insurance in expansion states were within the <100% FPL with a pre/post odds ratio of 2.176. The 100-138% FPL income group had the next largest pre/post-odds ratio of 2.122. The >400% FPL income group, although not directly targeted by the ACA, did see increases in insurance coverage odds in the post-ACA period, but not at similar rates as the lower income level groups. The increase seen in the <100% FPL was above the gains seen with the descriptive data seen in **Table 30**.

For non-expansion states in the post-ACA period, individuals living 100-138% FPL had the greatest gains in insurance with an odds ratio of 1.62. This was 13-percentage points greater than the next largest gain in the 138-400% FPL group. Greater gains in the 100-400% FPL group would be expected for non-expansion states as insurance subsides were available to this group;

whereas, residents who had incomes less than 100% FPL did not qualify for Medicaid and were not eligible for the premium tax credit. The Kaiser Family Foundation estimated that 2.2 million Americans in non-expansion states fell into this coverage gap (Kaiser Family Foundation, 2018). The 62% increase seen in the 100-138% FPL was above the gains seen with the descriptive data seen in **Table 29** (summarized in **Table 48** below). By calculating the change in the odds in the expansion group over the overall ACA effect for each income group, it is clear that the odds of having insurance in the post ACA period was 6-20% greater than the overall ACA effect, within expansions states. The lowest income groups benefited the most, at 20% gains over ACA effect.

Table 48.

Summary Table Comparing Changes in Odds Ratios from 3 Sources: Table 23 Descriptive Statistics, Table 46 for Overall Changes from Logistic Regressions, and Table 50 for Logistic Regression by Income Group.

PRE/POST-ACA ODDS RATIOS						
INCOME	**TABLE 28**	**TABLE 47: OVERALL**	**TABLE 53: EXP**	**TABLE 53: NEXP**	**RATIO: T53/T46 (EXP)**	**RATIO: T53/T46 (NEXP)**
<100% FPL	1.750	1.810	2.180	1.480	1.204	0.818
100-138% FPL	1.760	1.880	2.120	1.620	1.128	0.862
139-400% FPL	1.580	1.620	1.790	1.490	1.105	0.920
>400% FPL	1.320	1.340	1.420	1.270	1.060	0.948

Notes:
1. Under Table 28 heading: Percent insured converted to Odds Ratios
2. Under Table 47 heading: Overall ACA Effect
3. Under Table 53 headings: Computed odds ratio from baseline percentages by EXP status
4. Under Ratio: Expansion status odds divided by overall ACA effect odds

Generally, from this analysis expansion states benefited the most given the higher levels of insurance in the pre-ACA period, and potentially a political environment that was conducive of enrolling individuals for health insurance, which was not controlled for in this analysis. Non-expansion states did make coverage gains as highlighted in **Table 48**, but not enough to reap the full benefit of the ACA effect. The greatest opportunities to improve insurance enrollment within non-expansion states was among individuals living below 100% FPL, who were 28% less likely to benefit from the ACA (**Table 48**). The 100-138% FPL was close behind, with an odds ratio of 0.862. This highlights the integral role Medicaid expansion played in ensuring access to insurance for low-income adults during the ACA period.

For a summary of logistic regression results and discussion on additional regression coefficients found in this section, refer to Appendix AD.

Specific Aim 2- Health Care Access

In Specific Aim 2a, the purpose was to assess the impact of the ACA on increasing health care access (as measured by PCP or Checkup in the past year) in the U.S. by race, then by diabetes risk status. In Specific Aim 2b, the purpose was to determine if differences in health care access existed between non-expansion and Medicaid expansions states, stratified by race, then by diabetes risk status. Multivariate logit and logistic regressions were run with findings displayed in **Tables 49-68**. For each aim, the odds of having a PCP will be discussed first, followed by the odds of having a checkup in the past year. The odds of having a checkup in the past year was a secondary measure for health care access, with most of the analyses found in the appropriate Appendix. Important to note, explanatory variables included in this model are the same as the variables in Specific Aim 1, except insurance replaced income, and PCP supply was added as a control variable in the full model. As previously mentioned, the ACA is working via expanded insurance coverage, in part, to provide access to a PCP (or a checkup in the past year). As hypothesized, if insurance coverage is controlled for, the ACA effect on access to primary care should be less and possibly zero. Appendix AE contains additional Specific Aim 2 regressions models for PCP, including the time series models, not included in the text. Appendix AF contains additional Specific Aim 2 regression models for Checkup.

From the previously presented correlation matrix in **Table 41**, the INS and PCP variables for the analytic sample are highly correlated with a correlation coefficient of ρ= 0.3554 ($p<0.05$). The INS and Checkup variables are also highly correlated: ρ= 0.2383, ($p<0.05$), but less so then INS and PCP. Models 1 and 2, respectively, in **Table 49** convert the correlation coefficients into the odds of having health care access with versus without insurance. Models 1 and 2 only include the INS variable in each Model.

Table 49.

Logistic Regression Odds of Having a PCP or Checkup in the Past Year for White, Black or Hispanic Insured Adults Aged 18-64.

Probability of Health Care Access (n=1,283,537)	**Model 1 Odds Ratio (PCP)**	**95% CI**	**Model 2 Odds Ratio (Checkup)**	**95% CI**
Insurance				
Uninsured	Ref		Ref	
Insured	6.51**	(6.38, 6.65)	3.53**	(3.46, 3.61)
Constant	0.66**	(0.65, 0.67)	0.65**	(0.64, 0.66)
F Statistic	32268**		14704**	

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Averaged over 6 years, insured whites, blacks and Hispanics aged 18-64 living in one of the sample's 47-states were 6.5-times more likely to have a PCP ($p<0.001$) than the uninsured, and 3.53-times more likely to have a checkup in the past year ($p<0.001$). **Table 33** suggests a PCP fraction of 0.74 for the insured averaged 40-60% over the pre-and post-ACA periods converts into an odds ratio of 0.351. The logistic-based odds ratio for insured is exp{ln(0.66)+ln(6.51)}=(0.429)/(1+0.429)= 0.812, which is quite similar to 0.74 from **Table 33**. The constant term of 0.66 for Model 1 or 0.65 for Model 2 is the odds of being uninsured for a U.S adult aged 18-64 across the six years under study. The odds for PCP and checkup show that insurance plays an important role in ensuring health care access, especially in having a PCP. Insurance appears to play a lesser role in ensuring access to a checkup as many safety net systems are in place across the country that provide preventive medicine to the uninsured without a one-to-one assignment of a PCP.

Once the average odds for the insured were known over the 6-year period, regression models were run to determine the impact of the ACA on PCP access with and without insurance coverage. When ACA was stepped in Model 1 alone, respondents were only 3% more likely (p<0.001, 1.02-1.05 95% CI) to have a PCP in the post-ACA period, compared with the pre-ACA period. The constant of 2.79 is the overall odds of having a PCP for a U.S. adult aged 18-64 in the pre-ACA period (**Table 50**). The overall ACA average PCP gains in odds (3%) derives the rising PCP probability from 73.61% to 74.27% (**Table 33**).[8]

The likelihood of having a checkup was 10% greater (p<0.001, 1.08-1.12 95% CI) post-ACA, when compared to the pre-ACA period. The constant term of 1.70 was the overall odds of having a checkup in the past year for a U.S. adult aged 18-64 in the pre-ACA period (**Table 51**). The overall average gains in odds (10%) of having a checkup in the past year represents the rising checkup probability from 63.23% to 65.34% (**Table 33**).

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[8] OR= 1.03= (0.7427)/(1-0.7427)/(0.7361)/(1-0.7361)= 2.887/2.789

Table 50.

Logistic Regression Models for the Odds of Having a PCP by INS Status using Pre/Post ACA Indicator for 47-state Analytic Sample.

Probability of Having a PCP (n=1,283,537)	**Model 1 Odds Ratio**	**Model 2 Odds Ratio**	**Model 3 Odds Ratio**	**Model 4 Odds Ratio**
ACA				
Pre-ACA	Ref	Ref	Ref	Ref
Post-ACA	1.03**	1.04**	0.90**	1.01
Insurance				
Uninsured			Ref	Ref
Insured			5.33**	5.88**
ACA*INS				
ACA*INS				0.85**
Other Variables				
Race				
Whites		Ref	Ref	Ref
Blacks		0.86**	0.95*	0.95*
Hispanics		0.56**	0.69**	0.69**
Education				
Less than HS		Ref	Ref	Ref
HS Grad		1.62**	1.31**	1.31**
Some College		2.04**	1.49**	1.49**
College Grad		2.83**	1.78**	1.78**
Age				
18 to 44		Ref	Ref	Ref
45 to 64		2.50**	2.39**	2.39**
Sex				
Male		Ref	Ref	Ref
Female		1.94**	1.96**	1.96**
Diabetes Status				
No/Low Risk		Ref	Ref	Ref
High Risk		1.18**	1.18**	1.18**
Diabetes		2.98**	2.88**	2.88**
Chronic Disease				
Count 0-5		1.39**	1.36**	1.36**
Self Reported Health				
Healthy		Ref	Ref	Ref
Unhealthy		0.93**	1.03*	1.03*
PCP Supply				
Adequate Supply		Ref	Ref	Ref
Low Supply		0.74**	0.81**	0.81**
Constant	2.79**	0.85**	0.30**	0.28**
F Statistic	16**	2285**	3070**	2877**

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Appendix AE includes 95% CI's (Table AE-1) for regression models found in **Table 50.**

Table 51.

Logistic Regression Models for the Odds of having a Checkup in the past year using pre/post ACA indicator; 47-state Analytic Sample.

Probability of Checkup (n=1,283,537)	**Model 1 Odds Ratio**	**Model 2 Odds Ratio**	**Model 3 Odds Ratio**	**Model 4 Odds Ratio**
Time				
ACA				
Pre-ACA	Ref	Ref	Ref	Ref
Post-ACA	1.10**	1.10**	1.01	1.11**
Insurance				
Uninsured			Ref	Ref
Insured			3.49**	3.75**
ACA*INS				
ACA*INS				0.89**
Other Variables				
Race				
Whites		Ref	Ref	Ref
Blacks		1.81**	2.02**	2.02**
Hispanics		1.00	1.21**	1.21**
Education				
Less than HS		Ref	Ref	Ref
HS Grad		1.35**	1.13**	1.13**
Some College		1.42**	1.10**	1.11**
College Grad		1.67**	1.19**	1.19**
Age				
18 to 44		Ref	Ref	Ref
45 to 64		1.66**	1.57**	1.57**
Sex				
Male		Ref	Ref	Ref
Female		1.51**	1.49**	1.49**
Diabetes Status				
No/Low Risk		Ref	Ref	Ref
High Risk		1.08**	1.08**	1.08**
Diabetes		2.52**	2.43**	2.43**
Chronic Disease				
Count 0-5		1.23**	1.20**	1.20**
Self Reported Health				
Healthy		Ref	Ref	Ref
Unhealthy		0.92**	0.98	0.98
PCP Supply				
Adequate Supply		Ref	Ref	Ref
Low Supply		0.91**	0.98*	0.98*
Constant	1.70**	0.69**	0.32**	0.30**
F Statistic	158**	1229**	1827**	1706**

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Appendix AF includes 95% CI's (Table AF-1).

In Model 2, respondent demographic and health status variables, along with state supply of PCP were added to the model, still excluding insurance. Post-ACA odds changed by only 0.001 for PCP and was unchanged for checkup. This shows that the other predictor variables had no meaningful effect on the likelihood of having a PCP during the ACA period. The constant terms were reduced to 0.85 for PCP and 0.69 for checkup since the baseline group now includes only U.S. adults aged 18-64 living above 400% FPL in the pre-ACA period.

The next two models are key to the analysis but difficult to interpret as they require keeping in mind differences in insurance effects pre-versus post-ACA, as well as correlations of insurance with other included variables. Based on these results, two questions can be answered:

1. What effect does controlling for insurance coverage have on the effect of the ACA on PCP access?
2. What effect does controlling for the ACA time period plus other variables have on the insurance effect on PCP access?

Once INS is in Model 3, the post-ACA effect on PCP declined from 1.03 to 0.90. Individuals in the post-ACA period were 10% less likely to have a PCP. The gains in the one-year odds for having a checkup now was only 1% in the post-ACA period. This is consistent with the descriptive data that showed much slower gains in PCP than gains in having insurance. Such anomalous results, however, are largely due to controlling for the primary way the ACA could have affected PCP access. This become evident when an ACA*INS interaction term is added to Model 4. The post-ACA odds coefficient has increased to 1.01 and is not statistically different from 1.0. The 1% gain is consistent with the 0.9% gain in the PCP/INS ratio. The interaction coefficient, however, is 0.85, implying a 15% decline in the effectiveness of insurance in affording access to a regular PCP during the post-ACA period. The overall INS effect on PCP in Model 4 is determined as:

- Exp{ln(5.88)+ln(0.85)= 1.772- 0.163= 1.609}= 5.00,

which is about 6% less than the 5.33 estimate in Model 2. Comparing the INS effect of 5.00 to the uncontrolled effect of 6.51, the decline has been 23.2%.

We also note that in PCP Model 3, **Table 50**, that the insurance effect on having a PCP has declined from 6.51 to 5.33, an 18% reduction. This must be due to controlling for the ACA period and other variables in the model. Comparing Model 3 with Model 2, we see that the odds for minority status, self-reported health, and PCP supply have all increased. All three are negatively correlated with INS (see **Table 41**). Their effects on PCP access were less in Model 2 because they included their lower average level of insurance coverage. By contrast, minority status, college, and age saw their odds fall once INS was controlled for. This because some of the Model 2 coefficients reflected higher average levels of insurance (resulting from positive INS correlations; see **Table 41**).

Deriving ACA-INS Effect on PCP

In order to derive an ACA-INS to PCP effect, logit regression coefficients were produced in **Table 52.** The key ACA to INS pathway is measured by the logit coefficient 0.01, which is positive. When multiplied by the positive logit coefficient, 1.77, connecting INS to PCP, the product gives the contribution of the ACA through INS to having a PCP. The logit coefficients 0.01 and 1.77 are partial effects, adjusting for other covariates in the model. Hypothetically, a direct pathway (not going through INS) from ACA to PCP is included, but is hypothesized to approach zero when controlling for INS.

Table 52.

Logit Regression Models for the Likelihood of having a PCP using Pre/Post ACA Indicator; 47-state Analytic Sample.

Probability of Having a PCP (n=1,283,537)	**Model 1** Logit	**Model 2** Logit	**Model 3** Logit	**Model 4** Logit
ACA				
Pre-ACA	Ref	Ref	Ref	Ref
Post-ACA	0.03**	0.03**	-0.11**	0.01
Insurance				
Uninsured			Ref	Ref
Insured			1.67**	1.77**
ACA*INS				
ACA*INS				-0.16**
Other Variables				
Race				
Whites		Ref	Ref	Ref
Blacks		-0.15**	-0.05*	-0.05*
Hispanics		-0.59**	-0.37**	-0.37**
Education				
Less than HS		Ref	Ref	Ref
HS Grad		0.48**	0.27**	0.27**
Some College		0.71**	0.40**	0.40**
College Grad		1.04**	0.58*	0.58**
Age				
18 to 44		Ref	Ref	Ref
45 to 64		0.92**	0.87**	0.87**
Sex				
Male		Ref	Ref	Ref
Female		0.66**	0.67**	0.67**
Diabetes Status				
No/Low Risk		Ref	Ref	Ref
High Risk		0.16**	0.16**	0.16**
Diabetes		1.09**	1.06**	1.06**
Chronic Disease				
Count 0-5		0.33**	0.31**	0.31**
Self Reported Health				
Healthy		Ref	Ref	Ref
Unhealthy		-0.07**	0.03*	0.03*
PCP Supply				
Adequate Supply		Ref	Ref	Ref
Low Supply		-0.30**	-0.21**	-0.21**
Constant	1.03**	-0.16**	-1.19**	-1.26**
F Statistic	16**	2285**	3070**	2877**

Notes:

1. Contains logit coefficients for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logit regression models

The full effect of the ACA on PCP involves taking the total derivative of the semi-log logit function with respect to ACA (Keisler, 2012), i.e.,

(1) $\delta \ln PCP_{odds}/\delta ACA = 0.01*(\delta ACA/\delta ACA = 1) + 1.772*\delta INS/\delta ACA$

$- 0.163*\delta(ACA*INS)/\delta ACA.$

The derivative (δ) of a natural log is the percent change in the PCP log odds. The derivative, δ(ACA*INS)/δACA, has two terms:

- $INS*\ \delta ACA/\ \delta/ACA = INS_{base}$ x 1, plus
- $ACA_{base}*\ \delta INS/\ \delta ACA$.

The first term captures what would have happened to ln(PCP) if greater coverage boosted access at historical coverage rates. The second term reflects what happened to the 35% pre-ACA sample in terms of PCP access during the post-ACA period. Both are multiplied by a -0.163 [logit coefficient for ACA*INS] reflecting the weakening effect of insurance in gaining access to a PCP in the post-ACA period.

According to **Table 28**, the actual percent insured increased 8.85% post-ACA (from 78.3% to 85.2%) in the 47-state sample. Equation 1 was modified by inserting the 8.85% into the equation, as well as the base period average rate (0.7831) and percent of the sample in the pre-ACA period (0.35),

(2) $\delta \ln PCP_{odds}/\delta ACA = 0.01 + 1.772*.0885 - .163*(.7831 + 0.35*0.0885)$

$= 0.01 + \ 0.157 – 0.128 – 0.005 = 0.01 + 0.024 = 0.034.$

This estimate is almost identical to the 0.345 found using the single ACA term to explain PCP gains from the ACA. It assumes that the ACA was responsible for the entire observed growth in coverage; an assumption that is modified later.

The ACA effect is in four parts. Two are negative, and they offset the very large positive effect (0.157) that the ACA had on PCP by increasing insurance coverage at base period insurance rates.

From Equation 2, the ACA effect is in four parts, where two are negative and offset the very large positive effect (0.157) that the ACA had on PCP. The ACA increased insurance coverage at base period insurance rates. *This could have been the increase in PCP access had coverage remained as effective in the post-ACA period as earlier.* Once the potentially large ACA insurance effect is accounted for, the largest offset (-0.128= -0.163*0.7831) represents a downward shift in the advantage of having insurance coverage in the ACA versus the base period. From sample-weighted tables of trends in insurance and PCP, the ratio of PCP/INS fell from 0.939 in the ACA period to 0.873 in the base ACA period, a 7.6 reduction. Although many more individuals were gaining insurance coverage, these gains were not being transformed into gains in PCP at the former rate. This diminished gain was compounded by a 0.5% (-0.005 in equation 2) additional "loss" from being either insured or uninsured in the ACA period. Accounting for the two deficits, the net PCP gain from increased coverage was only 2.4 percentage points (0.024 in equation 2). Other ACA-related factors not controlled for in the model must have added almost another percentage point.

A Regression-based Measure of ACA's Effect on PCP via INS

Considering that all the gains in insurance coverage post-ACA was not due entirely to the ACA program, a regression-based measure is calculated to derive ACA's effect on PCP via INS. Controlling for the same variables as before, the ACA odds ratio for INS was 1.66, a ratio that is consistent with a predicted post-ACA insurance rate of 0.857 using 0.7831 as the pre-ACA rate.[9] This is very close to the 0.852 in the descriptive tables (**Table 28**). Therefore, the ACA-related percentage point change in coverage is 0.074 (0.857-0.7831). Inserting this new value into equation 2 gives:

(3) $\delta \ln PCP_{odds}/\delta ACA = 0.01 + 1.772*.074 - .163*(.7831 + 0.35*0.074)$

$= 0.01 + 0.131 – 0.128 – 0.004 = 0.01 -0.001 = 0.009.$

In this calculation, the ACA-related increase on PCP of 7.4 percentage points is completely offset by the weakening effect of insurance in leading to a PCP. This suggests that the entire expected growth in PCP access from greater coverage was hindered by a combination of newly insured individuals failing to access a PCP, and/or previously insured losing their access in the post-ACA period, despite retaining coverage. Additional considerations and discussion will follow in Chapter 5.

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[9] Predicted post-ACA insurance rate:
(1) Convert 0.7831 to odds = [0.7831/0.2169];
(2) Add pre-ACA odds to post-ACA change in odds (1.66)= exp((ln(5.9926)+ln(1.66))= 0.857.

Specific Aim 2a: Health Care Access by Race

Specific Aim 2a. Pre/Post-ACA Health Care Access Odds with ACA-Race Interactions. The previous two tables split the ACA effects between the insured and uninsured using pre/post ACA*INS interaction term. Single main effects coefficients were used for the three race/ethnic groups (with whites in the intercept). This implicitly assumes no differential effect of the ACA on race/ethnicity. In this section, this assumption is tested by introducing an ACA*Race interaction term in place of the INS interaction. Hypothesis 2a is that the ACA policies should increase access to primary health care and narrow disparities for the two minority groups, blacks and Hispanics. Insurance coverage is included in the model as the main effect; thus, any race-related effects of the ACA would be interpreted as “over-and-above” insurance effects. Sensitivity analyses with ACA*INS*Race, ACA*Race and ACA*INS interaction terms were included and discussed in Appendix AF.

Table 53 shows logistic results for models explaining variation in PCP and Checkup using main race and ACA interaction variables, along with the post-ACA indicator among other variables. When the ACA*Race interaction terms are included, it is apparent that both minority groups made gains in having a PCP relative to whites.

Table 53.

Logistic Regression Models for Health Care Access by Race/Ethnicity, using Pre/Post ACA Indicator for 47-state Analytic Sample.

Probability of Having Health Care Access (n=1,283,537)	**PCP Odds Ratio**	**95% CI**	**Checkup Odds Ratio**	**95% CI**
ACA				
Pre-ACA	Ref		Ref	
Post-ACA	0.87**	(0.85, 0.89)	1.01	(1.00, 1.03)
Race				
Whites	Ref		Ref	
Blacks	0.89**	(0.85, 0.93)	2.03**	(1.94, 2.12)
Hispanics	0.66**	(0.63, 0.69)	1.22**	(1.17, 1.27)
ACA*Race				
ACA*whites	Ref		Ref	
ACA*blacks	1.11**	(1.05, 1.18)	0.99	(0.94, 1.05)
ACA*hispanics	1.08*	(1.02, 1.14)	0.99	(0.94, 1.04)
Other Variables				
Insurance				
Uninsured	Ref		Ref	
Insured	5.33**	(5.21, 5.46)	3.49**	(3.41, 3.57)
Education				
Less than HS	Ref		Ref	
HS Grad	1.31**	(1.27, 1.36)	1.13**	(1.10, 1.17)
Some College	1.49**	(1.43, 1.54)	1.10**	(1.07, 1.14)
College Grad	1.78**	(1.72, 1.85)	1.19**	(1.15, 1.22)
Age				
18 to 44	Ref		Ref	
45 to 64	2.39**	(2.34, 2.43)	1.57**	(1.55, 1.60)
Sex				
Male	Ref		Ref	
Female	1.96**	(1.92, 1.99)	1.49**	(1.47, 1.51)
Diabetes Status				
No/Low Risk	Ref		Ref	
High Risk	1.18**	(1.17, 1.20)	1.08**	(1.06, 1.09)
Diabetes	2.88**	(2.74, 3.02)	2.43**	(2.34, 2.51)
Chronic Disease				
Count 0-5	1.36**	(1.33, 1.39)	1.20**	(1.18, 1.22)
Self Reported Health				
Healthy	Ref		Ref	
Unhealthy	1.03*	(1.00, 1.06)	0.98	(0.96, 1.003)
PCP Supply				
Adequate Supply	Ref		Ref	
Low Supply	0.81**	(0.80, 0.83)	0.98*	(0.96, 0.99)
Constant	0.31**	(0.30, 0.32)	0.32**	(0.30, 0.33)
F Statistic	2686**		1600**	

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Refer to Appendix AE (Table AE-3) for 95% CI's.

To gain a better understanding of the key ACA regression effects of having a PCP or checkup by race, **Table 54** provides a summary of key ACA-related coefficients. Columns 1, 3, and 4 were taken directly from **Table 53**; whereas columns 2 and 5 are calculated as shown below.

Table 54.

Summary of Pre/Post-ACA Effects on PCP and Checkup by Race/Ethnicity; 47-state Sample.

RACE GROUPS	PRE-ACA ODDS	POST-ACA ODDS	ACA*RACE ODDS	POST-ACA RACE ODDS	ACA MINORITY vs WHITE EFFECT
COLUMN	1	2	3	4	5
PCP					
WHITES	1.00	0.87	-	0.87	0.87
BLACKS	0.89	0.87	1.11	0.86	0.97
HISPANICS	0.66	0.87	1.08	0.62	0.94
CHECKUP					
WHITES	1.00	1.01	-	1.01	1.01
BLACKS	2.03	1.01	0.99	2.02	1.00
HISPANICS	1.22	1.01	0.99	1.22	1.00

Notes:
1. Pre-ACA Odds: Table 53, Specfic Aim 2a
2. Post-ACA Coefficient: Table 53, Specific Aim 2a
3. ACA*Race Interaction: Table 53, Specific Aim 2a
4. Post-ACA RACE Odds: Calculation (Exp{ln(preACA) + ln(postACA) + ln(ACA*Race)})
5. ACA MINORITY vs. WHITE EFFECT: Calculation (Exp{ln(postACA)+ ln(ACA*Race)})

Two types of ACA effects can be calculated from **Table 52**:

1. Post-ACA odds for whites and minorities compared with the pre-ACA period
2. ACA effects on minorities when compared to whites.

Post-ACA RACE Odds:

- Whites: 0.87
- Blacks: 0.86= EXP((LN(0.89)+LN(0.87)+LN(1.11))),
- Hispanics: 0.62= EXP((LN(0.66)+LN(0.87)+LN(1.08)))

Controlling for insurance and other variables, all three race/ethnic groups experience a decline in the likelihood of having a PCP. Such large declines are the result of a decline in the efficacy of insurance in increasing PCP access during the four post-ACA years.

To drive a net ACA effect (column 6) on the odds of having a PCP or a checkup in the past year for the racial groups, the Post-ACA and ACA*RACE coefficients were used:

<u>ACA MINORITY-WHITE EFFECT:</u>

- Whites: 0.87 (Reference Group)
- Blacks: 0.97= EXP((LN(0.87)+LN(1.11)))
- Hispanics: 0.94= EXP((LN(0.87)+LN(1.08)))

The ACA*Race interaction terms add 10% to PCP access for blacks relative to whites and 7% for Hispanics. Of course, the two minority groups were starting at lower pre-ACA PCP rates, but closed the gap relative to whites.

Similar calculations were made for Checkup as an alternative measure of primary care access. A statistically insignificant finding for the interaction terms means that there were not differences between whites and minorities in receiving a checkup in the past year in the post-ACA period.

Comparing Descriptive Results to Regression Results. For ease of interpretation, in **Table 55**, logistic regression results are compared with earlier descriptive results found in **Table 33**. Pre/post PCP and Checkup percentage changes are shown in the data column 3 heading “change”. It is clear that blacks and Hispanics saw slight gains (4%, respectively) in having a PCP over the ACA period; gains not enjoyed by whites. Any gains, however, may have been due to the relative gain insurance coverage for minorities which is not controlled for in the descriptive statistics. Still- Hispanics continued to have low levels of insurance in the post-ACA period (59.98%).

Table 55.

Comparison of BRFSS Descriptive Results with Regression Results, 47-state Sample.

DESCRIPTIVE STATISTICS									REGRESSION RESULTS		
RACE GROUP	PRE (%)	POST (%)	CHANGE	PRE (ODDS)	POST (ODDS)	CHANGE	PRE-REL ODDS WHITES		PRE-REL ODDS	POST-REL ODDS	CHANGE
COLUMN	1	2	3	4	5	6	7		8	9	10
PCP											
WHITES	78.18	78.00	0.9977	3.5830	3.5455	0.9895	1.0000		-	-	-
BLACKS	72.12	75.00	1.0399	2.5868	3.0000	1.1597	0.7220		0.8900	0.8600	0.9663
HISPANICS	57.54	59.98	1.0424	1.3552	1.4988	1.1060	0.3782		0.6600	0.6200	0.9394
CHECKUP											
WHITES	62.51	64.38	1.0299	1.6674	1.8074	1.0840	1.0000		-	-	-
BLACKS	73.45	76.10	1.0361	2.7665	3.1841	1.1510	1.6592		2.0300	2.0500	1.0099
HISPANICS	56.97	59.96	1.0525	1.3240	1.4975	1.1311	0.7940		1.2200	1.2300	1.0082

Notes:
1. Descriptive Results Source: Table 33, Percentages of PCP or Checkup by race/ethnic group and time, 47 states
2. Regression Results Source: Table 53 (PCP) and (Checkup), Logistic Regression Models for Specific Aim 2a

Descriptive PCP and Checkup percentages were converted to odds ratios to compare their changes to those based on the regression odds.

Pre-Odds (PCP or Checkup): [Pre (%)/(1-Pre INS %)]

- Example: Pre-Odds (PCP) for whites = [(0.7818)/(1-0.7818)]= 3.5830

Post-Odds (PCP or Checkup): [Post (%)/(1-Post (%)]

- Example: Post Odds (PCP) for whites= [(0.7800)/(1-0.7800)]= 3.5455.

The unadjusted, descriptive, odds ratios show that blacks had the largest increase in the odds of having a PCP post-ACA; an odds that was 5-percentage points higher than that of Hispanics and 17-percentage points higher than whites. Even though whites experienced a slight decline in having a PCP, the unadjusted odds of having a Checkup in the past year increased 8%.

This gain, however, was 7-percentage points lower than for blacks and 5-percentage points lower than for Hispanics.

Column 7 (Pre-ACA relative odds whites), is the ratio of the odds of a minority group having a PCP or a Checkup in the pre-ACA period (Pre-Odds) to that of whites, again, using descriptive data. Blacks were 28% less likely to have a PCP when compared with whites pre-ACA; whereas Hispanics were 62% less likely to have a PCP when compared with whites pre-ACA. For a checkup, blacks were 34% less likely and Hispanics 62% less likely to have a Checkup than whites pre-ACA.

The descriptive pre-ACA relative odds differ from the pre-ACA relative odds based on logistic regression models since they are not adjusted for other factors. Once adjusting for demographic, health and state-level factors in the regression models, the gap between minorities and whites in having a PCP narrows considerably. Hence, lower minority levels of education, insurance coverage, and other factors contribute to lower PCP rates. Still, variables controlled for in the regression models do not completely eliminate (or explain) all of the differences. Narrowing of the disparity between whites and minorities using regression methods is also demonstrated. In fact, whites become even less likely to have a Checkup when compared to blacks or Hispanics- and adjusting for other factors in the pre-ACA period.

When comparing changes in regression odds, column 10, with changes in descriptive odds for PCP, column 6, the positive minority gains from unadjusted data disappear. The only variable in the regression model with a strong time trend is insurance coverage, given the way the BRFSS sample is drawn and weighted. Thus, while the descriptive data suggest that minorities have better access during the ACA period, the regression results indicate that they should have fared even better given large relative gains in insurance coverage. Possibly, many newly insured did not have an immediate need for primary care or were not incentive enough in the legislation to seek a provider.

When adjusting for other factors, the 13-15% increases in the minority odds of having a Checkup based on descriptive data disappear. Across all race/ethnicities, the regression-based increase in having a Checkup post-ACA is only 1% from the pre-ACA period.

From **Table 50**, the ACA*INS interaction term is statistically significant and from **Table 53**, the ACA*Race interaction terms are also statistically significant. A sensitivity analysis was conducted by using a more complex logistic regression model that combines the ACA*INS, ACA*Race and ACA*INS*Race interaction terms. The three-way interactions indicate that blacks and Hispanics show different ACA effects from whites depending on their insurance coverage. Blacks were 26-27% more likely to have a PCP over whites in the post-ACA period; and Hispanics were 16-22% more likely to have a PCP over whites. Admittedly, the differences by insurance status are not great, but the odds ratios are statistically significant by themselves, and are therefore included and discussed in more detail in Appendix AF.

Specific Aim 2a. Annual ACA PCP Odds Ratios with ACA-Race Interactions. In the previous regression models, the ACA regression coefficient was averaged over 4 years (2014-2017). **Table 56** highlights post-ACA <u>changes</u> by year and race, which is the focus of this section. See Appendix AE for complete regression models.

Table 56.

Summary Table of Logistic Regression Results using Time Dummy Variables (2014-2017) for the Likelihood of having a PCP Post-ACA.

		2014	2015	2016	2017
POST-ACA YEAR (WHITES)		0.89**	0.90**	0.87**	0.81**
RACE GROUP	**PRE-ACA (2012/13)**	**2014*RACE**	**2015*RACE**	**2016*RACE**	**2017*RACE**
WHITES	REF	REF	REF	REF	REF
BLACKS	0.89**	1.10*	1.07	1.12*	1.15*
HISPANICS	0.66**	1.03	1.11*	1.07	1.11*

Notes:

1. Regression Coefficients taken from Appendix AE, 47-state sample
2. P value <0.001 (**), P value <0.05 (*)

In the pre-ACA period, blacks and Hispanics were 11% and 34%, respectively, less likely to have a PCP when compared with whites. In 2014, there was a decided downward shift in having a PCP (11% for whites). By 2017, the decline had reached 19%. It must be remembered, however, that the multivariate model is holding insurance coverage trends constant. Such declines indicate a fall in the PCP/INS ratio. Over the 2014 to 2017 period, blacks made gains in having a PCP from 10-15%- over that of whites. The gains in PCP between Hispanics and whites were fluctuated year by year, but as of 2017, Hispanics were 11% more likely to have a PCP over whites. Nevertheless, due to the general decline in the PCP/INS ratio, minority odds of having a PCP fell 7% for blacks and 10% for whites.[10] The overall pre/post-ACA differences have been tested in **Table 52**.

[10] Blacks post-ACA change in own odds by 2017= Pre*(0.81*1.15)= 0.93. Hispanics post-ACA change in own odds by 2017= Pre*(0.81*1.11)= 0.90.

Specific Aim 2a. Annual ACA Checkup Odds Ratios with ACA-Race Interactions. **Table 57** highlights post-ACA changes for having a checkup by year and race. See Appendix AF for complete regression models.

Table 57.

Summary Table of Logistic Regression Results using Time Dummy Variables (2014-2017) for Likelihood of having a Checkup in the Past Year (Post-ACA).

		2014	2015	2016	2017
POST-ACA YEAR (WHITES)		1.03*	1.00	1.04*	0.98
RACE GROUP	**PRE-ACA (2012/13)**	**2014*RACE**	**2015*RACE**	**2016*RACE**	**2017*RACE**
WHITES	REF	REF	REF	REF	REF
BLACKS	2.03**	1.00	0.97	0.98	1.03
HISPANICS	1.22**	1.01	0.99	0.99	0.98

Notes:
1. Regression Coefficients taken from Appendix AF, 47-state sample
2. P value <0.001 (**), P value <0.05 (*)

When compared to the pre-ACA period, whites saw gains of 3-4% in having a checkup, with variation in 2015 and 2017, post-ACA. The years 2015 and 2017 were not statistically significant, or different, pre-ACA period. In the pre-ACA period, blacks and Hispanics both had higher odds of having a checkup in the past year than the white reference group. However, post-ACA, there was no difference in the odds of having a checkup in the past year between whites and blacks, nor whites and Hispanics.

Specific Aim 2b: Health Care Access by Race and Expansion Status

Specific Aim 2b. Pre/Post-ACA Odds Ratios for PCP Controlling for Expansion Status by Race Group. Full regression models were estimated, stratified by race, with the addition of the expansion variable (EXP) and an ACA*Expansion interaction term to differentiate between pre/post differences in expansion groups. Each race/ethnic group model was estimated separately rather than using EXP*Race interaction terms. Consequently, respondents in each subgroup model are being compared only with others of the same race/ethnic background on insurance coverage, education, age, and the like- and not directly with other races and ethnicities (although regression coefficients are compared later in this section). See Appendix AE for complete models.

Table 58 summarizes the key ACA, expansion (EXP) and ACA*EXP interaction terms. These terms provide critical information on how PCP levels changed by race and expansion groups over the ACA period. Sample sizes differ by 8.6% between blacks and whites and 9.2% between Hispanic and whites. Statistical power for minorities, therefore, is only about one-third that of whites, as power increases by a square root factor with size.

Table 58.

Summary of Pre/Post-ACA Effects of the Likelihood of having a PCP by Race and Expansion Status. (Odds Ratios Adjusted for Other Variables).

	RACE/ETHNICITY		
	WHITES	**BLACKS**	**HISPANICS**
VARIABLE			
Post-ACA	0.87**	0.90*	0.87*
Expansion	1.15**	1.08	1.09
ACA*EXP	1.01	1.13*	1.11
Constant	0.31**	0.24**	0.19**
F-stat	2159**	417**	505**
N	1048152	121844	113541

Notes:
1. Data abstracted from Table AE-5, (odds of PCP by Race)
2. P value <0.001 (**), P value <0.05 (*)
3. Models adjusted for other variables

The constant term represents the odds ratio for the combined set of reference groups in each model. For example, the reference group for whites represents white uninsured adult males in good health, aged 18 to 64, with less than a HS education, living within non-expansion states with an adequate supply of PCPs in the pre-ACA period. This reference group is represented by the constant of 0.31 and shows that this group was not very likely to have a PCP in the pre-ACA period. Reference groups for blacks (0.24) or Hispanics (0.19) in the pre-ACA period were even lower than for whites.

In the post-ACA period, whites and Hispanics were 13% less likely to have a PCP than in the pre-ACA period- while blacks were 10% less likely. Whites living in expansion states before the ACA legislation was passed were 15% more likely to have a PCP than whites living in non-expansion states. There was no statistically significant difference for blacks (p=0.135) or Hispanics (0.082) in the likelihood of having a PCP in the pre-ACA period by state expansion status (although the p values are quite low).

It's important to remember that the constant term to underestimates the pre-ACA PCP rates and odds ratios for the three races. When an odds ratio is adjusted for using logistic regression, there is no longer a shared baseline risk in the constant term as the race/ethnicity covariates take on different baseline values (Grant, 2014). However, since pre-ACA PCP rates by race/ethnicity are known from Part III, **Tables 34 and 35**, they can be used to calculate average odds ratios for persons living in expansion and non-expansion states by race group (**Table 59**). "Average" (odds) refers to the pre-ACA descriptive odds ratios that exist before any adjustments are made for race, income, etc. Then, marginal odds ratios are calculated for the post-ACA period. "Marginal" (odds) refers to creating post-ACA odds ratios based on regression-adjusted coefficients and then comparing them with the pre-ACA odds. In an ideal setting, mean pre-values for expansion and non-expansion states would be used.

Pre-ACA. First, the pre-ACA percentages by PCP and expansion status were converted to odds ratios using the following formula and rates from **Tables 34 and 35**:[11]

(1) OR-pre= Percent insured/(1-percent insured)

- Example: OR [Non-expansion, whites, pre-ACA] = 0.7580/(1-0.7518)= 3.132.

The OR's in Rows 1 and 2 in **Table 59** become the base upon which logistic marginal ACA effects are constructed. Rows 1 and 2 are reproduced in Rows 3 and 6 for comparison purposes in non-expansion and expansion states separately.

Post-ACA. Post-ACA ORs, or ACA effects, by expansion status (Rows 4 and 7) were calculated using the following formulas:

(2) OR[NEXP]-post= exp{(ln(ACA OR) + ln(NEXP-pre)}

- Example OR [Non-expansion, whites, post-ACA] = exp{ln(0.87) + ln(3.132)}= 2.725

(3) OR[EXP]-post = exp((ln(ACA OR) + ln(ACA*EXP OR) + ln(EXP-pre))

- Example OR [Expansion, whites, post-ACA] =exp{ln(0.87) + ln(3.907) + ln(1.01)=3.432.

[11] An alternative is to multiply mean values for each variable by race, times its corresponding logit coefficient, add the logit constant term, and exponentiate the sum.

Table 59.

Conversion of Marginal Odds Ratios for PCP to Average Odds Ratio for PCP in Non-expansion and Medicaid Expansion States by Race.

	EXPANSION ODDS RATIOS W/ PRE-ACA %PCP ODDS			
Row	**Odds**	**Whites**	**Blacks**	**Hispanics**
1	**NEXP-pre**	**3.132**	**2.321**	**1.129**
2	**EXP-pre**	**3.907**	**2.894**	**1.503**
		NEXP		
3	**Pre-ACA**	3.132	2.321	1.129
4	**Post-ACA**	2.725	2.089	0.983
5	**Post/Pre**	0.870	0.900	0.870
		EXP		
6	**Pre-ACA**	3.907	2.894	1.503
7	**Post-ACA**	3.433	2.943	1.452
8	**Post/Pre**	0.8787	1.017	0.9657

The EXP coefficient is not included in calculating the post-ACA odds ratio, e.g, OR[EXP], because its effect is already included in the pre-ACA baseline insurance rate, EXP-pre. Then, Rows 5 and 8 show the post-ACA PCP gains over the pre-ACA period.

Using known descriptive pre-ACA odds, a decline in the likelihood of having a PCP in the post-ACA period occurred in both expansion and non-expansion states, except for blacks living within expansion states. Blacks living within expansion states saw about a 2% gain in having a PCP post-ACA, even holding insurance and other variables constant. This increase is quite modest when compared to the unadjusted probability-to-odds ratios based on percentages in **Tables 34 and 35** that showed blacks experienced a 27% increase (3.67/2.894; **Table 35**) in the likelihood odds of having a PCP in the post-ACA period. Still, blacks living in expansion states had a regression-adjusted 13% increase (1.017/0.90) in the likelihood of having a PCP, over those in non-expansion states. Hispanics experienced an unadjusted 4% increase (1.175/1.124; **Table 34**) in the likelihood of having a PCP in the post-ACA expansion states, but once adjusting for other factors, their PCP gain was 11% (0.966/0.87) over non-expansion states.

Specific Aim 2b. Pre/Post-ACA Odds Ratios for Checkup Controlling for Expansion Status by Race Group. Table 60 provides a summary of impacts of the three key ACA and expansion variables on having a checkup within one year by race/ethnic group. Refer to Appendix AF, Table AF-5 for full regression models.

Table 60.

Logistic Regression Odds of having a Checkup in the Past Year by Race and Expansion Status.

	RACE/ETHNICITY		
	WHITES	BLACKS	HISPANICS
VARIABLE			
Post-ACA	0.99	0.98	1.02
EXPANSION	0.90**	0.91*	0.89*
ACA*EXP	1.03	1.05	1.00
Constant	0.31**	0.75**	0.47**
F-stat	1457**	217**	265**
N	1048152	121844	113541

Notes:
1. Data abstracted from Table AF-5, (odds of Checkup by Race)
2. P value <0.001 (**), P value <0.05 (*)
3. Modesl adjusted for other variables

In the post-ACA period, the Checkup odds ratios for Post-ACA and ACA*EXP were statistically insignificant among whites, blacks and Hispanics living in expansion and non-expansion states, when controlling for other variables in the full model (**Table 60**). Null findings for Post-ACA (**Table 60)** without an ACA*INS interaction term is consistent with the general findings that ACA effects worked primarily through expanded coverage. Once coverage is held constant, the ACA effect disappears and the Checkup/INS ratio declines.

As a comparison, the full regression model (Appendix AF, Table AF-3), the Post-ACA odds was 1.10 and significant prior to including insurance coverage but did not differ from 1.0 when controlling for insurance. Post-ACA odds then became significant again (odds=1.11) when including an ACA*INS interaction term (odds=0.89). Adjusting for other variables, including insurance, whites were still 10% less likely to have a checkup within expansion states, compared with whites in non-expansion states. Hispanics were 11% less likely to have a Checkup in expansion states than in non-expansion states. Blacks were 9% less likely to have a Checkup in expansion states than in non-expansion states.

Refer to Appendix AF for additional results related to the odds of having a Checkup, which was the secondary measure of health care access. For a summary of logistic regression results and discussion on additional regression coefficients found in this section, refer to Appendix AE.

Specific Aim 2: Health Care Access by Diabetes Risk Status

Specific Aim 2a. Pre/Post-ACA PCP Odds with ACA-Diabetes Risk Interactions. In this section, an ACA*Diabetes Risk interaction term is used in place of the ACA*Race interaction term to determine the differential effect of the ACA on diabetes risk. Hypothesis 2a is that the ACA policies should increase access to primary health care, leading to greater gains in PCP/Checkup for the high risk for diabetes group. Changes in the high risk for diabetes group is the main focus in this section. Again, insurance coverage is included in the model as the main effect; thus, any diabetes risk-related effects of the ACA would be interpreted as “over-and-above" insurance effects. Sensitivity analyses with ACA*INS*Diabetes Risk, ACA*Diabetes Risk and ACA*INS interaction terms were included and discussed in Appendix AG.

Table 61 shows logistic results for models explaining variation in PCP and Checkup using main diabetes risk and ACA interaction variables, along with the post-ACA indicator among other variables. When the ACA*Diabetes Risk interaction terms are included, it is apparent that the high-risk group did not experience any statistically significant gains in health care access (PCP or Checkup) during the ACA period.

Table 61.

Logistic Regression Models for Health Care Access by Diabetes risk, using Pre/post-ACA Indicator; 47-state Analytic Sample.

Probability of Having a Health Care Access (n=1,283,537)	**PCP ODDS RATIO**	**CHECKUP ODDS RATIO**
ACA		
Pre-ACA	Ref	Ref
Post-ACA	0.88**	1.01
Diabetes Status		
No/Low Risk	Ref	Ref
High Risk	1.16**	1.08**
Diabetes	2.56**	2.28**
ACA*Diabetes Risk		
ACA*no/low risk	Ref	Ref
ACA*high risk	1.02	1.00
ACA*diabetes	1.20**	1.10*
Insurance		
Uninsured	Ref	Ref
Insured	5.33**	3.49**
Other Variables		
Race		
Whites	Ref	Ref
Blacks	0.95*	2.02**
Hispanics	0.69**	1.21**
Education		
Less than HS	Ref	Ref
HS Grad	1.31**	1.13**
Some College	1.49**	1.10**
College Grad	1.78**	1.19**
Age		
18 to 44	Ref	Ref
45 to 64	2.39**	1.57**
Sex		
Male	Ref	Ref
Female	1.96**	1.49**
Chronic Disease		
Count 0-5	1.36**	1.20**
Self Reported Health		
Healthy	Ref	Ref
Unhealthy	1.03*	0.98
PCP Supply		
Adequate Supply	Ref	Ref
Low Supply	0.81**	0.98*
Constant	0.31**	0.32**
F Statistic	2687**	1598**

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models
4. Values indicate odds ratios

Refer to Appendices AG (Table AG-1) and AH (Table AH-1) for full regressions and 95% CI's.

Table 62 is a summary of key ACA regression coefficients**.** Columns 1, 3 and 4 were taken directly from **Table 61**; whereas columns 2 and 5 are calculated as shown below:

Table 62.

Specific Aim 2a Summary Table of ACA Effects on PCP and Checkup by Diabetes Risk Status for the 47-state Sample.

RACE GROUPS	PRE-ACA ODDS	POST-ACA ODDS	ACA*RISK ODDS	POST-ACA RISK ODDS	ACA RISK vs NO RISK EFFECT
COLUMN	**1**	**2**	**3**	**4**	**5**
PCP					
NO/LOW RISK	1.00	0.88	-	0.88	0.88
HIGH RISK	1.16	0.88	1.02	1.04	0.90
DIABETES	2.56	0.88	1.20	2.70	1.06
CHECKUP					
NO/LOW RISK	1.00	1.01	-	1.01	1.01
HIGH RISK	1.08	1.01	1.00	1.09	1.10
DIABETES	2.28	1.01	1.10	2.53	2.56

Notes:
1. Pre-ACA Odds: Table 61, Specfic Aim 2a
2. Post-ACA Coefficient: Table 61, Specific Aim 2a
3. ACA*Diabetes Risk Interaction: Table 61, Specific Aim 2a
4. Post-ACA Diabetes Risk Odds: Calculation (Exp{ln(preACA) + ln(postACA) + ln(ACA*Diabetes Risk)})
5. ACA RISK vs. NO RISK EFFECT: Calculation (Exp{ln(postACA)+ ln(ACA*Diabetes Risk)})

Two types of ACA effects can be calculated from **Table 62:**

1. Post-ACA odds by diabetes risk compared with the pre-ACA period
2. ACA effects on individuals at high risk or with diabetes when compared to those at no or low risk for diabetes.

<u>Post-ACA Diabetes Risk Odds:</u>

- No/Low Risk: 0.88
- High Risk: 1.04= EXP((LN(1.16)+LN(0.88)+LN(1.02))),
- Diabetes: 2.70= EXP((LN(2.56)+LN(0.88)+LN(1.20)))

Controlling for insurance and other variables, differences in the uptake of a PCP in the post-ACA period are apparent. The no/low risk had a decline in the odds of having a PCP in the post-ACA period; however, saw a 1% increase in checkups. High-risk individuals experienced a 4% increase in the odds of having a PCP post-ACA. Individuals who reported diabetes saw the greatest gains in having a PCP and/or Checkup in the post-ACA period.

To derive a net ACA effect (column 6) on the odds of having a PCP or a Checkup in the past year for the diabetes risk groups, the Post-ACA and ACA*Diabetes Risk coefficients were used:

<u>ACA RISK-NO RISK EFFECT:</u>

- No/Low Risk: 0.88 (Reference Group)
- High-Risk: 0.90= EXP((LN(0.88)+LN(1.04)))
- Diabetes: 1.06= EXP((LN(0.88)+LN(2.70)))

The ACA*Diabetes Risk interaction terms add 2% to PCP access for the high-risk group relative to the no/low risk group and 18% for individuals with reported diabetes.

Similar calculations were made for Checkup as an alternative measure of primary care access. A statistically insignificant finding for the high-risk interaction terms means that there were not differences between those at high-risk and no risk in receiving a checkup in the past year post-ACA.

Comparing Descriptive Results to Regression Results. Earlier descriptive results found in **Table 38** are compared with logistic regression results for PCP and Checkup in **Table 63**. Pre/post PCP and Checkup percentage changes are shown in column 3.

Table 63.

Comparison of BRFSS Descriptive Results with Regression Results, 47-state Sample.

DESCRIPTIVE STATISTICS									REGRESSION RESULTS		
DIABETES RISK	PRE (%)	POST (%)	CHANGE	PRE (ODDS)	POST (ODDS)	CHANGE	PRE-REL ODDS LOW RISK		PRE-REL ODDS	POST-REL ODDS	CHANGE
COLUMN	1	2	3	4	5	6	7		8	9	10
PCP											
NO/LOW RISK	71.86	72.04	1.0025	2.5537	2.5765	1.0090	1.0000		-	-	-
HIGH RISK	73.22	74.21	1.0135	2.7341	2.8775	1.0524	1.0707		1.1600	1.0412	0.8976
DIABETES	88.49	90.69	1.0249	7.6881	9.7411	1.2670	3.0106		2.5600	2.7034	1.0560
CHECKUP											
NO/LOW RISK	60.68	62.63	1.0321	1.5432	1.6759	1.0860	1.0000		-	-	-
HIGH RISK	62.81	65.01	1.0350	1.6889	1.8580	1.1001	1.0944		1.0800	1.0908	1.0100
DIABETES	81.12	84.11	1.0369	4.2966	5.2933	1.2320	2.7842		2.2800	2.5331	1.1110

Notes:

1. Descriptive Results Source: Table 36, Percentages of PCP or Checkup by diabetes risk and time, 47 states
2. Regression Results Source: Table 61, Logistic Regression Models for Specific Aim 2a

Descriptive PCP and Checkup percentages were converted to odds ratios to compare their changes to those based on the regression odds.

Pre-Odds (PCP or Checkup): [Pre (%)/(1-Pre (%)]

- Example: Pre-Odds (PCP) for no/low risk= [(0.7186)/(1-0.7186)]=2.5537

Post-Odds (PCP or Checkup): [Post (%)/(1-Post (%)]

- Example: Post-Odds (PCP) for no/low risk= [(0.7204)/(1-0.7204)]=2.5765

The unadjusted, descriptive, odds ratios show that individuals who reported diabetes had the largest increase in the odds of having a PCP or Checkup post-ACA. The odds of having a PCP for the diabetes group was 22- percentage points higher than those at high risk for diabetes, and 26-percentage points higher than those at no/low risk for diabetes. The odds of having a checkup in the past year for the diabetes group was 13-percentage points higher than for those at high risk, and 14-percentage points higher for those at no/low risk.

Column 7 (Pre-ACA relative odds risk), is the ratio of the odds of a high risk or individual with diabetes having a PCP or a Checkup in the pre-ACA period (Pre-Odds) to that of the no/low risk group, using descriptive data. The high-risk group was 7% more likely to have a PCP than the no/low risk group; whereas the diabetes group was 3.01-times more likely to have a PCP than the no/low risk group. For checkup, the high-risk group was 9% more likely and the diabetes group was 2.78-times more likely to have a checkup in the past year than the no/low risk for diabetes group.

As discussed in the previous section based on race, the descriptive pre-ACA relative odds differ from the regression pre-ACA relative odds since they are unadjusted for other factors. Once adjusted, the gap in having a PCP between the high-risk and no/low risk widens, but narrows considerably between the diabetes group and the no/low risk group.

When comparing changes in regression odds, column 10, with changes in descriptive odds for PCP, column 6, the positive gains experienced by the high-risk group (in the unadjusted data) for having a PCP or checkup disappear. The diabetes group did experience gains in PCP and Checkup, but at a lesser degree. For example, the unadjusted data showed a 27% increase in having a PCP in the post-ACA period, whereas the regression results showed a 6% increase, when adjusting for other factors. The high-risk group experienced an adjusted 10% decline in having a PCP in the post-ACA period.

From **Table 50**, the ACA*INS interaction term is statistically significant and from **Table 61**, the ACA*high risk interaction term is not statistically significant. A sensitivity analysis was conducted by using a more complex logistic regression model that combines the ACA*INS, ACA*Risk and ACA*INS*Risk interaction terms. The three-way interactions indicate that high risk individuals had different ACA effects from the no/low risk group that were statistically significant, unlike in Model 4, **Table 50**. The high-risk group was found to be 10-11% more likely ($p<0.05$) to have a PCP in the post-ACA period when compared to the no/low risk group. A detailed discussion of the complex regression analysis can be found in Appendix AG.

Specific Aim 2a. Annual ACA PCP Odds Ratios with ACA-Diabetes Risk Interactions. In the previous regression models, the ACA regression coefficient was averaged over 4 years (2014-2017). **Table 64** highlights post-ACA changes by year and diabetes risk, which is the focus of this section. See Appendix AG for complete regression models.

Table 64.

Summary Table of Logistic Regression Results using Time Dummy Variables (2014-2017) for Likelihood of having a PCP in the Past Year (Post-ACA).

		2014	**2015**	**2016**	**2017**
POST-ACA YEAR (NO/LOW RISK)		0.90**	0.92**	0.87**	0.84**
DIABETES RISK	**PRE-ACA (2012/13)**	**2014*RISK**	**2015*RISK**	**2016*RISK**	**2017*RISK**
NO/LOW RISK	REF	REF	REF	REF	REF
HIGH RISK	1.16**	1.02	1.00	1.05	1.02
DIABETES	2.56**	1.10	1.21*	1.22*	1.29*

Note(s):
1. P value <0.001 (**), P value <0.05 (*)

In the pre-ACA period, both the high risk and diabetes groups were more likely to have a PCP when compared with the no/low risk group; however, had a much higher odds (2.56) than the high-risk group (1.16). In 2014, there was a downward shift in having a PCP (10% for the no/low risk group). By 2017, the decline reached 16%. Over the 2014 to 2017 period, the high-risk group made gains in having a PCP from 2-5% over that of the no/low risk group, but it was not statistically significant. The diabetes group made PCP gains from 10 to 29% over that of the no/low risk group. By 2017, the likelihood of having a PCP for the high-risk group was 18% over the no/low risk group, and 3.30-times for the diabetes group[12].

Specific Aim 2a. Annual ACA Checkup Odds Ratios with ACA-Diabetes Risk Interactions. Table 65 highlights post-ACA changes for having a checkup by year and diabetes risk status. See Appendix AG for complete regression models.

Table 65.

Summary Table of Logistic Regression Results using Time Dummy Variables (2014-2017) for the Likelihood of having a Checkup Post-ACA.

		2014	2015	2016	2017
POST-ACA YEAR (NO/LOW RISK)		1.03*	1.00	1.02	0.97*
DIABETES RISK	**PRE-ACA (2012/13)**	**2014*RISK**	**2015*RISK**	**2016*RISK**	**2017*RISK**
NO/LOW RISK	REF	REF	REF	REF	REF
HIGH RISK	1.08**	0.99	0.98	1.01	1.02
DIABETES	2.28**	1.06	1.11*	1.12*	1.10

Note(s):
1. P value <0.001 (**), P value <0.05 (*)

When compared to the pre-ACA period, the no/low risk group saw a decline of 6% in having a checkup in the past year, from 2014 to 2017. The years 2015 and 2016 were not statistically significant, or different, from the pre-ACA period. Pre-ACA, individuals at high risk or with reported diabetes had higher odds of having a checkup than the reference group, with individuals with diabetes being 2.28-times more likely to have a checkup. However, post-ACA, there was no difference in the odds of having a checkup in the past year between those at no/low

[12] The high-risk post-ACA change in own odds by 2017= Pre*(1.16*1.02)= 1.18. Diabetes post-ACA change in own odds by 2017= Pre*(2.56*1.29)= 3.30.

risk and those at high risk for diabetes. Post-ACA, individuals with reported diabetes were 11-12% more likely to have a checkup from 2015-2016, when compared to those at no/low risk.

Specific Aim 2b. Health Care Access by Diabetes Risk and Expansion Status

Specific Aim 2b. Pre/Post-ACA Odds Ratios for PCP Controlling for Expansion Status and Diabetes Risk Group. Full regression models were estimated, stratified by diabetes risk, with the addition of the expansion variable (EXP) and an ACA*Expansion interaction term to differentiate between pre/post differences in expansion groups. Each diabetes risk group model was estimated separately rather than using EXP*Diabetes Risk interaction terms. As a result, respondents in each subgroup model are compared only with others of the same diabetes risk group and not directly with other diabetes risk conditions (although regression coefficients are compared later in this section). See Appendix AG for complete models.

Table 66 summarizes key ACA, expansion (EXP) and ACA*EXP interaction terms. These terms provide critical information on how PCP levels changed by diabetes risk status and expansion groups over the ACA period. Sample sizes differ by 34.71% between the high risk and no/low risk groups, and 9.07% between the diabetes and no/low risk groups. The main group of interest in this analysis is the high-risk group which is about two-thirds the size of the no/low risk group. The diabetes group is included to provide context, but are not the main focus.

Table 66.

Summary of Pre/Post-ACA Effects of having a PCP by Diabetes Risk and Expansion Status.

	DIABETES RISK		
	NO/LOW	HIGH	DIABETES
VARIABLE			
Post-ACA	0.87**	0.87**	0.99
Expansion	1.14**	1.12**	1.06
ACA*EXP	1.03	1.06	1.11
Constant	0.27**	0.31**	1.05
F-stat	1707**	1128**	163**
N	721552	445547	116438

Notes:
1. Data abstracted from Table AG-3, (odds of PCP by Diabetes Risk)
2. All models adjusted for other variables
3. P value <0.001 (**), P value <0.05 (*)

Refer to Appendix AG for full models.

The constant term represents the odds ratio for the combined set of reference groups in each model. For example, the reference group for the no/low risk represents uninsured white adult males in good health, aged 18 to 64, with less than a HS education, living within non-expansion states with an adequate supply of PCPs in the pre-ACA period. This reference group is represented by the constant of 0.27 and shows that his group was not very likely to have a PCP in the pre-ACA period. Reference groups for the high risk (0.31) and diabetes (1.05) were higher than the no/low risk group.

In the post-ACA period, the no/low and high-risk groups had the same likelihood of having a PCP, when compared to the pre-ACA period. The no/low risk group in expansion states was 14% more likely to have a PCP than the same group in non-expansion states. The high-risk group in expansion states was 12% more likely to have a PCP than the same group in non-expansion states. However, the ACA*EXP interaction term was not statistically significant (using standard $p<0.05$) for any of diabetes risk groups, meaning there was no difference in the likelihood of having a PCP between expansion post-ACA for the diabetes risk subgroups. The no/low risk p value=0.184; the high-risk p value=0.071; and the diabetes p value=0.286. Considering that the p value for the high-risk is quite low and close to the standard cutoff of $p<0.05$, for policy implications, this finding is considered significant.

The constant term in these models underestimates the pre-ACA PCP rates and odds ratios for the three diabetes risk groups. Since the pre-ACA rates by diabetes risk are known from Part III, **Tables 39 and 40**, they can be used to calculate average odds ratios for persons living in expansion and non-expansion states by diabetes risk group (**Table 67**). "Average" (odds) refers to the pre-ACA descriptive odds ratios that exist before any adjustments are made for race, income, etc. Then, marginal odds ratios are calculated for the post-ACA period. "Marginal" (odds) refers to creating post-ACA odds ratios based on regression-adjusted coefficients and then comparing them with the pre-ACA odds. In an ideal setting, mean pre-values for expansion and non-expansion states would be used.

Pre-ACA. First, the pre-ACA percentages by diabetes risk and expansion status were converted to PCP odds ratios using the following formula and rates from **Tables 39 and 40**:[13]

(1) OR-pre= Percent insured/(1-percent insured)

- Example: OR [Non-expansion, no/low risk, pre-ACA] = 0.6886/(1-0.6886)= 2.211.

[13] An alternative is to multiply mean values for each variable by race, times its corresponding logit coefficient, add the logit constant term, and exponentiate the sum.

The OR's in Rows 1 and 2 in **Table 67** become the base upon which logistic marginal ACA effects are constructed. Rows 1 and 2 are reproduced in Rows 3 and 6 for comparison purposes in non-expansion and expansion states separately.

Post-ACA. Post-ACA ORs, or ACA effects, by expansion status (Rows 4 and 7) were calculated using the following formulas:

(2) OR[NEXP]-post= exp{(ln(ACA OR) + ln(NEXP-pre)}

- Example OR [Non-expansion, no/low risk, post-ACA] = exp{ln(2.211) + ln(0.87)}= 1.924

(3) OR[EXP]-post = exp((ln(ACA OR) + ln(ACA*EXP OR) + ln(EXP-pre))

- Example OR [Expansion, no/low risk, post-ACA] =exp{ln(2.801) + ln(0.87) + ln(1.14)=2.778.

The EXP coefficient is not included in calculating the post-ACA odds ratio, e.g, OR[EXP], because its effect is already included in the pre-ACA baseline insurance rate, EXP-pre. Then, Rows 5 and 8 show the post-ACA PCP gains over the pre-ACA period.

Table 67.

Conversion of Marginal Odds Ratios for PCP to Average Odds Ratio for PCP in Non-expansion and Expansion States by Diabetes Risk.

EXP ODDS RATIOS W/ PRE-ACA %PCP ODDS				
Row	**Odds**	**Low Risk**	**High Risk**	**Diabets**
1	**NEXP-pre**	**2.211**	**1.711**	**4.328**
2	**EXP-pre**	**2.801**	**3.002**	**8.425**
		Non-EXP		
3	**Pre-ACA**	2.211	1.711	4.328
4	**Post-ACA**	1.924	1.488	4.284
5	**Post/Pre**	0.870	0.870	0.990
		EXP		
6	**Pre-ACA**	2.801	3.002	8.425
7	**Post-ACA**	2.778	2.925	8.841
8	**Post/Pre**	0.9918	0.9744	1.0494

Using known descriptive pre-ACA odds, a decline in the likelihood of having a PCP in the post-ACA period occurred in both expansion and non-expansion states, except for individuals with diabetes living within expansion states. Individuals with diabetes saw about a 5% gain in having a PCP post-ACA, holding insurance and other variables constant.

The high-risk for diabetes group, which is the subgroup of interest, had an unadjusted 10% increase (3.31/3.00, **Table 36**) in the likelihood of having a PCP within expansion states and no change in the pre/post-ACA period in non-expansion states. The regression-adjusted increase in the likelihood of having a PCP was 12% (0.9744/0.870, **Table 67**) over those living in non-expansion states. Interestingly, the no/low risk group saw a regression-adjusted increase in the likelihood of having a PCP (14%), over those living in non-expansion states and was higher than the percentage for the high-risk group.

Specific Aim 2b. Pre/Post-ACA Odds Ratios for Checkup Controlling for Expansion Status by Diabetes Risk Group. Table 68 providers a summary of three key ACA and expansion variables on having a checkup within the past year by diabetes risk group.

Table 68.

Logistic Regression of the Odds of having a Checkup in the Past Year by Diabetes Risk and Expansion Status.

	DIABETES RISK		
	NO/LOW	HIGH	DIABETES
VARIABLE			
Post-ACA	0.99	0.99	1.07
Expansion	0.89**	0.91**	0.89
ACA*EXP	1.02	1.02	1.04
Constant	0.33**	0.36**	1.25*
F-stat	899**	662**	1.01**
N	721552	445547	116438

Notes:
1. Data abstracted from Table AH-3, (odds of Checkup by Diabetes Risk)
2. All models adjusted for other variables
3. P value <0.001 (**), P value <0.05 (*)

In the post-ACA period, the Checkup odds ratios for Post-ACA and ACA*EXP were statistically insignificant among the no/low risk, high-risk and diabetes groups living in expansion and non-expansion states, when controlling for other variables in the full model. The null findings for post-ACA are consistent with the general findings that ACA effects worked primarily through expanded coverage. Once coverage is held constant, the ACA effect disappears and the Checkup/INS ratio declines.

After adjusting for other variables, including insurance, the no/low risk were 11% less likely to have a checkup in expansion states, with the high-risk being 9% less likely to have a checkup in expansion states, when compared to non-expansion states- mainly due to the rising insurance rates.

Refer to Appendix AH for additional results related to the odds of having a Checkup, which was the secondary measure of health care access.

NAMCS Results

This section consists of four parts. Part I includes annual pre/post-ACA changes for independent and outcome variables. Part II includes concatenated data for independent and outcome variables to distinguish between non-expansion and Medicaid expansion states. Part III includes stratified outcome variables by race, then by diabetes risk status for the full sample, and by expansion status. Part IV consists of multivariate logistic regression results on the likelihood of having diabetes screening and diabetes prevention education. Sensitivity analysis using only 2014 data in the post-ACA period was done to compare changes in diabetes screening rates (Appendix AI). All results used sample-weighted data. Data weights were provided by NAMCS: PHYCODE [pweight=PATWTST], stata(CSTRATUM) singleunit(scaled). Single sampling units were handled the same way as with the BRFSS analysis (Appendix X).

NAMCS Analytic Sample Pre/Post ACA Descriptive Statistics

Analytic NAMCS Sample

The sampling unit in NAMCS is the physician-patient visit, which includes only visits to non-federally employed physicians classified by the AMA and AOA. Although, non-physician clinicians (i.e. physician assistants and advanced practice nurses) who work within Community Health Centers (CHCs) were eligible to participate in NAMCS data collection (Centers for Disease Control and Prevention, 2015). Office visit settings include: private practice, group practice, health maintenance organizations (HMOs), freestanding clinics, urgicenters, non-federal government clinics, CHCs, family planning clinics and faculty practice plans (Lau, McCaig, Hing, 2016). The total sample sizes for NAMCS years 2012 to 2015 are shown in **Table 69** below.

Table 69

Change in NAMCS Full and Analytic Unweighted Sample Sizes (2012-2015).

	2012	2013	2014	2015	Pre-ACA	Post-ACA
Full	76,330	54,873	45,710	28,332	131,203	74,042
Analytic	2,634	2,415	2,191	1,734	5,049	3,925

Note. NAMCS reduced the number of states surveyed over time. The analytic sample contains only white, black or Hispanics aged 18-64 who visited a provider for a preventive care visit from 2012-2015. Pre-ACA is 2012-2013; Post-ACA is 2014-2015.

There was a steady decline in the sample size from 2012 to 2015 as the number of state-based estimates decreased each year in accordance with funding availability. In fact, preventive care visits fell by 22% pre to post-ACA (**Table 69**). In 2012, 34 of the most populous states were included; 22 by 2013; 18 by 2014; and 16 by 2015 (Centers for Disease Control and Prevention, 2019). To maintain consistent sample sizes over time, only 15 states (Massachusetts excluded) were included in the analytic file. The unweighted pre-ACA analytic sample is 4% of the full NAMCS dataset; whereas the post-ACA sample is 5% of the full dataset when only keeping visits coded as preventive care for individuals aged 18-64 who were white, black or Hispanic living in one of 15 states.

As of 2008, 51.3% of the 956 million office visits were to primary care physicians, resulting in 490,428,000 primary care visits in the U.S (Agency for Healthcare Research and Quality, 2011.). In **Table 70**, the weighted sample from 2012 represents 61,547,461 preventive care visits in 15 states, representing about 12.5% of the national estimated sample.

Demographic Variables

Refer to **Table 70** for data on key demographic variables in this NAMCS analysis.

Table 70.

Change in Demographic Characteristics of Individuals Receiving Preventive Care within 15-State Sample (2012-2015).

	ANNUAL				Pre/Post ACA		Change (%)	Chi Square
Sample Size (unweighted)	2,634	2,415	2,191	1,734	5,049	3,925		
Preventive Visits (weighted)	61,547,461	60,245,157	51,194,211	66,143,533	121,792,619	117,337,744		
Preventive Visits, mean	-	-	-	-	60,896,310	58,668,872		
	2012	2013	2014	2015	Pre-ACA	Post-ACA	(Post/Pre)	P value
Race/Ethnicity								0.5274
Whites	67.43	70.11	70.09	59.95	68.75	64.37	-6.37%	
Blacks	10.58	13.99	11.66	14.68	12.27	13.37	8.96%	
Hispanics	21.99	15.90	18.25	25.37	18.98	22.26	17.28%	
Age								0.5530
18 to 34	38.55	41.81	34.44	38.96	40.16	36.99	-7.89%	
35 to 44	19.24	15.92	18.97	18.73	17.60	18.84	7.05%	
45 to 54	22.02	20.63	21.57	20.43	21.33	20.92	-1.92%	
55 to 64	20.20	21.63	25.03	21.87	20.91	23.25	11.19%	
Gender								0.8104
Male	28.79	26.60	32.79	25.01	27.71	28.41	2.53%	
Female	71.21	73.40	67.21	74.99	72.29	71.59	-0.97%	

Note. Sample includes all white, black and Hispanic adults aged 18-64 who received a preventive care visit in 15 states. Chi-square calculated for pre-vs. post-ACA differences for each variable. Pre-ACA includes 2012-2013; Post-ACA includes 2014-2015. Survey weighted data.
*p<0.05. **p<0.01. ***p<0.001

Race/Ethnicity. A greater proportion of white adults received a preventive care visit over time, despite a decline of 6.37% by the post-ACA period. Blacks and Hispanics both saw gains in their share of preventive clinic visits, with Hispanics experiencing a 17% increase by the post-ACA period. Differences in the number of preventive care visits pre vs. post-ACA by race were not statistically significant (p=0.5274).

Age. The 18 to 34 age group had the greatest proportion of individuals who received a preventive care visit (40%, pre-ACA). The rate for individuals aged 35 to 64 was between 18 to 21% in the pre-ACA period. Declines in preventive clinic visits in the post-ACA period were seen in the 18 to 34 age group (-7.89%) and the 45 to 54 (-1.92%). The pre-Medicare group saw the greatest increases in preventive care visits in the post-ACA period (11.19%). Differences in preventive care visits pre vs. post-ACA by age group were not statistically significant (p=0.5530).

Gender. There was greater representation of women receiving a preventive care clinic visit during the 2012-2015 period (67-75%) than men (25-33%). There was a slight increase in the number of men receiving a preventive care visit post-ACA (2.5%) and about a 1% decrease in the number of women receiving a preventive are visit post-ACA. Differences in preventive care visits pre vs. post-ACA by sex were not statistically significant (p=0.8104).

Health Status Data. Table 71 displays results on health status variables for the NAMCS analytic sample.

Table 71

Change in Health Status Characteristics of Individuals Receiving Preventive Care in 15-State Sample (2012-2015).

	ANNUAL				**Pre/Post ACA**		**Change (%)**	**Chi Square**
Sample Size (unweighted)	2,634	2,415	2,191	1,734	5,049	3,925		
Preventive Visits (weighted)	61,547,461	60,245,157	51,194,211	66,143,533	121,792,619	117,337,744		
Preventive Visits, mean	-	-	-	-	60,896,310	58,668,872		
	2012	2013	2014	2015	Pre-ACA	Post-ACA	(Post/Pre)	P value
Diabetes Risk Status[a]								0.0896
No/low risk	16.23	16.82	18.09	16.52	16.52	17.21	4.18%	
High Risk	36.03	35.95	41.87	40.77	35.99	41.25	14.62%	
Diabetes	6.40	6.07	7.71	7.56	6.24	7.63	22.28%	
Unknown	41.33	41.16	32.33	35.14	41.25	33.91	-17.79%	
Chronic Disease[b]								0.2137
No chronic disease	86.57	85.87	82.67	82.67	86.22	83.56	-3.09%	
At least 1 chronic disease	13.43	14.13	17.33	17.33	13.78	16.44	19.30%	

Note. Sample includes all white, black and Hispanic adults aged 18-64 who received a preventive care visit in 15 states. Chi-square calculated for pre-vs. post-ACA differences for each variable. Pre-ACA includes 2012-2013; Post-ACA includes 2014-2015. Survey weighted data.

[a]Diabetes Risk Status defined as: No/low-risk (BMI< 25 and no diagnosis of obesity or diabetes); High-risk (BMI=> 25 and <30 and no diagnosis of diabetes, or a obesity diagnosis); Diabetes (diabetes diagnosis); Unknown (BMI not available and no diagnosis of obesity or diabetes).

[b]Chronic disease included a diagnosis at least 1 of the following conditions: asthma, stroke, COPD, depression, CAD or CHF.

*p<0.05. **p<0.01. ***p<0.001

Diabetes Risk Status. Most of the individuals seen for preventive care services had an unknown diabetes risk status since their BMI's were missing or incalculable (32-41%) from 2012-2015. To gain a better understanding of the demographics of those in the "unknown" category, additional descriptive statistics were run (Appendix AI). By the post-ACA period, the “unknown” group had disproportionately more Hispanic visits than the other diabetes risk groups (30%), with non-expansion states having the most visits by Hispanic patients who were categorized as “unknown” risk (40%). The 18 to 34 age group made up 60% of the preventive care visits that were categorized as “unknown” risk, with the proportion rising to 66% for this age group in non-expansion states. Women made up 83% of the unknown risk group with about 27% being Medicaid recipients overall, with 35% being Medicaid recipients within non-expansion states.

Overall, there was a decline of almost 18% in the unknown risk group post-ACA, with increases seen for the low risk for diabetes group (4%), high risk for diabetes (15%) and diabetes (22%) groups in having a preventive care clinic visit. For preventive care visits with reported diabetes risk, 62.42% were high-risk, 26.04% were no/low risk and 11.54% had diabetes in the post-ACA period. By the post-ACA period, the high-risk group made up the largest proportion of preventive care visits, even when those with unknown diabetes risk (41% of visits) were included. Differences in the number of preventive care visits pre vs. post-ACA by diabetes risk status was not statistically significant (p=0.0896).

Chronic Disease Count. A majority of patient’s seen did not have a chronic disease (83-87%), but preventive care visits by patients with chronic disease increased by 19.3% post-ACA. In the post-ACA period, there was a small decline (3%) in preventive visits for individuals with no chronic disease. Differences in preventive care visits pre vs. post-ACA by chronic disease status were not statistically significant.

State ACA Expansion Status & Insurance Coverage. Refer to **Table 72** for the number of preventive care visits within non-expansion and Medicaid expansion states and the type of payment received for the visit over time.

Table 72

Change in Expansion Status and Payment Method for Preventive Care Visits in 15-State Sample (2012-2015).

	ANNUAL				Pre/Post ACA		Change (%)	Chi Square
Sample Size (unweighted)	2,634	2,415	2,191	1,734	5,049	3,925		
Preventive Visits (weighted)	61,547,461	60,245,157	51,194,211	66,143,533	121,792,619	117,337,744		
Preventive Visits, mean	-	-	-	-	60,896,310	58,668,872		
	2012	2013	2014	2015	Pre-ACA	Post-ACA	(Post/Pre)	P value
Medicaid Expansion Status[a]								0.8403
Non-expansion	38.59	39.12	37.24	38.42	38.85	37.91	-2.42%	
Expansion	61.41	60.88	62.76	61.58	61.15	62.09	1.54%	
Insurance Status								0.7571
Private	69.87	68.89	70.93	59.56	69.39	64.52	-7.02%	
Medicaid	12.99	14.23	11.49	20.15	13.60	16.37	20.37%	
Medicare	3.76	4.02	3.87	4.79	3.89	4.39	12.85%	
Self Pay	4.04	4.55	6.31	2.93	4.30	4.41	2.56%	
Other	9.34	8.31	7.40	12.57	8.83	10.31	16.76%	

Note. Sample includes all white, black and Hispanic adults aged 18-64 who received a preventive care visit in 15 states. Chi-square calculated for pre-vs. post-ACA differences for each variable. Pre-ACA includes 2012-2013; Post-ACA includes 2014-2015. Survey weighted data.

[a]Non-expansion includes 5 states and Medicaid expansion includes 10 states that expanded as of 2015.

*p<0.05. **p<0.01. ***p<0.001

Expansion Status. Expansion states were classified as states that expanded Medicaid by 2015 (**Figure 11**). Refer to Appendix U for a list of Medicaid expansion and non-expansion dates of expansion. Most (61-63%) of the preventive care visits occurred within Medicaid expansion states. An increase of almost 2% in preventive care visits occurred post-ACA. Differences in preventive care visits pre vs. post-ACA by expansion status were not statistically significant (p=0.8403). It is important to note that non-expansion and expansion groups grossly underestimate the total number of states within each group as shown in the state map in **Figure 11** and does not cover many of the states that are known to be rural or have high proportions of low-income adults.

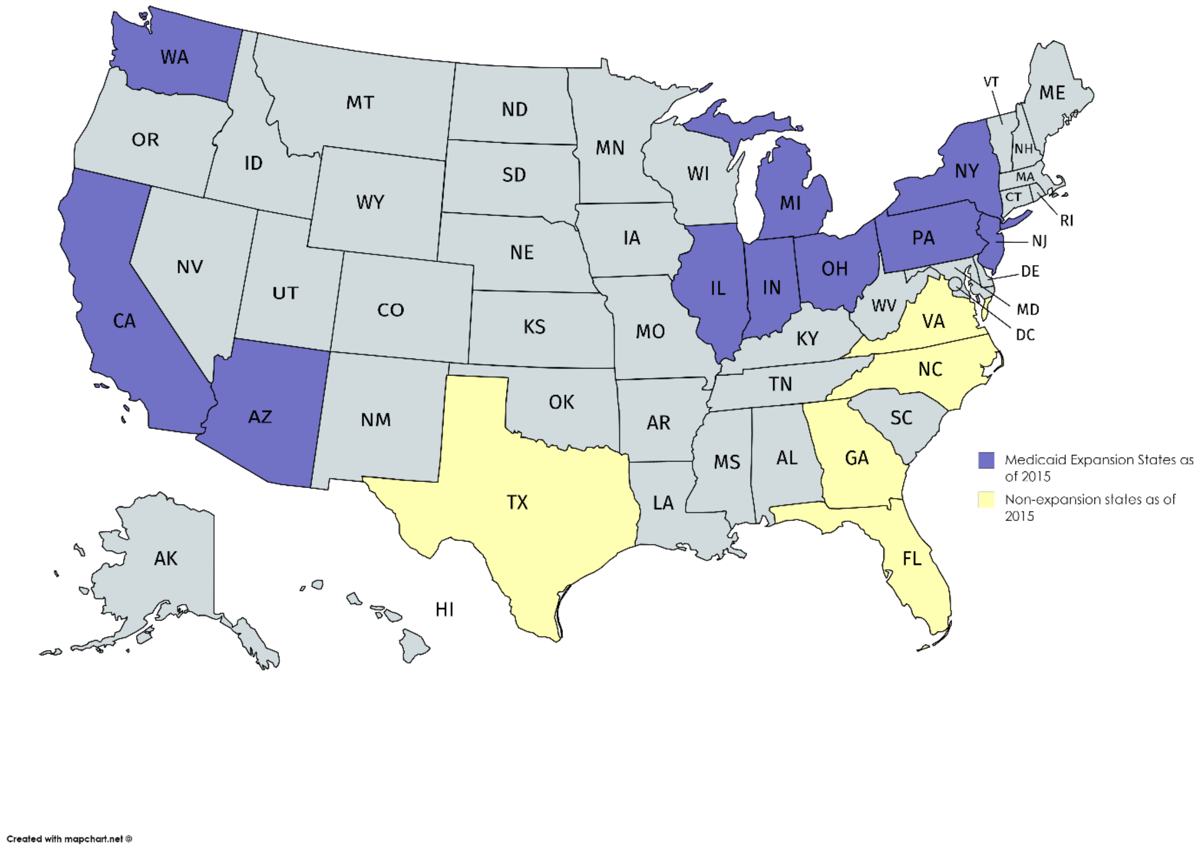

Figure 11. Map of Non-expansion vs. Medicaid Expansion States as of 2015. Purple states include Medicaid expansion states as of 2015.

In **Figure 11,** Yellow states are non-expansion states that never expanded Medicaid. Massachusetts was originally in the sample but was removed due to expanding Medicaid above 138% FPL in the pre-ACA period.

Insurance Status. In the pre-ACA period, private insurance accounted for almost 3/4th of the payment type for preventive care visits. This payment method decreased by 7% in the post-ACA period. Interestingly, Medicaid saw a 20% (p=0.5047) increase in the payment type for clinic visits in the post-ACA period, followed by Medicare (13%). The “other” insurance type included workers compensation, no charge, other and unknown payment types.

Outcome Variables

Diabetes Screening. Diabetes screening was measured as a blood glucose or HgA1c performed during the preventive care clinic visit. Diabetes screening increased in the post-ACA period by 1.53%, although not statistically significant (**Table 73**).

Diabetes Prevention Education. Diabetes prevention education (DPE) included receiving at one form of teaching within the clinical setting on diet/nutrition, exercise or weight reduction. DPE increased by 48.86% ($p<0.05$) in the post-ACA period (**Table 73**).

Table 73

Change in Diabetes Screening and Prevention Education for Preventive Care Visits in 15-state sample (2012-2015).

	ANNUAL				Pre/Post ACA		Change (%)	Chi Square
Sample Size (unweighted)	2,634	2,415	2,191	1,734	5,049	3,925		
Preventive Visits (weighted)	61,547,461	60,245,157	51,194,211	66,143,533	121,792,619	117,337,744		
Preventive Visits, mean	-	-	-	-	60,896,310	58,668,872		
	2012	2013	2014	2015	Pre-ACA	Post-ACA	(Post/Pre)	P value
Diabetes Screening[a]	12.16	11.39	9.82	13.86	11.78	11.96	1.53%	0.9465
Diabetes Prevention Education[b]	13.12	14.90	17.77	23.21	14.00	20.84	48.86%	0.0289*

Note . Sample includes all white, black and Hispanic adults aged 18-64 who received a preventive care visit in 15 states. Chi-square calculated for pre-vs. post-ACA differences for each variable. Pre-ACA includes 2012-2013; Post-ACA includes 2014-2015. Survey weighted data.

[a]Diabetes Screening includes a glucose or HgbA1c test performed during clinic visit.

[b]Diabetes Prevention Education includes at least 1 form of education (i.e. weight reduction, diet/nutrition or exercise) performed during visit.
*p<0.05. **p<0.01. ***p<0.001

NAMCS Descriptive Statistics by Expansion Status

In Part II, tables include the average number of preventive care visits by white, black and Hispanic individuals aged 18-64 overall, then by expansion status. The years 2012-2015 were concatenated in order to draw comparison between the two state groups, non-expansion and Medicaid expansion states. Chi square was the statistical method used to distinguish between the two state groups. Non-expansion states (n=3,089) included 5 states: Florida, Georgia, North Carolina, Texas and Virginia. The Medicaid expansion state group was almost twice as large as the non-expansion group (n=5,885) and included 10 states that expanded Medicaid to 138% FPL by 2015: Arizona, California, Illinois, Indiana, Michigan, New Jersey, New York, Ohio, Pennsylvania and Washington (**Table 74**).

Table 74

NAMCS Analytic Sample Size by Expansion Status for Years 2012-2015

	n	Unweighted (%)	Weighted (%)
Medicaid Expansion Status[a]			
Non-expansion	3,089	34.42	38.39
Expansion	5,885	65.58	61.61

Note. Sample includes all white, black and Hispanic adults aged 18-64 who received a preventive care visit in 15 states from 2012-2015.

[a]Non-expansion includes 5 states and Medicaid expansion includes 10 states that expanded as of 2015.

Demographic Variables

Table 75 displays weighted percentages of key demographic variables: race/ethnicity, age and gender.

Race/Ethnicity. Differences in the distribution of race/ethnicity within the 2012-2015 time period by expansion status existed, with a greater number of minorities receiving a preventive care visit within non-expansion states (43.51%), than in Medicaid expansion states (27.01%, p<0.001).

Age. There was no difference in the sampling distribution of age from 2012-2015 by expansion status (p=0.8239) within the NAMCS analytic sample.

Gender. There was no difference in the sampling distribution of gender from 2012-2015 by expansion status (p=0.2484) within the NAMCS analytic sample.

Table 75.

Differences in Demographic Characteristics by Expansion Status for Years 2012-2015

	Overall		**Non-expansion**[a]	**Expansion**[b]	
Sample Size (unweighted)	8,974		3,089	5,885	
Preventive Visits (weighted)	239,130,363		91,799,023	147,331,340	
Preventive Visits, mean	59,782,591		22,949,756	36,832,835	
	n	Weighted (%)	Weighted (%)	Weighted (%)	X^2 p value
Race/Ethnicity					p<0.001***
Whites	6,615	66.60	56.49	72.91	
Blacks	1,041	12.81	17.87	9.65	
Hispanics	1,318	20.59	25.64	17.45	
Age					p=0.8239
18 to 34	3,542	38.60	39.74	37.90	
35 to 44	1,592	18.21	18.42	18.07	
45 to 54	1,791	21.13	20.55	21.49	
55 to 64	2,049	22.06	21.29	22.54	
Gender					p=0.2484
Male	2,375	28.05	25.95	29.36	
Female	6,599	71.95	74.05	70.64	

Note. Sample includes all white, black and Hispanic adults aged 18-64 who received a preventive care visit in 2012-2015. Chi-square calculated for variable differences by expansion group. Survey weighted data.

[a]Non-expansion states includes 5 states.

[b]Medicaid Expansion states includes 10 states.

*p<0.05. **p<0.01. ***p<0.001

Health Status Variables

Table 76 displays weighted percentages of key health status variables by expansion status: diabetes risk and chronic disease.

Diabetes Risk Status. Most of the preventive care visits within non-expansion states were of unknown diabetes risk due to no documentation of BMI or obesity diagnosis (39%). The Medicaid expansion group also had a high rate of unknown diabetes risk (37%). When the unknown risk group was dropped, non-expansion and Medicaid expansion groups had similar proportions of high-risk individuals (62% for both groups), with slightly more individuals with diabetes (13%) who had a preventive care visit in non-expansion states than Medicaid expansion states (10%). The proportion of visits who were of no/low risk in non-expansion states was 25% and 28% in Medicaid expansion states. There was no difference in the sampling distribution of diabetes risk by expansion status in the sample that includes all four diabetes risk groups (p=0.5620) or when the unknown risk group was dropped (p=0.1037).

Chronic Disease. Chronic disease was a dichotomous variable with "0" being no chronic disease and "1" being at least one chronic disease or more. The diseases included in this variable were: asthma, stroke, chronic obstructive pulmonary disease, depression, coronary artery disease, and congestive heart failure. The rate of chronic disease between both state groups was very close (16% vs. 15%). There was no difference in the sampling distribution of chronic disease by expansion status in the NAMCS analytic sample (p=0.7533).

Table 76.

Differences in Health Status Characteristics by Expansion Status for Years 2012-2015

	Overall		Non-expansion[a]	Expansion[b]	
Sample Size (unweighted)	8,974		3,089	5,885	
Preventive Visits (weighted)	239,130,363		91,799,023	147,331,340	
Preventive Visits, mean	59,782,591		22,949,756	36,832,835	
	n	Weighted (%)	Weighted (%)	Weighted (%)	X^2 p value
Diabetes Risk Status[c]					p=0.4189
No/low risk	1,489	16.86	15.25	17.86	
High Risk	3,146	38.57	37.69	39.12	
Diabetes	607	6.92	7.92	6.29	
Unknown	3,732	37.65	39.13	36.72	
Chronic Disease[d]					p=0.7533
No chronic disease	7,751	84.91	84.45	85.20	
At least 1 chronic disease	1,223	15.09	15.55	14.80	

Note. Sample includes all white, black and Hispanic adults aged 18-64 who received a preventive care visit in 2012-2015. Chi-square calculated for variable differences by expansion group. Survey weighted data.

[a]Non-expansion states includes 5 states.

[b]Medicaid Expansion states includes 10 states.

[c]Diabetes Risk Status defined as: No/low-risk (BMI< 25 and no diagnosis of obesity or diabetes); High-risk (BMI=> 25 and <30 and no diagnosis of diabetes, or a obesity diagnosis); Diabetes (diabetes diagnosis); Unknown (BMI not available and no diagnosis of obesity or diabetes).

[d]Chronic disease included a diagnosis at least 1 of the following conditions: asthma, stroke, COPD, depression, CAD or CHF.

*p<0.05. **p<0.01. ***p<0.001

Health Insurance Coverage. Private insurance was the largest source of payment within both non-expansion (64%) and Medicaid expansion states (69%), with Medicaid being the second largest payer (15% in non-expansion states, 15% in Medicaid expansion states). There was no difference in the sampling distribution of insurance status by expansion group in the 2012-2015 NAMCS analytic sample (p=0.6171) (**Table 77**).

Table 77

Differences in Preventive Care Visit Payment Type by Expansion Status for Years 2012-2015

	Overall		Non-expansion[a]	Expansion[b]	
Sample Size (unweighted)	8,974		3,089	5,885	
Preventive Visits (weighted)	239,130,363		91,799,023	147,331,340	
Preventive Visits, mean	59,782,591		22,949,756	36,832,835	
	n	Weighted (%)	Weighted (%)	Weighted (%)	X^2 p value
Insurance Status					p=0.6286
Private	6,193	67.00	63.87	68.95	
Medicaid	1,220	14.96	15.30	14.75	
Medicare	364	4.13	4.73	3.76	
Self Pay	419	4.35	4.28	4.39	
Other	778	9.56	11.81	8.15	

Note. Sample includes all white, black and Hispanic adults aged 18-64 who received a preventive care visit in 2012-2015. Chi-square calculated for variable differences by expansion group. Survey weighted data.

[a]Non-expansion states includes 5 states.

[b]Medicaid Expansion states includes 10 states.

*p<0.05. **p<0.01. ***p<0.001

Outcome Variables

Table 78 displays weighted percentages of preventive care visits where diabetes screening or diabetes prevention education occurred within non-expansion and Medicaid expansion states.

Diabetes Screening. Of all visits, 11% of high-risk individuals in non-expansion states were screened for diabetes at their preventive care visit, compared to 12% of high-risk individuals in Medicaid expansion states. There was no difference in the sampling distribution of diabetes screening by expansion status for the NAMCS analytic sample (p=0.8710).
When the unknown group was dropped, 19% of high-risk individuals were screened in non-expansion and Medicaid expansion states. Yet, from **Table 76,** 38-39% of individuals in the sample were at high risk for diabetes, demonstrating the low rate of diabetes screening occurring during preventive care visits, not including those who were of unknown diabetes risk.

Diabetes Prevention Education. Slightly more individuals within non-expansions states (19%) received diabetes prevention education (DPE) compared to those living in Medicaid expansion states (16%). However, there was no difference in the sampling distribution of diabetes prevention education by expansion status in this sample (p=0.4560). When the unknown for diabetes group was dropped, 16% of high-risk individuals in non-expansion states received DPE, compared to 13% in expansion states. Again, despite the high levels of individuals at high-risk for diabetes attending a preventive care visit, low levels of diabetes prevention education were recorded in the medical record.

Table 78

Differences in Diabetes Screening and Prevention Education by Expansion Status for Years 2012-2015.

	Overall		**Non-expansion**[a]	**Expansion**[b]	
Sample Size (unweighted)	8,974		3,089	5,885	
Preventive Visits (weighted)	239,130,363		91,799,023	147,331,340	
Preventive Visits, mean	59,782,591		22,949,756	36,832,835	
	n	Weighted (%)	Weighted (%)	Weighted (%)	X^2 p value
Diabetes Screening[c]	820	11.87	11.44	12.14	p=0.8330
Diabetes Prevention Education[d]	1,306	17.36	18.99	16.34	p=0.4883

Note. Sample includes all white, black and Hispanic adults aged 18-64 who received a preventive care visit in 2012-2015. Chi-square calculated for variable differences by expansion group. Survey weighted data.

[a]Non-expansion states includes 5 states.

[b]Medicaid Expansion states includes 10 states.

[c]Diabetes Screening includes a glucose or HgbA1c test performed during clinic visit.

[d]Diabetes Prevention Education includes at least 1 form of education (i.e. weight reduction, diet/nutrition or exercise) performed during visit.

*p<0.05. **p<0.01. ***p<0.001

NAMCS Descriptive Statistics Stratified by Race and Diabetes Risk

In Part III, unadjusted changes in diabetes screening and diabetes prevention education over the ACA period are stratified by race, then by diabetes risk status in order to differentiate if changes occurred overall- and then between non-expansion and Medicaid expansion states. Criteria for testing for diabetes or prediabetes in asymptomatic adults includes testing for overweight or obese (BMI >= 25kg/m^2 or 23kg/m^2 in Asian Americans) adults who have one or more risk factors, with minority status (black or Hispanic) being one of the risk factors (American Diabetes Association, 2018). Although the criteria above are specific to testing of diabetes or prediabetes, no criteria exist for individuals at high-risk for diabetes; although a recent meta-analysis showed that obesity alone was significantly associated with an increased risk of Type II diabetes (Riaz, Khan, Siddiqi, 2018). As a result, BMI and race/ethnicity are of focus. Pearson Chi-square statistics were used to assess for differences in the sampling distributions between variables and outcomes of interest using survey (svy) weighted data. Sensitivity analysis using only 2012-2014 data is also included in this section and is discussed in the following paragraph.

In NAMCS from years 2012-2015, there are six lab tests that capture blood sugar levels: CMP, BMP, GLUCOSE, HGBA, FBG, A1C (with the last two tests being performed in the last year). The main text includes only the two lab tests that were drawn during the preventive care visit: Glucose or HgbA1c. In this sensitivity analysis, fasting blood glucose and HgbA1c that were drawn in the past 12 months were also included. To include labs drawn in the past 12 months, the year 2015 was dropped since no data on FBG or A1C in the past 12 months was available. The tables that follow display diabetes screening in two ways using only 2014 data in the post-ACA period. The first screening values included glucose and HgbA1c drawn during the visit from 2012-2014, whereas the second screening values included glucose and HgbA1c drawn during the visit or in the past 12 months from 2012-2014. CMP and BMP were not included as these two lab values were only collected in 2014 and 2015.

In NAMCS from years 2012-2015, there were four topics related to diabetes prevention education: Diabetes Education, Weight Reduction, Exercise and Diet/Nutrition. In the text, the main outcome (DPE) did not include diabetes education because data was not available for years 2012 and 2013. For the sensitivity analysis, diabetes education was included in the outcome variable, which only affected the post-ACA period. Per the NAMCS Micro-Data File Documentation, diabetes education includes helping patients manage their insulin, blood sugar, diet and fitness routine. An insulin pump is given as an example of managing insulin. This definition may be more consistent with education provided to those with diagnosed diabetes; however, the sensitivity analysis was still conducted since this included other areas relevant to individuals at high-risk for diabetes.

Pre-vs. Post-ACA Changes in Outcomes by Race

Overall Change in Diabetes Screening and Education by Race. The sample size for whites was almost 6-times the size of blacks or Hispanics. By the post-ACA period, diabetes screening rates ranged from 10-17% across all racial/ethnic groups (**Table 79**). Whites experienced a 17% decrease in diabetes screening in the post-ACA period, with blacks and Hispanics both experiencing 14-17% increases. All changes in diabetes screening by race/ethnicity over the ACA period were found to be statistically insignificant.

Table 79

Overall Change in Diabetes Screening and Prevention Education Pre-vs. Post-ACA by Race/Ethnicity (2012-2015)

	Whites			**Blacks**			**Hispanics**		
	Pre-ACA n=3,696	**Post-ACA** n=2,919	**Change (%)**	**Pre-ACA** n=599	**Post-ACA** n=442	**Change (%)**	**Pre-ACA** n=754	**Post-ACA** n=564	**Change (%)**
Diabetes Screening[a]	12.26	10.20	-16.80%	11.70	16.90	44.44%	10.08	14.08	39.68%
DPE[b]	16.05	19.19	19.56%	9.68	25.59**	164.36%	9.35	22.74	143.21%

Note. Chi square calculated for pre-(2012-2013) vs. post-ACA (2014-2015) differences in outcomes by race/ethnicity. 15-state group sample, survey weighted.

[a]Diabetes Screening includes a glucose or HgbA1c test performed during clinic visit.

[b]Diabetes Prevention Education includes at least 1 form of education (i.e. weight reduction, diet/nutrition or exercise) performed during visit.

*p<0.05. **p<0.01. ***p<0.001

Change in Diabetes Screening and Education by Race and Expansion Status. Blacks within non-expansion states had the lowest levels of diabetes screening in the pre-ACA period (6.91%); whereas Hispanics in Medicaid expansion states had the lowest levels of diabetes screening pre-ACA (10.43%). Post-ACA the largest gains in diabetes screening was among blacks living in non-expansion states (135%), with a post-ACA screening rate of 16%. The gains in screening for whites was very different. In non-expansion states, whites experienced a gain in screening of 30%, but a loss in screening of 11% in Medicaid expansion states. Hispanics experienced greater gains in diabetes screening within non-expansions states (70%). Although there were gains or losses in diabetes screening for all races, all changes were found to be statistically insignificant (**Tables 80 and 81)**.

Diabetes prevention education during preventive care visits increased post-ACA for all racial/ethnic groups. The greatest gains in the administration of diabetes prevention education occurred within non-expansion states. Blacks (247%, p<0.001) and Hispanics (333%, p<0.05) experienced major gains in receiving diabetes prevention education post-ACA (**Table 80**). The gains in diabetes prevention education for all race/ethnicities within Medicaid expansion states, however, were statistically insignificant (**Tables 80 and 81**).

Table 80

Change in Diabetes Screening and Prevention Education in Non-expansion States, Pre-vs. Post-ACA by Race/Ethnicity (2012-2015)

	Whites			Blacks			Hispanics			
	Pre-ACA n=1,156	**Post-ACA** n=836	**Change (%)**	**Pre-ACA** n=280	**Post-ACA** n=240	**Change (%)**	**Pre-ACA** n=352	**Post-ACA** n=225	**Change (%)**	**p**
Diabetes Screening[a]	12.13	8.53	-29.68%	6.91	16.25	135.17%	9.73	16.55	70.09%	0.5203
DPE[b]	14.60	20.45	40.07%	8.51	29.51***	246.77%	8.21	35.61*	333.74%	0.0485

Note. Chi square calculated for pre-(2012-2013) vs. post-ACA (2014-2015) differences in outcomes by race/ethnicity. Non-expansion (5-state) group sample, survey weighted.

[a]Diabetes Screening includes a glucose or HgbA1c test performed during clinic visit.

[b]Diabetes Prevention Education includes at least 1 form of education (i.e. weight reduction, diet/nutrition or exercise) performed during visit.

*p<0.05. **p<0.01. ***p<0.001

Table 81

Change in Diabetes Screening and Prevention Education in Medicaid Expansion States, Pre-vs. Post-ACA by Race/Ethnicity (2012-2015)

	Whites			Blacks			Hispanics		
	Pre-ACA n=2,540	**Post-ACA** n=2,083	**Change (%)**	**Pre-ACA** n=319	**Post-ACA** n=202	**Change (%)**	**Pre-ACA** n=402	**Post-ACA** n=339	**Change (%)**
Diabetes Screening[a]	12.33	10.97	-11.03%	16.78	17.7	5.48%	10.43	11.96	14.67%
DPE[b]	16.79	18.62	10.89%	10.93	20.67	89.11%	10.48	11.64	11.07%

Note .Chi square calculated for pre-(2012-2013) vs. post-ACA (2014-2015) differences in outcomes by race/ethnicity. Medicaid expansion (10-state) group sample, survey weighted.

[a]Diabetes Screening includes a glucose or HgbA1c test performed during clinic visit.

[b]Diabetes Prevention Education includes at least 1 form of education (i.e. weight reduction, diet/nutrition or exercise) performed during visit.

*p<0.05. **p<0.01. ***p<0.001

Pre-vs. Post-ACA Changes in Outcomes by Diabetes Risk

Overall Change in Diabetes Screening and Education by Diabetes Risk. The high-risk for diabetes group had the highest rate of diabetes screening in the pre-ACA period (15%)

when compared to other non-diabetes groups. Post-ACA, the high-risk group saw a 7% increase in diabetes screening, which was well above the percent change of the low-risk and unknown risk groups. Although screening rates increased for the high-risk group, the change was found to be statistically insignificant. The decline in screening among the unknown group was the only change in diabetes screening during the ACA period to be statistically significant (-44.54%, p<0.05).

The high-risk for diabetes group saw an increase of 30% in the rate of prevention education provided in the post-ACA period. In fact, all groups experienced increases except the no/low risk group which saw a minor decrease of 0.34%. However, any differences in the delivery of diabetes prevention education during a preventive care visit in the post-ACA period for each risk group was found to be statistically insignificant.

Table 82.

Overall Change in Diabetes Screening and Prevention Education, Pre-vs. Post-ACA by Diabetes Risk (2012-2015)

	No/Low Risk			High-Risk			Diabetes			Unknown		
	Pre-ACA n=875	Post-ACA n=614	Change (%)	Pre-ACA n=1,738	Post-ACA n=1,408	Change (%)	Pre-ACA n=335	Post-ACA n=272	Change (%)	Pre-ACA n=2,101	Post-ACA n=1,631	Change (%)
Screening[a]	10.63	10.00	-5.93%	14.96	16.02	7.09%	25.97	29.60	13.98%	7.32	4.06*	-44.54%
DPE[b]	17.73	17.67	-0.34%	19.59	25.34	29.35%	17.90	30.96	72.96%	7.04	14.69	108.67%

Note. Chi square calculated for pre-(2012-2013) vs. post-ACA (2014-2015) differences in outcomes by diabetes risk. 15-state group sample, survey weighted.

[a]Diabetes Screening includes a glucose or HgbA1c test performed during clinic visit.

[b]Diabetes Prevention Education includes at least 1 form of education (i.e. weight reduction, diet/nutrition or exercise) performed during visit.

*p<0.05. **p<0.01. ***p<0.001

Change in Diabetes Screening and Education by Diabetes Risk and Expansion Status. Diabetes screening increased for all groups in non-expansion states, with the high-risk group experiencing the greatest gains of all the risk groups (48%) (**Table 83**). Surprisingly, the non-expansion high-risk group experienced greater gains in diabetes screening than the Medicaid expansion state group. There was a 9% decrease in diabetes screening among the high-risk group in Medicaid expansion states, despite the low-risk and unknown risk groups experiencing gains in screening **(Table 84)**. Changes in diabetes screening for all risk groups were statistically insignificant in both non-expansion and Medicaid expansion states.

The rate of delivering diabetes prevention education was greater than the rate of providing diabetes screening for the high-risk groups in both non-expansion and Medicaid expansion states. The high-risk group in non-expansion states experienced a 75% increase in prevention education leading to a post-ACA teaching rate of 32% (p<0.01). This rate surpassed the education rate in expansion states by almost 10%. The increase in teaching for the high-risk group in expansion states was only 5%. Most of the diabetes prevention education provided in non-expansion states was targeted to the high-risk group, whereas most of the education provided in the expansion states targeted the group with already diagnosed diabetes.

Table 83

Change in Diabetes Screening and Prevention Education in Non-expansion States, Pre-vs. Post-ACA by Diabetes Risk (2012-2015)

	No/Low Risk			**High-Risk**			**Diabetes**			**Unknown**		
	Pre-ACA n=276	**Post-ACA** n=195	**Change (%)**	**Pre-ACA** n=630	**Post-ACA** n=460	**Change (%)**	**Pre-ACA** n=150	**Post-ACA** n=102	**Change (%)**	**Pre-ACA** n=732	**Post-ACA** n=544	**Change (%)**
Screening[a]	9.88	13.83	39.98%	11.28	16.68	47.87%	21.48	29.11	35.52%	8.51	2.72*	68.04%
DPE[b]	20.33	13.64	32.91%	18.20	31.83**	74.89%	13.23	22.54	70.37%	3.87	26.66**	588.89%

Note. Chi square calculated for pre-(2012-2013) vs. post-ACA (2014-2015) differences in outcomes by diabetes risk. Non-expansion (5-state) group sample, survey weighted.

[a]Diabetes Screening includes a glucose or HgbA1c test performed during clinic visit.

[b]Diabetes Prevention Education includes at least 1 form of education (i.e. weight reduction, diet/nutrition or exercise) performed during visit.

*p<0.05. **p<0.01. ***p<0.001

Table 84

Change in Diabetes Screening and Prevention Education in Medicaid Expansion States, Pre-vs. Post-ACA by Diabetes Risk (2012-2015)

	No/Low Risk			High-Risk			Diabetes			Unknown		
	Pre-ACA n=599	**Post-ACA** n=419	**Change (%)**	**Pre-ACA** n=1,108	**Post-ACA** n=948	**Change (%)**	**Pre-ACA** n=185	**Post-ACA** n=170	**Change (%)**	**Pre-ACA** n=1,369	**Post-ACA** n=1,087	**Change (%)**
Screening[a]	11.03	7.95	27.92%	17.22	15.63	-9.23%	30.27	29.93	-1.12%	6.53	4.96	24.04%
DPE[b]	16.37	19.84	21.20%	20.44	21.51	5.23%	22.38	36.51	63.14%	9.13	6.71	26.51%

Note .Chi square calculated for pre-(2012-2013) vs. post-ACA (2014-2015) differences in outcomes by diabetes risk. Medicaid expansion (10-state) group sample, survey weighted.

[a]Diabetes Screening includes a glucose or HgbA1c test performed during clinic visit.

[b]Diabetes Prevention Education includes at least 1 form of education (i.e. weight reduction, diet/nutrition or exercise) performed during visit.

*p<0.05. **p<0.01. ***p<0.001

Sensitivity Analysis for Changes in Diabetes Screening by Race

In **Table 85**, Diabetes Screening[a] included a glucose or HgbA1c test performed during the clinic visit which was consistent with the definition of diabetes screening in the main text. When 2015 was removed from the post-ACA period, the diabetes screening rates decreased even more so then when the post-ACA period included 2014 and 2015. For example, whites experienced a 17% decrease in screening in the post-ACA period using 2014-2015; while whites experienced a 24% decrease in screening using only 2014 data in the post-ACA period. This decline in screening was also seen for blacks and Hispanics. By including 2015 data, the post-ACA screening rates at the time of the visit were higher than only including 2014 data.

Dropping 2015 data for Diabetes Screening[a] was necessary to make a direct comparison between using 2 lab values vs. 4 lab values (Diabetes Screening[b]) in **Table 85**, since the fasting glucose and HgbA1c in the past 12 months did not have 2015 data. Notably, the pre-ACA screening rates using 4 lab values at least doubled for all racial/ethnic groups. It would make sense that the screening rate would be low 10-12% among all groups during their clinic visit because the provider saw a previous lab value within the past year. However, the problem with using glucose or HgbA1c drawn in the past year is that the additional values in 2014, may not have been drawn in 2014; rather those values may have been in 2013. Luckily, NAMCS does have 2 separate variables that capture the difference in days from when the glucose or A1c was drawn to the clinic visit data. Unfortunately, 83.30% of the values are missing for fasting glucose in the past 12 months and 92.80% of values are missing for HgbA1c in the past 12 months, making this outcome an undesirable measure to study, given the focus of this study on ACA effects as of 2014.

Table 85

Sensitivity Analysis: Change in Diabetes Screening, Pre-vs. Post-ACA by Expansion Status and Race (2012-2014)

	Whites			**Blacks**			**Hispanics**		
	Pre-ACA n=3,696	**Post-ACA** n=1,647	**Change (%)**	**Pre-ACA** n=599	**Post-ACA** n=257	**Change (%)**	**Pre-ACA** n=754	**Post-ACA** n=287	**Change (%)**
Overall									
Diabetes Screening[a]	12.26	9.34	-23.82%	11.70	11.56	-1.20%	10.08	10.53	4.64%
Diabetes Screening[b]	24.92	34.30**	37.64%	24.98	30.32	21.38%	25.31	33.23	31.29%
	Pre-ACA n=1,156	Post-ACA n=529		Pre-ACA n=280	Post-ACA n=137		Pre-ACA n=352	Post-ACA n=122	
Non-expansion									
Diabetes Screening[a]	12.13	5.85*	-51.77%	6.91	7.58	9.70%	9.72	8.03	-17.39%
Diabetes Screening[b]	25.86	27.48	6.26%	20.49	28.89	41.00%	28.53	44.05	54.40%
	Pre-ACA n=2,540	Post-ACA n=1,118		Pre-ACA n=319	Post-ACA n=120		Pre-ACA n=402	Post-ACA n=165	
Expansion									
Diabetes Screening[a]	12.33	11.11	-9.90%	16.78	14.89	-11.26%	10.43	12.66	21.38%
Diabetes Screening[b]	24.43	37.75**	54.52%	29.73	31.52	6.02%	22.17	24.03	8.39%

Note. Chi square calculated for pre-vs. post-ACA differences in outcomes by race/ethnicity. Overall includes 15-state group sample; Non-expansion includes 5-state group; Expansion includes 10-state group; survey weighted.

[a]Diabetes Screening includes a glucose or HgbA1c test performed during clinic visit using 2012-2014 data.

[b]Diabetes Screening includes: glucose or HgbA1c test performed during clinic visit or either test within the past 12 months using 2012-2014 data.

*p<0.05. **p<0.01. ***p<0.001

Sensitivity Analysis for Changes in Diabetes Prevention by Race

In **Table 86**, adding diabetes education did not increase post-ACA rates for diabetes prevention teaching by much. Whites and blacks experienced an increase in diabetes prevention education in the post-ACA period, even though the increase of adding diabetes education in the post-ACA period was minor (<1-percentage-point overall for whites and a little over 1-percentage point increase overall for blacks). The post-ACA rates of diabetes prevention education in the post-ACA period for Hispanics were unchanged overall, and within both non-expansion and Medicaid expansion states.

Table 86

Sensitivity Analysis: Change in Diabetes Prevention Education, Pre-vs. Post-ACA by Expansion Status and Race (2012-2014)

	Whites			Blacks			Hispanics		
	Pre-ACA n=3,696	**Post-ACA** n=2,919	**Change (%)**	**Pre-ACA** n=599	**Post-ACA** n=442	**Change (%)**	**Pre-ACA** n=754	**Post-ACA** n=564	**Change (%)**
Overall									
DPE[a]	16.05	19.80	23.36%	9.68	25.68**	165.29%	9.35	22.74	143.21%
	Pre-ACA n=1,156	Post-ACA n=836		Pre-ACA n=280	Post-ACA n=240		Pre-ACA n=352	Post-ACA n=225	
Non-expansion									
DPE[a]	14.60	21.80	49.32%	8.51	29.68***	248.77%	8.21	35.61*	333.74%
	Pre-ACA n=2,540	Post-ACA n=2,083		Pre-ACA n=319	Post-ACA n=202		Pre-ACA n=402	Post-ACA n=339	
Expansion									
DPE[a]	16.79	18.88	12.45%	10.93	20.67	89.11%	10.48	11.64	11.07%

Note. Chi square calculated for pre-vs. post-ACA differences in diabetes prevention education (DPE) by race/ethnicity. Overall includes 15-state group sample; Non-expansion includes 5-state group; Expansion includes 10-state group; survey weighted.

[a]Diabetes Prevention Education includes at least 1 form of education (i.e. weight reduction, diet/nutrition, exercise or diabetes education) performed during visit, using 2012-2015 data.

*p<0.05. **p<0.01. ***p<0.001

Sensitivity Analysis for Diabetes Screening by Diabetes Risk Status

When 2015 data was removed, the high-risk, diabetes and unknown risks groups experienced declines in diabetes screening (measuring only glucose or A1c), which is inconsistent with the descriptive data shown in the main text using 2014 and 2015 data. As previously mentioned, diabetes screening is underestimated in the post-ACA period when the year 2015 is dropped. When glucose and A1c in the past 12 months were added, the baseline screening rate in the pre-ACA more than doubled for the low-risk, high-risk and unknown risk groups. Since the date the screening was taken in the past 12 months was unknown for a majority of the patients, the overall increases in the post-ACA period for all risk groups is of concern.

Table 87

Sensitivity Analysis: Change in Diabetes Screening, Pre-vs. Post-ACA by Expansion Status and Diabetes Risk (2012-2015)

	No/Low Risk			High-Risk			Diabetes			Unknown Risk		
	Pre-ACA n=875	**Post-ACA** n=374	**Change (%)**	**Pre-ACA** n=1,738	**Post-ACA** n=860	**Change (%)**	**Pre-ACA** n=335	**Post-ACA** n=159	**Change (%)**	**Pre-ACA** n=2,101	**Post-ACA** n=798	**Change (%)**
Overall												
Diabetes Screening[a]	10.63	12.27	15.43%	14.96	11.89	-20.52%	25.97	15.34	-40.93%	7.32	4.44	-39.34%
Diabetes Screening[b]	22.54	35.07*	55.59%	32.00	41.02*	28.19%	42.03	54.42	29.48%	17.30	18.32	5.90%
	Pre-ACA n=276	Post-ACA n=129		Pre-ACA n=630	Post-ACA n=310		Pre-ACA n=150	Post-ACA n=67		Pre-ACA n=732	Post-ACA n=282	
Non-expansion												
Diabetes Screening[a]	9.88	8.22	-16.80%	11.28	5.41*	-52.04%	21.48	17.24	-19.74%	8.51	4.37	-48.65%
Diabetes Screening[b]	22.15	28.13	27.00%	29.50	35.48	20.27%	35.10	41.83	19.17%	21.87	24.38	11.48%
	Pre-ACA n=599	Post-ACA n=245		Pre-ACA n=1,108	Post-ACA n=550		Pre-ACA n=185	Post-ACA n=92		Pre-ACA n=1,369	Post-ACA n=516	
Expansion												
Diabetes Screening[a]	11.03	14.48	106.26%	17.22	16.09	-6.56%	30.27	14.02	-53.68%	6.53	4.48	-31.39%
Diabetes Screening[b]	22.75	38.85*	70.77%	33.54	44.60*	32.98%	48.69	63.23	29.86%	14.27	15.09	5.75%

Note. Chi square calculated for pre-vs. post-ACA differences in diabetes screening by diabetes risk. Overall includes 15-state group sample; Non-expansion includes 5-state group; Expansion includes 10-state group; survey weighted.

[a]Diabetes Screening includes a glucose or HgbA1c test performed during clinic visit using 2012-2014 data.

[b]Diabetes Screening includes: glucose or HgbA1c test performed during clinic visit or either test within the past 12 months using 2012-2014 data.

*p<0.05. **p<0.01. ***p<0.001

Sensitivity Analysis for Changes in Diabetes Prevention by Diabetes Risk

This sensitivity analysis reveals that individuals who only received diabetes education during the clinic visit were individuals who mainly had diagnosed diabetes, although there was a small 0.22-percentage increase in diabetes prevention education provided to the high-risk group overall in the post-ACA period. The post-ACA teaching rate for the diabetes group was 33%;

whereas in the main text the rate was 31%. Most of the gains in teaching was due to education being provided to the diabetes group in Medicaid expansion states (**Table 88**). This group experienced a 2.5-percentage point increase in the post-ACA period, over the rate seen when only three teaching methods were used (i.e. exercise, weight reduction, or diet/nutrition). For the high-group, the gains in diabetes prevention screening in the post-ACA period were within the non-expansion states, although gains were very small.

Table 88

Sensitivity Analysis: Change in Diabetes Prevention Education, Pre-vs. Post-ACA by Expansion Status and Diabetes Risk Status (2012-2015)

	No/Low Risk			**High-Risk**			**Diabetes**			**Unknown Risk**		
	Pre-ACA n=875	**Post-ACA** n=614	**Change (%)**	**Pre-ACA** n=1,738	**Post-ACA** n=1,408	**Change (%)**	**Pre-ACA** n=335	**Post-ACA** n=272	**Change (%)**	**Pre-ACA** n=2,101	**Post-ACA** n=1,631	**Change (%)**
Overall												
DPE[a]	17.73	17.67	-0.34%	19.59	25.56	30.47%	17.90	32.97	84.19%	7.04	15.15	115.20%
	Pre-ACA n=276	Post-ACA n=195		Pre-ACA n=630	Post-ACA n=460		Pre-ACA n=150	Post-ACA n=102		Pre-ACA n=732	Post-ACA n=544	
Non-expansion												
DPE[a]	20.33	13.64	-32.91%	18.20	32.42**	78.13%	13.23	23.80	79.90%	3.87	27.81**	619.61%
	Pre-ACA n=599	Post-ACA n=419		Pre-ACA n=1,108	Post-ACA n=948		Pre-ACA n=185	Post-ACA n=170		Pre-ACA n=1,369	Post-ACA n=1,087	
Expansion												
DPE[a]	16.37	19.84	21.20%	20.44	21.51	5.23%	22.38	39.01	74.31%	9.13	6.71	-25.51%

Note. Chi square calculated for pre-vs. post-ACA differences in diabetes prevention education (DPE) by diabetes risk. Overall includes 15-state group sample; Non-expansion includes 5-state group; Expansion includes 10-state group; survey weighted.

[a]Diabetes Prevention Education includes at least 1 form of education (i.e. weight reduction, diet/nutrition, exercise or diabetes education) performed during visit, using 2012-2015 data.

*p<0.05. **p<0.01. ***p<0.001

Multiple Logistic Regression Analyses of Diabetes Screening and Diabetes Prevention Education (DPE)

In this section, logistic regression results are presented and discussed by sub aim:

- **Specific Aim 3a** the impact of the ACA on the likelihood of receiving diabetes screening or diabetes prevention education overall, and by expansion status;
- **Specific Aim 3b:** the impact of the ACA on the likelihood of receiving diabetes screening or diabetes prevention education by race and then by diabetes risk status by expansion status.

For each aim, the ACA policy effect was measured with a pre/post ACA indicator, with 2014-2015 marking the post-ACA period. A difference-in-difference approach was used to quantify ACA effects between expansion and race or expansion and diabetes risk groups. ACA interaction terms formed the crucial difference-in-difference estimators. Logistic regression methods were used to determine the statistical significance and size of the causal paths from the ACA to the delivery of diabetes prevention screening and education. Given the previous BRFSS analysis, the ACA to PCP link showed a very small effect of the ACA on PCP gains, which in return should yield even smaller gains, if any, in diabetes prevention screening and/or education post-ACA.

Prior to running the multivariate logistic regressions, the correlations among the dependent and independent variables were reviewed to describe the association between the random variables. Although the correlation matrix does not control for confounders, it was helpful in identifying the presence of causal relationships, which were confirmed by regression results later in this section.

When interpreting the correlation coefficients in **Table 89**, the coefficients included 4 years of data and reflected mean differences between the values of 0 or 1, as most variables were dichotomous. All variables were dichotomous except for age which was a 4-category variable- with age increasing as the categories were coded from 0 to 4. For variables that were not time-sensitive, a single correlation was repeated 4 times, helping the power. For time-sensitive variables (such as ACA), the correlation coefficient gave an indication of how the variable means differed by time (pre vs. post ACA).

Table 89.

Pairwise Correlation Matrix for All Independent and Outcome Variables in 15-State Sample

	White	Black	Hispanic	AgeCat	Gender	Low Risk	High Risk	Diabetes	Unknown	C Disease	Expansion	ACA	Screening[a]	DPE[b]
White	1.0000													
Black	-0.6066*	1.0000												
Hispanic	-0.6948*	-0.1503*	1.0000											
AgeCat	0.1502*	-0.0479*	-0.1435*	1.0000										
Gender	-0.0794*	0.0430*	0.0598*	-0.2764*	1.0000									
Low Risk	0.0908*	-0.0652*	-0.0539*	0.0154	0.0347*	1.0000								
High Risk	0.0164	0.0540*	-0.0693*	0.2015*	-0.1670*	-0.3277*	1.0000							
Diabetes	-0.0236*	0.0368*	-0.0039	0.1780*	-0.1140*	-0.1201*	-0.1979*	1.0000						
Unknown	-0.0724*	-0.0218*	0.1098*	-0.2974*	0.1936*	-0.3763*	-0.6199*	-0.2273*	1.0000					
C Disease	0.0343*	0.0052	-0.0474*	0.0943*	-0.0076	0.0071	0.0839*	0.0676*	-0.1210*	1.0000				
Expansion	0.1518*	-0.1184*	-0.0817*	-0.0233*	-0.0189	0.0262*	-0.0035	-0.0402*	0.0041	-0.0110	1.0000			
ACA	0.0131	-0.0093	-0.0079	-0.0023	0.0218*	-0.0225*	0.0151	0.0058	-0.006	-0.0052	0.0237*	1.0000		
Screening[a]	-0.0065	0.0143	-0.0048	0.0611*	-0.0622*	-0.0084	0.0523*	0.1194*	-0.1052*	0.0194	0.0181	-0.0192	1.0000	
DPE[b]	0.0117	0.0025	-0.0168	0.0431*	-0.0132	0.0300*	0.1398*	0.0449*	-0.1809*	0.0258*	-0.0063	0.0578*	0.1148*	1.0000

Note. Correlation matrix using 2012-2015 data. Each variable is a dichotomous variable except for age.

[a]Diabetes Screening includes a glucose or HgbA1c test performed during clinic visit.

[b]Diabetes Prevention Education includes at least 1 form of education (i.e. weight reduction, diet/nutrition or exercise) performed during visit.

*p<0.05.

The variables of interest in the matrix included ACA, Expansion Status (EXP), Diabetes Screening (SCR) and Diabetes Prevention Education (DPE). There was no correlation between diabetes screening and the ACA or screening and expansion status. The correlation between ACA and DPE was a very weak positive relationship (0.0578, $p<0.05$). This suggests very little to no ACA effect on receiving DPE in the post-ACA period. There was no correlation between DPE and expansion status. Important to note, there was no correlations between race and diabetes screening; but weak relationships existed between screening and risk status: high risk (0.0523, $p<0.05$), diabetes (0.1194, $p<0.05$) or unknown risk status (-0.1052, $p<0.05$). Diabetes education had no association with race and a weak correlation with the diabetes risk status: low risk (0.0300, $p<0.05$), high-risk (0.1398, $p<0.05$), diabetes (0.0258, $p<0.05$), and unknown (-0.1809, $p<0.05$) risk groups.

In the next section, focus was placed on multivariate regression work where outside factors were adjusted to determine if the ACA impacted the delivery of diabetes prevention. Additionally, by controlling for variables, disparities for the subgroups of interest (race or diabetes risk status) in the post-ACA period could be assessed. Given the initial descriptive analysis, diabetes screening for the regression analysis was measured by a fasting glucose or A1c level drawn during a clinic visit from 2012-2015. This was further justified by a recent study using 2012-2015 NAMCS data that defined fasting glucose or A1C provided during visits as "a provision of screening for diabetes" (Shealy, Wu, Waits, Taylor & Sarbacker, 2019). Diabetes prevention education was measured by at least 1 form of diabetes prevention education (i.e. diet/nutrition, exercise, or weight reduction) provided during a preventive care visit. Shealy, et al. (2019) also used only these three forms of education to measure health education/counseling provided during a clinic visit.

Specific Aim 3a- Odds of Diabetes Prevention Delivery by Expansion Status

The focus of this section was to assess for differences in the delivery of diabetes screening and diabetes prevention education during preventive care visits for adults within non-expansion and Medicaid expansion states during the ACA period. Each set of regression models for the probability of receiving diabetes screening and the probability of receiving diabetes prevention education are presented separately, with a focus on differentiating differences in outcomes by expansion status.

Diabetes Screening and Expansion Status. The overall ACA effect (Model 1) on the probability of receiving diabetes screening in the post-ACA was an odds ratio of 1.02. However, the odds ratio was not statistically significant. When expansion status was added (Model 2), there was no difference in the odds of receiving diabetes screening between non-expansion and Medicaid expansion states. The interaction term of ACA*EXP (Model 3) also shows no difference in the pre vs. post-ACA period by expansion status. When adjusting for other demographic and health status factors, such as race, age, gender, diabetes risk and chronic disease, there was no significant ACA effect on diabetes screening or differences in the probability of being screened between non-expansion and Medicaid expansion states (Model 4). Notably, across the 4 years under study, the high-risk for diabetes group was 45% more likely to receiving diabetes screening than the low-risk group. Also, the group with unknown risk were 44% less likely to be screened when compared to the low-risk population. Individuals with diabetes were 2.84-times more likely to be screened than the no/low risk group. (**Table 90**). Refer to Appendix AJ, Table AJ-1 for full regression modes with 95% CI's.

Table 90.

Logistic Regression Models for the Probability of Receiving Diabetes Screening by Expansion Status (2012-2015)

Probability of being Screened[a] (n=8,974)	**Model 1** (Odds Ratio)	**Model 2** (Odds Ratio)	**Model 3** (Odds Ratio)	**Model 4** (Odds Ratio)
ACA				
Pre-ACA	Ref	Ref	Ref	Ref
Post-ACA	1.02	1.02	0.91	1.10
Expansion Status				
Non-expansion		Ref	Ref	Ref
Medicaid Expansion		1.07	1.13	1.31
Interaction Term				
ACA*nonEXP				Ref
ACA*EXP				0.74
Race				
Whites			Ref	Ref
Blacks			0.98	1.33
Hispanics			1.44	1.44
Age				
18 to 34			Ref	Ref
35 to 44			0.98	0.98
45 to 54			1.15	1.16
55 to 64			1.65**	1.67**
Gender				
Male			Ref	Ref
Female			0.85	0.85
Diabetes Risk				
No/low Risk			Ref	Ref
High Risk			1.45*	1.45*
Diabetes			2.82***	2.84**
Unknown			0.56*	0.56*
Chronic Disease				
No Disease			Ref	Ref
At least 1 or more			1.17	1.17
Constant	0.13**	0.13**	0.10***	0.09**
F Statistic	0.95***	0.94	9.71***	8.91***

Note. Logistic regressions for the Pb(SCR) by expansion status and race in 15-states (2012-2015); survey weighted data. Values indicate odds ratios.

[a]Diabetes Screening includes a glucose or HgbA1c test performed during a clinic visit using 2012-2015 data.

[b] Three-way interaction term includes interactions between race, ACA and expansion status. Referernce group: whies living in non-expansion states, pre-ACA.

*p<0.05. **p<0.01. ***p<0.001

Diabetes Prevention Education and Expansion Status. The odds of receiving diabetes prevention education (DPE) in the post-ACA period was 1.62 ($p<0.05$), meaning individuals were 62% more likely to receive DPE in the post-ACA period, than in the pre-ACA period during a preventive care visit (Model 1). Expansion status did not affect the odds of receiving DPE, overall (Model 2) or over time (Model 3). When adjusting for changes between expansion groups over time, the ACA coefficient increased to 2.61 ($p<0.05$). When adjusting for demographic and health status variables, the ACA effect decreased to 2.54 ($p<0.05$) (Model 4). Notably, across all years, the high-risk group was 44% more likely to receiving diabetes prevention education than the no/low risk group, but the unknown risk group was 49% less likely to receive diabetes prevention education than the no/low risk group (**Table 91**). Refer to Appendix AJ, Table AJ-3 for full regression modes with 95% CI's.

Table 91.

Logistic Regression Models for the Probability of Receiving Diabetes Prevention Education by Expansion Status (2012-2015)

Probability of Receiving Diabetes Prevention Education[a] **(n=8,974)**	**Model 1** (Odds Ratio)	**Model 2** (Odds Ratio)	**Model 3** (Odds Ratio)	**Model 4** (Odds Ratio)
ACA				
Pre-ACA	Ref	Ref	Ref	Ref
Post-ACA	1.62*	1.62*	1.55	2.54*
Expansion Status				
Non-expansion		Ref	Ref	Ref
Medicaid Expansion		0.83	0.81	1.29
Interaction Term				
ACA*nonEXP				Ref
ACA*EXP				0.44
Race				
Whites			Ref	Ref
Blacks			0.89	0.87
Hispanics			0.93	0.94
Age				
18 to 34			Ref	Ref
35 to 44			0.83	0.83
45 to 54			0.73	0.74
55 to 64			0.76	0.78
Gender				
Male			Ref	Ref
Female			1.11	1.11
Diabetes Risk				
No/low Risk			Ref	Ref
High Risk			1.44*	1.44*
Diabetes			1.69	1.72
Unknown			0.51*	0.51*
Chronic Disease				
No Disease			Ref	Ref
At least 1 or more			0.89	0.88
Constant	0.16***	0.18***	0.22***	0.16***
F Statistic	4.73*	2.72	6.74***	7.65***

Note. Logistic regressions for the Pb(DPE) by expansion status and race in 15-states (2012-2015); survey weighted data. Values indicate odds ratios.

[a]Diabetes Prevention Education (DPE): at least 1 form of teaching (i.e. exercise, diet/nutrition or weight reduction) provided during visit using 2012-2015 data.

[b] Three-way interaction term includes interactions between race, ACA and expansion status. Reference group: whites living in non-expansion states in the pre-ACA period.

*p<0.05. **p<0.01. ***p<0.001

Specific Aim 3b- Odds of Receiving Diabetes Prevention by Expansion and Race, then by Expansion and Diabetes Risk

In this section, the focus was to determine if the ACA's coverage expansion increased the rate of diabetes screening and diabetes prevention education within Medicaid expansion versus non-expansion states by race/ethnicity, then by diabetes risk status. First the odds of receiving diabetes screening and prevention education by expansion status and race is discussed; followed by the same outcomes by expansion and diabetes risk. To note, Model 4 from **Tables 90** and **91** serve as the baseline regression model before the addition of ACA*Race (or ACA*Risk) interaction terms in Model 5 and ACA*Race*EXP (or ACA*Risk*EXP) interaction terms in Model 6. Full regression Models 1-6 for each outcome, including 95% CI's, can be found in Appendix AJ.

Diabetes Screening by Expansion and Race. In **Table 92**, Model 5 introduces the ACA*Race interaction term. In this model, the odds of receiving diabetes screening for minority groups increased (to 81-88% more likely than whites) in the post-ACA period, but remained statistically insignificant (Model 5). A three-way interaction term (Race*ACA*Expansion) was introduced to assess for differences in expansion states in the post-ACA period by race. Model 6 shows that diabetes screening rates for minorities in expansion states, pre-ACA were 14% to 2-times less more likely than the rate for whites in non-expansion states in the pre-ACA period. By the post-ACA period, the screening rates decreased to 22-66% less likely to be screened than whites in non-expansion states in the pre-ACA period. However, all odds ratios associated with the three-way interaction term were statistically insignificant. Notably, over the 4 years, the 55 to 64 age cohort were 69% more likely to receive diabetes screening than the 18 to 34 age group. Refer to Appendix AJ, Table AJ-2 for 95% CI's.

Table 92

Logistic Regression Models for the Probability of Receiving Diabetes Screening by Expansion Status and Race (2012-2015)

Probability of being Screened[a] **(n=8,974)**	**Model 1** (Odds Ratio)	**Model 2** (Odds Ratio)	**Model 3** (Odds Ratio)	**Model 4** (Odds Ratio)	**Model 5** (Odds Ratio)	**Model 6** (Odds Ratio)
ACA						
Pre-ACA	Ref	Ref	Ref	Ref	Ref	Ref
Post-ACA	1.02	1.02	0.91	1.10	0.83	0.64
Expansion Status						
Non-expansion		Ref	Ref	Ref	Ref	Ref
Medicaid Expansion		1.07	1.13	1.31	1.25	1.12
Interaction Term						
ACA*nonEXP				Ref	Ref	Ref
ACA*EXP				0.74	0.81	1.17
Race						
Whites			Ref	Ref	Ref	Ref
Blacks			0.98	1.33	0.99	0.64
Hispanics			1.44	1.44	1.04	0.95
Interaction Term						
ACA*whites					Ref	Ref
ACA*blacks					1.81	3.15*
ACA*Hispanics					1.88	3.29
3-Way Interaction Term[b]						
whites*preACA*nonEXP						Ref
B*Pre-ACA*EXP						2.00
B*Post-ACA*EXP						0.88
H*Pre-ACA*EXP						1.14
H*Post-ACA*EXP						0.44
Age						
18 to 34			Ref	Ref	Ref	Ref
35 to 44			0.98	0.98	0.98	0.99
45 to 54			1.15	1.16	1.16	1.16
55 to 64			1.65**	1.67**	1.68**	1.69**
Gender						
Male			Ref	Ref	Ref	Ref
Female			0.85	0.85	0.84	0.84
Diabetes Risk						
No/low Risk			Ref	Ref	Ref	Ref
High Risk			1.45*	1.45*	1.46*	1.46*
Diabetes			2.82***	2.84**	2.82***	2.82***
Unknown			0.56*	0.56*	0.56*	0.56*
Chronic Disease						
No Disease			Ref	Ref	Ref	Ref
At least 1 or more			1.17	1.17	1.19	1.17
Constant	0.13**	0.13**	0.10***	0.09**	0.10**	0.11***
F Statistic	0.95***	0.94	9.71***	8.91***	7.82***	6.59***

Note. Logistic regressions for the Pb(SCR) by expansion status and race in 15-states (2012-2015); survey weighted data. Values indicate odds ratios.

[a]Diabetes Screening includes a glucose or HgbA1c test performed during a clinic visit using 2012-2015 data.

[b] Three-way interaction term includes interactions between race, ACA and expansion status. Referernce group: whies living in non-expansion states, pre-ACA.

*p<0.05. **p<0.01. ***p<0.001

Diabetes Prevention Education by Expansion and Race. In **Table 93**, with the addition of the ACA*Race interaction term in Model 5, blacks were found to be 46% less likely to receive DPE than whites in the pre-ACA period. Post-ACA, however, blacks were 2.20-times more likely to receive DPE than whites, when adjusting for other factors. There was no statistically significant difference between whites and Hispanics in receiving DPE in the post-ACA period. The three-way interaction (Race*ACA*Expansion) showed no difference between expansion groups by race in the post-ACA period. After adjusting for differences in the expansion groups over time by race, the ACA*Black coefficient in Model 5 increased from 2.20 to 2.92 ($p<0.05$) in Model 6. This shows that despite no differences in the post-ACA period by expansion groups and race, blacks in the post-ACA period overall experienced gains in DPE, over whites. Refer to Appendix AJ, Table AJ-3 for 95% CI's.

Table 93

Logistic Regression Models for the Probability of Receiving Diabetes Prevention Education by Expansion Status and Race (2012-2015)

Probability of Receiving Diabetes Prevention Education[a] **(n=8,974)**	**Model 1** (Odds Ratio)	**Model 2** (Odds Ratio)	**Model 3** (Odds Ratio)	**Model 4** (Odds Ratio)	**Model 5** (Odds Ratio)	**Model 6** (Odds Ratio)
ACA						
Pre-ACA	Ref	Ref	Ref	Ref	Ref	Ref
Post-ACA	1.62*	1.62*	1.55	2.54*	1.89	1.42
Expansion Status						
Non-expansion		Ref	Ref	Ref	Ref	Ref
Medicaid Expansion		0.83	0.81	1.29	1.22	1.19
Interaction Term						
ACA*nonEXP				Ref	Ref	Ref
ACA*EXP				0.44	0.49	0.77
Race						
Whites			Ref	Ref	Ref	Ref
Blacks			0.89	0.87	0.54**	0.54
Hispanics			0.93	0.94	0.60	0.88
Interaction Term						
ACA*whites					Ref	Ref
ACA*blacks					2.20*	2.92*
ACA*Hispanics					2.05	4.63
3-Way Interaction Term[b]						
whites*preACA*nonEXP						Ref
B*Pre-ACA*EXP						1.01
B*Post-ACA*EXP						0.65
H*Pre-ACA*EXP						1.19
H*Post-ACA*EXP						0.23
Age						
18 to 34			Ref	Ref	Ref	Ref
35 to 44			0.83	0.83	0.82	0.84
45 to 54			0.73	0.74	0.74	0.73
55 to 64			0.76	0.78	0.78	0.79
Gender						
Male			Ref	Ref	Ref	Ref
Female			1.11	1.11	1.10	1.10
Diabetes Risk						
No/low Risk			Ref	Ref	Ref	Ref
High Risk			1.44*	1.44*	1.45*	1.44*
Diabetes			1.69	1.72	1.70	1.71
Unknown			0.51*	0.51*	0.51*	0.50*
Chronic Disease						
No Disease			Ref	Ref	Ref	Ref
At least 1 or more			0.89	0.88	0.89	0.87
Constant	0.16***	0.18***	0.22***	0.16***	0.19***	0.20***
F Statistic	4.73*	2.72	6.74***	7.65***	7.66***	7.12***

Note. Logistic regressions for the Pb(DPE) by expansion status and race in 15-states (2012-2015); survey weighted data. Values indicate odds ratios.

[a]Diabetes Prevention Education (DPE): at least 1 form of teaching (i.e. exercise, diet/nutrition or weight reduction) provided during visit using 2012-2015 data.

[b] Three-way interaction term includes interactions between race, ACA and expansion status. Reference group: whites living in non-expansion states in the pre-ACA period.

*p<0.05. **p<0.01. ***p<0.001

Diabetes Screening by Expansion and Risk Status. In **Table 94**, Model 5, the ACA*Risk interaction term was introduced which showed the high-risk and diabetes group to have 10-18% greater likelihood of being screened over the no/low risk; whereas the unknown risk group was 45% less likely to be screened in the post-ACA period. The odds ratios associated with the interaction terms were all statistically insignificant. With the addition of the three-way interaction term (Risk*ACA*Expansion), there was no statistically significant differences between expansion states in the pre vs. post-ACA period by diabetes risk (Model 6). Notably, the other covariates that were statistically significant were the 55 to 64 age cohort (1.65, $p<0.01$) and the diabetes group (2.14, $p<0.01$), which are averaged over 4 years of data. The interaction term that was statistically significant was ACA*unknown, which showed that the unknown diabetes risk group was 81% less likely to receive diabetes screening in the post-ACA period, when compared to the no/low risk group in the pre-ACA period.

Table 94

Logistic Regression Models for the Probability of Receiving Diabetes Screening by Expansion Status and Diabetes Risk (2012-2015)

Probability of being Screened[a] (n=8,974)	Model 1 (Odds Ratio)	Model 2 (Odds Ratio)	Model 3 (Odds Ratio)	Model 4 (Odds Ratio)	Model 5 (Odds Ratio)	Model 6 (Odds Ratio)
ACA						
Pre-ACA	Ref	Ref	Ref	Ref	Ref	Ref
Post-ACA	1.02	1.02	0.91	1.10	1.15	1.55
Expansion Status						
Non-expansion		Ref	Ref	Ref	Ref	Ref
Medicaid Expansion		1.07	1.13	1.31	1.30	1.22
Interaction Term						
ACA*nonEXP				Ref	Ref	Ref
ACA*EXP				0.74	0.74	0.44
Diabetes Risk						
No/low Risk			Ref	Ref	Ref	Ref
High Risk			1.45*	1.45*	1.38	1.08
Diabetes			2.82***	2.84**	2.58**	2.14*
Unknown			0.56*	0.56*	0.70	0.90
Interaction Term						
ACA*no/low risk					Ref	Ref
ACA*high risk					1.10	1.00
ACA*diabetes					1.18	1.00
ACA*unknown					0.55	0.19*
3-Way Interaction Term[b]						
NoRisk*preACA*nonEXP						Ref
HR*Pre-ACA*EXP						1.43
HR*Post-ACA*EXP						1.78
Dia*Pre-ACA*EXP						1.39
Dia*Post-ACA*EXP						1.83
UnK*Pre-ACA*EXP						0.64
Unk*Post-ACA*EXP						3.65
Race						
Whites			Ref	Ref	Ref	Ref
Blacks			0.98	1.33	1.33	1.32
Hispanics			1.44	1.44	1.44	1.46
Age						
18 to 34			Ref	Ref	Ref	Ref
35 to 44			0.98	0.98	0.98	0.98
45 to 54			1.15	1.16	1.16	1.15
55 to 64			1.65**	1.67**	1.65**	1.65**
Gender						
Male			Ref	Ref	Ref	Ref
Female			0.85	0.85	0.84	0.84
Chronic Disease						
No Disease			Ref	Ref	Ref	Ref
At least 1 or more			1.17	1.17	1.16	1.16
Constant	0.13**	0.13**	0.10***	0.09**	0.09**	0.09***
F Statistic	0.95***	0.94	9.71***	8.91***	7.19***	5.70***

Note. Logistic regressions for the Pb(SCR) by expansion status and diabetes risk in 15-states (2012-2015); survey weighted data. Values indicate odds ratios.

[a]Diabetes Screening: Glucose or HgbA1c test during visit (2012-2015).

[b] Three-way interaction term: Diabetes risk, ACA and expansion status. Reference group:no/low risk for diabetes individuals living in non-expansion states in the pre-ACA period.

*p<0.05. **p<0.01. ***p<0.001

Diabetes Prevention Education by Expansion and Risk Status. With the addition of the ACA*Risk interaction term in Model 5, the high-risk group that was more likely to receive diabetes screening in Model 4, reduced to an odds ratio of 1.40 and was statistically insignificant. In fact, all odds ratios associated with the interaction term were statistically insignificant. Also, the ACA term went from 2.54, $p<0.05$ in Model 4 to 1.63 in Model 5 and was statistically insignificant. In Model 6, the three-way interaction term showed that individuals with unknown risk living within expansion groups experienced the greatest gains in receiving DPE (12.69, $p<0.05$). All other interactions in the post-ACA period within the three-way were found to be statistically insignificant when compared to the reference group: no/low risk for diabetes individuals living in non-expansion states in the pre-ACA period. Refer to Appendix AJ, Table AJ-4 for 95% CI's.

Table 95

Logistic Regression Models for the Probability of Receiving Diabetes Prevention Education by Expansion Status and Diabetes Risk (2012-2015)

Probability of Receiving Diabetes Prevention Education[a] **(n=8,974)**	**Model 1** (Odds Ratio)	**Model 2** (Odds Ratio)	**Model 3** (Odds Ratio)	**Model 4** (Odds Ratio)	**Model 5** (Odds Ratio)	**Model 6** (Odds Ratio)
ACA						
Pre-ACA	Ref	Ref	Ref	Ref	Ref	Ref
Post-ACA	1.62*	1.62*	1.55	2.54*	1.63	0.61
Expansion Status						
Non-expansion		Ref	Ref	Ref	Ref	Ref
Medicaid Expansion		0.83	0.81	1.29	1.28	0.75
Interaction Term						
ACA*nonEXP				Ref	Ref	Ref
ACA*EXP				0.44	0.45	2.08
Diabetes Risk						
No/low Risk			Ref	Ref	Ref	Ref
High Risk			1.44*	1.44*	1.21	0.92
Diabetes			1.69	1.72	1.16	0.67
Unknown			0.51*	0.51*	0.33***	0.15***
Interaction Term						
ACA*no/low risk					Ref	Ref
ACA*highrisk					1.40	3.46*
ACA*diabetes					2.01	3.14
ACA*unknown					2.21	14.91**
3-Way Interaction Term						
no/low*preACA*nonEXP						Ref
HR*Pre-ACA*EXP						1.51
HR*Post-ACA*EXP						0.37
DIA*Pre-ACA*EXP						2.45
DIA*Post-ACA*EXP						1.28
Unkn*Pre-ACA*EXP						3.32*
Unkn*Post-ACA*EXP						12.69*
Race						
Whites			Ref	Ref	Ref	Ref
Blacks			0.89	0.87	0.87	0.86
Hispanics			0.93	0.94	0.93	0.90
Age						
18 to 34			Ref	Ref	Ref	Ref
35 to 44			0.83	0.83	0.83	0.86
45 to 54			0.73	0.74	0.73	0.74
55 to 64			0.76	0.78	0.78	0.76
Gender						
Male			Ref	Ref	Ref	Ref
Female			1.11	1.11	1.10	1.11
Chronic Disease						
No Disease			Ref	Ref	Ref	Ref
At least 1 or more			0.89	0.88	0.87	0.88
Constant	0.16***	0.18***	0.22***	0.16***	0.21***	0.29***
F Statistic	4.73*	2.72	6.74***	7.65***	6.53***	5.75***

Note. Logistic regressions for the Pb(DPE) by expansion status and diabetes risk in 15-states (2012-2015); survey weighted data. Values indicate odds ratios.

[a]Diabetes Prevention Education (DPE) includes at least 1 form of teaching (i.e. exercise, diet/nutrition or weight reduction) provided during a clinic visit using 2012-2015 data.

[b] Three-way interaction term includes interactions between race, ACA and expansion status. Reference group:no/low risk for diabetes individuals living in non-expansion states in the pre-ACA period.

*p<0.05. **p<0.01. ***p<0.001

Sensitivity Analysis for the Pb (SCR) and Pb (DPE) Stratified by Diabetes Risk Status

To gain a better understanding of each diabetes risk group (excluding the unknown risk group), logistic regression analyses were conducted where the full regression model was stratified by diabetes risk. Two interaction terms were used: ACA*Expansion and ACA*Race to differentiate between differences in the outcome variables (i.e. diabetes screening or prevention education) by expansion group and by race. The key interest in this sensitivity sub-analysis is to discern if outcomes for individuals in the high-risk group differed by a state's expansion status or by an individual's race. Following clinical practice guidelines alone, being a minority who is overweight is enough to warrant diabetes screening, which hypothetically should mean more minorities are screened than whites just using these two broad criteria. The interaction terms in the regression models in the main text did not capture this information as diabetes risk was not interacted with race. Refer to Appendix AJ for full regression models including 95% CI's.

In **Table 96**, high-risk individuals who were 45+ years were more likely to be screened for diabetes, than high-risk individuals aged 18 to 34. The 55 to 54 age group had the greatest odds of being screened, 2.56 ($p<0.001$). Hispanics in the post-ACA period were 4.49-times ($p<0.05$) more likely to be screened compared to whites, when adjusting for other factors. Blacks were also 2.17-times more likely to be screened than whites, but this difference was not statistically significant. There was no difference in the overall likelihood of being screened by expansion group. The high-risk for diabetes regression model was the only model to have a statistically significant F Statistic (3.57, $p<0.001$), which means the other two models for low risk and diabetes were not different than the intercept-only model. Refer to Appendix AJ, Table AJ-5 for 95% CI's.

Table 96

Logistic Regression Models for the Probability of Receiving Diabetes Screening, Stratified by Known Diabetes Risk

Probability of being Screened[a]	Low Risk (n=1,489)	95% CI	High-Risk (n=3,146)	95% CI	Diabetes (n=607)	95% CI
ACA						
Pre-ACA	Ref		Ref		Ref	
Post-ACA	1.17	(0.42, 3.26)	0.92	(0.36, 2.38)	1.39	(0.33, 5.93)
Expansion Status						
Non-expansion	Ref		Ref		Ref	
Medicaid Expansion	1.15	(0.46, 2.83)	1.66	(0.95, 2.91)	1.68	(0.71, 3.93)
Age						
18 to 34	Ref		Ref		Ref	
35 to 44	0.91	(0.33, 2.52)	0.98	(0.42, 2.25)	1.40	(0.40, 4.86)
45 to 54	0.72	(0.22, 2.33)	1.65*	(1.11, 2.45)	1.33	(0.46, 3.88)
55 to 64	1.47	(0.67, 3.25)	2.56***	(1.61, 4.08)	1.00	(0.34, 2.92)
Gender						
Male	Ref		Ref		Ref	
Female	0.61	(0.26, 1.44)	0.74	(0.47, 1.17)	1.16	(0.68, 1.99)
Race						
White	Ref		Ref		Ref	
Black	0.62	(0.18, 2.08)	1.15	(0.64, 2.05)	0.39	(0.12, 1.28)
Hispanic	1.10	(0.51, 2.39)	0.81	(0.42, 1.53)	1.18	(0.44, 3.20)
Chronic Disease						
No Disease	Ref		Ref		Ref	
At least 1 or more	0.89	(0.46, 1.72)	1.08	(0.60, 1.94)	1.94	(0.93, 4.03)
Interaction Term						
ACA*Non-expansion	Ref		Ref		Ref	
ACA*Expansion	0.44	(0.11, 1.82)	0.64	(0.18, 2.28)	0.72	(0.14, 3.65)
ACA*White	Ref		Ref		Ref	
ACA*Black	1.03	(0.08, 13.39)	2.17	(0.82, 5.75)	2.46	(0.30, 20.20)
ACA*Hispanic	2.56	(0.61, 10.73)	4.49*	(1.12, 17.97)	0.36	(0.08, 1.67)
Constant	0.16***	(0.06, 0.38)	0.10***	(0.05, 0.18)	0.20*	(0.05, 0.83)
F Statistic	1.67		3.57***		1.04	

Note. Logistic regressions for the Pb(SCR) by expansion status and race in 15-states (2012-2015); survey weighted data. Values indicate odds ratios.

[a]Diabetes Screening: Glucose or HgbA1c test performed during a clinic visit from 2012-2015.

*p<0.05. **p<0.01. ***p<0.001

In **Table 97**, the focus is on the likelihood of receiving diabetes prevention education in the post-ACA period. The delivery of diabetes education increased by 96% for the high-risk for diabetes group post-ACA. However, blacks were 2.17-times more likely (p=0.056) to receive diabetes prevention education, compared to their white counterparts in the post-ACA period. Hispanics were 39% less likely to receive diabetes prevention education than their white counterparts post-ACA, although not statistically significant. There was no overall difference in diabetes prevention education provided between expansion groups. Interesting to note, blacks who were no/low risk were almost 11-times more likely to receive diabetes prevention education in the post-ACA period, when compared to their white no/low risk counterparts. Refer to Appendix AJ, Table AJ-6 for 95% CI's.

Table 97

Logistic Regression Models for the Probability of Receiving Diabetes Prevention Education, Stratified by Known Diabetes Risk

Probability of Receiving DPE[a]	Low Risk (n=1,489)	95% CI	High-Risk (n=3,146)	95% CI	Diabetes (n=607)	95% CI
ACA						
Pre-ACA	Ref		Ref		Ref	
Post-ACA	0.47	(0.17, 1.34)	1.96*	(1.11, 3.45)	2.05	(0.48, 8.74)
Expansion Status						
Non-expansion	Ref		Ref		Ref	
Medicaid Expansion	0.73	(0.33, 1.53)	1.07	(0.66, 1.76)	1.77	(0.56, 5.59)
Age						
18 to 34	Ref		Ref		Ref	
35 to 44	0.67	(0.34, 1.29)	0.88	(0.60, 1.29)	0.38	(0.12, 1.24)
45 to 54	1.09	(0.63, 1.89)	0.73	(0.50, 1.08)	0.38*	(0.15, 0.96)
55 to 64	1.07	(0.61, 1.88)	0.78	(0.51, 1.18)	0.42	(0.15, 1.16)
Gender						
Male	Ref		Ref		Ref	
Female	1.31	(0.70, 2.45)	0.90	(0.65, 1.23)	1.17	(0.62, 2.22)
Race						
White	Ref		Ref		Ref	
Black	0.27*	(0.08, 0.86)	0.55*	(0.32, 0.93)	0.54	(0.16, 1.81)
Hispanic	0.78	(0.31, 1.99)	0.65	(0.34, 1.24)	1.17	(0.35, 3.84)
Chronic Disease						
No Disease	Ref		Ref		Ref	
At least 1 or more	0.73	(0.39, 1.35)	0.79	(0.45, 1.39)	1.17	(0.55, 2.50)
Interaction Term						
ACA*Non-expansion	Ref		Ref		Ref	
ACA*Expansion	2.34	(0.71, 7.74)	0.54	(0.27, 1.09)	1.13	(0.19, 6.85)
ACA*White	Ref		Ref		Ref	
ACA*Black	10.97*	(1.68, 71.49)	2.17	(0.98, 4.81)	1.04	(0.18, 6.01)
ACA*Hispanic	1.13	(0.25, 5.09)	0.61	(0.21, 1.77)	0.60	(0.10, 3.68)
Constant	0.25**	(0.11, 0.57)	0.35***	(0.22, 0.57)	0.31	(0.08, 1.24)
F Statistic	1.02		2.21**		1.05	

Note. Logistic regressions for the Pb(SCR) by expansion status and race in 15-states (2012-2015); survey weighted data. Values indicate odds ratios.

[a]Diabetes Prevention Education (DPE) includes at least 1 form of teaching (i.e. exercise, diet/nutrition or weight reduction) provided during a clinic visit using 2012-2015 data.

*p<0.05. **p<0.01. ***p<0.001

CHAPTER 5

RESEARCH FINDINGS, POLICY IMPLICATIONS & LIMITATIONS

Historically, changes to national U.S. health policy have been incremental, and highly debated. The incremental policy approach to improving our health care system up to 2010, had left 49.9 million Americans uninsured with limited access to health care services (Kaiser Health News, 2012). In this section, we discuss the findings of our research and compare the findings with previous scholarly work on the ACA and access to care, specifically focusing on racial/ethnic health disparities and diabetes preventive care. Methodological challenges are discussed, including opportunities for future research. This discussion is centered around developing evidenced-based policy recommendations to address the existing gaps in health insurance coverage and primary care access for low-income, minority adult populations and individuals at high-risk for diabetes within our fragmented health care system.

The overall purpose of this research was to assess the impact of the ACA on reducing health disparities in the delivery of diabetes prevention for those at high-risk of developing diabetes in the U.S. The literature reviewed included 7 studies that met the following four criteria: (1) Medicaid expansion or the insurance marketplace as the policy intervention, (2) a variable for race/ethnicity, (3) a variable for diabetes and (3) analysis of data post 2013. However, to conduct this research, a connection had to be made first from the ACA to health care coverage, and then from coverage to health care access and the delivery of diabetes preventive care.

Conceptually, the Modified Quality Health Outcomes Model linked the ACA's Medicaid expansion and insurance subsidies to increased coverage options for low-income adults, with greater gains seen for those living between 100-400% FPL in Medicaid expansion states, than in non-expansion states. The increased levels of insurance had a positive 1% spillover effect (gain) in the percent of individuals who had access to the primary health care system, as measured by the percent of individuals who reported having a primary care provider in the post-ACA period. There was also a narrowing of racial/ethnic disparities, but Hispanics continued to have the lowest levels of reported PCP in the post-ACA period. The small increases in PCP did not lead to differences between the no/low risk and high risk for diabetes groups in having diabetes screening or diabetes prevention education in the post-ACA period. However, Hispanics at high-risk for diabetes were 4 times more likely to be screened than high-risk whites. There were no differences by race in receiving at least one form of diabetes prevention in the post-ACA period; although the high-risk for diabetes group was 96% more likely to receive diabetes prevention than the no/low risk group. To note, blacks at no/low risk were 11 times more likely to receive diabetes prevention education in the post-ACA period, than low-risk whites. Supplemental studies were included in this discussion section to compare our overall results to other study findings that address the specific aim/sub aim.

Specific Aim 1 Study Findings for ACA Effect on Insurance, Overall and by Expansion Status

The ACA's Medicaid expansion and insurance subsides worked primarily through income (i.e. eligibility by % FPL) to provide access to insurance coverage. From our research it was apparent that of the almost 9% gains in insurance coverage nationwide, most of the gains occurred in the two lower income groups (<138% FPL). Surprisingly, the <100% FPL experienced the largest gains in insurance by the post-ACA period. Despite these gains, the low-income groups still had many individuals who remained uninsured, especially within states that did not expand Medicaid.

To compare our findings, we discuss one study that met the inclusion criteria (Sommers et al, 2015) and three supplemental articles that included post-ACA data (Decker e al., 2017, Griffith et al., 2017, and McKenna et al., 2018). All of these studies used national federal datasets (i.e. BRFSS and NHIS) except Sommers et al. (2015) who used the Gallup-Healthways Well-Being Index. McKenna et al. (2018) was the only study that included data up to 2016. Our study included post-ACA years up to 2017.

Overall, these four studies confirmed our results that insurance coverage rates improved post-ACA, with the largest gains in insurance occurring within Medicaid expansion states. In our study we used percent of FPL to assess where the changes in insurance levels occurred since BRFSS did not provide the type of insurance coverage available (i.e private vs. Medicaid.). Sommers et al. (2015) also converted household income from the Gallup survey to %FPL, but only had three groups: (1) 0-138; (2) 139-400; and (3) >400 to which overall changes and changes by expansion status were assessed. Griffith et al. (2017) who also used BRFSS (2013 to 2015) did not convert household income to a % of FPL as was done in our study. Instead a binary dummy variable for household poverty was created to identify households most likely to live below the 2014 FPL line, which was a household income less than $25,000 per year. Income was also used as a continuous variable as provided by BRFSS in the main models (Griffith et al., 2017). Decker et al., (2017) limited their study sample to individuals living below 138% FPL, which did not allow for the study of the insurance subsidies. McKenna et al. (2018) did a similar approach to ours and converted household income to %FPL. The categories included: (1) 0-

124%; (2) 125% to 199%; (3) 200 to 299%; (4) 300 to 399%; and (5) > or = to 400% (McKenna et al., 2018).

A benefit to the way we isolated ACA effects by income was that our income (or %FPL variable) was created to easily discern which income levels were affected by Medicaid, and which by the insurance subsidies. By not taking into account household income, this may contribute to a misrepresentation of individuals in poverty as some higher household incomes with a large household size would be excluded from the low-income sample. In the Griffith (2017) study the pre-ACA insurance estimate was 90% for households with incomes more than $75,000 and 60% insured for households with incomes below $25,000 per year. In our study we were able to see that the <100% FPL had even lower insurance rates in the pre-ACA period, a rate of 54.96%, which decreased to 48.20% in non-expansion states. As insurance levels increased past 100% FPL, it becomes a challenge to interpret changes by income if it is not directly aligned with the %FPL associated with Medicaid or the insurance subsidies.

Medicaid expansion states were different within all studies. We excluded 4 states that expanded Medicaid up to 200% FPL in the pre-ACA period. McKenna et al. (2018) did not control for Medicaid expansion and all assessed overall ACA effects. Sommers et al. (2015) used all 50 states in their analyses, 28 Medicaid expansion states plus D.C. Decker et al (2015) also used all 50 states to make the expansion groups. Griffith et al. (2017) excluded several states and D.C. from the Medicaid expansion group: Arizona, Delaware, Hawaii, New York, Vermont, Massachusetts, Maryland. When we performed a sensitivity analysis keeping the 4 states in our analyses, there was not much difference between the 50-state and 47-state sample; but it was easier to interpret ACA effects when the 4 states were dropped.

All studies used a difference-in-difference approach which is a version of fixed effects estimation using data in aggregate instead of repeated observations on individuals (Angrist & Pischke, 2009). Sommers et al., (2015) used an interrupted time-series linear regression models using quarterly indicators for ACA (time); whereas the other studies used linear probability regression models with a pre/post-ACA indicator. Generally, linear models were used instead of logistic models to improve to interpretability (McKenna et al., 2018). In the Griffith et al. (2017), the largest regression-adjusted percentage-point change in insurance (15 percentage points) was seen among the $0-<$35,000 household income groups, living within Medicaid expansion states, which is consistent with our results that the lowest income group experienced the greatest gains in insurance. McKenna et al. (2018) also found the greatest insurance gains for incomes <199% FPL and also ran sensitivity analyses using logistic regression which found no observable changes in the significance or direction of main effects. Sommers et al. (2017) saw a 7.9 percentage point decrease in the overall rate of uninsured.

Griffith et al. (2017) measured the narrowing of socioeconomic disparities as the absolute gap difference in insurance coverage between the two income groups in expansion and non-expansion states. A greater reduction in socioeconomic disparities was seen in Medicaid expansion states (Griffith et al. 2017). McKenna et al. (2018) measured the narrowing of socioeconomic disparities as the relative difference from the >400% FPL reference group. We measured differences in disparities as absolute differences.

From recent research on the ACA, it was clear that being an expansion state amplified the overall ACA effect, increasing the likelihood of having insurance for the low-income groups. From our analysis, there was no statistically significant expansion effect on the >400% FPL group, although the p value for the ACA*EXP interaction term was 0.068. The increase in the likelihood of having insurance among the >400% FPL group could be attributed to the "welcome-matt effect" as more individuals were aware of insurance recruitment efforts and subsequently enrolled for coverage, or possibly because the individual mandate that was effect early in the post-ACA period (Medicaid and CHIP Payment and Access Commission, 2019).

Generally, from our analysis and previous research, expansion states benefited the most given the higher levels of insurance in the pre-ACA period, more coverage options for the 100-138% FPL group and potentially a political environment that was conducive of enrolling individuals for health insurance, which was not controlled for in this analysis (and discussed in the future research section). Non-expansion states did make coverage gains, but not enough to reap the full benefit of the ACA effect. From our analysis, the greatest opportunities to improve insurance enrollment within non-expansion states was among individuals living below 138% FPL. This highlights the integral role Medicaid expansion played in ensuring access to insurance for low-income adults during the ACA period

Specific Aim 2 on ACA Effect on Health Care Access, Overall and by Expansion Status

The ACA worked through expanded insurance coverage to provide health care access to low-income adults. Health care access was defined as the report of having a primary care provider (PCP) or a checkup in the past year; although having a PCP was considered the primary measure of health care access for our analysis. Griffith et al. (2015) used the same BRFSS PCP measure as we did, but found that Medicaid expansion reduced the percentage of individuals without a PCP by 3.6 percentage points (Griffith et al., 2015). Sommers et al.(2015) also saw a decline of 3.4 percentage points in the number of individuals without a PCP. In our study, we hypothesized that the ACA's subsidy and Medicaid expansion provisions would lead to an overall increase in health care access for adults aged 18-64, with racial and ethnic minorities and those at high-risk for diabetes experiencing greater gains in having a PCP within Medicaid expansion states, than non-expansion states. Unexpectedly, large gains in insurance coverage did not yield similar gains in having a PCP or checkup in the past year, even within Medicaid expansion states.

Overall, our descriptive study statistics showed only a 1% gain in having a PCP and a 3% gain in having a checkup in the past year. Most of the gains in health care access occurred within Medicaid expansion states (2% gains in PCP, 4% gains in Checkup), with a slight decline in having a PCP in non-expansion states (-0.07% loss in PCP). The low levels of PCP uptake could be attributed to three areas: (1) a low supply of PCPs within a state, which this data is not adjusted for; (2) an increase in the utilization of another type of health care provider, such as an Nurse Practitioner or Physician Assistant, which the BRFSS does not fully capture; or (3) the lack of an incentive in the ACA to encourage the selection of a PCP. It is important to note that when an individual enrolls for private insurance, only a Health Maintenance Organization (HMO) requires an enrollee to select a PCP, while a Preferred Provider Organization (PPO) insurance plan does not. Most Medicaid programs use HMOs to manage care delivery (Centers for Medicare and Medicaid Services, n.d.). However, given the different payment structure for Medicaid, many primary care physicians could choose not to accept Medicaid payments (or patients) even after the ACA temporarily included increases to physician payments in some states (Decker, 2012) potentially limiting the availability of PCP's for Medicaid patients.

The overall increased rate in having a checkup (despite an overall lower percentage of individuals reporting a PCP) could be attributed to respondents seeking preventive services in non-traditional settings (i.e. convenient care clinics) or with non-traditional primary care providers living in states that have expanded provider scope of practice laws for Nurse Practitioners and Physician Assistants. The increase in checkups may also be related to the ACA provision that was added to insurance coverage, which ensures preventive care services are covered at no additional cost to the consumer. Coverage of *Essential Health Benefits* began in September 2010, but was effective much more broadly as of January 1, 2014- the same time as coverage expansion (National Conference of State Legislatures, 2019). Therefore, even if someone did not have a provider assigned to them, preventive care services would still be covered for a visit. Although it is great that increases in a checkup in the past year did occur, lower increases in PCP is of concern as having a PCP is an integral component of ensuring timely, consistent and coordinated preventive care.

It was a challenge to compare our regression analysis to Sommers et al. (2016), McKenna et al. (2018) and Griffith et al. (2017) because our analysis was the only one to replace income levels with insurance. The other regression models kept income as a predictor variable which may have led to PCP gains instead of a decline in the odds of having a PCP or checkup in our analysis in the post-ACA period. Since we did not focus our analysis on ACA effects of PCP by income, we did not see changes by income group in having a PCP. McKenna et al. (2018) found that the 0% to 124% and the 125% to 199% FPL groups experienced increases in having a PCP in the post-ACA period, relative to the >400% FPL group.

However, in our study once INS and other covariates were controlled, we were able to see the ACA effect on PCP, was over and above the main insurance effect. With insurance alone, individuals were 6.5-times more likely to have a PCP than the uninsured and 3.5-times more likely to have a checkup in the past year than the uninsured over the unadjusted 6-year time period. This shows that insurance plays a lesser role in ensuring access to a checkup as many safety net systems are in place across the country that provide preventive medicine to the uninsured without a one-to-one assignment of a PCP. Additionally, otherwise healthy adults, especially younger adults tend to utilize primary care services less frequently, with yearly annual exams being emphasized for adults (>45) at higher risk for certain chronic conditions.

PCP supply was added as a covariate for our regression analysis to adjust for differences in the supply of primary care providers across states. Sommers et al. (2015) did include a measure for residence, urban vs. rural. However, Sommers et al. (2016), adjust for a variable labeled as "lives in county designated a primary care health profession shortage area". In this study the researchers found a 12.1 percentage point increase in having a PCP in Medicaid expansion states. Large increases here are attributed to the sample only comparing Arkansas and Kentucky (Medicaid expansion states) with Texas (non-expansion states).

Quantifying the INS to PCP Link

We were the only study to quantify the link between the ACA to INS to PCP. When adjusting for other variables, the calculated ACA-related increase on PCP of 7.4 percentage points was completely offset by the weakening effect of insurance in leading to a PCP. The ACA effect on PCP via insurance was only 1%, which was much lower than expected. This suggests that the entire expected growth in PCP access from greater coverage was hindered by a combination of newly insured individuals failing to access a PCP, and/or previously insured losing their access in the post-ACA period, despite retaining coverage. It may be possible that the post-ACA period under study may be too short of a time to see dramatic increases in PCP, considering healthy adults aged 18 to 64 may not seek out preventive care if they feel otherwise healthy. To gain a better understanding of which additional factors may have contributed to the low levels of PCP update in the post-ACA period, sub-analyses by race and diabetes risk status were also considered.

Descriptive Sub-Analysis for Overall ACA Effect on Health Care Access by Race

In this sub-analysis, the hypothesis was that the ACA would increase access to primary health care and narrow disparities for blacks and Hispanics when compared to whites. Since insurance coverage was included in the regression model as a main effect, any race-related effects were interpreted as “over-and-above” insurance effects. Unadjusted data showed that blacks and Hispanics had 10-15% increased likelihood of having a PCP. But, once controlling for insurance and other variables, the regression results indicated that blacks and Hispanics should have fared better given their large relative gains in insurance coverage. In the post-ACA period, blacks were 14% and Hispanics 38% less likely to have a PCP than whites in the pre-ACA period. This may be due to newly insured not seeking a PCP right away, or not enough incentive in the legislation to seek a provider.

Griffith et al. (2017) did not include race as a predictor variable. Sommers et al. (2015) included only whites and Latinos in the study which showed no statistically significant differences between whites and Latinos in having a personal physician in the post-ACA period. Sommers et al. (2016) showed that blacks and Hispanics experienced significant increases in office visits and checkups, although the sample size was limited to 3 states. McKenna et al. (2018) included blacks and Hispanics in their study, and US citizenship and language of interview as covariates, but did not explore disparities by race.

Previous research has linked low-income and educational attainment of Hispanics as barriers to health care; and for some Hispanic sub-populations, acculturation, language and immigration status are additional obstacles that prohibit health care access- which we could not control for in our analysis (Escarce & Kaur, 2006). In addition, a lack of awareness has been cited as a reason that Hispanics have not enrolled for health insurance which would then affect their ability to obtain a PCP. Two years after ACA's open enrollment, a recent survey of Hispanic adults showed that 1 in 4 heard "nothing at all about the health insurance marketplaces or exchanges, with another 28 percent indicating they heard "not that much". In addition, of the individuals who were insured, only 68% were insured for the full year. More than one in ten Hispanics sited they did not enroll in health care because it was either "too expensive" or they would rather pay the fine (Sanchez, Pedraza & Vargas, 2015).

Even if Hispanics did manage to enroll for insurance, low levels of health insurance literacy contributed to the disconnect between insurance enrollment and health care access to health care providers. Only 1/3rd of Hispanic adults were somewhat or very confident in their understanding of the terms "provider network, covered services, annual limits on services, and excluded services", while 2/3^{rds} of non-Hispanic whites reported understanding these terms (Blavin, Zuckerman, Karpman & Clemans-Cope, 2014). Misunderstanding of these terms among the Hispanic community highlights the disconnect many may have in linking improved coverage to increased access to a PCP.

The minor growth in the uptake of a PCP led to a decline in the PCP/INS ratio for all racial/ethnic groups. Interesting to note, black and whites had relatively similar post-ACA PCP rates (75% and 78%, respectively), yet, the PCP/INS ratio was greater for blacks than whites, which was also confirmed by the regression analysis showing blacks had a 13% increased likelihood of having a PCP in the post-ACA period in expansion states. Although changes in insurance was not explored by race, it is hypothesized that whites made major coverage gains, surpassing that of blacks, leading to a small PCP/INS ratio for whites. In addition, considering that blacks may have better access to a PCP due to primarily living in urban areas (that tend to have more PCPs) when compared to whites, may also be contributing to the increased PCP/INS ratio for blacks. Additionally, cities tend to have more safety net primary care systems that will see patients without insurance, as the PCP numerator can include access to a PCP even for the uninsured. However, it is interesting that Hispanics also tend to live in urban areas but have not experienced similar increases in having a PCP as blacks have. Exploring differences in insurance by race is a potential area for future research that is discussed in the future research section.

Sub-Analysis for Overall ACA Effect on Health Care Access by Diabetes Risk Status

For this sub-analysis, it was hypothesized that the high-risk for diabetes group would experience PCP gains over that of the low-risk group, with most of the gains occurring within expansion states. From our review of literature, it was apparent that research using a high-risk for diabetes variable was missing in the literature. Therefore, this section will focus on a discussion of our results. Of most concern is the 10% decline in having a PCP among the high-risk for diabetes group in the post-ACA period. Considering that individuals who were aware of their diabetes status experienced an increase in the PCP rate. A strong first step to increasing the PCP rate among the high-risk group would be to increase awareness of this health condition to those who have it. Awareness from a health care provider would serve as an incentive for individuals to seek a PCP, as demonstrated by the gains in PCP experienced by the diabetes group. In our analysis, there was an extremely low rate of self-reported pre-diabetes within the high-risk for diabetes group. In fact, less than 2% of respondents reported pre-diabetes, meanwhile the estimated population percentage with diabetes is 33%. Using BRFSS data, the vast majority of individuals were unaware of their pre-diabetes status which could be contributing to the low PCP gains for the high-risk group. Of the individuals who were aware and reported pre-diabetes, 81% reported having a PCP. This is why assessing the delivery of diabetes prevention to the high-risk group was integral to this analysis and is explored further with the NAMCS dataset in the next section.

Specific Aim 3 for the Delivery of Diabetes Prevention Screening and Education

It was initially hypothesized that more individuals would receive diabetes screening and diabetes prevention education overall, with greater proportions receiving diabetes prevention within Medicaid expansion states due to the increased number of individuals gaining health insurance coverage. There were no studies in the literature that focused on the high-risk for diabetes group and the ACA effects on diabetes prevention outcomes. However, two recent studies will be discussed that focus on prediabetes using the NAMCS database. The time period under study was 2013-2015 NAMCS for the Wu, Ward & Zhiqiang (2018) study and only 2012 NAMCS data was used in the Mainous, Tanner and Baker (2016) study. Our sub-study is timely considering a new commentary was published July 2019 in *The Journal of American Board of Family Medicine* states that it's time to prioritize diabetes prevention in practice (Mainous & Schatz, 2019).

Mainous et al. (2016) focused on assessing if individuals with prediabetes were likely to be diagnosed correctly or receive treatment. The study found that the most common primary diagnosis for visits with individuals with pre-diabetes was hypertensive disease and that 3/4^{ths} were not provided a treatment plan (i.e. education or medication). Prediabetes was defined as mainly as an individual aged 45 or older with a HbA1c between 5.7 to 6.4% since the diagnosis code for prediabetes was too small to allow reliable estimates to be produced (Mainous et al., 2016).

Wu et al. (2018) also focused on individuals with prediabetes and defined the population as visits where patients with a recent A1C (5.7-6.4%), fasting blood glucose (100-125 mg/dL) for years 2013-2014 since lab data was removed from 2015 due to low response rate. As a result, 2015 was only coded as prediabetes if an ICD-9 code was available for impaired fasting glucose, impaired glucose tolerance, or other abnormal glucose levels. The main outcome was to assess if lifestyle management (i.e. education) was provided. The sample size was limited to visits with individuals who were identified to have prediabetes (Wu et al., 2018). Wu et al. (2018) found that 22.8% of visits with patients who had prediabetes received lifestyle management and that individuals who were younger than 65, obese, black living in the south or had hyperlipidemia were more likely to receive education.

The structural study differences between these two studies and our study is that high risk for diabetes was used instead of prediabetes only, and the sample was limited only to preventive care visits within states that NAMCS provided state level estimates in order to compare non-expansion to expansion states. Unlike Mainous et al. (2016), we included everyone aged 18 to 64. We did not use lab data to determine if a patient had prediabetes since one of our primary outcomes of interest was diabetes screening. The other main outcome was the delivery of at least 1 form of diabetes education in the post-ACA period.

One of the major challenges that the two previous studies did not mention (since they did not use BMI to determine prediabetes status), was the lack of documentation for height and weight. By 2015, there were many missing values which NAMCS has made researchers aware of. Overall, there was a 22% decline in preventive care visits by the post-ACA period, with this decline being mainly among whites (-6.37%). The decline in preventive care visits by whites is consistent with the smaller white PCP/INS ratio, compared to the black and Hispanic PCP/INS ratios. However, this could also be related to the fact that there is a high number of missing data in 2015, leading to a decline in the size of the unweighted group. When focusing on diabetes risk groups, the unknown risk group was the only group to experience a decline in the post-ACA period. This is most likely related to better documentation in the post-ACA period, which allowed us to categorize the individual within the appropriate diabetes risk group of low, high or diabetes. For preventive care visits with reported diabetes risk, 62.42% were high-risk, 26.04% were no/low risk and 11.54% had diabetes in the post-ACA period.

ACA Effect on the Delivery of Diabetes Prevention Overall, and by Expansion Status

Per the American Diabetes Association's (ADA's) *Standards of Medical Care in Diabetes (2018)*, criteria for testing of diabetes or prediabetes in asymptomatic adults includes testing for overweight/obese adults with one or more of the following risk factors:

- A1c>5.7%
- Impaired fasting glucose on previous testing
- First degree relative with diabetes
- High-risk race/ethnicity (i.e. black and Hispanics)
- Women diagnosed with gestational diabetes or polycystic ovary disease
- History of cardiovascular disease
- Hypertension (>= 140/90 mmHg or on medication for HTN)
- HDL cholesterol level ,35mg/dl and/or triglyceride level >250mg/dL

- Physical inactivity
- Other clinical conditions associated with insulin resistance (i.e. severe obesity or acanthosis nigricans.

In the full 15-state sample of preventive care visits, there was only a 1.5% increase in diabetes screening. Of the 62% of visits with individuals identified at high-risk, only 17% were screened for diabetes post-ACA, which was a 48% increase from the pre to post-ACA period. A decline of 9% screening for the visits with high-risk individuals was noted in Medicaid expansion states, which could be related to the greater proportion of whites living in these states (as whites were the only racial/ethnic group to experience declines in diabetes screening).

When ACA was unadjusted, the regression model showed a 2% increase in diabetes screening in the post-ACA period; however, this was statistically insignificant, but similar to what was found in the descriptive statistics. Expansion status did not play a statistically significant role in increasing diabetes screening during the ACA period, which may be related to the low number of states included in this analysis. Across all 4 years in the full model, individuals aged 55 to 64 (1.67 OR, $p<0.01$), individuals at high-risk (1.45 OR, $p<0.05$) and individuals with diabetes (2.84 OR, $p<0.01$) were more likely to receive diabetes screening in the post-ACA period. The unknown risk group were 44% less likely to receive diabetes screening which could be attributed to a greater proportion of this group being of younger age (18 to 34).

Interestingly, the rate of diabetes prevention education was higher than the overall screening rate. There was a 49% increase ($p<0.05$) in diabetes prevention education provided in the post-ACA period. One would think that if a patient received diabetes prevention education during a clinic visit, then they should have been screened for diabetes also, which was not the case. The high-risk for diabetes group was about 1.5-times more likely to receive diabetes prevention education than the no/low risk group, with non-expansion states providing more education than Medicaid expansion states.

The regression model with only ACA showed an overall 62% increase in diabetes prevention education in the post-ACA period. However, once adjusted for other factors, the rate of DPE provided increased to 2.54-time greater than the likelihood of receiving DPE in the pre-ACA period. The high-risk for diabetes alone, experienced a 44% increased likelihood of receiving DPE in the post-ACA period over the no/low risk group. However, there was no statistically significant difference between expansion groups in receiving DPE in the post-ACA period.

ACA Effect on Diabetes Prevention Stratified by Diabetes Risk and Race

The main focus in this sub-analysis was to assess if racial/ethnic disparities in screening existed by race, primarily among the high-risk for diabetes group. High-risk individuals who were 45+ years were more likely to be screened for diabetes, than high-risk individuals aged 18 to 34. This practice follows the 2018 ADA Guidelines diabetes screening criteria, as diabetes screening was recommended yearly for high-risk individuals aged 45 or older. For individuals under 45, if results were normal, testing should be repeated at least every 3 years. Interesting to note that within the no/low risk group, there was no statistically significant difference in screening rates among the no/low risk group by age, even though the ADA recommends screening for all adults at age 45. There is an opportunity to improve the screening rates for no/low risk adults 45 and older. High-risk Hispanics had 4.49-times increased odds of being screened than their high-risk white counterparts in the post-ACA period. However, Hispanics also started at lower screening levels than whites in the pre-ACA period. In fact, 50% of the preventive care visits made by Hispanics had an unknown diabetes risk based on no BMI documentation. For blacks and whites, the percent of visits with unknown diabetes status was about 34%, based on no BMI documentation.

The high-risk for diabetes group did experience an overall 95% increased likelihood of receiving diabetes prevention education in the post-ACA period. The no/low risk and diabetes groups did not. This is interesting considering there was an overall decline of 8% in the likelihood of being screened in the post-ACA period for the high-risk group (although not statistically significant). Based on the descriptive statistics, this decline was primarily driven by whites who saw a reduction in diabetes screening in the post-ACA period.

When it came to providing DPE by race, minorities had lower rates of education provided in the pre-ACA period. However, blacks experienced a two-fold increased likelihood of having DPE in the post-ACA period compared to whites, although not statistically significant. The low levels of diabetes prevention provided to Hispanics relative to whites could be due to language or literacy issues that this study did not control for. Interesting to note that no/low risk blacks saw an almost 11-times increased likelihood of being screened in the post-ACA period when compared to their white counterparts. Further research into this no/low risk black group would be needed to see how no/low risk whites differ from blacks. For example, do more normal weight blacks have insulin resistance than whites? A 2006 study found that normal weight black women were at greater risk of insulin resistance than white or Hispanic women (Harvard Health Publishing, 2006). A closer look at diabetes screening for the no/low risk black population by sex and documented glucose/A1c levels would be needed to determine population differences.

Policy Implications

This research has shed light on four priority areas: (1) elevating insurance levels for low-income adults; (2) increasing access to primary care providers, (3) improving quality within primary care practices and (4) and a comprehensive plan by health professions to diversify the nursing (health care) workforce.

Elevating National Insurance Levels for Low-income Adults

Previous research has estimated that nearly 20 million people gained coverage in the post-ACA period (Kaiser Family Foundation, 2018). According to our research, approximately 12 million adults aged 18-64 gained health insurance in the post-ACA period (2014-2017). Had insurance levels for all income groups reached the levels of the >400% FPL group, an additional 21 million adults aged 18 to 64 would have gained insurance coverage in the post-ACA period, but instead remained uninsured (Appendix AJ). As a result, approximately 73% of the targeted population (individuals living below <400% FPL) gained insurance from the ACA's Medicaid expansion or insurance subsidies in the 2014-2017 period. *But is this enough??*

According to a May 2019 national opinion poll on U.S. registered voters, Americans across the country ranked health care as the top policy issue facing the country today-but there was not consensus over which health care issue was the priority. Democrats focused on ensuring access for all; whereas Republicans prioritized lowering costs. Overall, costs outweighed accessibility (RealClear Opinion Research, 2019). Current Democratic policy proposals focus heavily on increasing coverage options, not only for the uninsured, but for individuals who also feel the burden of increased health care costs (Goldstein, 2019). The hot topic and highly debated "*Medicare for All"* is the policy platform that many Democratic Candidates have been proposing during the current campaign season, but it's not the only one. To date, the Kaiser Family Foundation (2019) has an ongoing list of current proposals to expand the role of public programs for health care. Democrats have introduced 10 public plan proposals in the 116th Congress and fit into 5 categories: (1) A national single-payer health insurance program, commonly known as *Medicare for All;* a new public plan with an opt out option, *Medicare for America*; (3) a public plan option; (4) Medicare Buy-in for Older Adults (under 65); and (5) Medicaid Buy-In (Kaiser Family Foundation, 2019).

On the other hand, Republican policy proposals have focused mainly on repealing and replacing the ACA, with some of the key highlights including: (1) repealing the ACA's individual mandate (which was successful); (2) Modifying the ACA premium tax credits; (3) Converting federal Medicaid funding to a per capita allowance; (4) Adding the option for states to add a work requirement for eligibility of Medicaid coverage and (5) Phasing out the enhanced FMAP for Medicaid expansion states or eliminating Medicaid expansion all together (Kaiser Family Foundation, 2019).

From our research, it was apparent that the ACA made major coverage gains for low-income groups, but there was opportunity to enroll more individuals who were eligible. The positive gains in insurance would have been a good sign of success if there were signs that the gains would continue into 2018. However, by 2017, small declines in the percent insured occurred for both the 139-400% FPL and >400% FPL income groups. This was the first decrease in the percent insured since the implementation of the ACA and was attributable to plans to "repeal and replace" the ACA (Kliff, 2019). Any further eradication of the ACA's current structure would put more low-income and vulnerable individuals at risk of losing coverage. Most of the focus for Republicans is reducing eligibility for Medicaid and insurance premiums. In our research we were able to quantify the benefit of Medicaid expansion and the insurance subsides in increasing coverage for low-income adults in states that expanded Medicaid, which should be upheld in order to ensure individuals continue to have access to the health care system.

Had non-expansion states expanded Medicaid, post-ACA insurance levels could have reached 75% for the <100% FPL group and 78% for the 100-138% FPL group. With non-expansion states reaching levels of insurance like Medicaid expansion states, an estimated 2.3 million more individuals living below 100% FPL and 1.9 million more individuals living 100-138% FPL could have gained Medicaid coverage in non-expansion states. By not expanding Medicaid, non-expansion states left 4.1 million low-income Americans without options for affordable health care, especially at a time when health care costs continue to escalate nationwide Refer to Appendix AJ for a table where uninsured values are calculated. The Kaiser Family Foundation estimated that 2.2 million Americans with incomes <100% FPL in non-expansion states fell into the Medicaid coverage gap, which was confirmed in our analysis to be 2.2 million uninsured living <100% FPL in non-expansion states (Kaiser Family Foundation, 2018).

From a nursing perspective, reducing insurance coverage options by either retracting Medicaid expansion or lowering the percent of FPL subsidy levels when there are still 21.4 million Americans uninsured (and counting) is not a viable policy option. In fact, the American Nurses Association (ANA) believes everyone deserves access to the highest quality of care (American Nurses Association, n.d.) The uninsured have been known to face worse health outcomes due to their inability to access the health care system, leading to inconsistent interaction with care. The greatest opportunity to improve accessibility and reduce costs for low-income families is to ensure individuals in non-expansion states gain access to Medicaid up to 138% FPL.

Since nationwide polls have expressed that Americans are overall concerned about health care costs, it is also imperative that any national health policy recommendation include a public option that will serve as a competitor to private insurance and drive down costs, instead of transitioning to a fully public health care system. In 2 of the 4 public option plans, premium tax credits are available for individuals living between 100-600% FPL, which extends beyond the ACA's current 400% FPL. Even though the percent insured above 400% FPL is high, this will make more affordable coverage options available and address rising health care costs that many Americans are worried about. The public program "with opt out" limits out of pocket costs to $3,550/individual or $5,000/family; whereas the OOP costs in the 4 other public option plans limited annual costs to $7,900 in 2019 (Kaiser Family Foundation, 2019). The lesser OOP limit option would make health care more affordable for Americans across the country and would be an improvement; whereas the other four public options would keep the OOP expenses at the same rate as that of the ACA (Anderman, 2018).

In addition, the ACA's individual mandate must come back. Every member of society is a consumer of health care and this is the only way to ensure that people sign up for coverage. The individual mandate will also narrow disparities by race since all members of society would be expected to have health insurance coverage. Additional federal funding should be allocated to states that have high rates of uninsured; in order to ensure that enrolling in health care- either Medicaid or via the Insurance Marketplace-is not a barrier. The ACA did something similar to this by allocating federal funds for federal marketplace Navigators who were responsible for providing outreach, education and enrollment assistance to eligible consumers (Pollitz, Tolbert & Diaz, 2018).

Any future public insurance option should also include the 10 Essential Health Benefits that were implemented during the ACA period, which included coverage for preventative services (Kaiser Family Foundation, 2019). When preventive care is covered by insurance plans, it serves as an incentive for individuals to seek out this type of care. Since all insurance plans offer the 10 Essential Health Benefits due to the ACA (Kaiser Family Foundation, 2019), all plans should allow an individual to select a primary care provider within 60 days. If one is not selected, an in-network provider closest to the patient's home address should be assigned to their health plan and communicated to the patient. It would be the responsibility of the health care system after that point to welcome the *new patient* to their care team. For many Americans, understanding health insurance is difficult as evidenced by 44% of first-time insurance marketplace buyers being unaware of the network configuration of the health insurance plan they chose (Anderman, 2018). By streamlining the insurance to PCP process, it will lead more individuals to accessing primary care.

Increasing Access to Primary Care

Even though the ACA covered preventive care services, our research showed only a 1% increase in the PCP rate by the post-ACA period under study. This shows that either people were unaware of their insurance benefit, the process for obtaining a PCP was unclear, or this "free" preventive care was not enough of an incentive for an individual to find a PCP. The small gains in PCP were of concern as the point of having health insurance is to gain access to the health care system. Interestingly, our research showed that the ratio of whites with a PCP to whites with insurance was lower than the PCP/INS ratio for blacks and Hispanics. This may be due to more whites living in rural areas than racial/ethnic minorities, where primary care resources are of low supply. However, Hispanics (who tend to be of lower-income strata) had the lowest PCP rates, which shows an opportunity to increase PCP levels for both low-income individuals and those living in rural areas. It's important to improve access to a provider for these two areas that have been known to be low resourced areas for primary care providers.

One way to approach this would be implement full practice authority for board certified Nurse Practitioners and Physician Assistants in every state across the country. To date, 22 states and D.C. allow NPs to practice to the full extent of their license. Most of the barriers to gaining full practice authority stem from physician vs. non-physician debate over the educational requirements needed to practice independently (Cheney, 2019). Most NPs (89%) are prepared to work in primary care and have a "proven track record" of providing equal or better quality of care at a lower cost, than their physician counterparts (American Association of Nurse Practitioners, 2019). In fact, a recent study showed that more NPs provide primary care in low-income and rural areas where there is a shortage of physicians, than any other provider (Xue, Smith & Spetz, 2019). In addition, the VA, the largest integrated health care organization, has already granted full practice authority to Nurse Practitioners across the country (Sofer, 2017), which was a major step for the nursing profession to gain more ground in providing care to underserved populations.

Interestingly, NPs and PA's make up the CVS Minute Clinic workforce with more than 1,100 locations in 33 states and D.C; with a majority of their services costing less than $100 (CVS Health, 2019). Of the services provided, prevention and wellness services are included, (including screening and monitoring for diabetes) (CVS Health, 2019). CVS plans to transform some of their stores and retail clinics into wellness hubs which has created controversy of whether primary care belongs in the traditional medical home model, or if convenient clinics can enhance access to and the delivery of primary care. A J.D. Power survey showed that 45% of respondents would consider getting primary care at a CVS clinic, with only 36% of individuals over the age of 65 reporting they would go to CVS for primary care. A benefit to providing primary care at a CVS Health Hub is that 85% of Americans live within 4 miles of a CVS store (Kodjack, 2019). This could not only increase access to a primary care provider, but increase the convenience for consumers. Having insurance plans include CVS Health providers or the entity as a covered provider could greatly increase the number of individuals who obtain primary care services. Most large employers (76%) already cover services received in retail clinics, with a small share providing financial incentives for employees to use these services (Tozi, 2018).

Improving Quality within Primary Care Practices

From our study, it was apparent that the proportion of individuals who were aware of their pre-diabetes status was strikingly very low (<2%), compared to national estimates. This is a major public health problem as prediabetes is likely to become diabetes if left unmanaged. Managing diabetes is costly to the health system, including public programs where antidiabetics became the second largest source of Medicaid spending by 2017 (Mainly driven by the price of insulin) (Young, 2019). To date, there is not a Prediabetes Quality Measure, although in 2018 one has been developed and proposed by the American Medical Association's (AMA) Prediabetes Quality Measure Technical Expert Panel. This measure goes beyond screening for obesity, and is focused on increasing screening and follow-up testing for prediabetes; and providing those at risk with an intervention. The intervention must include: referral to a diabetes prevention program that is CDC approved; referral to a registered dietician for nutrition therapy; or prescription for metformin (American Medical Association, 2018).

Current federal regulations require states to develop and maintain a Quality Strategy, but the states can decide what are the priority areas. It would be in the best interest of states to implement a Quality strategy to address and include a primary care measure for prediabetes, such as the one developed by the AMA. Usually the Quality strategy is open to the public for comments. For example, the New York Department of Health (DoH) reviews their quality strategy every three years and places it on their public website for at least 30 days where stakeholders can provide comments on the content and strategic approach (The National DPP, 2019). Health care providers, including nurses, should be aware of these public comment sessions and participate/advocate for prediabetes Quality Metrics to be included within the State's Quality strategy.

Within the Primacy Care setting, there is great opportunity to improve the documentation of basic health measures (i.e. height and weight). Within the NAMCS dataset, there were about 38% of clinic visits (weighted) that did not have a height, a weight or both documented. Without a height and weight, we were unable to calculate a BMI and categorize someone within a diabetes risk group. Potentially, documentation of height and weight could be added to the prediabetes quality measure proposed by the AMA since providers will only follow the prediabetes measure if a patient has a documented BMI. Or, primary care electronic medical records (if available) should flag a patient who does not have a current height and weight to remind the provider or ancillary staff to measure the patient during the visit and record it. In our study, only focusing on the *unknown* diabetes risk group, 52% of clinic visits had all electronic medical record keeping, 18% had partial electronic and partial paper record keeping and 30%

had only paper record keeping. As most of the clinic visits had access to an electronic medical record, a clinical reminder for height and weight should be reasonable.

Diversifying the Nursing (Health Care) Workforce

Through our research, it became apparent that even after the passage of the ACA, Hispanics across the country continued to have the lowest levels of insurance and access to a primary care provider, and even the lowest levels of diabetes prevention education being provided to high-risk Hispanics, when compared to high-risk whites. One nursing specific intervention to address Hispanic health disparities is to reduce barriers into entry to the nursing profession for Hispanic students. It is integral to not only the mission of nursing as a profession to have a diverse workforce, but to the health of the Hispanic community to have greater representation within the health care workforce.

The American Nurses Association (ANA) and the National Association of Hispanic Nurses (NAHN) on June 21, 2019 proposed two recommendations for increasing the diversity of the nursing workforce, specifically targeting Hispanics who are underrepresented in nursing. The first recommendation was for states to allow Deferred-Action Childhood Arrivals (DACA) nursing students to sit for the NCLEX exam in all states, and the second requires nursing schools to make clear the inability for DACA students to sit for the NCLEX in their state (Zegers & Cuellar, 2019). There were about 690,000 individuals enrolled in DACA as of 2017, with more than 90% coming from Latin America (primarily Mexico) (Lopez & Krogstad, 2017). A major challenge to passing state-level legislation for DACA students includes the current political climate that is focused on ending the overall DACA program. The Supreme Court announced that they will review three cases related to the legality of the Trump administration ending DACA, with a decision expected by June 2020 (Higgins, 2019).

Even if the recommendations and the collaborative advocacy efforts of the ANA and NAHN do not immediately lead to changes, these nursing organizations have taken a major leap in pushing their voices to national level policies. Especially for NAHN, a small non-profit organization that represents the health interests of the Hispanic community, this is an opportunity to continue to work with other nursing organizations to purse Hispanic interests at the national level, which include policy recommendations to improve health care access for Hispanics. Dr. Rouse (2017) points out, that given the size of the Hispanic population, Hispanic leaders should be able to inform and participate in national health care decision-making, but there is a notable absence of prominent Hispanic leadership at the national level capable of mobilizing Hispanics and advocating for their interests. Hispanic-serving organizations do exist and advocate for Hispanic interests, but none have reached the level of influence of organizations that have promoted the interests of African Americans (Rouse, 2017). This is apparent in the health care sector as the Trump's administration did a "silent rollback" of Hispanic partnerships, which included removal of bilingual information on the government site. This rollback lessened the ability of Hispanic coalitions to work together to enroll more Hispanics in health care (Ollstein, 2017). ANA and NAHN have begun a partnership to build nursing's voice on issues that affect the Hispanic community. Future engagement from other nursing organizations would only amplify nursing's voice to the national level.

Methodological Challenges & Limitations

Overall Study Design

This quasi-experimental study design was effective in studying the policy impact of the ACA's two main coverage expansion provisions on increasing insurance coverage, access to primary care, and the delivery of diabetes prevention. A challenge to studying these three aims was finding one dataset that had all three outcomes of interest, which led to pursing two different federal datasets, BRFSS and NAMCS. Each dataset included yearly cross-sectional data. BRFSS included years 2012-2017; whereas NAMCS included years 2012-2015 only, leading to different years under study for the post-ACA period. Changes in the study design, from one with state-level estimates to regional estimates made the NAMCS study limited to 2014-2015 and for a small subset of states for the post-ACA period. Therefore, the post-ACA periods and state groups under study are different for aims 1-2 and aim 3. In addition, given the retrospective nature of secondary data analysis, challenges in the construction of specific key variables arose, which are discussed in the following paragraphs.

BRFSS Variable Construction

Insurance. Ideally, the primary outcome INS variable would have been constructed using data on the type of insurance held by each BRFSS respondent. However, this data was not available. Instead, the INS variable was a dichotomous "yes" or "no" variable to a question asking about having insurance- and "yes" included any type of insurance. To overcome this limitation, income levels were estimated by calculating the percent of federal poverty level (FPL) for each respondent by using respondent information on household income, household size and state of residency. Then, percent of FPL was used as a proxy for income in this study.

Income was categorized in four groups: (1) <100% FPL; (2) 100-138% FPL; (3) 139-400% FPL and (4) >400% FPL. The four groups in this study were compared with known population estimates and were found to be comparable. Post-ACA changes in the <100% FPL were associated with increases in Medicaid enrollment, changes in the 100-138% FPL were associated with increases in Medicaid enrollment in the 28 expansion states or increases in subsidized private insurance in 19 non-expansion states; changes in 139-400% FPL were associated with increases in subsidized private insurance and increases in >400% FPL were associated with increases in private insurance enrollment.

PCP/Checkup in past year. The secondary outcome variable used PCP and Checkup in the past year to determine whether a respondent had access to primary health care. Having a PCP was the main focus in the BRFSS analysis but also had limitations. There may be an underreporting of having a PCP as the question focuses on having a personal doctor or health care provider but does not actually include the terms *Nurse Practitioner* or *Physician Assistant*. This is also an issue for the checkup question which only asks "*About how long has it been since you last visited a doctor for a routine checkup?"* (Appendix I), which may also prompt individuals to underreport primary care visits to non-physician providers. However, a personal doctor or health care provider could also be confused with a health care specialist which would lead to PCP being overstated to include physicians who are not primary care physicians.

Additionally, checkups were analyzed on a yearly basis, but may not be the best measure of health care access as yearly checkups are not needed for otherwise young, healthy adults. A better increment of time may have been using every 2-3 years for checkup, but given the small number of years under study 2012-2017 and the fact that the data was not longitudinal, using the checkup in the past year as the outcome variable seemed to be the most logical approach.

High Risk for Diabetes. A major limitation to studying the high-risk for diabetes group was the inability to accurately capture the group with prediabetes. The prediabetes group was an important group to capture but BRFSS did not have lab tests available that captured glucose or hemoglobin A1c levels to determine a respondent's prediabetes status. The only question to capture prediabetes was the question that asked if a respondent had prediabetes, which was later found to be severely underreported in the descriptive statistics section. Therefore, only known prediabetes, gestational diabetes, BMI and known exercise were used to estimate the percentage of adults who were at high-risk for diabetes. This algorithm potentially underestimated the number of individuals at high risk for diabetes due to the reliance on critical self-reported information, such as height, weight and exercise routine; but allowed for the identification of a population that required adequate access to primary care. The measure could be improved upon by adding smoking and cardiovascular disease to the algorithm as this is commonly used in industry quality metrics focused on BMI (The National DPP, 2019).

Medicaid Expansion Status. Previous research has not been consistent on how the Medicaid expansion group was defined. In this study, since focus was on both Medicaid expansion up to 138% FPL and the insurance subsidies available to respondents living between 100-400% FPL, the four states that expanded Medicaid beyond the 138% FPL were excluded as Medicaid expansion due to the ACA could not be studied. A dummy variable that accounted for changes in expansion status per state over time was initially created but was found to be highly correlated with the time. Therefore, the decision was made to include all states that expanded Medicaid by 2017 in the dummy variable. This was not expected to have a major impact in the analysis since most states that expanded Medicaid, did so by 2014.

PCP Supply. PCP supply was a dichotomous variable that only took into account the state supply of primary care physicians in the pre-ACA period. As a result, we may be underestimating the supply of PCPs, especially in states that have full practice authority for non-physician providers. A future study could also adjust for the supply of non-physician primary care providers per state.

NAMCS Variable Construction.

Classification of Preventive Care Visits. In the NAMCS analysis, there was an overall decline of 22% in preventive care visits by the post-ACA period (2014-2015). Reasons for this decline may have included the declining survey response rates NAMCS reported over time or the under capturing of primary care services provided by non-physician providers (Centers for Disease Control and Prevention, 2018; Lau et al., 2016). In fact, only 2 states (Washington and Arizona) in the 15-sample had full practice authority legislated for Nurse Practitioners (American Association of Nurse Practitioners, 2018). Therefore, the decline in preventive care visits is not generalizable as only 15 states were available for this analysis, compared to 47 states in the BRFSS sample. Additionally, the focus of this analysis was primarily accounting for physician-patient visits, which does not fully capture every preventive care visit available in the U.S.

Diabetes Screening and Prevention Education. In NAMCS from years 2012-2015, there were six lab tests that captured blood sugar levels: CMP, BMP, GLUCOSE, HGBA, FBG, A1C (with the last two tests being performed in the last year). However, CMP and BMP data was only captured in years 2014-2015 and A1C and FBG in the past 12 months was not captured in 2015. The inconsistent availability of data from year to year made it difficult to truly capture diabetes screening rates. The main analysis captured screening during a clinic visit, but a provider could have forgone screening if a recent CMP, BMP, A1c or glucose reading was available in the past year. Furthermore, of the A1c and glucose data that was available in the past year, the actual date was not entered in the majority of patient visits, which made these two variables unreliable as we could not distinguish if the past year included 2013, the pre-ACA period.

The three education topics for nutrition, exercise and weight reduction were consistent from year to year, although diabetes education was added in 2015; although this was not considered diabetes prevention as it included medication management.

High Risk for Diabetes. Another major limitation in studying the ACA effect on the delivery of diabetes prevention overall, and by expansion status was that most of the preventive care visits were missing heights and/or weights (32-41% from 2012-2015), leading to incalculable BMI's for each patient visit. For this analysis the unknown diabetes risk group was created to capture this limitation and draws attention to the lack of documentation of heights and weights during a primary care visit. Although this section of the study could have been conducted by dropping the unknown diabetes risk group, this group did not appear to have the characteristics of a random sample and was kept in to acknowledge potential non-response bias where the screening rate may be higher than it actually is since those who were unknown were not considered in the denominator. To note, the unknown diabetes risk group was comprised of greater proportions of Hispanics, females and individuals aged 18 to 34.

Medicaid Expansion Status. As only 2012-2015 data was available, states that expanded Medicaid as of 2015 were included as expansion states, following similar logic as the BRFSS construction of this variable. A limitation to this was the small number of states available for this study (only 15 states compared to 47 states in BRFSS). The Medicaid expansion group did not have representation of the Midwest or south. Future analysis may consider a dataset that has administrative and clinical data available within all states.

Future Research

Exploring Differences in Insurance Coverage by Race

Intuitively, future research would focus on building upon the initial analyses conducted using BRFSS. Racial/ethnic disparities (as measured as a statistically significant 10% difference between the reference group and the comparison group) were only measured for the PCP/checkup outcomes, but could also be explored for differences in INS by race. From our analysis, disparities in having a PCP were the greatest among whites and Hispanics, with Hispanics being 38% less likely to have a PCP in the post-ACA period when compared to their white counterparts. This racial/ethnic disparity must also exist by insurance status, which our initial logic model did not account for. If the goal is to increase overall health care access for all racial/ethnic groups, the Hispanic population is one group that needs additional attention given the low levels of insurance and PCP post-ACA.

As we move into an election year and healthcare remains at the forefront, future research could include studying insurance and PCP levels among the 65+ older Hispanic population, relative to whites who are covered under Medicare. This could be done using the current BRFSS dataset by adding back in the 65+ older population. By doing so, more information on how universal coverage affects a specific age cohort of the Hispanic population would be provided, and if insurance and PCP rates are similar to those of whites under universal coverage. This type of study would also provide maximum ceiling levels of insurance and PCP, which in our current research was 95.83% insurance rate for the >400% FPL group (who are mainly covered by private insurance) and an average of 74.27% PCP rate, which a higher PCP rate of 90.69% among individuals with a known health condition. Again, a limitation to this study would be that insurance does not necessarily mean Medicare for this population. We could potentially supplement this future study with the Health and Retirement Study at the University of Michigan which provided more detailed information on insurance and health care access given it is a longitudinal study.

Exploring the INS to PCP uptake lag time

In the current BRFSS study, only 4 years (2014-2017) were included in the post-ACA period, which could be expanded to include years 2018 and 2019 once the data is available. By adding additional years to this study, trends in insurance and PCP could be assessed, but also the relationship between insurance and PCP. Currently, it is unknown if there is a lag time between when someone signs up for insurance and when someone chooses a primary care provider. Focus would be placed on states that expanded Medicaid by 2014 as more years are available to study the uptake of a PCP post-ACA.

Exploring State Level Differences in Expansion Status

When studying differences between non-expansion and Medicaid expansions states, each group was studied in aggregate and it was difficult to discern which states benefited the most from the ACA's coverage expansion. In **Table 97**, the *performance* of the non-expansion group in aggregate was compared to the performance of the Medicaid expansion group in aggregate. However, the performance of individual states relative to changes that occurred in aggregate were also assessed. When each state's change in insurance from pre-ACA to post-ACA was plotted, a curvilinear function was estimated and used to derive an estimated post-ACA value that could be used to determine if a state reached its expected level of insurance. States that started at lower levels of insurance- had a greater opportunity to increase insurance levels within the state.

The 5 states with the lowest levels of insurance in the pre-ACA period included: (1) Texas (67%); (2) Arkansas (71%); (3) Nevada (71%); (4) Florida (73%) and (5) Mississippi (79%). The two states that expanded Medicaid (Arkansas and Nevada) both out-performed their predicted insurance rates, while the three remaining non-expansion states performing below their predicted insurance rates. An area for future research is to compare the high-performers who started out with lower levels of insurance to those at the top. This comparison could shed light to how insurance and PCP levels changed according to how a state performed after ACA implementation.

Another way to test state level differences to the national BRFSS dataset would be to include a measure of political climate assigned to each state. The current study did not control for this yet vastly impacts a state’s decision to expand Medicaid. Potential indicators could include the 2017 Cook Political Report Partisan Voter Index which measures how Democratic or Republican a district performed during presidential elections (The Cook Political Report, 2018) or The CATO Institute’s Freedom measure which ranks states individually by policies that shape personal and economic freedom (CATO Institute, 2019). The type of measure could provide additional information on how insurance and PCP levels changed given the political environment in the state.

Capturing the High Risk for Diabetes Group

A major challenge for this research was capturing the high risk for diabetes group given the low levels of awareness of prediabetes in the BRFSS sample, and the high number of missing height and weight values in the NAMCS dataset. Therefore, any discussion on the high risk for diabetes population is a crude estimate considering by relying on weight only, we may have not captured other individuals with known risk factors mentioned in the ADA Clinical Guidelines for Diabetes Screening. This is apparent as even individuals at no/low risk for diabetes were screened in our NAMCS study. This does not mean that they shouldn't have been screened, it means that our method for capturing the high risk for diabetes group should probably include additional criteria. An additional possibility would be to do a sensitivity analysis where the high-risk for diabetes group also includes individuals with high blood pressure and age over 45. Or, individuals who are at no/low risk or unknown risk who are on metformin medication would be considered high-risk. This may help to move some of the no/low risk and unknown risk individuals into the high risk for diabetes group, if appropriate.

Conclusion

As health care continues to be a national priority this year, our research contributes to the growing evidence that the ACA's Medicaid expansion and insurance subsidies increased access to health insurance coverage for millions of low-income adults across the United States. We then went a step further to link gains in insurance to primary care access, which was found to be limited, especially for individuals at high-risk for diabetes. As a result, this research highlighted the minimal role the ACA played in improving access to primary care, and the need to increase an individuals' awareness of their high-risk status. It is therefore imperative that any health care policy proposals not only reflect the benefits of expanded coverage for low-income adults, but include provisions that expand access to primary care and include quality measures to improve the delivery of preventive care across the U.S. Future research includes exploring systemic barriers for organizations and providers in order to understand the processes needed to improve preventive care delivery for high-risk populations.

LIST OF APPENDICES

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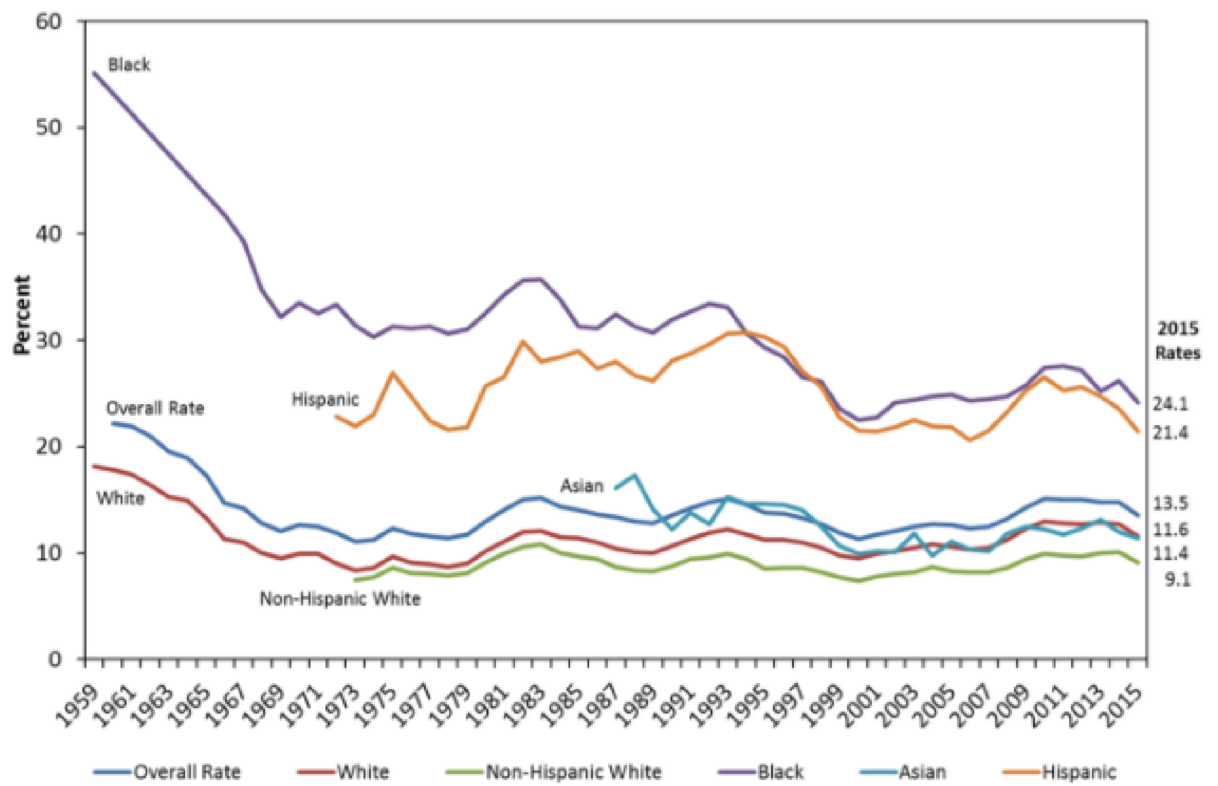
APPENDIX A

U.S. POVERTY RATES BY RACE/ETHNICITY: 1961-2015



Source: U.S. Census Bureau, Current Population Survey, Annual Social and Economic Supplements.

Note: Black poverty rate data from 1960 to 1965 are not available. The line shown connects the 1959 rate of 55.1 percent to the 1966 rate of 41.8 percent and is included to represent the trend but not to imply specific numerical data.

Figure A-1. U.S. poverty rates vary significantly by race and ethnicity: 1961-2015. Reprinted from https://www.irp.wisc.edu/faqs/faq3.htm (Institute for Research and Poverty, 2016).

APPENDIX B

CONCENSUS CORE SET FOR COMPREHENSIVE DIABETES CARE

Table B-1.

Consensus Core Set for Comprehensive Diabetes Care for ACO and PCMH/Primary Care Measures.

Core Measure on Comphrensive Diabetes Care		
1	**HbA1C Poor Control (>9.0%)**	The percentage of patients 18-75 years of age withdiabetes (type 1 and type 2) whose most recent HbA1c level during the measurement year was greater than 9.0% (poor control) or was missing a result, or if an HbA1c test was not done during the measurement year.
2	**Eye Exam**	The percentage of patients 18-75 years of age with diabetes (type 1 and type 2) who had an eye exam (retinal) performed.
3	**Hemoglobin A1c testing**	The percentage of patients 18-75 years of age with diabetes (type 1 and type 2) who received an HbA1c test during the measurement year.
4	**Foot Exam**	The percentage of patients 18-75 years of age with diabetes (type 1 and type 2) who received a foot exam (visual inspection and sensory exam with mono filament and pulse exam) during the measurement year.
5	**Medical Attention for Nephropathy**	The percentage of patients 18-75 years of age with diabetes (type 1 and type 2) who received a nephropathy screening test or had evidence of nephropathy during the measurement year.

APPENDIX C

THE CONCEPTUAL MODEL OF NURSING AND HEALTH POLICY AND IHI TRIPLE FRAMEWORK

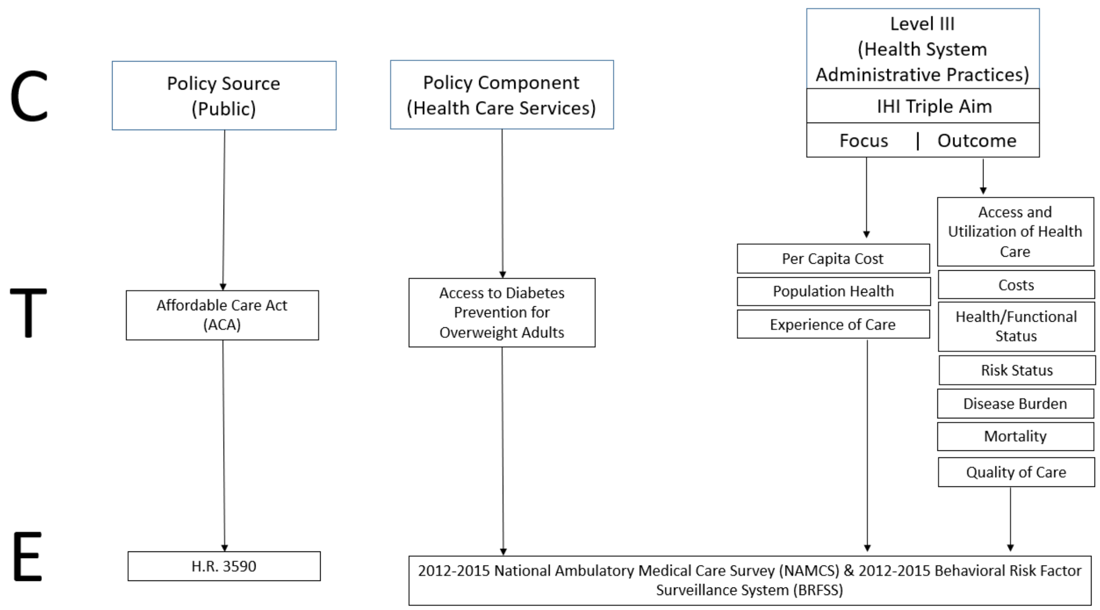


Figure C-1. The Conceptual Model of Nursing and Health Policy and IHI Triple Framework to study the impact of ACA's coverage expansion on the quality of diabetes prevention provided to high risk adults in the United States.

APPENDIX D

MODIFIED QUALITY HEALTH OUTCOMES MODEL

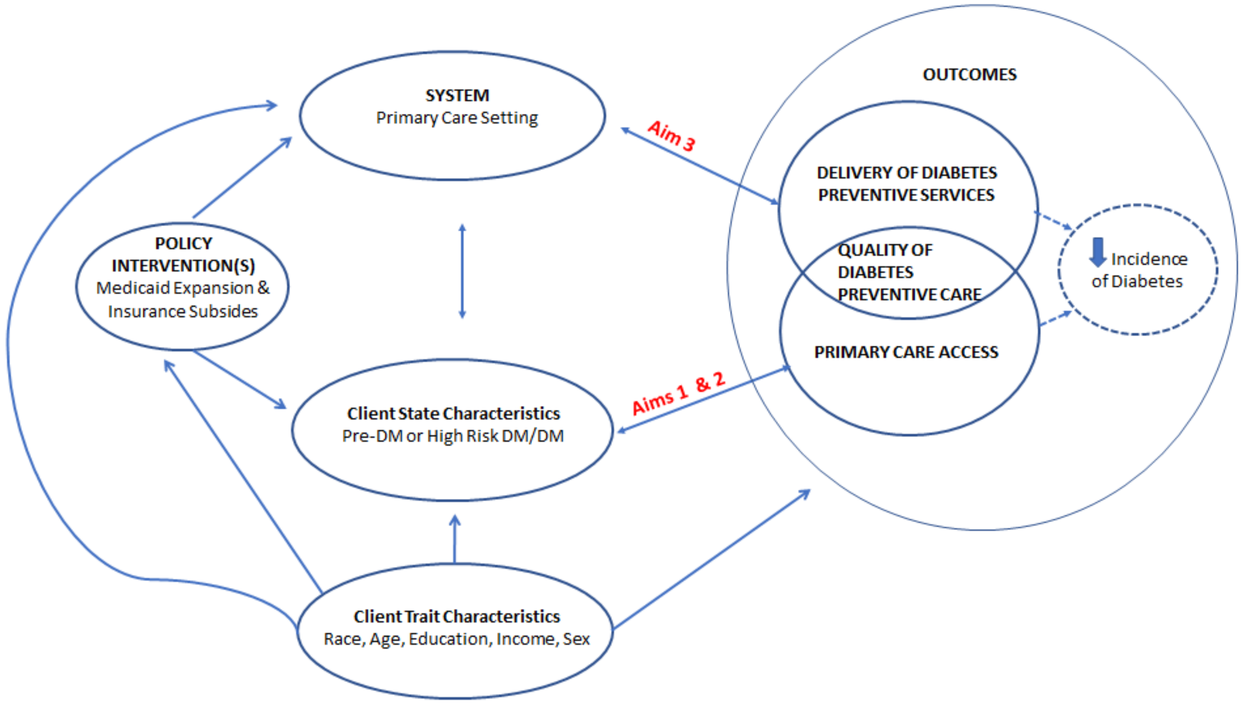


Figure D-1. Modified Quality Health Outcomes Model to study the impact of the ACA's coverage expansion on the quality of diabetes prevention provided adults aged 18 to 64 at high risk for diabetes in the United States.

APPENDIX E

PRISMA FLOW DIAGRAM

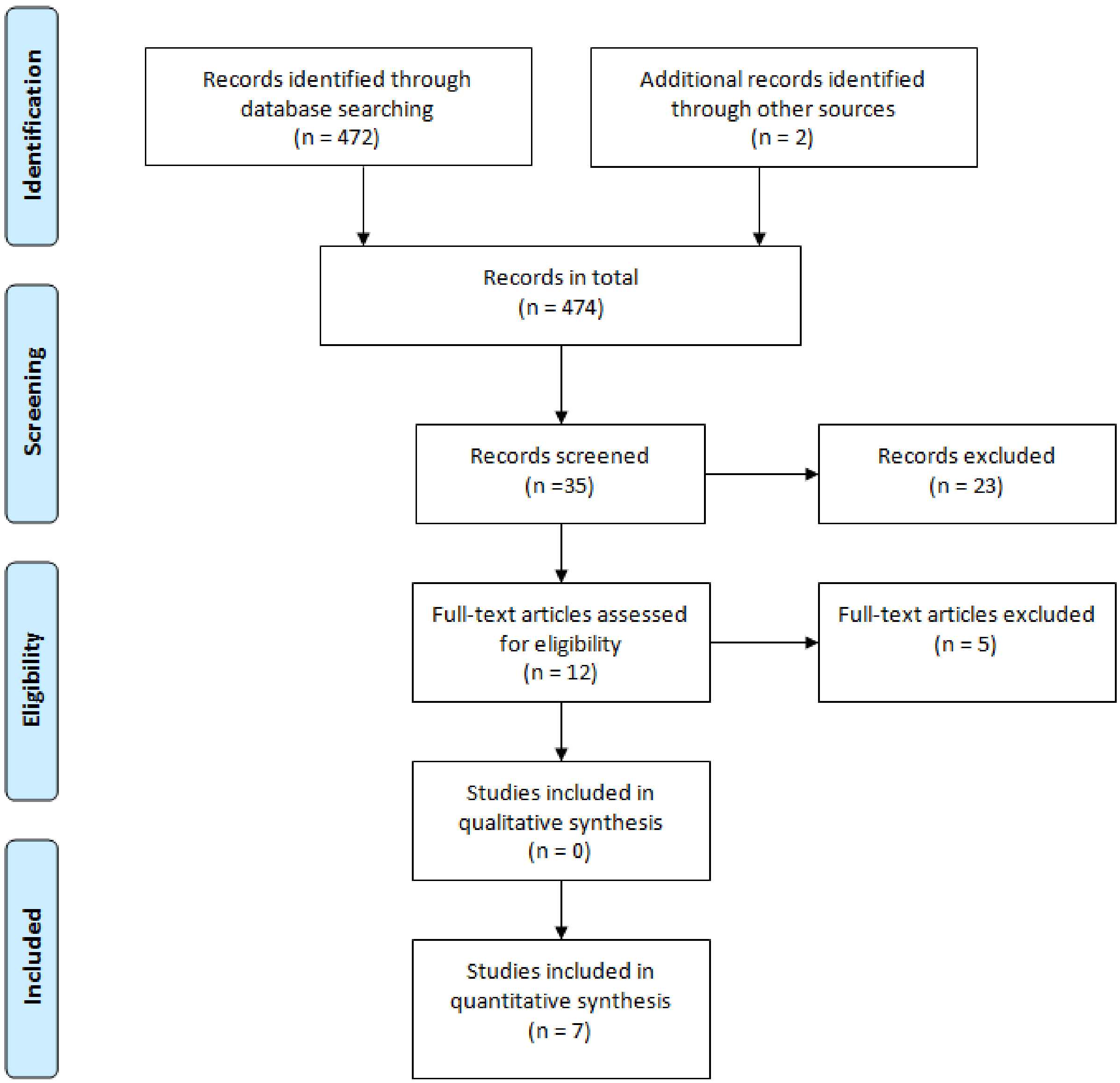


Figure E-1. PRISMA Flow Diagram

APPENDIX F

SUMMARY TABLE OF LITERATURE REVIEW

Table F-1.

Summary Table Demonstrating Key Features of the Literature Review Articles on ACA's Expansion.

Citation	Aims	Dataset	Study Period	Methods	Sample Size	Comparison Groups	Outcomes
(Alcala, Chen, Langellier, Roby & Ortega, 2017)	To examine the impact of the ACA on access to and utilization of health care among Hispanic subgroups. To determine the underlying effects of heritage, nativity and language on access to care. To determine the effects of the ACA on access and utilization of health care by heritage group, language and nativity.	National Health Interview Survey (NHIS)	2011 to 2015	Descriptive statistics, chi square tests and logistic regressions	65,703 non-Latino whites and 20,764 Latino adults	1,995 Puerto Ricans, 12,983 Mexicans, 871 Cubans, 3,592 Central Americans and 1,323 others.	Access to and utilization of health care.
(Cole, Galarraga, Wilson, Wright & Trivedi, 2017)	To analyze the impact of states' Medicaid expansion decision on community health centers as patient population are mainly low-income and uninsured	Uniform Data System	2011 to 2014	Difference-in-difference analysis with inverse probability of treatment weights to compare outcomes in centers in expansion and nonexpansion states. Health center was the unit of analysis. Propensity scores were calculated for each measure.	1,057 U.S. based community health centers with each center reporting on quality measures, number of patients served, organizational features and characteristics of patients Total number of patients served ranged from 19.4 million in 2011 to 21.3 million in 2014	Treatment group included 492 federally funded community health centers in 5 Medicaid expansion states and Washington, DC. Control group included 565 federally funded community health centers in states that did not expand Medicaid.	Access to and utilization of health care; quality of care Outcomes: (1) percentage of patients without insurance, patients' type of coverage (percentage of patients with Medicaid and with private coverage), number of unique patients seen, and quality of care (performance on eight quality measures that may be sensitive to Medicaid expansion i.e. Hgb <10%)
(Gingold, Pierre-	To study the	Picis	2013 to 2014	Retrospective, cross-	Before expansion 2013	Before expansion 2013	Access to and utilization of health care

Mathieu, Cole, Miller & Khaldun, 2017)	impact of changes in insurance eligibility following the 2014 Medicaid expansion on ED utilization for ambulatory care sensitive conditions (ACSC) by high ED utilizers in an urban safety net hospital.	EDPulseCheck	January 1, 2013-December 31, 2014 Pre- July 1 to December 31, 2013 Post- July 1 to December 31, 2014 (Avoided seasonal bias)	sectional study. Difference in difference between high ED utilizers and low ED utilizers.	(N= 17,069) Low utilizers (n=17,069) High utilizers (n=726) Post expansion 2014 (N=16,458 people) Low utilizers (n=16,078) High utilizers (n=380)	(N= 17,795 people) Post expansion 2014 (N=16,458 people)	Outcomes: Odds rations for high vs. low utilizers as well as ACSC-visit likelihoods
(Sharma, Dresden, Powell, Kang & Feinglass, 2017)	To study changes in ED use by uninsured patients. Study aim was to document the use of emergency care after uninsured residents obtained Medicaid or health insurance exchange coverage.	Illinois Hospital Association Comparative Health Care and Hospital Data Reporting Services	2011 to 2015	Analyzed visit-level administrative billing data for all ED visits by patients age (18-64) with an Illinois zip code. Patient zip code matched to five-year American Community Survey census data to derive median household income. For patients admitted through the ED, classified ambulatory care sensitive hospitalizations (ACSH) using AHRQ Prevention Quality Indicators criteria was used to measure change in diagnoses. Pre-ACA defined as 2011-2013. Analysis included logistic regression to test the significance of period (2011-2013 versus 2014-2015) for the likelihood of ACSH.	201 non-federal Illinois hospitals	Pre-expansion 2011 to 2013 Post-expansion 2014 to 2015	Access to and utilization of health care; burden of disease Outcomes: ED visits and hospitalizations by Insurance Status; ACSH Prevalence before and after Illinois ACA insurance expansion; Risk Factors for ACSHs among the uninsured.
(Sommers, Blendon, Orav & Epstein,	To access changes to access	Random digit telephone	2013 to 2015	Difference-in-difference analysis of survey data	U.S. citizens ages 19 to 64 with incomes below	Medicaid expansion in Kentucky and private	Self-reported access to primary care, specialty care, and medications,

2016)	to care, utilization, and self-reported health among low-income adults in 3 states taking alternative approaches to ACA.	survey adapted from National Health Interview Survey (NHIS), the Behavioral Risk Factor Surveillance System (BRFSS), the American Community Survey (ACS), and Oregon Health Insurance Experiment		from November 2013 to December 2015. Data analysis was conducted between January and May 2016.	138% of the federal poverty level in Kentucky, Arkansas and Texas	option in Arkansas, compared with no expansion in Texas.	affordability of care outpatient, inpatient and emergency utilization; receiving glucose and cholesterol testing, annual check-up, and care for chronic conditions; quality of care, depression score and overall health.
(Sommers, Gunja, Finegold & Musco, 2015)	To assess national changes in self-reported coverage, access to care, and health during the first 2 open enrollment periods. In addition, to assess the differences between low-income adults in Medicaid expansion and non-expansion states.	Gallup-Healthways Well-Being Index (WBI)	2012 to 2015	Linear regressions modeled each outcome as a function of time. In addition, an interrupted time-series was also conducted. Subgroup analysis were conducted based on race/ethnicity, sex, residence and presence of at least 1 chronic condition (including diabetes). An additional analysis focused on low-income sample. A difference in difference analysis was conducted in this sample to address changes in outcomes comparing low-income adults in expansion to non-expansion states.	Full sample included 507,055 adults aged 18-64. The low-income sample included 48,905 in expansion states and 37,283 adults in non-expansion states.	Medicaid expansion states versus nonexpansion states	Main outcomes of interest included: being uninsured, not having a personal physician, ability to get medications, ability to afford medical care in past year, overall health status, and percentage of days in the past month where activities were limited by poor health.
(Wherry & Miller, 2017)	To evaluate whether Medicaid expansion was associated with changes in health insurance coverage, access	National Health Interview Survey (NHIS)	2010 to 2014 Study period included 4 years before (2010-2013) and the first year after (2014) expansion. Post-	A quasi-experimental difference-in-differences design comparing changes in outcomes for residents in expansion versus non-expansion states.	Expansion states (n=19,140) and nonexpansion states (n=21,287)	Medicaid expansion versus nonexpansion states	Outcomes related to insurance coverage and utilization and access to care, diagnoses of health conditions and self-reported health. (including diabetes).

	to and utilization of health care, and self-reported health.		expansion period included interviews in the second half of 2014.	Multivariate regression model was used to compare outcomes for expansion and non-expansion states. Interrupted time-series design used to see how Medicaid expansions affected trends over time in outcome variables. Study period: 2010 to 2013 (pre) and 2014 (post)			

APPENDIX G

DIABETES-RELATED OUTCOMES BY RACE

Table G-1.

Diabetes-related Outcomes by Race.

	Population Health				Patient Experience	Per Capita Cost	
Citation	**Health/Functional Status**	**Risk Status**	**Disease Burden**	**Mortality**	**Quality of Care**	**Access to and Utilization of Health Care**	**Costs**
(Alcala, Chen, Langellier, Roby & Ortega, 2017)						Among Hispanics, the odds of being insured were greater in 2014 and 2015 compared to 2011. Some groups saw poorer patterns in delaying care (Cubans, Central Americans and Other), forgoing care (Mexicans and Cubans) and visiting a physician (non-Latino whites, Mexicans, Cubans and Central Americans). Mexicans and Central Americans had lower odds of being insured compared to whites. Puerto Rican had higher odds of using the ED compared to whites. Mexicans had lower odds of using the ED and having a physician visit when compared to whites.	

						Those who answered the survey in Spanish had lower odds of being insured, forgoing care, using an ED and having a physician visit compared to those who completed the survey in English.	
(Cole, Galarraga, Wilson, Wright & Trivedi, 2017)					There were no significant differences found for the recommended treatment of diabetes among expansion and nonexpansion states, even among racial or ethnic groups.	There was an 11.1-percentage-point decrease in the uninsured rate and an 11.8-percentage-point increase in Medicaid coverage in centers in expansion states, compared to non-expansion states. About 1 in 4 patients in expansion states remained uninsured in 2014. There was no difference in the number of unique patients served at health centers in neither expansion nor nonexpansion states.	
(Gingold, PierreMathieu, Cole, Miller & Khaldun, 2017)			Following 2014 expansion, likelihood of patients having an ACSC diagnosis decreased from 15.7% to 14% ($p<0.001$).			In 2014, a higher proportion of all patients identified as Hispanic and lower proportion as black compared to 2013. Mean ED length of stay increased from 5.5 hour to 5.8 hours ($p<0.0001$). In 2014, slight increase in the percentage of patients	

						with Medicaid (25.3% vs. 26.4%, p=0.02) Less discharges in 2014 (61.6% vs. 59.4%, p=0.001). Before expansion, frequent ED utilizers were less likely to be male, 358Hispanic (4.1% vs. 9.1%, P<0.001), uninsured or discharged. ACSC-associated visit predicted being a higher utilizer in 2013 (OR 1.66) and 2104 (OR 1.65), but this was not different between years.	
(Sharma, Dresden, Powell, Kang & Feinglass, 2017)			Acute ACSH diagnoses decreased from 4.9% to 4.5% while chronic ACSH increased from 10.5 to 11%. Among those on Medicaid, the proportion of ACSH post-ACA decreased from 17.1 to 16.7%.			Average monthly ED visits increased sharply for Medicaid (41.9%), compared to privately insured patients (10%). When looking at the uninsured population, the largest decreases were among those aged 45-54 (3.8%), non-Hispanic whites (6.6%) and blacks (3.6%). There was an increase in the number of uninsured among Hispanics (5%) and Cook County residents (5.4%).	
(Sommers, Blendon, Orav & Epstein, 2016)					Quality of care ratings improved significantly as did the share of adults reporting excellent health in expansion	There was increased access to primary care, fewer skipped medications due to cost, reduced	Reduced out-of-pocket spending and reduced report of difficulty paying medical

					states.	likelihood of emergency department visits and increased outpatient visits in expansion states. Screening for diabetes, glucose testing among patients with diabetes and regular care for chronic conditions all increased significantly after expansion. Higher diabetes glucose testing rates were seen in Kentucky (Medicaid expansion state). Minorities experienced significant increases in health coverage, office visits and checkups in expansion states; with lower ED visits.	bills in expansion states. Minorities experienced significant increases in affordability of care.
(Sommers, Gunja, Finegold & Musco, 2015)						The uninsured rate declined significantly in Medicaid expansion states compared to non-expansion states. In addition, lacking a personal physician and limited access to medications declined significantly in expansion states compared to non-expansion states.	
(Wherry & Miller, 2017)	There were no significant changes in measures associated with access, health status or mental health between expansion and non-		There was a significant increase in the reporting of the diagnosis of diabetes associated			Low-income adults in the expansion states were less likely to be black (18.7%) and more likely to white	

	expansion states.		with the expansion of Medicaid.			(73.5%). Physician visits and inpatient stays increased significantly in the expansion states versus non-expansion states.	

APPENDIX H

LIST OF PREDICTOR VARIABLES USED IN BRFSS ANALYSIS

Table H-1.

List of Predictor Variables used in BRFSS Analysis.

Independent Variables	Coding	Acronym
Race/Ethnicity		
Black	(0) Non-Hispanic White	
	(1) Non-Hispanic Black	BLK
Hispanic	(0) Non-Hispanic White	
	(1) Hispanic, All Races	HISP
whiteBLKhisp	(0) Non-Hispanic White	
	(1) Non-Hispanic Black	
	(2)Hispanic	WBH
Income		
Income (% FPL)	(0) <100% FPL	
	(1) =>100% or <=138% FPL	
	(2) =>139% or <=400% FPL	
	(2) > 400% FPL	INC
Diabetes Risk		
High Risk for Diabetes	(0) No/Low Risk	
	(1) High Risk	
	(2) Diabetes	HRD
Medicaid Expansion State Status		
Medicaid Expansion State	(0) Non-expansion State	
	(1) Medicaid Expansion State	EXP

APPENDIX I

BRFSS VARIABLE QUESTIONNAIRE

Race (2012)

Question 1. Are you Hispanic or Latino?

1. Yes
2. No
7. Don’t know/Not Sure
9. Refused

Question 2. Which one or more of the following would you say is your race? (Check all that apply).

1. White
2. Black or African American
3. Asian
4. Native Hawaiian or Other Pacific Islander
5. American Indian or Alaska Native
6. Other [Specific] ____________________
7. Don’t know/Not sure
8. No additional choices
9. Refused

Question 3. (If more than one response to Q2, then continue).
Which one of these groups would you say best represents your race?

1. White
2. Black or African American
3. Asian
4. Native Hawaiian or Other Pacific Islander
5. American Indian or Alaska Native
6. Other [specify] _____________
7. Don’t know/Not sure
9. Refused

Computed Variable(s): _racegr2 (2012) and _racegr3 (2013-2017)

1. White only, Non-Hispanic
2. Black only, Non-Hispanic
3. Other race only, Non-Hispanic
4. Multiracial, Non-Hispanic
5. Hispanic

9. Don’t know/Not sure/Refused

Education (2012)

Question 1. What is the highest grade or year of school you completed?

1. Never attended school or only attended kindergarten
2. Grades 1 through 8 (Elementary)
3. Grades 9 through 11 (Some high school)
4. Grade 12 or GED (High school graduate)
5. College 1 year to 3 years (Some college or technical school)
6. College 4 years or more (College graduate)
7. Don’t know/Not sure
9. Refused

Income (2012)

Question 1. Is your annual household income from all sources-

04. Less than $25,000 ($20,000 to less than $25,000)
03. Less than $20,000 ($15,000 to less than $15,000)
02. Less than $15,000 ($10,000 to less than $15,000)
01. Less than $10,000
05. Less than $35,000 ($25,000 to less than $35,000)
06. Less than $50,000 ($35,000 to less than $50,000)
07. Less than $75,000 ($50,000 to less than $75,000)
08. $75,000 or more
77. Don’t know/Not sure
99. Refused

Health Care Access (INS, PCP & PCA)

Question 1 (INS). Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, government plans such as Medicare, or Indian Health Service?

1. Yes
2. No
7. Don’t know/Not sure
9. Refused

Question 2 (PCP). Do you have one person that you think of as your personal doctor or health care provider? If “No”, is there more than one, or is there no person who you think of as your personal doctor or health care provider?

1. Yes, only one
2. More than one

3. No
7. Don’t know/Not sure
9. Refused
Question 3 (PCA). About how long has it been since you last visited a doctor for a routine checkup? A routine checkup is a general physical exam, not an exam for a specific injury, illness, or condition.

1. Within the past year (anytime less than 12 months ago)
2. Within the past 2 years (1 year but less than 2 years ago)
3. Within the past 5 years (2 years but less than 5 years ago)
4. 5 or more years ago
7. Don’t know/Not sure
8. Never
9. Refused

APPENDIX J

THE BRFSS ALGORITHM FOR HIGH-RISK FOR DIABETES VARIABLE

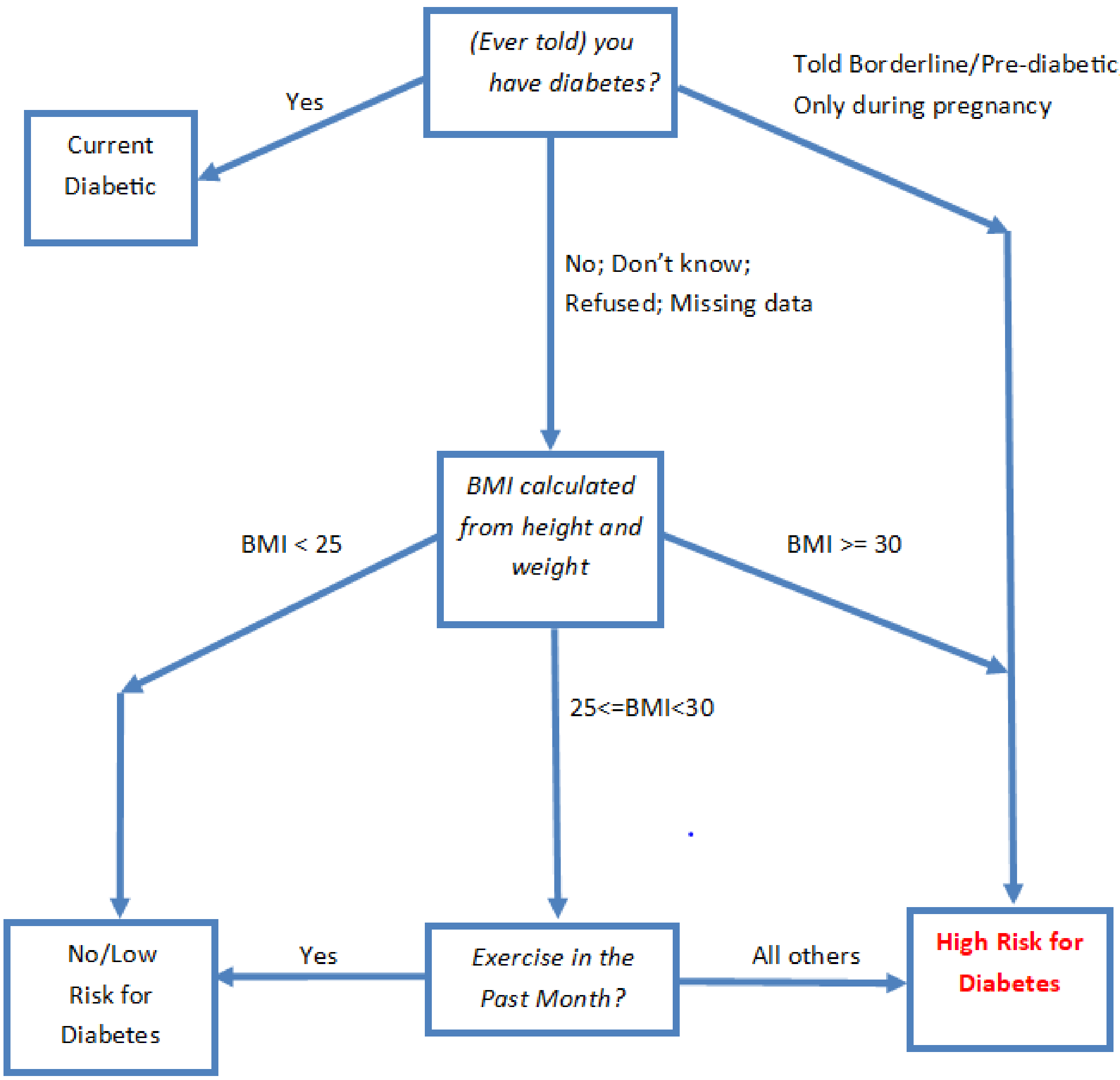


Figure J-1. The BRFSS Algorithm for High Risk for Diabetes (HRD) Variable.

APPENDIX K

BRFSS CONTROL VARIABLES

Table K-1.

List of Control Variables used in BRFSS Analysis.

Control Variables	Coding	Acronym
Demographics		
Age	(0) 18 to 34	
	(1) 35 to 44	
	(2) 45 to 54	
	(3) 55 to 64	AGEcat
Sex	(0) Male	
	(1) Female	FEM
Education	(0) Less than HS	
	(1) HS Grad	
	(2) Some College	
	(3) College Grad	EDU
Limited Health Status		
Chronic Disease Count	0	
	1	
	2	
	3	
	4	
	5	CDcount
Self-Reported Health	(0) Healthy	
	(1) Not Healthy	SRH
Primary Care Provider Supply		
PCP Supply	(0) Adequate Supply	
	(1) Shortage	SUPP

Refer to Table L-1 for full list of chronic diseases.

APPENDIX L

BRFSS CHRONIC DISEASE VARIABLES

Table L-1.

Chronic Diseases in BRFSS CDcount control variable in Table K-1.

Chronic Disease Variables	Coding	Acronym
Cancer	0= No	
	1= Yes	CAN
COPD/Emphysema/Chronic Bronchitis	0= No	
or Asthma	1= Yes	RESP
Coronary Heart Disease or	0= No	
Myocardial Infarction	1= Yes	CAR
Kidney Disease	0= No	
	1= Yes	KID
Stroke	0= No	
	1= Yes	STK

APPENDIX M

BRFSS OUTCOME VARIABLES

Table M-1.

List of Outcome Variables used in BRFSS Analysis.

Dependent Variables	Coding	Acronym
Health Coverage	(0) No (1) Yes	INS
Health Care Provider	(0) No (1) Yes	PCP
Primary Care Access	(0) Checkup > 1 year (1) Checkup < 1 year	PCA

APPENDIX N

NAMCS PATIENT RECORD FORM (FRONT)

Form Approved: OMB No. 0920-0234; Expiration date 2/28/2013

Assurance of confidentiality – All information which would permit identification of an individual, a practice, or an establishment will be held confidential; will be used for statistical purposes only by NCHS staff, contractors, and agents only when required and with necessary controls; and will not be disclosed or released to other persons without the consent of the individual or establishment in accordance with section 308(d) of the Public Health Service Act (42 USC 242m) and the Confidential Information Protection and Statistical Efficiency Act (PL-107-347).

PATIENT INFORMATION

Patient medical record No.

Date of visit
Month | Day | Year 2 0 1

ZIP Code

Date of birth
Month | Day | Year

Sex
1 ☐ Female – Is patient pregnant?
1 ☐ Yes - *Specify gestation week* →
OR
LMP Month | Day | Year 2 0 1
2 ☐ No
3 ☐ Unknown
2 ☐ Male

Ethnicity
1 ☐ Hispanic or Latino
2 ☐ Not Hispanic or Latino

Race
1 ☐ White
2 ☐ Black or African American
3 ☐ Asian
4 ☐ Native Hawaiian or Other Pacific Islander
5 ☐ American Indian or Alaska Native

Expected source(s) of payment for this visit – *Mark (X) all that apply.*
1 ☐ Private insurance
2 ☐ Medicare
3 ☐ Medicaid or CHIP
4 ☐ Worker's compensation
5 ☐ Self-pay
6 ☐ No charge/Charity
7 ☐ Other
8 ☐ Unknown

Tobacco use
1 ☐ Not current
2 ☐ Current
3 ☐ Unknown

VITAL SIGNS

Height: ___ ft ___ in OR ___ cm

Weight: ___ lb ___ oz OR ___ kg ___ gm

Temperature: ___ ☐ °C ☐ °F

Blood pressure: Systolic / Diastolic

INJURY/POISONING/ADVERSE EFFECT

Is this visit related to an injury, poisoning, or adverse effect of medical treatment?
1 ☐ Yes, injury/trauma
2 ☐ Yes, poisoning →
3 ☐ Yes, adverse effect of medical treatment
4 ☐ No
5 ☐ Unknown
SKIP to Reason For Visit

Is this injury/poisoning unintentional or intentional
1 ☐ Unintentional
2 ☐ Intentional
3 ☐ Unknown

REASON FOR VISIT

Patient's complaint(s), symptom(s), or other reason(s) for this visit – *Use patient's own words.*
(1) Most important
(2) Other
(3) Other

CONTINUITY OF CARE

Are you the patient's primary care physician?
1 ☐ Yes – *SKIP to* →
2 ☐ No
3 ☐ Unknown

Was patient referred for this visit?
1 ☐ Yes
2 ☐ No
3 ☐ Unknown

Has the patient been seen in your practice before?
1 ☐ Yes, established patient –
How many past visits in the last 12 months? *Exclude this visit.*
___ Visits
1 ☐ Unknown
2 ☐ No, new patient

Major reason for this visit
1 ☐ New problem (<3 mos. onset)
2 ☐ Chronic problem, routine
3 ☐ Chronic problem, flare-up
4 ☐ Pre/Post surgery
5 ☐ Preventive care (e.g., routine prenatal, well-baby, screening, insurance, general exams)

DIAGNOSIS

As specifically as possible, list diagnoses related to this visit including chronic conditions.
(1) Primary diagnosis
(2) Other
(3) Other

Regardless of the diagnoses previously entered, does the patient now have – *Mark (X) all that apply.*
1 ☐ Arthritis
2 ☐ Asthma

Asthma severity:
1 ☐ Intermittent
2 ☐ Mild persistent
3 ☐ Moderate persistent
4 ☐ Severe persistent
5 ☐ Other – *Specify*
6 ☐ None recorded

Asthma control:
1 ☐ Well controlled
2 ☐ Not well controlled
3 ☐ Very poorly controlled
4 ☐ Other – *Specify*
5 ☐ None recorded

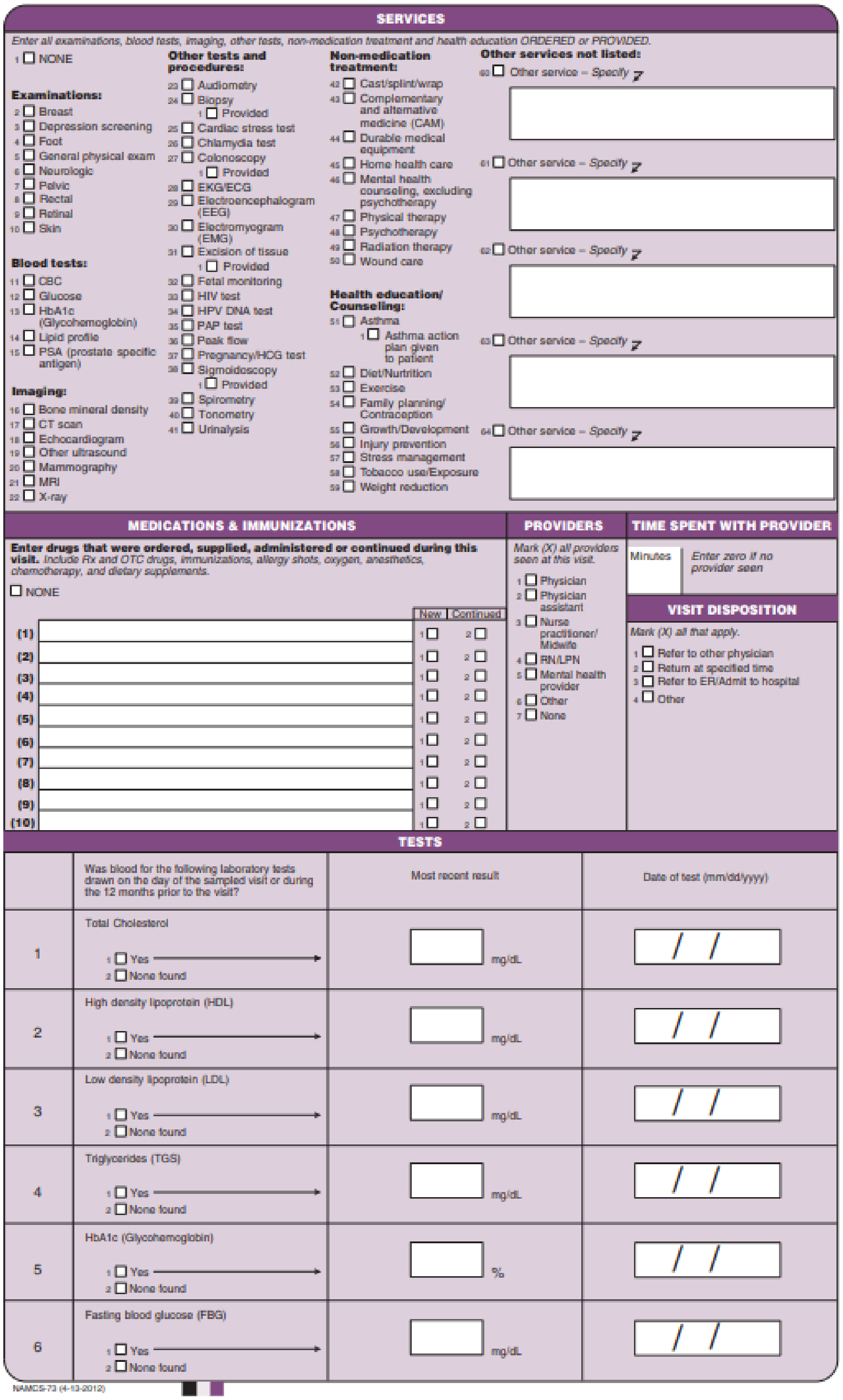
3 ☐ Cancer
1 ☐ In situ
2 ☐ Stage I
3 ☐ Stage II
4 ☐ Stage III
5 ☐ Stage IV
6 ☐ Unknown stage

4 ☐ Cerebrovascular disease/History of stroke or transient ischemic attack (TIA)
5 ☐ Chronic obstructive pulmonary disease (COPD)
6 ☐ Chronic renal failure
7 ☐ Congestive heart failure
8 ☐ Depression
9 ☐ Diabetes
10 ☐ Hyperlipidemia
11 ☐ Hypertension
12 ☐ Ischemic heart disease
13 ☐ Obesity
14 ☐ Osteoporosis
15 ☐ None of the above

Figure N-1. 2012 NAMCS Patient Record Form (Front Side).

APPENDIX O

NAMCS PATIENT RECORD FORM (BACK)



SERVICES

Enter all examinations, blood tests, imaging, other tests, non-medication treatment and health education ORDERED or PROVIDED.

1 ☐ NONE

Examinations:
2 ☐ Breast
3 ☐ Depression screening
4 ☐ Foot
5 ☐ General physical exam
6 ☐ Neurologic
7 ☐ Pelvic
8 ☐ Rectal
9 ☐ Retinal
10 ☐ Skin

Blood tests:
11 ☐ CBC
12 ☐ Glucose
13 ☐ HbA1c (Glycohemoglobin)
14 ☐ Lipid profile
15 ☐ PSA (prostate specific antigen)

Imaging:
16 ☐ Bone mineral density
17 ☐ CT scan
18 ☐ Echocardiogram
19 ☐ Other ultrasound
20 ☐ Mammography
21 ☐ MRI
22 ☐ X-ray

Other tests and procedures:
23 ☐ Audiometry
24 ☐ Biopsy
1 ☐ Provided
25 ☐ Cardiac stress test
26 ☐ Chlamydia test
27 ☐ Colonoscopy
1 ☐ Provided
28 ☐ EKG/ECG
29 ☐ Electroencephalogram (EEG)
30 ☐ Electromyogram (EMG)
31 ☐ Excision of tissue
1 ☐ Provided
32 ☐ Fetal monitoring
33 ☐ HIV test
34 ☐ HPV DNA test
35 ☐ PAP test
36 ☐ Peak flow
37 ☐ Pregnancy/HCG test
38 ☐ Sigmoidoscopy
1 ☐ Provided
39 ☐ Spirometry
40 ☐ Tonometry
41 ☐ Urinalysis

Non-medication treatment:
42 ☐ Cast/splint/wrap
43 ☐ Complementary and alternative medicine (CAM)
44 ☐ Durable medical equipment
45 ☐ Home health care
46 ☐ Mental health counseling, excluding psychotherapy
47 ☐ Physical therapy
48 ☐ Psychotherapy
49 ☐ Radiation therapy
50 ☐ Wound care

Health education/ Counseling:
51 ☐ Asthma
1 ☐ Asthma action plan given to patient
52 ☐ Diet/Nutrition
53 ☐ Exercise
54 ☐ Family planning/ Contraception
55 ☐ Growth/Development
56 ☐ Injury prevention
57 ☐ Stress management
58 ☐ Tobacco use/Exposure
59 ☐ Weight reduction

Other services not listed:
60 ☐ Other service – *Specify*
61 ☐ Other service – *Specify*
62 ☐ Other service – *Specify*
63 ☐ Other service – *Specify*
64 ☐ Other service – *Specify*

MEDICATIONS & IMMUNIZATIONS

Enter drugs that were ordered, supplied, administered or continued during this visit. *Include Rx and OTC drugs, immunizations, allergy shots, oxygen, anesthetics, chemotherapy, and dietary supplements.*

☐ NONE

		New	Continued
(1)		1 ☐	2 ☐
(2)		1 ☐	2 ☐
(3)		1 ☐	2 ☐
(4)		1 ☐	2 ☐
(5)		1 ☐	2 ☐
(6)		1 ☐	2 ☐
(7)		1 ☐	2 ☐
(8)		1 ☐	2 ☐
(9)		1 ☐	2 ☐
(10)		1 ☐	2 ☐

PROVIDERS

Mark (X) all providers seen at this visit.

1 ☐ Physician
2 ☐ Physician assistant
3 ☐ Nurse practitioner/ Midwife
4 ☐ RN/LPN
5 ☐ Mental health provider
6 ☐ Other
7 ☐ None

TIME SPENT WITH PROVIDER

Minutes | *Enter zero if no provider seen*

VISIT DISPOSITION

Mark (X) all that apply.

1 ☐ Refer to other physician
2 ☐ Return at specified time
3 ☐ Refer to ER/Admit to hospital
4 ☐ Other

TESTS

	Was blood for the following laboratory tests drawn on the day of the sampled visit or during the 12 months prior to the visit?	Most recent result	Date of test (mm/dd/yyyy)
1	Total Cholesterol 1 ☐ Yes → 2 ☐ None found	mg/dL	/ /
2	High density lipoprotein (HDL) 1 ☐ Yes → 2 ☐ None found	mg/dL	/ /
3	Low density lipoprotein (LDL) 1 ☐ Yes → 2 ☐ None found	mg/dL	/ /
4	Triglycerides (TGS) 1 ☐ Yes → 2 ☐ None found	mg/dL	/ /
5	HbA1c (Glycohemoglobin) 1 ☐ Yes → 2 ☐ None found	%	/ /
6	Fasting blood glucose (FBG) 1 ☐ Yes → 2 ☐ None found	mg/dL	/ /

NAMCS-73 (4-13-2012)

Figure O-1. 2012 NAMCS Patient Record From (Back Side).

APPENDIX P

NAMCS ALGORITHM FOR HIGH-RISK FOR DIABETES VARIABLE

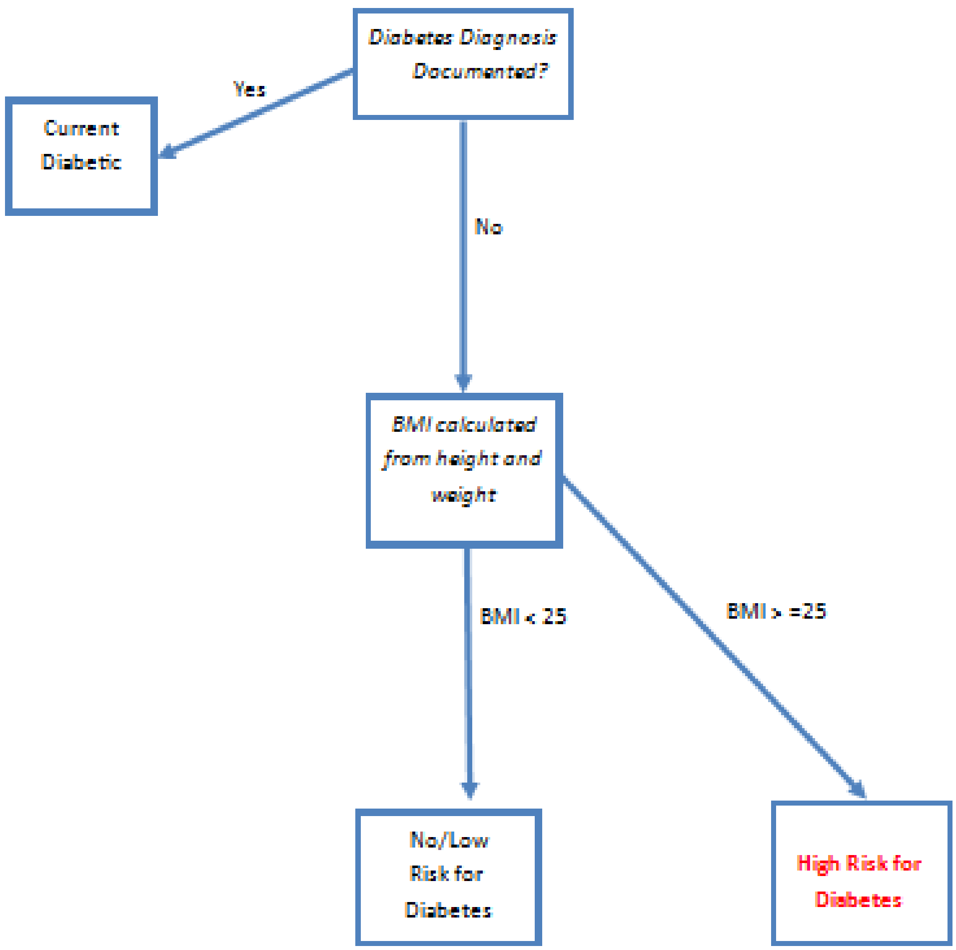


Figure P-1. NAMCS Algorithm for High Risk for Diabetes (HRD) Variable.

APPENDIX Q

NAMCS OUTCOME VARIABLES

Table Q-1.

NAMCS Outcome Variables.

Dependent Variables	Coding	Acronym
Diabetes Screening	0= No	
	1= Yes	SCR
Diabetes Prevention Education	0= No	
	1= Yes	DPE

APPENDIX R

NAMCS PREDICTOR VARIABLES

Table R-1.

NAMCS Predictor Variables.

Independent Variables	Coding	Acronym
	Race/Ethnicity	
Black	0= Non-Hispanic White	
	1= Non-Hispanic Black	BLK
Hispanic	0= Non-Hispanic White	
	1= Hispanic, All Races	HISP
	Diabetes Risk	
High Risk for Diabetes	0= No/Low Risk	
	1= High Risk	
	2= Diabetes	HRD
	Medicaid Expansion State Status	
Medicaid Expansion State	0=Non-expansion State	
	1= Medicaid Expansion State	EXP

APPENDIX S

NAMCS CONTROL VARIABLES

Table S-1.

NAMCS Control Variables.

Control Variables	Coding	Acronym
Age	Continuous	AGE
Gender	0= Male	
	1= Female	GEN
Chronic Disease	0= No Chronic Disease	
	1= At Least 1 Chronic Disease	CDV

APPENDIX T

NAMCS CHRONIC DISEASE VARIABLES

Table T-1.

NAMCS Chronic Disease Variables.

Chronic Disease Variables	Coding	Acronym
Arthritis	0= No	
	1= Yes	ART
Asthma	0= No	
	1= Yes	AST
Cancer	0= No	
	1= Yes	CAN
Chronic Renal Failure	0= No	
	1= Yes	CRF
COPD	0= No	
	1= Yes	COP
Depression	0= No	
	1= Yes	DEP
Ischemic Heart Disease	0= No	
	1= Yes	IHD
Stroke	0= No	
	1= Yes	STK

APPENDIX U

STATE MEDICAID EXPANSION DECISIONS AND PCP SUPPLY

Table U-1.

Status of State Medicaid Expansion Decisions and PCP supply status for U.S. 50 states and D.C.

STATE	BRFSS CODE	STATUS	SIGNED INTO LAW	KFF EXPANSION DATE	GOVENOR	COMMENTS	PCP SUPPLY
ALASKA	2	E	9/1/2015	9/1/2015	BILL WALKER (I)		Low
ARIZONA	4	E	6/17/2013	1/1/2014	JAN BREWER (R)	PRE-EXPANSION PARENTS 22% FPL, CHILDLESS ADULTS 100% FPL (ENROLLMENT FROZEN FROM '11-'14), POST EXPANSION, 133% FPL	Low
ARKANSAS	5	E	4/23/2013	1/1/2014	MIKE BEEBE (D)		Low
CALIFORNIA	6	E	6/27/2013	1/1/2014	JERRY BROWN (D)	EARLY EXPANSION UP TO 200% IN SOME COUNTIES, NOT STATEWIDE- 7/1/2011	Adequate
COLORADO	8	E	5/13/2013	1/1/2014	JOHN HICKENLOOPER (D)		Adequate
CONNECTICUT	9	E		1/1/2014	DANIEL MALLY (D)	EARLY EXPANSION UP TO 56 OR 68% DEPENDING ON REGION- 4/1/2010	Adequate
DELAWARE	10	E	7/1/2013	1/1/2014	JACK MARKELL (D)	EARLY EXPANSION UP TO 100% FPL FOR CHILDLESS ADULTS- 1996	Adequate
DISTRICT OF COLUMBIA	11	E	5/13/2010	1/1/2014		EARLY EXPANSION UP TO 200%- 7/1/2010	Adequate
HAWAII	15	E		1/1/2014	NEIL ABERCROMBIE (D)	EARLY EXPANSION UP TO 200% FOR ADULTS MEETING QUEST-ACE ELIGIBILITY- 2/2008; EXPANSION UP TO 133% FOR ALL OTHER ADULTS 4/2012	Adequate
ILLINOIS	17	E	7/22/2013	1/1/2014	PAT QUINN (D)		Adequate
INDIANA	18	E	1/27/2015	2/1/2015			Low
IOWA	19	E	12/12/2013	1/1/2014	TERRY BRANSTAD (R)		Adequate
KENTUCKY	21	E	9/3/2013	1/1/2014	STEVE BESHEAR (D)		Low
LOUISIANA	22	E	1/12/2016	7/1/2016	JOHN BEL EDWARDS (D)		Low
MARYLAND	24	E	5/5/2013	1/1/2014	MARTIN O'MALLEY (D)	EARLY EXPANSION FOR JOBLESS PARENTS-116% FPL	Adequate
MASSACHUSETTS	25	E	7/5/2013	1/1/2014	DEVAL PATRICK (D)	EARLY EXPANSION UP TO 300% FPL- 2006	Adequate
MICHIGAN	26	E	9/16/2013	4/1/2014	RICK SNYDER (R)		Adequate
MINNESOTA	27	E	2/1/2013	1/1/2014	MARK DAYTON (D)	EARLY EXPANSION UP TO 75%- 3/1/2011	Adequate
MONTANA	30	E	4/29/2015	1/1/2016	STEVE BULLOCK (D)		Adequate
NEVADA	32	E	12/1/2012	1/1/2014	BRIAN SANDOVAL (R)		Low
NEW HAMPSHIRE	33	E	3/27/2014	8/15/2014	MAGGIE HASSAN (D)		Adequate
NEW JERSEY	34	E	6/28/2013	1/1/2014	CHRIS CHRISTIE (R)		Adequate
NEW MEXICO	35	E	1/9/2013	1/1/2014	SUSANA MARTINEZ (R)		Adequate
NEW YORK	36	E	6/28/2012	1/1/2014	ANDREW CUOMO (D)	Pre-ACA, childless adults 100% FPL, parents 150% FPL	Adequate
NORTH DAKOTA	38	E	4/1/2013	1/1/2014	JACK DARYMPLE (R)		Adequate
OHIO	39	E	10/21/2013	1/1/2014	JOHN KASICH (R)		Adequate
OREGON	41	E		1/1/2014	JOHN KITZHABER (D)	EARLY EXPANSION UP TO 100% -1994	Adequate
PENNSYLVANIA	42	E	8/28/2014	1/1/2015	TOM CORBETT (R)		Adequate
RHODE ISLAND	44	E	7/3/2013	1/1/2014	LINCOLN CHAFEE (I)		Adequate
VERMONT	50	E	7/1/2012	1/1/2014		EARLY EXPANSION UP TO 300% FPL SINCE 1996	Adequate
WASHINGTON	53	E	6/30/2013	1/1/2014	JAY INSLEE (D)		Adequate
WEST VIRGINIA	54	E	5/1/2013	1/1/2014	EARL RAY TOMBLIN (D)		Adequate
ALABAMA	1	N					Low
FLORIDA	12	N					Adequate
GEORGIA	13	N					Low
IDAHO	16	N		11/1/2018	Little		Low
KANSAS	20	N					Adequate
MAINE	23	E	11/7/2017	1/10/2019	PAUL LEPAGE (R)		Adequate
MISSISSIPPI	28	N					Low
MISSOURI	29	N					Adequate
NEBRASKA	31	N		4/1/2019			Adequate
NORTH CAROLINA	37	N					Low
OKLAHOMA	40	N					Low
SOUTH CAROLINA	45	N					Low
SOUTH DAKOTA	46	N					Adequate
TENNESSEE	47	N					Adequate
TEXAS	48	N					Low
UTAH	49	N		4/1/2019			Low
VIRGINIA	51	E	5/31/2018	1/1/2019	NORTHAM		Adequate
WISCONSIN	55	N					Adequate
WYOMING	56	N					Low

KEY: [blue] *States that will be excluded due to FPL > 138% pre-ACA

REFERENCES:

https://www.kff.org/medicaid/issue-brief/status-of-state-medicaid-expansion-decisions-interactive-map/
https://www.advisory.com/daily-briefing/resources/primers/medicaidmap
https://www.healthaffairs.org/doi/pdf/10.1377/hlthaff.2013.1087
https://www.urban.org/sites/default/files/publication/89536/2001222-aca_medicaid_expansion_led_to_widespread_reductions_in_uninsurance_among_poor_childless_adults.pdf
https://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Waivers/1115/downloads/vt/Global-Commitment-to-Health/vt-global-commitment-to-health-ext-req-cms-01012014-12312018-revised-052013.pdf
https://udspace.udel.edu/bitstream/handle/19716/21429/Overview%20of%20Medicaid%20in%20Delaware.pdf?sequence=1&isAllowed=y
https://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Waivers/1115/downloads/hi/QUEST-Expanded/hi-quest-expanded-ext-app-06292012.pdf
http://vitalysthealth.org/wp-content/uploads/2017/08/Medicaid0817.pdf
https://fas.org/sgp/crs/misc/R43564.pdf
https://data.hrsa.gov/topics/health-workforce/ahrf
https://www.rwjf.org/content/dam/farm/reports/issue_briefs/2011/rwjf69759
https://dhcf.dc.gov/sites/default/files/dc/sites/dhcf/publication/attachments/DCMedicaidAllianceFactSheet.pdf

APPENDIX V

CALCULATION FOR MEAN INCOME >$75,000 GROUP

BRFSS provides income as a categorical variable with the top-end income group open ended ($75,000+). This is problematic since a dollar term is needed to assign top-end BRFSS respondent households to a Federal Poverty Level (FPL) and ACA income group. To estimate the mean income for the greater than $75,000 income group, the following formula was used:

(4) $HINC_{g,t} = HINC_{<75,g,t} + p_{>75,g,t} \bullet Y_{>75,g,t}$

- $HINC_{g,t}$ = mean income for all households in the g-th race/ethnic group in year t (2012-2017)
- $HINC_{<75,g,t}$ = BRFSS sample weighted mean income for households in the g-th group in year t in j-th income category <$75,000
- $p_{>75,g,t}$ = weighted proportion of households in g-th group in year t in income category >$75,000
- $Y_{>75,g,t}$ = mean (imputed) income in g-th group in year t with incomes >$75,000

Solving for the mean income of the top end group:

(5) $Y_{>75,g,t} = \{HINC_{g,t} - HINC_{<75,g,t}\} / p_{>75,g,t}$

Mean income for all households ($HINC_{g,t}$) was taken from the Current Population Survey (CPS) Annual Social and Economic (ASEC) Supplement public data provided by the Bureau of Labor Statistics and the Census Bureau[14]. Mean incomes are available by year and by race/ethnicity. Whites are labeled as "white, non-Hispanic", blacks as; "black only" and Hispanics as; "Hispanics, all races". Top-end mean income (>$75,000) is imputed separately for

[14] Link to reference: https://www.census.gov/data/tables/time-series/demo/income-poverty/cps-finc/finc-01.html

the three race/ethnic groups and by year to account for large differences in mean income.

Mean income ($HINC_{<75,g,t}$) for the seven income categories below \$75,000 was calculated using STATA command "svy: mean" and adjusting for weighted sample proportions by year and race/ethnicity to conform to mean Census incomes ($HINC_{g,t}$) for the entire U.S. population, i.e.,

(6) $HINC_{<75,g,t} = \Sigma p_{j,g,t} \bullet Y_{j,g,t} / \Sigma p_{j,g,t}$

Where $p_{j,g,t}$ = proportions of BRFSS weighted households in the j-th income category (j{1,7}) and $Y_{j,g,t}$ = mid-point value of the j-th BRFSS income category.

Imputed mean income of top end households in the g-th group in year t ($Y_{>75,g,t}$; eq.2), was calculated by, first, subtracting the overall mean income of lower income groups from Census mean income and then dividing the difference by the BRFSS proportion of households with incomes >\$75,000 using STATA "svy: tab". Table 1 displays the results by race and year.

Table V-1.

Calculated Mean Income in the U.S. population by year in the BRFSS dataset. (Note: "Y" is equal to the mean income of the $75K+ group for each racial/ethnic group).

ALL RACES	Mean Income ($HINC_{g,t}$)	Mean Income ($HINC_{<75,g,t}$)	$P_{>75,g,t}$	$Y_{>75,g,t}$
2012	$82,843	$33,166.00	0.2849	$174,366.44
2013	$87,671	$33,033.93	0.2946	$185,461.88
2014	$88,765	$33,339.21	0.3058	$181,248.50
2015	$92,673	$34,215.38	0.3258	$179,427.93
2016	$97,357	$34,080.67	0.3365	$188,042.59
2017	$100,400	$34,119.18	0.3481	$190,407.41
WHITE, NON-HISPANIC				
2012	$86,514	$36,244.15	0.3357	$149,746.35
2013	$96,869	$36,285.35	0.3488	$173,691.66
2014	$99,084	$36,504.06	0.3603	$173,688.43
2015	$102,209	$37,402.71	0.3829	$169,251.21
2016	$107,416	$37,160.76	0.3933	$178,630.16
2017	$110,888	$37,283.12	0.4083	$180,271.57
BLACK				
2012	$55,189	$28,028.96	0.1592	$170,603.27
2013	$58,754	$27,973.41	0.1637	$188,030.48
2014	$60,358	$28,323.19	0.1735	$184,638.67
2015	$64,188	$29,086.57	0.1828	$192,020.95
2016	$67,966	$29,270.67	0.2036	$190,055.65
2017	$69,670	$29,588.43	0.2013	$199,113.61
HISPANIC				
2012	$55,528	$26,938.09	0.1268	$225,472.48
2013	$61,151	$26,640.10	0.1375	$250,988.36
2014	$60,140	$26,689.13	0.1428	$234,249.79
2015	$66,339	$28,239.06	0.1561	$244,073.93
2016	$70,106	$28,281.83	0.1649	$253,633.54
2017	$72,321	$28,382.29	0.1752	$250,791.72

Sources: $HINC_{g,t}$: http:/www.census.gov/data/tables/time-series/demo/income-poverty/cps-finc/finc-01.html ; $HINC_{<75,g,t}$, $p_{>75,g,t}$: BRFSS Annual Surveys.

The mean household income for all races was $100,400 in 2017, a 21% increase over 2012. The contribution of lower income groups to this overall mean was only $34,119 resulting in an imputed top-end income of $190,407 for 34.8% of BRFSS households with incomes >$75,000. Mean Census incomes for blacks and Hispanics were 37% and 35% below that of Whites. The proportion of whites in the BRFSS top-end income group was at least twice that of blacks and Hispanics.

Implications

The likelihood that we will correctly assign 65% of BRFSS respondents in the two less than 400% FPL groups (i.e. Medicaid expansion group and middle-income subsidy groups) should be high. Using the midpoints of fairly narrow income categories, we should know their income levels within a narrow range. Moreover, the FPL level even for a household of 14 persons was $66,400 in 2017, a figure somewhat below the $5,00 threshold for the top-end category that must be imputed. Finally, there is no need to adjust for race/ethnicity for household incomes <$75,000 as BRFSS respondents are reporting incomes within a narrow range as well as their race/ethnicity status.

The need to adjust for race/ethnicity becomes important in imputing incomes >$75,000 given differences in imputed mean incomes in these groups. The effect of using three different top-end income levels will be to increase slightly the mean household incomes for blacks and Hispanics relative to whites (as shown in Table 1, last column). This is counterintuitive until one realizes that minorities are less than one-half as likely to report incomes >$75,000.

Counteracting these high imputed top-end incomes will be systematic differences in family size by race/ethnicity. The average Hispanic household size is 3.25 people, with black households averaging 2.51 people; and white households averaging 2.37 people according to the 2017 U.S. Census Bureau[15]. Assuming these differences in family size are similar among BRFSS respondents, household total incomes will be reduced by 1/3.25 for Hispanics, ½.51 for blacks, and ½.37 for whites. Further assuming that family size differences are consistent throughout the income range, the per person top-end income for whites in 2017 will be $76,037 compared with $79,283 for blacks and $77,166 for Hispanics. And the still-higher figures for minorities will be applied to a much smaller proportion of top-end households. Hence, minorities will be even more common in the

[15] Link to U.S. Census Bureau household sizes as of 2017: http://demomemo.blogspot.com/2018/02/household-size-by-race-and-hispanic.html

lower two ACA income groups.

In sum, blacks and Hispanics should fall disproportionately into the lower two ACA income categories as they are far more likely than whites to report incomes <$75,000. This effect is reinforced by their larger family sizes. Offsetting these effects to a very minor degree might be higher imputed incomes for minorities in the top-end income group of BRFSS if they continue to report the same relative family sizes.

APPENDIX W

U.S. POVERTY GUIDELINES: 2012-2017

Table W-1.

The 2017 Poverty Guidelines. (Source: https://aspe.hhs.gov/2017-poverty-guidelines).

2017 Poverty Guidelines for the 48 Contiguous States and the District of Columbia	
Persons in Family/Household	Poverty Guideline
1	$12,060
2	$16,240
3	$20,420
4	$24,600
5	$28,780
6	$32,960
7	$37,140
8	$41,320
9	$45,500
10	$49,680
11	$53,860
12	$58,040
13	$62,220
14	$66,400
For familes/households with more than 8 persons, add $4,180 for each additional person	
Alaska	
Persons in Family/Household	Poverty Guideline
1	$15,060
2	$20,290
3	$25,520
4	$30,750
5	$35,980
6	$41,210
7	$46,440
8	$51,670
9	$56,900
10	$62,130
11	$67,360
12	$72,590
13	$77,820
14	$83,050
For families/households with more than 8 persons, add $5,230 for each additional person	
Hawaii	
Persons in Family/Household	Poverty Guideline
1	$13,860
2	$18,670
3	$23,480
4	$28,290
5	$33,100
6	$37,910
7	$42,720
8	$47,530
9	$52,340
10	$57,150
11	$61,960
12	$66,770
13	$71,580
14	$76,390
For families/households with more than 8 persons, add $4,810 for each additional person	

Table W-2.

The 2016 Poverty Guidelines. (Source: https://www.peoplekeep.com/blog/2016-federal-poverty-level-fpl-guidelines).

2016 Poverty Guidelines for the 48 Contiguous States and the District of Columbia	
Persons in Family/Household	Poverty Guideline
1	$11,880
2	$16,020
3	$20,160
4	$24,300
5	$28,440
6	$32,580
7	$36,730
8	$40,890
9	$45,050
10	$49,210
11	$53,370
12	$57,530
13	$61,690
14	$65,850
For familes/households with more than 8 persons, add $4,160 for each additional person	
Alaska	
Persons in Family/Household	Poverty Guideline
1	$14,840
2	$20,020
3	$25,200
4	$30,380
5	$35,560
6	$40,740
7	$45,920
8	$51,120
9	$56,320
10	$61,520
11	$66,720
12	$71,920
13	$77,120
14	$82,320
For families/households with more than 8 persons, add $5,200 for each additional person	
Hawaii	
Persons in Family/Household	Poverty Guideline
1	$13,670
2	$18,430
3	$23,190
4	$27,950
5	$32,710
6	$37,470
7	$42,230
8	$47,010
9	$51,790
10	$56,570
11	$61,350
12	$66,130
13	$70,910
14	$75,690
For families/households with more than 8 persons, add $4,780 for each additional person	

Table W-3.

The 2015 U.S. Poverty Guidelines. (Source: https://aspe.hhs.gov/2015-poverty-guidelines)

2015 Poverty Guidelines for the 48 Contiguous States and the District of Columbia	
Persons in Family/Household	Poverty Guideline
1	$11,770
2	$15,930
3	$20,090
4	$24,250
5	$28,410
6	$32,570
7	$36,730
8	$40,890
9	$45,050
10	$49,210
11	$53,370
12	$57,530
13	$61,690
14	$65,850
For familes/households with more than 8 persons, add $4,160 for each additional person	
Alaska	
Persons in Family/Household	Poverty Guideline
1	$14,720
2	$19,920
3	$25,120
4	$30,320
5	$35,520
6	$40,720
7	$45,920
8	$51,120
9	$56,320
10	$61,520
11	$66,720
12	$71,920
13	$77,120
14	$82,320
For families/households with more than 8 persons, add $5,200 for each additional person	
Hawaii	
Persons in Family/Household	Poverty Guideline
1	$13,550
2	$18,330
3	$23,110
4	$27,890
5	$32,670
6	$37,450
7	$42,230
8	$47,010
9	$51,790
10	$56,570
11	$61,350
12	$66,130
13	$70,910
14	$75,690
For families/households with more than 8 persons, add $4,780 for each additional person	

Table W-4.

The 2014 U.S. Poverty Guidelines. (Source: https://aspe.hhs.gov/2014-poverty-guidelines)

2014 Poverty Guidelines for the 48 Contiguous States and the District of Columbia	
Persons in Family/Household	Poverty Guideline
1	$11,670
2	$15,730
3	$19,790
4	$23,850
5	$27,910
6	$31,970
7	$36,030
8	$40,090
9	$44,150
10	$48,210
11	$52,270
12	$56,330
13	$60,390
14	$64,450
For familes/households with more than 8 persons, add $4,060 for each additional person	
Alaska	
Persons in Family/Household	Poverty Guideline
1	$14,580
2	$19,660
3	$24,740
4	$29,820
5	$34,900
6	$39,980
7	$45,060
8	$50,140
9	$55,220
10	$60,300
11	$65,380
12	$70,460
13	$75,540
14	$80,620
For families/households with more than 8 persons, add $5,080 for each additional person	
Hawaii	
Persons in Family/Household	Poverty Guideline
1	$13,420
2	$18,090
3	$22,760
4	$27,430
5	$32,100
6	$36,770
7	$41,440
8	$46,110
9	$50,780
10	$55,450
11	$60,120
12	$64,790
13	$69,460
14	$74,130
For families/households with more than 8 persons, add $4,670 for each additional person	

Table W-5.

The 2013 Poverty Guidelines. (Source: https://aspe.hhs.gov/2013-poverty-guidelines).

2013 Poverty Guidelines for the 48 Contiguous States and the District of Columbia	
Persons in Family/Household	Poverty Guideline
1	$11,490
2	$15,510
3	$19,530
4	$23,550
5	$27,570
6	$31,590
7	$35,610
8	$39,630
9	$43,650
10	$47,670
11	$51,690
12	$55,710
13	$59,730
14	$63,750
For familes/households with more than 8 persons, add $4,020 for each additional person	
Alaska	
Persons in Family/Household	Poverty Guideline
1	$14,350
2	$19,380
3	$24,410
4	$29,440
5	$34,470
6	$39,500
7	$44,530
8	$49,560
9	$54,590
10	$59,620
11	$64,650
12	$69,680
13	$74,710
14	$79,740
For families/households with more than 8 persons, add $5,030 for each additional person	
Hawaii	
Persons in Family/Household	Poverty Guideline
1	$13,230
2	$17,850
3	$22,470
4	$27,090
5	$31,710
6	$36,330
7	$40,950
8	$45,570
9	$50,190
10	$54,810
11	$59,430
12	$64,050
13	$68,670
14	$73,290
For families/households with more than 8 persons, add $4,620 for each additional person	

Table W-6.

The 2012 U.S. Poverty Guidelines. (Source: https://aspe.hhs.gov/2012-hhs-poverty-guidelines)

2012 Poverty Guidelines for the 48 Contiguous States and the District of Columbia	
Persons in Family/Household	Poverty Guideline
1	$11,170
2	$15,130
3	$19,090
4	$23,050
5	$27,010
6	$30,970
7	$34,930
8	$38,890
9	$42,850
10	$46,810
11	$50,770
12	$54,730
13	$58,690
14	$62,650
For familes/households with more than 8 persons, add $3,960 for each additional person	
Alaska	
Persons in Family/Household	Poverty Guideline
1	$13,970
2	$18,920
3	$23,870
4	$28,820
5	$33,770
6	$38,720
7	$43,670
8	$48,620
9	$53,570
10	$58,520
11	$63,470
12	$68,420
13	$73,370
14	$78,320
For families/households with more than 8 persons, add $4,950 for each additional person	
Hawaii	
Persons in Family/Household	Poverty Guideline
1	$12,860
2	$17,410
3	$21,960
4	$26,510
5	$31,060
6	$35,610
7	$40,160
8	$44,710
9	$49,520
10	$54,330
11	$59,140
12	$63,950
13	$68,760
14	$73,570
For families/households with more than 8 persons, add $4,810 for each additional person	

APPENDIX X

HANDLING SINGLE PRIMARY SAMPLING UNITS (PSU) IN BRFSS

The years 2012 to 2017 BRFSS datasets were concatenated for this study. BRFSS documentation offers complex survey weighting to make the sample representative of the U.S. population. The problems with using this weighting in STATA 15 includes:

1. BRFSS data need to be weighted to assure that analytic statistics (e.g. means, coefficients) conform to the national sample. Data must be reweighted due to the complex 2-level sampling, first by PSU, then by stratum, including those with a single PSU.
2. BRFSS documentation does not provide example weighting codes for STATA. STATA 15 can produce general statistics like means, medians, etc., but cannot produce variances and, hence, inference statistics (eg., chi2, t-stats) if any single PSU is within a stratum. This is because, even if several households are in the stratum, the weighting is required to have 2+ PSU's to properly adjust the weights and preserve the extent of the variance.
3. Very small PSU's may not be able to support more than 1 stratum.
4. A way to get around this problem was to: (1) identify all the single PSU's and delete them; or (2) move the single PSU's to a different stratum; or (3) use the STATA command "singleunit (*method*)" with the svyset STATA command.

Initially, the STATA command "svydescribe" was used to identify all single PSU's, but even after deleting them, in later analyses rogue singletons were found. Therefore, the automatic command was the preferred method. The STATA manual provides four methods (i.e. missing, certainty, scaled or centered) to handle strata with one sampling unit[16]. For this analysis, the

[16] Link to STATA Manual: https://www.stata.com/manuals13/svysvyset.pdf

STATA command “singleunit (scaled)” was used; which uses the average of variances from the strata with multiple sampling units for each stratum with 1 PSU. The STATA weighting code that was used for all analyses was:

```
svyset _psu [pweight= _llcpwt], strata (_ststr) singleunit (scaled)
```

Refer to the STATA manual for additional information on commands for handling single PSUs.

APPENDIX Y

BRFSS NON-REPORTED INCOMES DROPPED FROM SAMPLE

Income was the only variable that had greater than >5% of observations missing, for a total of 428,289 observations being dropped in a 2,765,318 observation sample. To gain a better understanding of who was being dropped, non-reported income respondents were weighted and cross-tabulated by race and education. Since the relationship between education and income is strong, Table 27 gives an approximation of who was being dropped from the national sample.

Table Y-1.

Sample of Non-reported Incomes (n=428,289) for Whites, Blacks, Hispanics and Other Races from Full BRFSS sample (n=2,765,318).

2012-2017 BRFSS Non-reported Incomes					
	Whites, %	**Blacks, %**	**Hispanics, %**	**Other, %**	**Total, %**
	Weighted	Weighted	Weighted	Weighted	Weighted
Less than HS	7.76	2.78	7.05	1.55	19.14
HS Grad	20.61	4.43	4.51	3.28	32.84
Some College	18.89	3.26	3.07	3.57	28.8
College Grad	12.87	1.35	1.14	3.85	19.22
Total	60.13	11.82	15.77	12.25	100

The majority of respondents who did not report an income where white (60.13%), which is expected given whites are the largest racial/ethnic group in the sample. Interestingly, the distribution of whites, blacks and Hispanics in Table 27, resemble those of the national sample (with the missing income variables dropped), 64.14%, 11.59% and 15.32%; respectively. This would lead us to believe that the non-reported income variables are missing at random.

APPENDIX Z

CURVILINEAR FUNCTION GOODNESS OF FIT CALCULATIONS

In order to determine if the curvilinear functions accurately estimate post-ACA insurance values, pre-ACA values of percent insured were inserted into the appropriate curvilinear function equation. The five states with the lowest pre-ACA percent insured were used and are displayed below in Table 26 in the text. Refer to the text for the interpretation of the results.

Texas

All states Equation:

$Y=25 + 0.942(66.53)- 0.0021 (66.53)^2$

$Y= 25 + 62.67 -9.30$

Y= 78.37 | Actual 73.75

Non-expansion state equation:

$Y= -0.0073x^2 + 1.91x -21$

$Y= -0.0073 (66.53)^2 + 1.91 (66.53) -21$

$Y= -32.31 + 127.07 -21$

Y= 73.76 | Actual: 73.75

Arkansas

All State Equation:

$Y=25 + 0.942(70.99)- 0.0021 (70.99)^2$

$Y= 25 + 66.87 – 10.58$

Y= 81.29 | Actual: 86.06

Expansion Equation:

$Y= 0.0243x^2 -3.5453x + 216$

$Y= 0.0243 (70.99)^2 -3.5453(70.99) + 216$

Y= 122.46 – 251.68 + 216

Y = 86.78 | Actual: 86.06

<u>Nevada</u>

All State Equation:

$Y=25 + 0.942(71.14)- 0.0021 (71.14)^2$

Y=25 + 67.01 – 10.63

Y= 81.38 | Actual 90.04

Expansion Equation:

$Y= 0.0243x^2 -3.5453x + 216$

$Y= 0.0243 (71.14)^2 -3.5453(71.14) + 216$

Y= 122.98 – 252.21 + 216

Y= 86.77 | Actual 90.04

Florida

All State Equation:

$Y=25 + 0.942(72.63)- 0.0021 (72.63)^2$

Y= 25+ 68.42-11.08

Y = 82.34 | Actual: 79.82

Non-expansion state equation:

$Y= -0.0073x^2 + 1.91x -21$

$Y= -0.0073 (72.63)^2 + 1.91 (72.63) -21$

Y=-38.51 + 138.72 -21

Y= 79.21 | Actual 79.82

<u>Mississippi</u>

All State Equation:

$Y=25 + 0.942(72.72)- 0.0021 (72.72)^2$

$Y= 25+ 68.50 – 11.11$

Y= 82.39 | Actual: 78.88

Non-expansion state equation:

$Y= -0.0073x^2 + 1.91x -21$

$Y= -0.0073 (72.72)^2 + 1.91 (72.72) -21$

$Y= -38.60 + 138.90 – 21$

Y = 79.3 | Actual: 79.3

APPENDIX AA

BRFSS DESCRIPTIVE STATISTICS BY TIME: 2012-2017

Table AA-1.

Mean Changes for Predictor and Control Variables by Time for 19-state Non-expansion Group.

	2012	2013	2014	2015	2016	2017	Pre ACA	Post ACA	P Value
Variables	n=89,949	n=102,209	n=92,004	n=84,656	n=86,727	n=88,577	n=192,158	n=351,964	X^2
Demographics									
Income									
>400% FPL	35.15	36.32	33.06	34.48	35.99	36.72	35.73	35.07	p<0.05
139-400% FPL	37.08	36.63	41.48	41.65	41.91	41.30	36.85	41.58	p<0.001
100-138% FPL	9.29	9.14	8.71	8.52	8.26	8.10	9.22	8.40	p<0.001
<100% FPL	18.48	17.91	16.75	15.35	13.85	13.88	18.20	14.95	p<0.001
Race									
Whites	66.10	65.72	66.36	65.48	65.51	65.31	65.91	65.67	0.4162
Blacks	17.41	17.29	17.13	17.33	16.92	17.20	17.35	17.15	0.3875
Hispanics	16.49	16.99	16.50	17.19	17.56	17.49	16.74	17.19	0.1073
Education									
<HS	13.35	13.78	13.26	12.71	12.58	11.88	13.56	12.60	-
HS Grad	28.51	28.04	28.30	28.01	27.95	27.85	28.28	28.03	-
Some College	32.45	32.67	33.02	33.12	32.76	33.36	32.56	33.07	-
College Grad	25.70	25.51	25.42	26.16	26.72	26.91	25.60	26.30	p<0.001
Age									
18 to 34	34.48	34.39	34.88	34.76	35.69	35.34	34.44	35.17	-
35 to 44	21.70	21.19	21.26	21.43	21.00	21.51	21.45	21.30	-
45 to 54	23.71	23.63	22.88	22.44	21.96	21.61	23.67	22.22	-
55 to 64	20.11	20.78	20.99	21.37	21.35	21.55	20.44	21.31	p<0.001
Sex									
Male	51.77	51.39	51.61	51.89	52.07	51.80	51.58	51.84	-
Female	48.23	48.61	48.39	48.11	47.93	48.20	48.42	48.16	0.368
Health									
Diabetes Status									
No/Low Risk	58.75	54.68	57.39	53.71	55.84	53.10	56.74	55.01	p<0.001
High Risk	33.00	37.02	34.22	37.95	35.77	38.37	34.99	36.58	p<0.001
Diabetes	8.25	8.30	8.39	8.33	8.40	8.54	8.28	8.42	p<0.001
Chronic Disease									
0	80.71	80.26	80.36	80.25	80.35	80.03	80.49	80.25	-
1	15.27	15.92	15.73	15.99	15.93	15.93	15.59	15.89	-
2	3.19	2.93	3.07	2.93	2.97	3.15	3.06	3.03	-
3	0.65	0.70	0.67	0.66	0.63	0.68	0.68	0.66	-
4	0.15	0.14	0.16	0.15	0.10	0.20	0.15	0.16	-
5	0.04	0.03	0.00	0.01	0.01	0.02	0.03	0.01	p<0.05
Self Reported Health									
Healthy	82.90	82.89	83.10	83.61	83.57	82.61	82.90	83.22	-
Unhealty	17.10	17.11	16.90	16.39	16.43	17.39	17.10	16.78	0.1507
State Level									
PCP Supply									
Adequate	44.06	43.29	44.7	45.1	43.27	43.09	43.68	44.03	-
Low	55.94	56.71	55.30	54.90	56.73	56.91	56.32	55.97	0.1132

Table AA-2.

Mean Changes for Predictor and Control Variables by Time for 28-state Expansion Group.

Variables	2012 n=135,522	2013 n=130,865	2014 n=120,861	2015 n=106,506	2016 n=128,019	2017 n=117,642	Pre ACA n=266,387	Post ACA n=473,028	P Value X^2
Demographics									
Income									
>400% FPL	39.70	40.87	37.29	40.31	40.85	42.56	40.29	40.26	0.9162
139-400% FPL	33.62	33.17	38.36	37.38	37.46	36.51	33.39	37.42	p<0.001
100-138% FPL	8.40	8.11	7.83	7.80	7.40	7.44	8.25	7.61	p<0.001
<100% FPL	18.29	17.85	16.53	14.51	14.30	13.49	18.07	14.70	
Race									
Whites	69.60	69.80	70.64	69.90	68.56	68.84	69.70	69.48	0.3327
Blacks	11.39	11.03	11.15	11.10	11.31	11.38	11.21	11.24	0.8513
Hispanics	19.01	19.16	18.20	19.00	20.13	19.78	19.09	19.28	0.1073
Education									
<HS	13.52	13.84	13.02	12.52	12.84	12.40	13.68	12.70	-
HS Grad	27.71	27.46	27.75	27.52	27.43	27.50	27.59	27.55	-
Some College	32.15	32.24	32.14	32.19	32.21	32.20	32.19	32.18	-
College Grad	26.61	26.47	27.10	27.76	27.51	27.90	26.54	27.57	p<0.001
Age									
18 to 34	34.59	34.53	34.41	35.07	5.53	34.75	34.56	34.94	-
35 to 44	21.15	20.34	20.75	20.58	20.69	20.88	20.74	20.73	-
45 to 54	23.77	23.80	23.29	22.73	21.96	21.91	23.78	22.46	-
55 to 64	20.49	21.33	21.55	21.62	21.82	22.46	20.91	21.87	p<0.001
Sex									
Male	51.80	51.79	51.81	52.07	52.25	51.83	51.80	51.99	-
Female	48.20	48.21	48.19	47.93	47.75	48.17	48.20	48.01	0.385
Health									
Diabetes Status									
No/Low Risk	60.37	57.78	58.86	56.97	58.88	55.69	59.07	57.60	p<0.001
High Risk	32.14	34.98	33.60	35.74	33.73	36.78	33.56	34.96	p<0.001
Diabetes	7.49	7.25	7.54	7.30	7.39	7.53	7.37	7.44	0.5237
Chronic Disease									
0	80.09	79.54	79.50	80.74	79.95	79.88	79.81	80.01	-
1	16.46	17.12	16.93	15.89	16.46	16.50	16.79	16.45	-
2	2.67	2.73	2.85	2.71	2.78	2.92	2.70	2.82	-
3	0.68	0.53	0.64	0.57	0.69	0.55	0.60	0.61	-
4	0.09	0.08	0.07	0.08	0.12	0.14	0.09	0.10	-
5	0.02	0.00	0.01	0.01	0.02	0.01	0.01	0.01	0.0968
Self Reported Health									
Healthy	83.92	83.86	84.16	84.64	84.32	83.75	83.89	84.21	-
Unhealty	16.08	16.14	15.84	15.36	15.68	16.25	16.11	15.79	0.0626
State Level									
PCP Supply									
Adequate	84.54	84.86	83.94	84.65	84.65	84.33	84.70	84.39	-
Low	15.46	15.14	16.06	15.35	15.35	15.67	15.30	15.61	p<0.01

APPENDIX AB

BRFSS OUTCOME VARIABLES BY TIME: 2012-2017

Table AB-1.

Percent Insured by Income Group and Time for Full Analtyic Sample (50 States and D.C.).

Mean INS by Income and Time (50 States)											
		2012	2013	2014	2015	2016	2017	Pre ACA	Post ACA	Growth Rate	P Value
Mean (INS)	BRFSS Sample	Weighted %								(Post/Pre ACA)	X^2
U.S. Income Groups											
>400% FPL	105,863	94.56	94.91	95.97	95.95	96.00	95.67	94.73	95.89	1.22%	p<0.001
139-400% FPL	87,251	76.70	76.99	82.71	84.31	85.14	83.50	76.85	83.91	9.19%	p<0.001
100-138% FPL	18,751	60.63	63.19	71.75	75.29	73.33	75.73	61.89	74.00	19.57%	0.4793
<100% FPL	32,084	54.14	56.90	64.40	68.18	70.81	70.90	55.50	68.37	23.19%	p<0.001
Analytic Sample											
All 50 States	243,949	78.03	79.34	83.56	85.67	86.50	86.16	84.14	89.49	6.36%	p<0.001

Table AB-2.

Mean PCP or Checkup in Past Year by Race and Year for Full Analytic Sample.

Mean Health Care Access by Race and Time (50 States)											
	2012		2013	2014	2015	2016	2017	Pre ACA	Post ACA	Growth Rate	P Value
	BRFSS Sample	Weighted %								(Post/Pre ACA)	X^2
Mean (PCP)											
U.S. Race/Ethnic Groups											
Whites	199,386	79.26	77.69	78.09	78.95	78.58	77.54	78.48	78.28	-0.25%	p<0.001
Blacks	24,977	72.73	71.86	74.60	75.04	75.64	75.21	72.30	75.12	3.90%	p<0.01
Hispanics	19,586	58.65	56.95	58.58	61.33	60.54	60.59	57.80	60.27	4.27%	p<0.001
Analytic Sample											
All 50 States	243,949	74.70	73.16	74.23	75.24	74.77	74.06	73.93	74.57	0.87%	p<0.001
Mean (Checkup)											
U.S. Race/Ethnic Groups											
Whites	199,386	62.31	63.24	64.54	64.44	65.34	64.04	62.77	64.59	2.90%	p<0.01
Blacks	24,977	73.21	73.94	75.99	75.48	76.56	76.62	73.57	76.17	3.53%	0.7143
Hispanics	19,586	56.01	58.36	59.86	59.73	60.95	60.01	57.19	60.15	5.18%	p<0.01
Analytic Sample											
All 50 States	243,949	62.67	63.78	65.27	65.08	66.01	65.00	63.23	65.34	3.34%	p<0.001

Table AB-3.

Mean PCP or Checkup in the Past Year by Diabetes Risk and Year for Full Analytic Sample.

Mean Health Care Access by Diabetes Risk and Time (50 States)											
		2012	2013	2014	2015	2016	2017	Pre ACA	Post ACA	Growth Rate	P Value
	BRFSS Sample	Weighted %								(Post/Pre ACA)	X^2
Mean (PCP)											
U.S. Diabetes Risk											
No/Low Risk	144,428	73.00	71.43	72.06	73.30	72.48	71.82	72.24	72.40	0.22%	p<0.001
High Risk	77,818	74.47	72.69	74.35	74.78	74.99	73.81	73.54	74.47	1.26%	p<0.001
Diabetes	21,703	88.93	88.25	89.94	91.47	91.01	90.78	88.60	90.79	2.47%	p<0.01
Analytic Sample											
All 50 States	243,949	74.70	73.16	74.23	75.24	74.77	74.06	73.93	74.57	0.87%	p<0.001
Mean (Checkup)											
U.S. Diabetes Risk											
No/Low Risk	144,428	60.36	61.58	62.77	62.76	63.50	62.34	60.95	62.85	3.12%	p<0.001
High Risk	77,818	62.71	63.37	65.27	64.53	66.04	64.93	63.05	65.18	3.38%	p<0.001
Diabetes	21,703	80.42	82.18	83.87	84.52	84.72	83.89	81.29	84.24	3.63%	0.1376
Analytic Sample											
All 50 States	243,949	62.67	63.78	65.27	65.08	66.01	65.00	63.23	65.34	3.34%	p<0.001

APPENDIX AC

BRFSSS DESCRIPTIVE STATISTICS 2013 VS. 2017

Up to this point, focus has been placed on changes in outcomes that led to an increase in insurance and health care access in the pre vs. post-ACA periods. Here, descriptive statistics were run for the last pre-ACA year (2013) vs. the last post-ACA (2017), with an emphasis placed on changes in outcomes among the uninsured, and those who continue to have limited access to health care services. This appendix is important to consider given that even without insurance, individuals still have access to a PCP, as seen in some subgroups in **Table 39**. Among the uninsured, 40% of respondents reported having a PCP in 2013, with 38% reporting having a PCP in 2017 (**Table AC-1**). Given the high percentage of uninsured with a PCP, one would think the U.S. primary care has the capacity to treat the uninsured. However, the number of uninsured individuals who report a PCP (40%, n=38,151 in 2013) is averaged for the nation and does not consider regional/state differences. The 40% of the uninsured with a PCP accounts 3.6% of the U.S. white, black and Hispanic adult population aged 18-64 in 2013 (~ 30 million people). The three outcomes of interest, (i.e. the uninsured, report of no PCP and report of no checkup in the past year) were stratified in more complex analytic tables by race, income, diabetes risk status and state expansion status in 2013 vs. 2017 to gain a better understanding of how the ACA impacted specific subgroups.

Table AC-1.

Percent PCP for Uninsured by Year (47-state Analytic Sample). (Sample size of uninsured is 164,779 respondents aged 18-64 who are white, black or Hispanic).

		% PCP (Yes, Provider)																	
		2012			2013			2014			2015			2016			2017		
INSURANCE	**SAMPLE**	NEXP	EXP	TOTAL	NEXP	EXP	TOTAL	NEXP	EXP	TOTAL	NEXP	EXP	TOTAL	NEXP	EXP	TOTAL	NEXP	EXP	TOTAL
	n	16,038	21,535	37,573	18,469	19,682	38,151	12,921	12,271	25,192	10,521	9,076	19,597	11,534	10,114	21,648	12,361	10,257	22,618
Uninsured	164,779	40.24	41.60	40.99	39.19	40.37	39.84	37.86	40.22	39.06	37.53	42.40	39.89	38.89	41.01	39.92	35.74	40.99	38.21

Changes in Outcomes by Diabetes Risk and by Race. In 2013, the weighted sample size included 147,246,499 whites, blacks and Hispanics aged 18-64. The weighted sample size in 2017 was 146,120,516, a difference of 0.8% (**Table AC-2**). To note, there was a decline of about 30,000 observations in the unweighted sample from 2013 to 2017; however, weighting adjusts the sample to be aligned with what is known about the population, which keeps the imputed total sample representative. The difference in the sampling distributions of the uninsured in both year groups was statistically significant ($p<0.001$) with a 33% decrease in the rate of being uninsured post ACA implementation. The availability of additional insurance options post ACA, in conjunction with the insurance mandate led to an increase in the number insured. The greatest decrease in the rate of being uninsured was seen among whites (37.3%), then blacks (36.8%). This is interesting as minorities were expected to have the greatest gains, given their lower income status when compared to whites. Whites may be benefiting even more so from the insurance subsidies, than minorities are.

In terms of health care access, differences in the sampling distributions of having a PCP or having a checkup at 1 year were statistically significant ($p<0.05$ and $p<0.001$, respectively). There was a 3.4% decrease in the report of not having a PCP, where blacks reported the greatest gains in obtaining a PCP post ACA implementation (11.9%). There was also a 3.4% decrease in the report of not having a checkup in the past year, with blacks also reporting the greatest gains in having a yearly checkup (10.3%). To note, whites had the greatest uptake in insurance, but did not increase their rate of obtaining a PCP or having a yearly checkup. Despite the uptake in insurance coverage, ACA coverage expansion legislation did does not have a direct effect on having a provider or receiving a checkup in the past year, therefore, the percent change in insurance coverage and in health care access will not be 1:1. Additional factors need to be considered with health care access, including, primary care provider supply, individual health status and individual demographics in order to see an increase in behaviors that lead to an increase in health care access. However, blacks were the racial/ethnic group that increased their report of having a PCP and attending a yearly checkup post ACA implementation. As stated earlier, this could be due to minorities living within urban areas with greater resources than in rural areas which are mainly occupied by whites.

Table AC-2 is then broken out into **Table AC-3** and **Table AC-4**, differentiating between non-expansion and Medicaid expansion groups. Medicaid expansion states had the greatest overall decrease in the report of being uninsured (41.9%, $p<0.001$ vs. 23.6%, $p<0.001$) (**Tables AC-2** and **AC-4**). In non-expansion states, the uninsured rate of blacks decreased by 28.1%, compared to a decrease of 24.6% in whites and a decrease of 21.2% in Hispanics. Minorities are showing large declines in being uninsured within non-expansion states due to the availability of insurance subsides. Blacks and whites had the greatest decrease in the report of being uninsured in Medicaid expansion states, with a percent change of -48%. The almost 20 percentage-point difference in the report of being uninsured for blacks and whites in Medicaid expansion states over non-expansion states is most likely due to an increase in Medicaid enrollment. Therefore, Medicaid expansion was needed in order for states to see a decrease in the report of no provider or no checkup in the past year. In Medicaid expansion states, changes in the report of health care access variables from 2013 to 2017 was statistically significant; whereas, in non-expansion states, the changes in the report of a PCP or a checkup in the past year from 2013 to 2017 was not statistically significant ($p=0.38$ vs. $p=0.95$, respectively).

Table AC-2.

Percent Change in Insurance, Health Care Access and Health Status by Race in All U.S. States from 2013 to 2017.

All States													
	Pre ACA				Post ACA				Percent Change				
	2013				2017				2013 to 2017				p
Sample Size	Whites	Blacks	Hispanics	Total	Whites	Blacks	Hispanics	Total	White	Blacks	Hispanics	Total	
Unweighted	203,958	23,913	21,001	248,872	174,642	20,869	21,145	216,656	-14.4%	-12.7%	0.7%	-12.9%	
Weighted	100,951,827	19,628,949	26,665,722	147,246,499	98,917,460	19,911,112	27,291,943	146,120,516	-2.0%	1.4%	2.3%	-0.8%	
Outcomes													
Uninsured	15.0	25.4	38.7	20.7	9.4	16.1	28.4	13.8	-37.3%	-36.8%	-26.7%	-33.0%	<0.001
No PCP	22.3	28.1	43.1	26.8	22.5	24.8	39.4	25.9	0.7%	-11.9%	-8.5%	-3.4%	<0.05
No Checkup	36.8	26.1	41.6	36.2	36.0	23.4	40.0	35.0	-2.2%	-10.3%	-4.0%	-3.4%	<0.001
Diabetes Risk													
High Risk	33.1	42.9	40.1	35.6	34.6	43.4	42.6	37.3	4.7%	1.3%	6.2%	4.7%	<0.001
Diabetes													
Diabetes Diagnosis	6.6	10.9	9.1	7.6	6.8	11.6	9.2	7.9	3.4%	6.5%	0.4%	3.7%	0.0812

Notes:
1. Analtyic sample: All BRFSS respondents aged 18-64 who are white, Hispanic or black living in the U.S., proportions weighted by sampling fractions
2. Proportions are rounded and may not add up to 100
3. P value column: Pearson Chi-squre tests to assess differences in sample distribution between characteristic of interest and year (2013 vs. 2017)

Health Status. Overall, the high risk for diabetes group increased post ACA implementation (4.7%, p<0.001) (**Table AC-2**). Blacks had the highest proportions of individuals at high risk for diabetes in 2013 and 2017, with Hispanics closely behind; however, Hispanics had the greatest increase (6.2%) in the proportion of individuals at high risk, when compared to whites (4.7%) or blacks (1.3%). Despite the increase in the number of Hispanics at high risk for diabetes, blacks had the greatest increase in the number of individuals with diabetes (6.5%). Whites and Hispanics also saw increases (3.4% and 0.4%, respectively). Although report of diabetes increased in 2017, this increase was not statistically significant (3.7%, p=0.08).

In non-expansion states, a greater proportion of individuals were at high risk for diabetes pre and post ACA (37% vs. 38%), than in Medicaid expansion states (35% vs. 37%). Interestingly, there was an increase in the proportion of high-risk individuals in Medicaid expansion states, when compared to the increase in non-expansion states (5.3% vs. 3.5%). This may be due to increased access to preventive care, where individuals would be screened for their high-risk status. Strikingly, there was a 1.4% decrease in the proportion of blacks who were at high risk for diabetes from 2013-2017 in non-expansion states (**Table AC-3**). Better utilization of the health care system could be one reason for the decrease in high risk status among blacks, since they would be more aware of their actual health status. Further analytic tables are needed to discern what is causing the decrease in the high-risk group among blacks in **Table AC-3**.

As increases in diabetes risk occurred post ACA, increases in the report of a diabetes diagnosis also occurred from 2013 to 2017 (**Table AC-4**). In Medicaid expansion states, there was a greater increase in the report of diabetes (3.8%), when compared to the report of diabetes in non-expansion states (3.0%). The greater increase in diabetes in expansion states may be attributed to more individuals being aware of their health status do to an increase in the proportions of individuals who gained insurance. Overall, in both expansion groups, pre/post changes in diabetes were not statistically significant. The next set of tables that follow will stratify diabetes risk and the report of diabetes diagnosis with the outcomes of interest- insurance and health care access.

Table AC-3.

Percent Change in Insurance, Health Care Access and Health Status by Race in the U.S. Non-expansion States from 2013 to 2017.

Non-expansion States													
	Pre ACA				**Post ACA**				**Percent Change**				
	2013				2017				2013 to 2017				p
Sample Size	Whites	Blacks	Hispanics	Total	Whites	Blacks	Hispanics	Total	White	Blacks	Hispanics	Total	
Unweighted	76,368	11,910	7,260	95,538	65,190	9,387	7,106	81,683	-14.6%	-21.2%	-2.1%	-14.5%	
Weighted	36,338,024	9,631,114	9,675,857	55,644,995	37,227,394	9,915,450	10,318,798	57,461,642	2.4%	3.0%	6.6%	3.3%	
Outcomes													
Uninsured	17.4	28.6	47.0	24.5	13.1	20.6	37.0	18.7	-24.6%	-28.1%	-21.2%	-23.6%	p<0.001
No PCP	25.4	30.1	47.2	26.8	26.3	29.1	46.7	25.9	3.5%	-3.4%	-1.1%	-3.4%	0.3753
No Checkup	36.2	26.4	42.5	35.6	36.8	24.2	42.1	35.6	1.6%	-8.3%	-1.1%	-0.1%	0.9452
Diabetes Risk													
High Risk	34.3	43.8	40.4	37.0	35.7	43.2	43.0	38.3	4.1%	-1.4%	6.3%	3.5%	p<0.05
Diabetes													
Diabetes Diagnosis	7.3	11.1	9.0	8.3	7.4	12.2	9.0	8.5	1.2%	9.8%	0.0%	3.0%	0.3755

Notes:
1. Analtyic sample: All BRFSS respondents aged 18-64 who are white, Hispanic or black living in the U.S. non-expansion states, proportions weighted by sampling fractions
2: Non-expansion states: 19 states that did not expand Medicaid by end of 2017
3. Proportions are rounded and may not add up to 100
4. P value column: Pearson Chi-squre tests to assess differences in sample distribution between characteristic of interest and year (2013 vs. 2017)

Table AC-4.

Percent Change in Insurance, Health Care Access and Health Status by Race in the U.S. Medicaid expansion states from 2013 to 2017.

Medicaid Expansion States													
	Pre ACA				Post ACA				Percent Change				p
	2013				2017				2013 to 2017				
Sample Size (SS)	Whites	Blacks	Hispanics	Total	Whites	Blacks	Hispanics	Total	White	Blacks	Hispanics	Total	
Weighted	118,905	11,828	13,323	144,056	101,444	11,291	13,320	126,055	-14.7%	-4.5%	0.0%	-12.5%	
Unweighted	63,811,217	9,953,561	16,911,739	90,676,516	60,840,555	9,945,251	16,880,076	87,665,883	-4.7%	-0.1%	-0.2%	-3.3%	
Outcomes													
Uninsured	13.62	22.27	33.9	18.35	7.09	11.57	23.02	10.67	-47.9%	-48.0%	-32.1%	-41.9%	p<0.001
No PCP	20.55	26.28	40.64	24.93	20.15	20.57	34.93	23.05	-1.9%	-21.7%	-14.1%	-7.5%	p<0.001
No Checkup	36.98	25.71	41.09	36.51	35.4	22.52	38.68	34.57	-4.3%	-12.4%	-5.9%	-5.3%	p<0.001
Diabetes Risk													
High Risk	32.33	42.03	39.94	34.81	33.91	43.68	42.34	36.64	4.9%	3.9%	6.0%	5.3%	p<0.001
Diabetes													
Diabetes Diagnosis	6.1	10.6	9.2	7.2	6.4	11.0	9.3	7.5	4.3%	3.0%	0.8%	3.8%	0.1637

Notes:
1. Analtyic sample: All BRFSS respondents aged 18-64 who are white, Hispanic or black living in the U.S. Medicaid expansion states, proportions weighted by sampling fractions
2: Medicaid expansion states: 31 states and D.C. that expanded Medicaid by end of 2017
3. Proportions are rounded and may not add up to 100
4. P value column: Pearson Chi-squre tests to assess differences in sample distribution between characteristic of interest and year (2013 vs. 2017)

Changes in Outcomes by Diabetes Risk/Diagnosis. Among the high risk for diabetes group, there was a 33% decrease in the report of being uninsured, a 4% decrease in the report of no provider and a 4% decrease in the report of no checkup in the past year post-ACA. Interestingly, in the diabetes group, there was a 32% decrease in the report of being uninsured, a 22% decrease in the report of no provider and a 10% decrease in the report of no checkup in the past year. The diabetes risk and diabetes diagnosis groups had similar decreases in the rates of the uninsured, but those with diabetes had better health care access in terms of having a provider or receiving a checkup in the past year. This is expected as diabetes is a chronic condition with symptoms due to elevated blood glucose levels, requiring further clinical management. Individuals in the high-risk group, although some may have elevated blood glucose levels, they are not at the severity of those with diabetes, and are typically asymptomatic, decreasing the urgency for health care services. Changes in insurance and health care access among both diabetes groups post-ACA were statistically significant.

Table AC-5.

Percent Change in Insurance and Health Care Access by Diabetes Status in all U.S. States from 2013 to 2017.

All States								
	Pre ACA		**Post ACA**		**Percent Change**			
	2013		2017		2013 to 2017		p	p
Sample Size	High Risk	Diabetes	High Risk	Diabetes	High Risk	Diabetes	High Risk	Diabetes
Unweighted	87,515	21,519	79,816	19,806	-8.8%	-8.0%		
Weighted	52,472,679	11,188,052	54,506,119	11,513,505	3.9%	2.9%		
Outcomes								
Uninsured	22.99	17.41	15.49	11.78	-32.6%	-32.3%	<0.001	<0.001
No PCP	27.31	11.75	26.19	9.22	-4.1%	-21.5%	<0.05	<0.001
No Checkup	36.63	17.82	35.07	16.11	-4.3%	-9.6%	<0.05	0.0457

Notes:
1. Analtyic sample: All BRFSS respondents aged 18-64 who are white, Hispanic or black living in the U.S., proportions weighted by sampling fractions
2. Proportions are rounded and may not add up to 100
3. P value column: Pearson Chi-squre tests performed to assess differences in sample distribution between outcome of interest and health status by year (2013 vs. 2017)

The high-risk group living within Medicaid expansion states experienced greater decreases in the report of being uninsured (43%) post ACA than the high-risk group living within non-expansion states (22%). This was true also for the diabetes group, who had a greater decrease in the report of being uninsured in expansion states (40%), compared to those living within non-expansion states (26%). To note, despite having a 22% decrease in the report of being uninsured in non-expansion states, the high-risk group experienced a 0.1% increase in the report of having no PCP. The slight increase in the report of no PCP in non-expansion states was not seen in expansion states; rather, there was an 8% decrease in the report of no PCP. For both expansion groups, there was a decrease in the report of no checkup in the past year; however, this change was statistically significant only within Medicaid expansion states. As discussed earlier, the high-risk group has less clinical incentives to seek a provider or have a checkup when symptoms tend to be asymptomatic. Yet, the small changes in having a provider or receiving a checkup in the past year for the high-risk group were statistically significant within both expansion groups.

Table AC-6.

Percent Change in Insurance and Health Care Access by Diabetes Status in U.S. Non-expansion States from 2013 to 2017.

Non-expansion States								
	Pre ACA		**Post ACA**		**Percent Change**			
	2013		2017		2013 to 2017		p	p
Sample Size	High Risk	Diabetes	High Risk	Diabetes	High Risk	Diabetes	High Risk	Diabetes
Unweighted	34,686	9,192	30,824	7,938	-11.1%	-13.6%		
Weighted	20,585,596	4,613,210	22,005,759	4,908,904	6.9%	6.4%		
Outcomes								
Uninsured	27.06	21.41	21.08	15.76	-22.1%	-26.4%	<0.001	<0.001
No PCP	30.6	13.65	30.63	11.11	0.1%	-18.6%	<0.05	<0.001
No Checkup	36.49	17.77	36.07	16.96	-1.2%	-4.6%	0.6089	0.5481

Notes:
1. Analtyic sample: All BRFSS respondents aged 18-64 who are white, Hispanic or black living in the U.S. non-expansion states, proportions weighted by sampling fractions
2: Non-expansion states: 19 states that did not expand Medicaid by end of 2017
3. Proportions are rounded and may not add up to 100
4. P value column: Pearson Chi-squre tests performed to assess differences in sample distribution between outcome of interest and health status by year (2013 vs. 2017)

Table AC-7.

Percent Change in Insurance and Health Care Access by Diabetes Status in U.S. Medicaid Expansion States from 2013 to 2017.

Medicaid Expansion States								
	Pre ACA		**Post ACA**		**Percent Change**			
	2013		2017		2013 to 2017		p	p
Sample Size	High Risk	Diabetes	High Risk	Diabetes	High Risk	Diabetes	High Risk	Diabetes
Unweighted	49,376	11,618	45,387	11,116	-8.1%	-4.3%		
Weighted	31,565,898	6,513,686	32,122,170	6,533,971	1.8%	0.3%		
Outcomes								
Uninsured	20.41	14.55	11.68	8.76	-42.8%	-39.8%	<0.001	<0.001
No PCP	25.2	10.45	23.19	7.78	-8.0%	-25.6%	<0.001	<0.05
No Checkup	36.63	17.81	34.35	15.46	-6.2%	-13.2%	<0.001	<0.05

Notes:
1. Analtyic sample: All BRFSS respondents aged 18-64 who are white, Hispanic or black living in the U.S. Medicaid expansion states, proportions weighted by sampling fractions
2: Medicaid expansion states: 31 states and D.C. that expanded Medicaid by end of 2017
3. Proportions are rounded and may not add up to 100
4. P value column: Pearson Chi-squre tests performed to assess differences in sample distribution between outcome of interest and health status by year (2013 vs. 2017)

Changes in Outcomes by Income. In the previous tables, differences in the outcomes of interest by diabetes health status and race were seen between non-expansion states and Medicaid expansion states. Key differences between expansion groups is based on the type of insurance coverage that was available to persons living within the lower income groups (<400% FPL). The next set of tables focus on pre/post ACA changes in insurance and health care access by income. As a reminder, income categories are as follows: (1) less than 100% FPL, (2) 100-138% FPL, (3) 139-400 % FPL and (4) greater than 400% FPL. Sample sizes for each income group in 2013 and 2017 are shown in **Table AC-9**. A weighted sample size is also provided that adjusts for differences in the unweighted sample sizes from 2013 to 2017.

Overall, the 100-138% FPL group experienced the greatest decrease in the report of being uninsured post ACA (34.1%, $p<0.001$). This is expected as this income group benefited from the insurance subsides, and in expansion states, this group further benefited from Medicaid expansion. For health care access, the less than 100% FPL group experienced the greatest decrease in the report of no PCP (18%, $p<0.001$), when compared to the other income groups. Interesting to note, those with high incomes saw an 19% increase in the report of not having a provider, despite having an 15% decrease in the report of being uninsured. The 100-138% FPL group saw the greatest decrease in the report of no checkup in the past year (14.6%, $p<0.001$) when compared to the other incomes. Again, the high-income group saw an increase in the report of no checkup in the past year (7%, $p<0.001$) despite seeing a reduction in the report of not having insurance. The increase in the report of no provider or checkup is not expected for the high-income group, given their low rates of being uninsured and higher educational levels when compared to lower income groups. One would think the higher income group would understand the importance of preventive care, even if they are healthy.

Table AC-8.

Percent Change in Insurance and Health Care Access by Income in All U.S. States (2013 to 2017).

All States																
	Pre ACA				Post ACA				Percent Change							
	2013				2017				2013 to 2017				p	p	p	p
Sample Size	**<100%**	**100-138**	**139-400**	**>400%**	**<100%**	**100-138**	**139-400**	**>400%**	**<100%**	**100-138**	**139-401**	**>400%**	**<100%**	**100-139**	**139-402**	**>400%**
Unweighted	32,474	19,089	88,404	108,905	22,686	15,083	86,109	92,778	-30.1%	-21.0%	-2.6%	-14.8%				
Weighted	26,065,869	12,428,403	50,593,838	58,158,389	19,712,611	11,138,114	55,818,432	59,451,359	-24.4%	-10.4%	10.3%	2.2%				
Outcomes																
Uninsured	43.1	36.81	23.01	5.09	29.1	24.27	16.5	4.33	-32.5%	-34.1%	-28.3%	-14.9%	<0.001	<0.001	<0.001	<0.001
No PCP	41.45	37.19	29.5	15.77	34.05	32.96	29.42	18.68	-17.9%	-11.4%	-0.3%	18.5%	<0.001	<0.001	0.8642	<0.001
No Checkup	42.5	42.54	38.32	30.21	37.19	36.32	36.89	32.24	-12.5%	-14.6%	-3.7%	6.7%	<0.001	<0.001	<0.05	<0.001

Notes:
1. Analtyic sample: All BRFSS respondents aged 18-64 who are white, Hispanic or black living in the U.S., proportions weighted by sampling fractions
2. Proportions are rounded and may not add up to 100
3. P value column: Pearson Chi-squre tests performed to assess differences in sample distribution between outcome of interest and income by year (2013 vs. 2017)

Respondents living within 100-138% FPL in non-expansion states saw the greatest decrease in the report of being uninsured (-25%, $p<0.001$), when compared to the other income groups. In Medicaid expansion states, the less than 100% FPL saw the greatest decrease in the report of being uninsured (-45%, $p<0.001$), when compared to other income groups. The increase in insurance coverage seen in this group could be related to the state-led advocacy efforts to enroll low income groups in Medicaid. The Kaiser Family Foundation states that large increases in Medicaid enrollment occurred among individuals who were previously eligible for but not enrolled in Medicaid within expansion states. This effect is known as “woodwork” or “welcome matt” effect and describes why an increase in Medicaid enrollment occurred due to incentives to increase enrollment coverage by the ACA (Kaiser Family Foundation, 2018).

In non-expansion states, the less than 100% FPL group had the greatest decrease in the report of no PCP (10%, $p<0.05$) and no checkup (9%, $p<0.05$), when compared to higher income groups. The high-income group within non-expansion states had an increase of 18% in the report of no PCP and an increase of 10% in the report of no checkup by 2017. In Medicaid expansion states, the less than 100% FPL group also had the greatest decrease in the report of no PCP

(25%, p<0.001), but the 100-138% FPL had the greatest decrease in the report of no checkup (19%, p<0.001). The high-income group within Medicaid expansion states saw an increase in the report of no PCP and no checkup as well. However, the report of no PCP was higher in Medicaid expansion states by 1.0 percentage point and the report of no checkup was lower in Medicaid expansion states by almost 5.0 percentage points than in non-expansion states.

It is interesting that the "welcome matt" effect may have played a major role in enrolling low-income adults in Medicaid within expansion states as the change in the uninsured decreased by 45% in the less than 100% FPL group, when compared to the decrease of 20% in the same group within non-expansion states. One would think that to see large gains in having a PCP or a checkup, many more people would need to have insurance coverage. However, the high-income group contradicts this; despite seeing increases in insurance, health care access is getting worse for this group. The ACA coverage expansion did not directly affect this income group, but one would think the "welcome matt" effect may have a small role in this group as well, in terms of encouraging people to sign up for coverage, and subsequently seeking access to health care services.

Table AC-9.

Percent Change in Insurance and Health Care Access by Income in U.S. Non-expansion States (2013 to 2017).

Non-Expansion States																
	Pre ACA				Post ACA				Percent Change							
	2013				2017				2013 to 2017				p	p	p	p
Sample Size	**<100%**	**100-138**	**139-400**	**>400%**	**<100%**	**100-138**	**130-400**	**>400%**	**<100%**	**100-138**	**139-401**	**>400%**	**<100%**	**100-139**	**139-402**	**>400%**
Unweighted	13,890	8,227	35,556	37,865	9,055	6,205	35,021	31,402	-34.8%	-24.6%	-1.5%	-17.1%				
Weighted	10,019,443	5,088,489	20,353,396	20,183,667	8,039,224	4,673,535	23,723,570	21,025,313	-19.8%	-8.2%	16.6%	4.2%				
Outcomes																
Uninsured	50.7	42.1	25.5	6.0	40.6	31.5	20.2	5.8	-19.9%	-25.1%	-20.7%	-3.8%	<0.001	<0.001	<0.001	0.61
No PCP	44.8	38.9	32.2	18.2	40.3	39.3	33.3	21.4	-10.0%	1.0%	3.5%	17.7%	<0.05	0.84	0.15	<0.001
No Checkup	42.8	41.9	37.9	28.2	39.1	38.5	37.8	31.1	-8.6%	-8.1%	-0.1%	10.0%	<0.05	0.06	0.98	<0.001

Notes:
1. Analtyic sample: All BRFSS respondents aged 18-64 who are white, Hispanic or black living in the U.S. non-expansion states, proportions weighted by sampling fractions
2: Non-expansion states: 19 states that did not expand Medicaid by end of 2017
3. Proportions are rounded and may not add up to 100
4. P value column: Pearson Chi-squre tests performed to assess differences in sample distribution between outcome of interest and income by year (2013 vs. 2017)

Table AC-10.

Percent Change in Insurance and Health Care Access by Income in U.S. Medicaid Expansion states (2013 to 2017).

Medicaid Expansion States																
	Pre ACA				Post ACA				Percent Change							
	2013				2017				2013 to 2017				p	p	p	p
Sample Size	**<100%**	**100-138**	**139-400**	**>400%**	**<100%**	**100-138**	**139-400**	**>400%**	**<100%**	**100-138**	**139-401**	**>400%**	**<100%**	**100-139**	**139-402**	**>400%**
Unweighted	17,688	10,178	48,951	67,239	12,813	8,307	46,969	57,966	-27.6%	-18.4%	-4.0%	-13.8%				
Weighted	15,939,395	7,264,436	29,867,090	37,605,595	11,575,125	6,400,703	31,671,215	38,018,840	-27.4%	-11.9%	6.0%	1.1%				
Outcomes																
Uninsured	38.3	33.08	21.39	4.64	21.04	18.94	13.75	3.54	-45.1%	-42.7%	-35.7%	-23.7%	<0.001	<0.001	<0.001	<0.001
No PCP	39.4	36	27.66	14.49	29.69	28.37	26.55	17.2	-24.6%	-21.2%	-4.0%	18.7%	<0.001	<0.001	0.0515	<0.001
No Checkup	42.26	42.88	38.53	31.24	35.82	34.67	36.11	32.88	-15.2%	-19.1%	-6.3%	5.2%	<0.001	<0.001	<0.001	<0.05

Notes:
1. Analtyic sample: All BRFSS respondents aged 18-64 who are white, Hispanic or black living in the U.S. Medicaid expansion states, proportions weighted by sampling fractions
2: Medicaid expansion states: 31 states and D.C. that expanded Medicaid by end of 2017
3. Proportions are rounded and may not add up to 100
4. P value column: Pearson Chi-squre tests performed to assess differences in sample distribution between outcome of interest and income by year (2013 vs. 2017)

Likelihood and Absolute Changes in Outcomes

In **Tables AC-11** through **AC-13**, the relative risk, or risk ratio, is presented for each of the three outcomes of interest (i.e. uninsured, no PCP and no checkup in the past year). Relative risk (RR) was calculated by diving the probability of an outcome occurring in group 1, divided by the probability of an outcome occurring for group 2. Group 2 is the reference group and has a RR of ***. For example, in the race/ethnicity category, whites are the reference group, and each RR is calculated by dividing a different racial/ethnic group's percent uninsured by the percent uninsured of whites. A RR>1 means the risk is increased; whereas a RR<1 means the risk of an outcome is decreased. The RR has statistical significance only if the 95% Confidence Interval (CI) does not include the value=1. In the RR tables, only the RR's with statistical significance are in bold text. The 95% CI was calculated using a two-step process. First, a confidence interval was generated for Ln(RR), and then the antilog of the upper and lower limits of the CI for Ln(RR) was computed (Step 2) to give the 95% CI for the RR (Boston University School of Public Health, n.d). The confidence interval that is shown in the Tables AA-2 – AA-4 show the antilog upper and lower limits of the CI for Ln(RR).

The following formula was used to calculate Step 1 CI of Ln(RR):

$$\mathrm{Ln(RR)} \pm 1.96 \sqrt{\frac{(n_1-x_1)/x_1}{n_1} + \frac{(n_2-x_2)/x_2}{n_2}}$$

Table AC-11.

Computation of CI of Ln(RR) (Step 1).

	Uninsured	Insured	Total
Group 1	x_1	n_1-x_1	n_1
Group 2 (Reference)	x_2	n_2-x_2	n_2

Refer to **Appendix AC** for a more detailed description of the RR calculation.

When compared to whites, blacks and Hispanics were at an increased risk of being uninsured pre-ACA, with Hispanics being 2.6 times more likely to be uninsured than whites. In 2017, Hispanics' risk for being uninsured increased (RR=3.0) compared to whites, meaning whites benefited from the ACA. However, the likelihood of being uninsured post ACA for blacks when compared to whites remained the same, with blacks being 1.7 times more likely to be uninsured post ACA. Overall, whites were the least likely to be uninsured both pre and post ACA, with the disparity gap between whites and Hispanics widening post ACA.

For the income category, the greater than 400% FPL group was the reference group as the ACA did not target this income level group. Lower income groups were at greater risk of being uninsured in 2013, with this risk being decreased by 2017. The group at increased risk of being uninsured pre-ACA were those living below 100% FPL, when compared to the >400% FPL income group, with a RR of 8.5. This is interesting because the ACA did not specifically target this income group, and even post ACA, the less than 100% FPL group continues to be at increased risk of being uninsured when compared to the greater than 400% FPL group and the relative risks of other income groups.

From 2013 and 2017, there was no change in the relative risk of being uninsured between the high risk and diabetes groups versus the no/low risk for diabetes group. The high-risk group is 1.2 times more likely to be uninsured than individuals with no/low risk. Individuals with diabetes are 10% less likely to be uninsured than individuals at no/low risk. It is expected that individuals with a diagnosed chronic disease, such as diabetes, would be incentivized to seek insurance coverage. Whereas, those at high risk would be at higher risk of being uninsured since they may be unaware of their health status and are more likely to belong to demographic factors that put them at higher risk (i.e. minority status, low-income status).

Individuals living within expansion states were 25% less likely to be uninsured compared to those living in non-expansion states in 2013. Medicaid expansion residents’ risk of being uninsured decreased by 42% post ACA. This decrease in the risk of being uninsured among expansion states is expected as residents benefited from increased eligibility to Medicaid, where non-expansion states did not. The percent change among the 100-138% FPL group was the largest among all income groups, at 34.1% (**Table AC-13**).

Table AC-12.

Calculation of Relative Risk, Percent Change and Absolute Change in the Uninsured by Race/ethnicity, Income, Diabetes Status and Expansion Status from 2013 to 2017.

RELATIVE RISK (UNINSURED)										
		Pre ACA 2013				**Post ACA** 2017				
	Unweighted (n)	Uninsured (%)	Relative Risk	95% CI	Unweighted (n)	Uninsured (%)	Relative Risk	RR (95% CI)	Percent Change	Absolute Change (n)
Race/Ethnicity										
Whites	203,958	15.0	***	***	174,642	9.4	***	***	-37.3	-21201.6
Blacks	23,913	25.4	**1.69**	(1.65, 1.73)	20,869	16.1	**1.71**	(1.65, 1.77)	-36.6	-4164.7
Hispanics	21,001	38.7	**2.58**	(2.53, 2.63)	21,145	28.4	**3.02**	(2.94, 3.10)	-26.6	-4341.0
Income										
<100%	32,474	43.1	**8.47**	(8.23, 8.71)	22,686	29.1	**6.72**	(6.48, 6.97)	-32.5	-7722.4
100-138	19,089	36.8	**7.23**	(7.01, 7.46)	15,083	24.3	**5.61**	(5.38, 5.84)	-34.1	-4285.2
139-400	88,404	23.0	**4.52**	(4.39, 4.65)	86,109	16.5	**3.81**	(3.68, 3.94)	-28.3	-11360.8
>400%	108,905	5.1	***	***	92,778	4.3	***	***	-14.9	-1532.8
Diabetes Status										
No/Low Risk	139,838	19.6	***	***	117,034	13.0	***	***	-33.6	-16927.9
High Risk	87,515	23.0	**1.17**	(1.15, 1.19)	79,816	15.5	**1.19**	(1.15, 1.19)	-32.6	-12549.8
Diabetes	21,519	17.4	**0.89**	(0.86, 0.92)	19,806	11.8	**0.91**	(0.86, 0.92)	-32.3	-2326.6
Expansion Status										
Non-expansion	102,209	24.5	***	***	88,577	18.7	***	***	-23.7	-11065.6
Expansion	146,663	18.4	**0.75**	(0.74, 0.76)	12,079	10.7	**0.57**	(0.74, 0.76)	-41.9	-12191.4

Notes:

1. Analtyic sample: All BRFSS respondents aged 18-64 who are white, Hispanic or black living in the U.S., proportions weighted by sampling fractions
2. The (***) represents the reference group in each category
3. RR's in **bold** signifiy statistical significance (p<0.05)

The percent change column has been shown and discussed in previous sections, but is added to show the comparison to absolute changes. Absolute changes are the difference from 2017 to 2013, multiplied by the category's total population (2013 and 2017's unweighted sample size) and 0.01, in order to convert the percentage change to a numerical change measured by n. In **Table AC-13**, the absolute change displays how many people in the analytic sample (unweighted n) either gained or lost insurance coverage from 2013 to 2017. In **Tables AC-14** and **AC-15**, the absolute change displays how many people in the analytic dataset either gained or lost a PCP or received or did not receive a checkup in the past year, respectively.

When focusing on health care access, Hispanics were 1.9 times more likely to not have a PCP in 2013 when compared to whites. This risk ratio decreased slightly in 2017 (RR=1.8). Blacks and whites did not differ in the likelihood in being uninsured in 2013, but by 2017, blacks were 10% more likely to not have a PCP than whites. Lower income groups were more likely to not have PCP pre and post ACA, when compared to the greater than 400% FPL group. The income group at greatest risk of not having a PCP was the <100% FPL group in 2013 and 2017.

Individuals at high risk of diabetes were 4% less likely to not have a PCP than the no/low risk group in 2013. This is interesting considering the high-risk group was at greater risk of not having insurance than the no/low risk group, yet was more likely to have a PCP. (Potentially paying out of pocket?) After the ACA, the high-risk group was 7% less likely to not have a PCP than the no/low risk group. The ACA also improved access to a PCP among individuals with diabetes, when compared to the no/low risk group.

An individual with diabetes was 67% less likely to not have a PCP when compared to the no/low risk group in 2017. It appears that individuals with a diagnosis, such as diabetes, are more likely to have a provider, than those who do not have a chronic disease diagnosis. The slight increase in having a provider among the high-risk group may be related to some individuals being aware of their prediabetes or gestational diabetes status. Unfortunately, for a majority of individuals within the high-risk group, and possibly for some in the diabetes group, many may be undiagnosed or asymptomatic for years, leading them to believe they do not need to see a PCP.

Therefore, the perception of being "healthy" would not lead to an incentive to seek a health care provider.

Post ACA, individuals living within expansion states had a 11% decrease in not having a provider, when compared to those living in non-expansion states; this was a decrease of 7.5%.

Table AC-13.

Calculation of Relative Risk, Percent Change and Absolute Change in the Report of No PCP by Race/ethnicity, Income, Diabetes Status and Expansion Status from 2013 to 2017.

	RELATIVE RISK (NO PCP)									
		Pre ACA 2013				Post ACA 2017				
	Unweighted (n)	No PCP (%)	Relative Risk	95% CI	Unweighted (n)	No PCP (%)	Relative Risk	95%CI	Percent Change	Absolute Change (n)
Race/Ethnicity										
Whites	203,958	22.3	***	***	174,642	22.5	***	***	0.9	757.2
Blacks	23,913	28.1	1.26	(0.79, 2.02)	20,869	24.8	**1.10**	(1.07, 1.13)	-11.7	-1477.8
Hispanics	21,001	43.1	**1.93**	(1.90, 1.97)	21,145	39.4	**1.75**	(1.71, 1.78)	-8.6	-1559.4
Income										
<100%	32,474	41.5	**2.63**	(2.58, 2.68)	22,686	34.1	**1.82**	(1.78, 1.86)	-17.9	-4081.8
100-138	19,089	37.2	**2.36**	(2.30, 2.41)	15,083	33.0	**1.76**	(1.72, 1.81)	-11.4	-1445.5
139-400	88,404	29.5	**1.87**	(1.84, 1.90)	86,109	29.4	**1.57**	(1.55, 1.60)	-0.3	-139.6
>400%	108,905	15.8	***	***	92,778	18.7	***	***	18.5	5869.0
Diabetes Status										
No/Low Risk	139,838	28.6	***	***	117,034	28.2	***	***	-1.4	-1001.8
High Risk	87,515	27.3	**0.96**	(0.94, 0.97)	79,816	26.2	**0.93**	(0.92, 0.94)	-4.1	-1874.1
Diabetes	21,519	11.8	**0.41**	(0.40, 0.43)	19,806	9.2	**0.33**	(0.31, 0.34)	-21.5	-1045.5
Expansion Status										
Non-expansion	102,209	26.8	***	***	88,577	26.0	***	***	-3.0	-1526.3
Expansion	146,663	24.9	**0.93**	(0.92, 0.94)	128,079	23.1	**0.89**	(0.87, 0.90)	-7.5	-5165.1

Notes:

1. Analtyic sample: All BRFSS respondents aged 18-64 who are white, Hispanic or black living in the U.S., proportions weighted by sampling fractions
2. The (***) represents the reference group in each category
3. RR's in **bold** signifiy statistical significance (p<0.05)

Health care access was also measured by an individual receiving checkup in the past year. Blacks reported more checkups in 2013 and 2017 than whites; whereas Hispanics reported less checkups in the past year, than whites in 2013 and 2017. Generally speaking, the low-income groups were more likely to not have a checkup in 2013 or 2017 when compared to the high-income group.

Individuals at high risk for diabetes were 7% less likely to not have a checkup in 2017, compared to the no/low risk group. Individuals with diabetes were 57% less likely to not have a checkup in 2017, when compared to the no/low risk group. Again, having a chronic condition, such as diabetes increased the likelihood that someone would receive a checkup, when compared to those without diabetes. However, when comparing the RR of the diabetes group in **Table AC-14** and **Table AC-15**, individuals with diabetes were more likely to have a PCP, than receive a checkup.

Overall, respondents in expansion states before the ACA were 3% more likely to not have a checkup than in non-expansion states. Post ACA, this changed with respondents in expansion states being 3% less likely to not have a checkup, when compared to those living in non-expansion states. In the following section, inferential statistics will be displayed to determine the probability that an observed difference between groups is dependable, once adjusted for other factors.

Table AC-14.

Calculation of Relative risk, Percent Change and Absolute Change in the Report of No Checkup in the Past Year by Race/ethnicity, Income, Diabetes Status and Expansion Status (2013 and 2017).

RELATIVE RISK (NO CHECKUP)										
		Pre ACA 2013				Post ACA 2017				
	U.S. Pop (m.)	No Checkup (%)	Relative Risk	RR (95% CI)	Unweighted (n)	No Checkup (%)	Relative Risk	RR (95% CI)	Percent Change	Absolute Change (m.)
Race/Ethnicity										
Whites	203,958	36.8	***	***	174,642	36.0	***	***	-2.2	-3028.8
Blacks	23,913	26.1	**0.71**	(0.70, 0.73)	20,869	23.4	**0.65**	(0.63, 0.67)	-10.3	-1209.1
Hispanics	21,001	41.6	**1.13**	(1.11, 1.15)	21,145	40.0	**1.11**	(1.09, 1.13)	-3.8	-674.3
Income										0.0
<100%	32,474	42.5	**1.41**	(1.39, 1.43)	22,686	37.2	**1.15**	(1.13, 1.18)	-12.5	-2929.0
100-138	19,089	42.5	**1.41**	(1.38, 1.43)	15,083	36.3	**1.13**	(1.10, 1.15)	-14.6	-2125.5
139-400	88,404	38.3	**1.27**	(1.25, 1.28)	86,109	36.9	**1.14**	(1.13, 1.16)	-3.7	-2495.5
>400%	108,905	30.2	***	***	92,778	32.2	***	***	6.7	4094.2
Diabetes Status										0.0
No/Low Risk	139,838	38.4	***	***	117,034	37.7	***	***	-2.0	-1952.2
High Risk	87,515	36.6	**0.95**	(0.94, 0.96)	79,816	35.1	**0.93**	(0.92, 0.94)	-4.3	-2610.4
Diabetes	21,519	17.8	**0.46**	(0.45, 0.48)	19,806	16.1	**0.43**	(0.41, 0.44)	-9.6	-706.7
Expansion Status										0.0
Non-expansion	102,209	35.6	***	***	88,577	35.6	***	***	0.0	0.0
Expansion	146,663	36.5	**1.03**	(1.01, 1.04)	128,079	34.6	**0.97**	(0.96, 0.98)	-5.3	-5330.0

Notes:

1. Analtyic sample: All BRFSS respondents aged 18-64 who are white, Hispanic or black living in the U.S., proportions weighted by sampling fractions
2. The (***) represents the reference group in each category
3. RR's in **bold** signifiy statistical significance (p<0.05)

(summarized from Rosner, 6th ed., 2006, p. 636)

Let the Relative Risk of two randomly determined fractions be: RR = p_1/p_2 . This ratio tends to be highly skewed and can be corrected, approximately, to a normal distribution by taking the difference of natural logs:

(1) Ln[RR] = lnp1 - lnp2 .

A confidence interval for the logged RR depends upon its standard error, or square root of the variance of eq.(1). Variance can be decomposed as the sum of log-variances:

(2) Var[lnRR] = Var[lnp_1] + Var[lnp_2]

In turn, the log-variance of a variable, X, can be closely approximated by

(3) Var[lnX] = $f'(X)^2$ x Var X = $VarX/X^2$: f'(X) = the derivative of the variable

so that Var[lnp_1] = $(p_1q_1/n_1)*(1/p_1^2)$, Var[lnp_2] = $(p_2q_2/n_2)*(1/p_2^2)$, where q_1, q_2 equal 1 minus p_1 and p_2 , respectively. Thus, the standard error, or square root, of the log-variance of RR is

(4) SE[lnRR] = $\{ (q_1/p_1)/(n_1) + (q_2/p_2)/(n_2) \}^{-1/2}$.

In words, the standard error of the log-variance of RR is the sum of ratios of "not p1-to-p1" and "not-p2-to-p2, weighted by the inverse of their sample sizes.

The 95% Confidence Interval surrounding the actual RR (= p_1 /p_2), is the exponentiated (exp) formula:

(5) CI = exp{ lnRR +- 1.96*SE[lnRR]}.

As an example, consider the Table XXX and the relative risk of being uninsured for Hispanics versus whites. Uninsured (q) rates were 0.387 for Hispanics and 0.150 for whites in 2013, with RR(2013) = 0.387/0.15 = 2.58. Corresponding rates were 0.284 and 0.094 in 2017, four years later (0.284/0.094 = 3.02). The ratios of insured to uninsured in eq.(4) were 1.58 for Hispanics and 5.66 for whites in 2013 and 2.52 and 9.64 for 2017. (Relative risk rises exponentially with lower uninsured rates). These ratios are divided by

21,001 (2013) and 21,145 (2017) for Hispanics and 203,958 (2013) and 174,642 (2017) for whites, or the unweighted actual BRFSS sample sizes for the two years. The standard errors of the logged RR for Hispanics versus whites were SQRT(0.000103) = 0.0101 in 2013 and SQRT(0.000174) = 0.0132 in 2017, which results in the following lower and upper confidence intervals:

2013: CI[lower] = exp{ ln[(.387/.15)=2.58) – 1.96*0.0101 } = 2.53

2013: CI[upper] = exp{ ln[(.387/.15)=2.58) + 1.96*0.0101 } = 2.63

2017: CI[lower] = exp{ ln[(.284/.094)=3.02) – 1.96*0.0132 } = 2.94

2017: CI[lower] = exp{ ln[(.284/.094)=3.02) + 1.96*0.0132 } = 3.10.

The confidence intervals are very narrow around the two RRs due to very low standard errors, which are the result of very large sample sizes.

APPENDIX AD

LOGISTIC REGRESSIONS FOR ODDS OF INSURANCE

Specific Aim 1a. Pre/Post-ACA Insurance Coverage Odds with ACA-Income Interactions. Refer to Chapter 4, page 171 for in text discussion. Full regression models available in Table AD-1.

Specific Aim 1a. Annual ACA Insurance Coverage Odds Ratios with ACA-Income Interactions. Refer to Chapter 4, page 179 for in text discussion. Full regression models available in Table AD-2.

Specific Aim 1b. Pre/Post-ACA Insurance Coverage Odds Ratios Controlling for Expansion Status. In **Table AD-3**, the expansion status variable was added to Specific Aim 1a's full model to determine the effect of the ACA when controlling for expansion status. When adjusting for expansion status and other factors, individuals in the post-ACA period were 68% more likely to have insurance, then in the pre-ACA period. The ACA regression coefficient was about 3% higher than in Model 3**.** When the ACA*EXP interaction term was added in Model 5, it showed that individuals living in Medicaid expansion states post-ACA were 26% ($p<0.001$, 1.21, 1.32 95% CI) more likely to have insurance than individuals in non-expansion states. The overall ACA effect on expansion states was the sum of the natural log of the ACA term (1.48) and the ACA*EXP term (1.26), then exponentiating the sum, which led to an ACA effect of 86%. The post-ACA odds of having insurance for expansion states was 2.61, over non-expansion states. This was calculated by adding the natural log of EXP (1.40) to the ACA effect, then exponentiating the sum. Refer to **Table AD-3** to view Models 1-5.

Specific Aim 1b. Annual ACA Insurance Coverage Odds Ratio Controlling for Expansion Status. In **Table AD-4**, the expansion status variable was added to Specific Aim 1a's full model to determine the effect of the ACA when controlling for expansion status. When adjusting for expansion status and other factors, individuals in the post-ACA period were 46-85% more likely to have insurance, then in the pre-ACA period. The time coefficients were marginally higher than the time coefficients (45-83%) in Model 3. When the YEAR*EXP interaction terms were added in Model 5, it showed that individuals living in Medicaid expansion states post-ACA were 15-40% ($p<0.001$) more likely to have insurance than individuals in non-expansion states. In fact, the odds were gradually increasing over time, from 15% more likely in 2014 to 40% more likely in 2017, than in non-expansion states in the post-ACA period.

The overall annual ACA effect on expansion states was the sum of the natural log of the year term and the YEAR*EXP term, then exponentiating the sum. The overall ACA effect per year in odds was: 1.56 (2014); 1.74 (2015); 2.10 (2016); and 2.02 (2017). The post-ACA odds of having insurance for expansion states was 2.19 (2014); 2.43 (2015); 2.93 (2016); and 2.82 (2017), over non-expansion states. This was calculated by adding the natural log of EXP to the overall ACA effect, then exponentiating the sum (for each year). Refer to **Table AD-4** to view Models 1-5.

Table AD-1.

Logistic Regression Models for Specific Aim 1a (i.e. odds of insurance using pre/post ACA indicator for 47-state analytic sample.

Probability of Insurance (n=1,283,537)	**Model 1 Odds Ratio**	**95% CI**	**Model 2 Odds Ratio**	**95% CI**	**Model 3 Odds Ratio**	**95% CI**	**Model 4 Odds Ratio**	**95% CI**
Time								
ACA								
Pre-ACA	Ref		Ref		Ref		Ref	
Post-ACA	1.60**	(1.57, 1.63)	1.61**	(1.57, 1.64)	1.66**	(1.62, 1.70)	1.34**	(1.26, 1.42)
Income								
>400% FPL			Ref		Ref		Ref	
139-400% FPL			0.21**	(0.20, 0.21)	0.28**	(0.27, 0.29)	0.25**	(0.23, 0.26)
100-138% FPL			0.11**	(0.10, 0.11)	0.17**	(0.17, 0.18)	0.14**	(0.13, 0.15)
<100% FPL			0.08**	(0.08, 0.08)	0.15**	(0.14, 0.16)	0.13**	(0.12, 0.13)
ACA*Income								
ACA* >400% FPL							Ref	
ACA* 139-400% FPL							1.21**	(1.14, 1.30)
ACA* 100-138% FPL							1.40**	(1.29, 1.53)
ACA* <100% FPL							1.35**	(1.25, 1.45)
Other Variables								
Race								
Whites					Ref		Ref	
Blacks					0.79**	(0.77, 0.82)	0.79**	(0.77, 0.82)
Hispanics					0.52**	(0.51, 0.54)	0.52**	(0.51, 0.53)
Education								
Less than HS					Ref		Ref	
HS Grad					1.61**	(1.55, 1.66)	1.61**	(.56, 1.67)
Some College					2.13**	(2.06, 2.21)	2.13**	(2.06, 2.21)
College Grad					3.66**	(3.52, 3.81)	3.67**	(3.52, 3.82)
Age								
18 to 44					Ref		Ref	
45 to 64					1.43**	(1.40, 1.47)	1.43**	(1.40, 1.46)
Sex								
Male					Ref		Ref	
Female					1.42**	(1.39, 1.45)	1.42**	(1.39, 1.45)
Health Variables								
Diabetes Status								
No/Low Risk					Ref		Ref	
High Risk					1.08**	(1.05, 1.10)	1.08**	(1.05, 1.10)
Diabetes					1.60**	(1.53, 1.68)	1.60**	(1.53, 1.68)
Chronic Disease								
Count 0-5					1.26**	(1.23, 1.29)	1.26**	(1.23, 1.29)
Self Reported Health								
Healthy					Ref		Ref	
Unhealthy					0.88**	(0.85, 0.91)	0.88**	(0.85, 0.91)
Constant	3.61**	(3.56, 3.66)	15.63**	(15.15, 16.12)	4.92**	(4.68, 5.17)	5.57**	(5.24, 5.92)
F Statistic	2149**		5574**		2301**		1948**	

Notes:
1. Contains odds ratio for 47-state analtyic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Table AD-2.

Logistic Regression Models for Specific Aim 1a (i.e. odds of insurance using 2014-2017-time dummies for 47-state sample).

Probability of Insurance (n=1,283,537)	**Model 1 Odds Ratio**	**95% CI**	**Model 2 Odds Ratio**	**95% CI**	**Model 3 Odds Ratio**	**95% CI**	**Model 4 Odds Ratio**	**95% CI**
Year								
2012	Ref		Ref		Ref		Ref	
2013	Ref		Ref		Ref		Ref	
2014	1.38**	(1.34, 1.42)	1.44**	(1.40, 1.49)	1.45**	(1.41, 1.50)	1.34**	(1.22, 1.47)
2015	1.63**	(1.58, 1.68)	1.64**	(1.59, 1.70)	1.70**	(1.64, 1.75)	1.36**	(1.24, 1.49)
2016	1.75**	(1.69, 1.80)	1.73**	(1.68, 1.79)	1.83**	(1.77, 1.89)	1.40**	(1.28, 1.52)
2017	1.69**	(1.64, 1.75)	1.64**	(1.59, 1.69)	1.71**	(1.64, 1.77)	1.27**	(1.17, 1.38)
Income								
>400% FPL			Ref		Ref		Ref	
139-400% FPL			0.21**	(0.20, 0.21)	0.28**	(0.27, 0.29)	0.25**	(0.23, 0.26)
100-138% FPL			0.11**	(0.10, 0.11)	0.17**	(0.17, 0.18)	0.14**	(0.13, 0.15)
<100% FPL			0.08**	(0.08, 0.09)	0.15**	(0.15, 0.16)	0.13**	(0.12, 0.14)
Year*Income								
2014* >400% FPL							Ref	
2014 * 139-400% FPL							1.08	(0.98, 1.19)
2014* 100-138% FPL							1.21*	(1.07, 1.37)
2014* <100% FPL							1.08	(0.97, 1.20)
2015* >400% FPL							Ref	
2015 * 139-400% FPL							1.22**	(1.10, 1.35)
2015* 100-138% FPL							1.47**	(1.29, 1.67)
2015* <100% FPL							1.32**	(1.18, 1.48)
2016* >400% FPL							Ref	
2016 * 139-400% FPL							1.30**	(1.18, 1.44)
2016* 100-138% FPL							1.35**	(1.19, 1.52)
2016* <100% FPL							1.49**	(1.34, 1.66)
2017* >400% FPL							Ref	
2017 * 139-400% FPL							1.26**	(1.15, 1.39)
2017* 100-138% FPL							1.65**	(1.45, 1.87)
2017* <100% FPL							1.62**	(1.45, 1.81)
Other Variables								
Race								
Whites					Ref		Ref	
Blacks					0.79**	(0.77, 0.82)	0.79**	(0.77, 0.82)
Hispanics					0.52**	(0.50, 0.53)	0.52**	(0.50, 0.53)
Education								
Less than HS					Ref		Ref	
HS Grad					1.61**	(1.56, 1.66)	1.61**	(1.56, 1.67)
Some College					2.13**	(2.06, 2.21)	2.14**	(2.06, 2.21)
College Grad					3.66**	(3.52, 3.81)	3.67**	(3.53, 3.82)
Age								
18 to 44					Ref		Ref	
45 to 64					1.43**	(1.40, 1.47)	1.43**	(1.40, 1.46)
Sex								
Male					Ref		Ref	
Female					1.42**	(1.39, 1.45)	1.42**	(1.39, 1.45)
Diabetes Status								
No/Low Risk					Ref		Ref	
High Risk					1.08**	(1.05, 1.10)	1.08**	(1.05, 1.10)
Diabetes					1.60**	(1.53, 1.68)	1.60**	(1.53, 1.68)
Chronic Disease								
Count 0-5					1.26**	(1.23, 1.29)	1.26**	(1.23, 1.29)
Self Reported Health								
Healthy					Ref		Ref	
Unhealthy					0.88**	(0.85, 0.91)	0.88**	(0.85, 0.91)
Constant	3.61**	(3.56, 3.66)	15.60**	(15.13, 16.09)	4.91**	(4.67, 5.16)	5.57**	(5.24, 5.92)
F Statistic	574**		3192**		1918**		1175**	

Notes:

1. Contains odds ratio for 47-state analtyic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Table AD-3.

Logisitic Regression Models by Income for Specific Aim 1b (i.e. odds of insurance using Pre/Post-ACA indicator by Expansion Status for 47-state sample).

Probability of Insurance by Income Group	**Income <100% FPL Odds Ratio** (n=152,358)	**95% CI**	**Income <100% FPL Odds Ratio** (n=152,358)	**95% CI**	**Income 100-138% FPL Odds Ratio** (n=94,466)	**95% CI**	**Income 100-138% FPL Odds Ratio** (n=94,466)	**95% CI**	**Income 139-400% FPL Odds Ratio** (n=500,262)	**95% CI**	**Income 139-400% FPL Odds Ratio** (n=500,262)	**95% CI**	**Income >400% FPL Odds Ratio** (n=576,687)	**95% CI**	**Income >400% FPL Odds Ratio** (n=576,687)	**95% CI**
ACA																
Pre ACA	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
Post ACA	1.85**	(1.77, 1.93)	1.48**	(1.39, 1.58)	1.88**	(1.77, 1.99)	1.62**	(1.49, 1.77)	1.64**	(1.59, 1.69)	1.49**	(1.42, 1.56)	1.36**	(1.28, 1.45)	1.27**	(1.15, 1.40)
Expansion Status																
Non-expansion	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
Expansion	2.28**	(2.18, 2.38)	1.82**	(1.70, 1.95)	1.76**	(1.66, 1.87)	1.50**	(1.37, 1.64)	1.36**	(1.32, 1.40)	1.21**	(1.15, 1.27)	1.30**	(1.22, 1.38)	1.21**	(1.10, 1.34)
Interaction Term																
ACA*EXP			1.47**	(1.34, 1.60)			1.31**	(1.16, 1.47)			1.20**	(1.2, 1.28)			1.12	(0.99, 1.27)
Other Variables																
Race																
Whites	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
Blacks	0.94*	(0.89, 0.99)	0.94*	(0.89, 0.99)	0.99	(0.91, 1.07)	0.99	(0.91, 1.06)	0.78**	(0.75, 0.82)	0.78**	(0.75, 0.82)	0.64**	(0.58, 0.71)	0.64**	(0.58, 0.71)
Hispanics	0.46**	(0.44, 0.49)	0.46**	(0.44, 0.49)	0.56**	(0.52, 0.60)	0.56**	(0.52, 0.60)	0.52**	(0.50, 0.55)	0.52**	(0.50, 0.55)	0.49**	(0.44, 0.54)	0.49**	(0.44, 0.54)
Sex																
Male	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
Female	1.40**	(1.34, 1.47)	1.40**	(1.34, 1.47)	1.34**	(1.27, 1.43)	1.35**	(1.27, 1.43)	1.40**	(1.35, 1.44)	1.39**	(1.35, 1.44)	1.58**	(1.48, 1.68)	1.58**	(1.48, 1.68)
Age																
18 to 44	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
45 to 64	1.17**	(1.11, 1.22)	1.17**	(1.11, 1.22)	1.32**	(1.24, 1.41)	1.33**	(1.24, 1.41)	1.50**	(1.45, 1.55)	1.50**	(1.45, 1.55)	1.79**	(1.69, 1.90)	1.79**	(1.69, 1.90)
Education																
Less than HS	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
HS Grad	1.34**	(1.27, 1.42)	1.34**	(1.27, 1.42)	1.54**	(1.42, 1.67)	1.54**	(1.42, 1.67)	2.05**	(1.95, 2.16)	2.05**	(1.95, 2.16)	2.25**	(1.97, 2.56)	2.25**	(1.97, 2.56)
Some College	1.66**	(1.57, 1.76)	1.66**	(1.57, 1.77)	1.95**	(1.79, 2.12)	1.95**	(1.79, 2.12)	2.75**	(2.60, 2.90)	2.75**	(2.60, 2.90)	3.43**	(3.02, 3.90)	3.44**	(3.03, 3.90)
College Grad	1.87**	(1.73, 2.02)	1.87**	(1.73, 2.02)	2.35**	(2.12, 2.60)	2.35**	(2.12, 2.60)	4.48**	(4.23, 4.75)	4.49**	(4.23, 4.75)	7.75**	(6.83, 8.79)	7.75**	(6.83, 8.79)
Diabetes Status																
No/Low Risk	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
High Risk	1.04	(1.00, 1.09)	1.04	(1.00, 1.09)	1.12**	(1.06, 1.19)	1.12**	(1.06, 1.19)	1.11**	(1.08, 1.15)	1.11**	(1.08, 1.15)	2.25**	(1.97, 2.56)	1.08*	(1.01, 1.15)
Diabetes	1.66**	(1.53, 1.80)	1.66**	(1.53, 1.80)	1.61**	(1.45, 1.80)	1.61**	(1.45, 1.80)	1.67**	(1.56, 1.79)	1.67**	(1.56, 1.79)	1.53**	(1.33, 1.76)	1.53**	(1.33, 1.76)
Chronic Disease																
Count 0-5	1.36**	(1.31, 1.41)	1.36**	(1.31, 1.41)	1.35**	(1.28, 1.42)	1.35**	(1.27, 1.42)	1.18**	(1.14, 1.22)	1.18**	(1.14, 1.22)	1.09*	(1.02, 1.18)	1.09*	(1.02, 1.18)
Self Reported Health																
Healthy	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
Unhealthy	0.98	(0.94, 1.03)	0.99	(0.94, 1.04)	0.96	(0.89, 1.03)	0.96	(0.89, 1.03)	0.80**	(0.76, 0.83)	0.80**	(0.76, 0.83)	0.77**	(0.69, 0.86)	0.77**	(0.69, 0.86)
Constant	0.52**	(0.48, 0.56)	0.59**	(0.55, 0.64)	0.58**	(0.52, 0.64)	0.63**	(0.57, 0.71)	0.94	(0.89, 1.00)	1.01	(0.94, 1.07)	2.78**	(2.43, 3.17)	2.89**	(2.51, 3.34)
F Statistic	308**		286**		143**		133**		538**		499**		231**		214**	

Notes:
1. Contains odds ratio for 47-state analtyic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Table AD-4.

Logistic Regression Models by Income for Specific Aim 1b (i.e. odds of insurance using 2014-2017-time dummies by expansion status for 47-state sample).

Probability of Insurance (Non-expansion vs. Expansion)	Income <100% FPL Log Odds	95% CI	Income <100% FPL Log Odds	95% CI	Income 100-138% FPL Log Odds	95% CI	Income 100-138% FPL Log Odds	95% CI	Income 139-400% FPL Log Odds	95% CI	Income 139-400% FPL Log Odds	95% CI	Income >400% FPL Log Odds	95% CI	Income >400% FPL Log Odds	95% CI
Expansion Status																
Non-expansion	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
Expansion	2.28**	(2.19, 2.39)	1.82**	(1.70, 1.95)	1.76**	(1.66, 1.87)	1.50**	(1.37, 1.64)	1.36**	(1.32, 1.40)	1.21**	(1.15, 1.27)	1.30**	(1.22, 1.38)	1.21**	(1.10, 1.34)
Year																
2012	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
2013	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
2014	1.48**	(1.39, 1.57)	1.26**	(1.16, 1.37)	1.63**	(1.50, 1.77)	1.53**	(1.36, 1.73)	1.46**	(1.39, 1.52)	1.38**	(1.29, 1.47)	1.36**	(1.24, 1.49)	1.38**	(1.19, 1.61)
2015	1.88**	(1.76, 2.00)	1.54**	(1.40, 1.70)	2.00**	(1.83, 2.18)	1.77**	(1.55, 2.02)	1.68**	(1.60, 1.77)	1.54**	(1.43, 1.66)	1.39**	(1.27, 1.52)	1.39**	(1.19, 1.61)
2016	2.11**	(1.97, 2.25)	1.61**	(1.45, 1.78)	1.88**	(1.72, 2.05)	1.52**	(1.33, 1.73)	1.85**	(1.76, 1.94)	1.69**	(1.57, 1.82)	1.42**	(1.30, 1.55)	1.30**	(1.13, 1.50)
2017	2.11**	(1.97, 2.27)	1.61**	(1.44, 1.80)	2.07**	(1.88, 2.27)	1.69**	(1.46, 1.95)	1.62**	(1.54, 1.70)	1.38**	(1.28, 1.49)	1.29**	(1.18, 1.40)	1.09	(0.95, 1.25)
Year*EXP																
2012*EXP			Ref				Ref				Ref				Ref	
2013*EXP			Ref				Ref				Ref				Ref	
2014*EXP			1.31**	(1.16, 1.47)			1.11	(0.94, 1.31)			1.11*	(1.01, 1.21)			0.97	(0.81, 1.18)
2015*EXP			1.42**	(1.24, 1.61)			1.25*	(1.05, 1.49)			1.18*	(1.07, 1.30)			1.00	(083, 1.20)
2016*EXP			1.61**	(1.41, 1.84)			1.49**	(1.25, 1.78)			1.18*	(1.07, 1.29)			1.17	(0.98, 1.40)
2017*EXP			1.62**	(1.40, 1.88)			1.46**	(1.21, 1.76)			1.35**	(1.22, 1.48)			1.34*	(1.13, 1.59)
Other Variables																
Race																
Whites	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
Blacks	0.93*	(0.88, 0.99)	0.93*	(0.89, 0.99)	0.99	(0.91, 1.07)	0.98	(0.91, 1.06)	0.78**	(0.75, 0.82)	0.78**	(0.75, 0.82)	0.64**	(0.58, 0.71)	0.64**	(0.58, 0.71)
Hispanics	0.46**	(0.44, 0.48)	0.46**	(0.44, 0.48)	0.56**	(0.52, 0.60)	0.56**	(0.52, 0.60)	0.52**	(0.50, 0.55)	0.52**	(0.50, 0.54)	0.49**	(0.44, 0.54)	0.49**	(0.44, 0.54)
Sex																
Male	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
Female	1.40**	(1.34, 1.47)	1.40**	(1.34, 1.47)	1.34**	(1.27, 1.42)	1.34**	(1.27, 1.43)	1.39**	(1.35, 1.44)	1.39**	(1.35, 1.44)	1.58**	(1.48, 1.68)	1.58**	(1.48, 1.68)
Age																
18 to 44	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
45 to 64	1.17**	(1.11, 1.22)	1.17**	(1.11, 1.22)	1.33**	(1.24, 1.41)	1.33**	(1.25, 1.41)	1.50**	(1.46, 1.55)	1.50**	(1.45, 1.55)	1.79**	(1.69, 1.90)	1.80**	(1.69, 1.90)
Education																
Less than HS	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
HS Grad	1.34**	(1.27, 1.42)	1.34**	(1.27, 1.42)	1.54**	(1.42, 1.67)	1.54**	(1.42, 1.67)	2.05**	(1.95, 2.16)	2.06**	(1.95, 2.17)	2.25**	(1.98, 2.56)	2.25**	(1.98, 2.56)
Some College	1.67**	(1.57, 1.77)	1.67**	(1.57, 1.77)	1.95**	(1.79, 2.12)	1.95**	(1.79, 2.12)	2.75**	(2.61, 2.90)	2.75**	(2.61, 2.91)	3.44**	(3.02, 3.90)	3.44**	(3.03, 3.91)
College Grad	1.87**	(1.73, 2.02)	1.87**	(1.73, 2.02)	2.36**	(2.13, 2.61)	2.36**	(2.13, 2.61)	4.49**	(4.24, 4.76)	4.50**	(4.24, 4.77)	7.75**	(6.84, 8.79)	7.77**	(6.85, 8.82)
Diabetes Status																
No/Low Risk	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
High Risk	1.65**	(1.52, 1.79)	1.04	(0.99, 1.09)	1.12**	(1.05, 1.19)	1.12**	(1.05, 1.19)	1.11**	(1.07, 1.15)	1.11**	(1.07, 1.15)	1.08*	(1.01, 1.15)	1.08*	(1.01, 1.15)
Diabetes	1.65**	(1.52, 1.79)	1.65**	(1.53, 1.80)	1.61**	(1.44, 1.79)	1.61**	(1.44, 1.80)	1.67**	(1.56, 1.79)	1.67**	(1.56, 1.79)	1.53**	(1.33, 1.76)	1.53**	(1.33, 1.76)
Chronic Disease																
Count 0-5	1.36**	(1.31, 1.41)	1.36**	(1.31, 1.41)	1.35**	(1.28, 1.42)	1.35**	(1.28, 1.42)	1.18**	(1.14, 1.22)	1.18**	(1.14, 1.22)	1.10*	(1.02, 1.18)	1.10*	(1.02, 1.18)
Self Reported Health																
Healthy	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
Unhealthy	0.98	(0.93, 1.03)	0.99	(0.94, 1.04)	0.96	(0.89, 1.03)	0.96	(0.89, 1.03)	0.80**	(0.76, 0.83)	0.80**	(0.76, 0.83)	0.77**	(0.69, 0.86)	0.77**	(0.69, 0.86)
Constant	0.52**	(0.48, 0.56)	0.59**	(0.55, 0.64)	0.58**	(0.52, 0.64)	0.64**	(0.57, 0.71)	0.95	(0.89, 1.00)	1.01	(0.94, 1.07)	2.77**	(2.43, 3.17)	2.89**	(2.50, 3.33)
F Statistic	258**		207**		118**		94**		441**		353**		188**		150**	

Notes:
1. Contains odds ratio for 47-state analtyic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios
4. Separate model run per income level

Discussion on Additional Regression Coefficients

Expanding health insurance options to low-income adults who were previously uninsured was the main goal of the ACA because having insurance is the first step to ensuring access to the health care system. However, differences in insurance coverage did not only exist among income groups. **Table AD-5** summarizes all regression coefficients for demographic and health status variables in this analysis. Of particular focus for the next section are two variables: race and diabetes risk status. Overall racial/ethnic minorities were less likely to have insurance when compared to whites; with Hispanics being 48% less likely to have insurance. The overall odds are averaged over 6 years.

Interestingly, when stratifying by income, disparities in insurance coverage among whites and minorities groups were the worst for the highest income group, after adjusting for other factors, including education in the pre-ACA period. In the pre-ACA period, the insurance gap between whites and blacks was narrow, with widening occurring at higher incomes. This was not the case for Hispanics, disparities between whites and Hispanics were stark in the pre-ACA period.

In the post-ACA period, blacks were 6% more likely to have insurance coverage than whites; whereas Hispanics were 30% less likely to have insurance coverage compared to whites, when adjusting for other factors. These odds were calculated using the following formula:

<u>Example Overall ACA effect for Blacks:</u>

- $\text{Exp}\{\ln(0.79)+\ln(1.34)\}=1.0586$

The odds of insurance in the post ACA period for blacks when compared to whites by income group was:

- <100% FPL: 39% more likely;
- 100-138% FPL: 60% more likely;
- 139-400% FPL: 16% more likely;
- >400% FPL: 19% less likely.

The odds of insurance in the post ACA period for Hispanics when compared to whites by income group was:

- <100% FPL: 32% less likely;
- 100-138% FPL: 9% less likely;
- 139-400% FPL: 23% less likely;
- >400% FPL: 38% less likely.

The ACA improved insurance overall coverage for minorities, with blacks benefiting well above the white reference group. Opportunities still exist to close the coverage gap between whites and Hispanics post-ACA. As the odds ratio coefficients for expansion status range from 27-69% more than in non-expansion states, it is apparent that minorities made larger insurance gains in expansion states as well.

Table AD-5.

Summary Table Comparing Overall Logistic Coefficients for Demographic and Health Status Variables to Logistic Coefficient for Subgroups by Income Group.

	TABLE AD-1 ODDS RATIOS		TABLE AD-3 ODDS RATIOS BY INCOME GROUP (% FPL)			
COVARIATE	**OVERALL**		**<100%**	**100-138%**	**139-400%**	**>400%**
Blacks	0.79		0.94	0.99	0.78	0.64
Hispanics	0.52		0.46	0.56	0.52	0.49
Female	1.42		1.40	1.35	1.39	1.58
45-64	1.43		1.17	1.33	1.50	1.79
HS Grad	1.61		1.34	1.54	2.05	2.25
Some College	2.13		1.66	1.95	2.75	3.44
College Grad	3.67		1.87	2.35	4.49	7.75
High Risk	1.08		1.04	1.12	1.11	1.08
Diabetes	1.60		1.66	1.61	1.67	1.53
CD Count 0-5	1.26		1.36	1.35	1.18	1.09
Unhealthy	0.88		0.99	0.96	0.80	0.77
Post-ACA	1.34		1.48	1.62	1.49	1.27
EXP	-		1.82	1.50	1.21	1.21
ACA*EXP	-		1.47	1.31	1.20	1.12

Note(s):

1. Data sources from stepwise regression in Tables AD-1 and AD-3

For the high risk for diabetes group, the odds of having insurance ranged from 4-12% over the no/low risk in the pre-ACA period, when adjusting for other factors. High risk individuals with a higher income (>100% FPL) had higher odds of having insurance in the pre-ACA period, yet it was still relatively low. Post-ACA gains in insurance coverage seemed to benefit the high-risk group. High risk individuals in the <100% FPL group were 54% more likely to have insurance than those at no/low risk when adjusting for other variables. In fact, all high-risk groups made gains in insurance coverage post-ACA over the no/low risk group:

- <100% FPL: 54% more likely;
- 100-138% FPL: 81% more likely;
- 139-400% FPL: 65% more likely;
- >400% FPL: 37% more likely.

As the odds ratio coefficients for expansion status range from 27-69% more than in non-expansion states, it is apparent that high risk individuals made larger insurance gains in expansion states as well. In the next section, the impact of the ACA on increasing health care access for racial/ethnic minorities and those at high risk for diabetes will be explored.

APPENDIX AE

LOGISTIC REGRESSIONS FOR ODDS OF PCP BY INS AND RACE

Introduction to Specific Aim 2-Health Care Access. This section begins with describing the impact of insurance on the odds of having a PCP. Refer to Chapter 4, page 190 for in-text discussion. Full regression models using pre/post-ACA indicator available in Table AE-1. Full regression models using time dummy variables are available in Table AE-2. After 2014, there was a 6% decline of in the report of having a PCP from 2014 to 2017 among individuals who reported having insurance coverage.

Specific Aim 2a. Pre/Post-ACA Health Care Access Odds with ACA-Race Interactions. Refer to Chapter 4, page 201 for in-text discussion. Full regression models available in Table AE-3.

Specific Aim 2a. Annual ACA PCP Odds Ratios with ACA-Race Interactions. Refer to Chapter 4, page 207 for in-text discussion. Full regression models available in Table AE-4.

Specific Aim 2b. Pre/Post-ACA Odds Ratios for PCP Controlling for Expansion Status by Race Group. Refer to Chapter 4, page 210 for in-text discussion. Full regression models available in Table AE-5.

Specific Aim 2b. Annual ACA PCP Odds Ratios Controlling for Expansion Status by Race Group. Full regression models using time variables are available in Table AE-6. Although whites and Hispanics time tends were not statistically significant, the odds of having a PCP in expansion states was increasing slightly for whites, and at a faster rate for Hispanics in 2016. In 2014, blacks were 7% more likely to have a PCP than whites within expansion states, and the rate continued to increase in the post-ACA period to a likelihood of having a PCP at 18% for blacks in expansion states by 2017.

Table AE-1.

Logistic Regression Models for the Odds of having a PCP by INS status using Pre/post ACA Indicator for 47-state Analytic Sample.

Probability of Having a PCP (n=1,283,537)	**Model 1 Odds Ratio**	**95% CI**	**Model 2 Odds Ratio**	**95% CI**	**Model 3 Odds Ratio**	**95% CI**	**Model 4 Odds Ratio**	**95% CI**
ACA								
Pre-ACA	Ref		Ref		Ref		Ref	
Post-ACA	1.03**	(1.02, 1.05)	1.04**	(1.02, 1.05)	0.90**	(0.88, 0.91)	1.01	(0.97, 1.05)
Insurance								
Uninsured					Ref		Ref	
Insured					5.33**	(5.21, 5.46)	5.88**	(5.67, 6.09)
ACA*INS								
ACA*INS							0.85**	(0.81, 0.89)
Other Variables								
Race								
Whites			Ref		Ref		Ref	
Blacks			0.86**	(0.84, 0.88)	0.95*	(0.93, 0.98)	0.95*	(0.93, 0.98)
Hispanics			0.56**	(0.54, 0.57)	0.69**	(0.67, 0.71)	0.69**	(0.67, 0.71)
Education								
Less than HS			Ref		Ref		Ref	
HS Grad			1.62**	(1.57, 1.67)	1.31**	(1.27, 1.36)	1.31**	(1.27, 1.36)
Some College			2.04**	(1.98, 2.11)	1.49**	(1.44, 1.54)	1.49**	(1.44, 1.54)
College Grad			2.83**	(2.74, 2.92)	1.78**	(1.72, 1.84)	1.78**	(1.72, 1.85)
Age								
18 to 44			Ref		Ref		Ref	
45 to 64			2.50**	(2.46, 2.55)	2.39**	(2.34, 2.43)	2.39**	(2.34, 2.43)
Sex								
Male			Ref		Ref		Ref	
Female			1.94**	(1.91, 1.98)	1.96**	(1.92, 1.99)	1.96**	(1.92, 1.99)
Diabetes Status								
No/Low Risk			Ref		Ref		Ref	
High Risk			1.18**	(1.15, 1.20)	1.18**	(1.16, 1.20)	1.18**	(1.16, 1.20)
Diabetes			2.98**	(2.84, 3.13)	2.88**	(2.74, 3.02)	2.88**	(2.74, 3.02)
Chronic Disease								
Count 0-5			1.39**	(1.36, 1.42)	1.36**	(1.33, 1.39)	1.36**	(1.33, 1.39)
Self Reported Health								
Healthy			Ref		Ref		Ref	
Unhealthy			0.93**	(0.90, 0.95)	1.03*	1.00, 1.06)	1.03*	(1.00, 1.06)
PCP Supply								
Adequate Supply			Ref		Ref		Ref	
Low Supply			0.74**	(0.73, 0.75)	0.81**	(0.80, 0.83)	0.81**	(0.80, 0.83)
Constant	2.79**	(2.75, 2.83)	0.85**	(0.82, 0.88)	0.30**	(0.29, 0.32)	0.28**	(0.27, 0.30)
F Statistic	16**		2285**		3070**		2877**	

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Table AE-2.

Logistic Regression Models for the likelihood of having a PCP by INS Status using 2012-2017 Time Dummy Variables; 47-state analytic sample.

Probability of Having a PCP (n=1,283,537)	**Model 1 Odds Ratio**	**95% CI**	**Model 2 Odds Ratio**	**95% CI**	**Model 3 Odds Ratio**	**95% CI**	**Model 4 Odds Ratio**	**95% CI**
ACA								
2012	Ref		Ref		Ref		Ref	
2013	Ref		Ref		Ref		Ref	
2014	1.01	(0.99, 1.04)	1.01	(0.98, 1.03)	0.91**	(0.89, 0.93)	0.98	(0.93, 1.04)
2015	1.07**	(1.05, 1.10)	1.08**	(1.05, 1.10)	0.93**	(0.91, 9.96)	1.06	(0.99, 1.13)
2016	1.05**	(1.02, 1.07)	1.06**	(1.03, 1.09)	0.89**	(0.87, 0.92)	1.06	(1.00, 1.12)
2017	1.01	(0.99, 1.04)	1.00	(0.98, 1.03)	0.85**	(0.83, 0.87)	0.95	(0.89, 1.01)
Insurance								
Uninsured					Ref		ref	
Insured					5.34**	(5.22, 5.47)	5.88**	(5.67, 6.09)
ACA*INS								
2012*INS							Ref	
2013*INS							Ref	
2014*INS							0.90*	(0.84, 0.96)
2015*INS							0.84**	(0.78, 0.90)
2016*INS							0.80**	(0.75, 0.90)
2017*INS							0.86**	(0.80, 0.92)
Other Variables								
Race								
Whites			Ref		Ref		Ref	
Blacks			0.86**	(0.83, 0.88)	0.95*	(0.93, 0.98)	0.95*	(0.93, 0.98)
Hispanics			0.55**	(0.54, 0.57)	0.69**	(0.67, 0.71)	0.69**	(0.67, 0.71)
Education								
Less than HS			Ref		Ref		Ref	
HS Grad			1.62**	(1.57, 1.67)	1.31**	(1.27, 1.36)	1.31**	(1.27, 1.36)
Some College			2.04**	(1.98, 2.11)	1.49**	(1.44, 1.54)	1.49**	(1.43, 1.54)
College Grad			2.83**	(2.74, 2.92)	1.79**	(1.72, 1.85)	1.79**	(1.73, 1.85)
Age								
18 to 44			Ref		Ref		Ref	
45 to 64			2.50**	(2.46, 2.55)	2.39**	(2.34, 2.43)	2.39**	(2.34, 2.43)
Sex								
Male			Ref		Ref		Ref	
Female			1.94**	(1.91, 1.98)	1.96**	(1.92, 1.99)	1.96**	(1.92, 1.99)
Diabetes Status								
No/Low Risk			Ref		Ref		Ref	
High Risk			1.18**	(1.15, 1.20)	1.18**	(1.16, 1.20)	1.18**	(1.16, 1.20)
Diabetes			2.98**	(2.84, 3.13)	2.88**	(2.74, 3.02)	2.88**	(2.74, 3.02)
Chronic Disease								
Count 0-5			1.39**	(1.36, 1.42)	1.36**	(1.33, 1.39)	1.36**	(1.33, 1.39)
Self Reported Health								
Healthy			Ref		Ref		Ref	
Unhealthy			0.93**	(0.90, 9.96)	1.03*	(1.00, 1.06)	1.03*	(1.00, 1.06)
PCP Supply								
Adequate Supply			Ref		Ref		Ref	
Low Supply			0.93**	(0.90, 0.96)	0.81**	(0.80, 0.83)	0.81**	(0.80, 0.83)
Constant	2.79**	(2.75, 2.83)	0.85**	(0.82, 0.88)	0.30**	(0.29, 0.32)	0.28**	(0.27, 0.30)
F Statistic	10**		1858**		2532**		2061**	

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Table AE-3.

Regression Models for the Likelihood of having a PCP by Race/ethnicity, using Pre/post ACA Indicator; 47-state Analytic Sample.

Probability of Having a PCP (n=1,283,537)	**Model 1 Odds Ratio**	**95% CI**	**Model 2 Odds Ratio**	**95% CI**	**Model 3 Odds Ratio**	**95% CI**	**Model 4 Odds Ratio**	**95% CI**
ACA								
Pre-ACA	Ref		Ref		Ref		Ref	
Post-ACA	1.03**	(1.02, 1.05)	0.89**	(0.87, 0.91)	0.90**	(0.88, 0.91)	0.87**	(0.85, 0.89)
Race								
Whites					Ref		Ref	
Blacks					0.95*	(0.93, 0.98)	0.89**	(0.85, 0.93)
Hispanics					0.69**	(0.67, 0.71)	0.66**	(0.63, 0.69)
ACA*Race								
ACA*whites							Ref	
ACA*blacks							1.11**	(1.05, 1.18)
ACA*hispanics							1.08*	(1.02, 1.14)
Other Variables								
Insurance								
Uninsured			Ref		Ref		Ref	
Insured			5.57**	(5.44, 5.71)	5.33**	(5.21, 5.46)	5.33**	(5.21, 5.46)
Education								
Less than HS			Ref		Ref		Ref	
HS Grad			1.44**	(1.39, 1.49)	1.31**	(1.27, 1.36)	1.31**	(1.27, 1.36)
Some College			1.66**	(1.60, 1.71)	1.49**	(1.44, 1.54)	1.49**	(1.43, 1.54)
College Grad			2.02**	(1.96, 2.10)	1.78**	(1.72, 1.85)	1.78**	(1.72, 1.85)
Age								
18 to 44			Ref		Ref		Ref	
45 to 64			2.46**	(2.42, 2.51)	2.39**	(2.34, 2.43)	2.39**	(2.34, 2.43)
Sex								
Male			Ref		Ref		Ref	
Female			1.94**	(1.91, 1.98)	1.96**	(1.92, 1.99)	1.96**	(1.92, 1.99)
Diabetes Status								
No/Low Risk			Ref		Ref		Ref	
High Risk			1.16**	(1.14, 1.19)	1.18**	(1.16, 1.20)	1.18**	(1.17, 1.20)
Diabetes			2.890**	(2.67, 2.93)	2.88**	(2.74, 3.02)	2.88**	(2.74, 3.02)
Chronic Disease								
Count 0-5			1.40**	(1.39, 1.43)	1.36**	(1.33, 1.39)	1.36**	(1.33, 1.39)
Self Reported Health								
Healthy			Ref		Ref		Ref	
Unhealthy			1.01	(0.98, 1.04)	1.03*	(1.00, 1.06)	1.03*	(1.00, 1.06)
PCP Supply								
Adequate Supply			Ref		Ref		Ref	
Low Supply			0.82**	(0.80, 0.83)	0.81**	(0.80, 0.83)	0.81**	(0.80, 0.83)
Constant	2.79**	(2.75, 2.83)	0.25**	(0.24, 0.26)	0.30**	(0.29, 0.32)	0.31**	(0.30, 0.32)
F Statistic	16**		3576**		3070**		2686**	

Notes:

1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Table AE-4.

Logistic Regressions using Time Dummy Variables (2014-2017) for the Likelihood of having a PCP Post-ACA.

Probability of Having a PCP (n=1,283,537)	**Model 1 Odds Ratio**	**95% CI**	**Model 2 Odds Ratio**	**95% CI**	**Model 3 Odds Ratio**	**95% CI**	**Model 4 Odds Ratio**	**95% CI**
Year								
2012	Ref		Ref		Ref		Ref	
2013	Ref		Ref		Ref		Ref	
2014	1.01	(0.99, 1.04)	0.91**	(0.89, 0.93)	0.91**	(0.89, 0.93)	0.89**	(0.87, 0.92)
2015	1.07**	(1.05, 1.10)	0.93**	(0.90, 0.95)	0.93**	(0.91, 0.96)	0.90**	(0.87, 0.93)
2016	1.05**	(1.02, 1.07)	0.88**	(0.86, 0.91)	0.90**	(0.87, 0.92)	0.87**	(0.84, 0.89)
2017	1.01	(0.99, 1.04)	0.84**	(0.82, 0.87)	0.85**	(0.83, 0.87)	0.81**	(0.79, 0.84)
Race								
Whites					Ref		Ref	
Blacks					0.95*	(0.93, 0.98)	0.89**	(0.85, 0.93)
Hispanics					0.69**	(0.67, 0.71)	0.66**	(0.63, 0.69)
Year*Race								
2014*whites							Ref	
2014 *blacks							1.10*	(1.01, 1.19)
2014*hispanics							1.03	(0.96, 1.11)
2015*whites							Ref	
2015 *blacks							1.07	(0.98, 1.17)
2015*hispanics							1.11*	(1.03, 1.20)
2016*whites							Ref	
2016 *blacks							1.12*	(1.03, 1.22)
2016*hispanics							1.07	(0.99, 1.15)
2017*whites							Ref	
2017 *blacks							1.15*	(1.06, 1.25)
2017*hispanics							1.11*	(1.03, 1.20)
Other Variables								
Insurance								
Uninsured			Ref		Ref		Ref	
Insured			5.58**	(5.45, 5.71)	5.34**	(5.22, 5.47)	5.34**	(5.21, 5.46)
Education								
Less than HS			Ref		Ref		Ref	
HS Grad			1.44**	(1.39, 1.49)	1.31**	(1.27, 1.36)	1.31**	(1.27, 1.36)
Some College			1.65**	(1.60, 1.71)	1.49**	(1.44, 1.54)	1.49**	(1.44, 1.54)
College Grad			2.03**	(1.96, 2.10)	1.79**	(1.72, 1.84)	1.79**	(1.73, 1.85)
Age								
18 to 44			Ref		Ref		Ref	
45 to 64			2.46**	(2.41, 2.51)	2.39**	(2.34, 2.43)	2.39**	(2.34, 2.43)
Sex								
Male			Ref		Ref		Ref	
Female			1.94**	(1.91, 1.98)	1.96**	(1.92, 1.99)	1.96**	(1.92, 1.99)
Diabetes Status								
No/Low Risk			Ref		Ref		Ref	
High Risk			1.16**	(1.14, 1.89)	1.18**	(1.6, 1.20)	1.18**	(1.16, 1.20)
Diabetes			2.80**	(2.67, 2.94)	2.88**	(2.74, 3.02)	2.88**	(2.74, 3.02)
Chronic Disease								
Count 0-5			1.40**	(1.37, 1.43)	1.36**	(1.33, 1.39)	1.36**	(1.33, 1.39)
Self Reported Health								
Healthy			Ref		Ref		Ref	
Unhealthy			1.01	(0.98, 1.04)	1.03*	(1.00, 1.06)	1.03*	(1.00, 1.06)
PCP Supply								
Adequate Supply			Ref		Ref		Ref	
Low Supply			0.82**	(0.80, 0.83)	0.81**	(0.80, 0.83)	0.81**	(0.80, 0.83)
Constant	2.79**	(2.75, 2.83)	0.24**	(0.24, 0.25)	0.30**	(0.29, 0.32)	0.31**	(0.30, 0.32)
F Statistic	10**		2865**		2532**		1723**	

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Table AE-5.

Logistic Regression Models for the Odds of having a PCP Post-ACA by Race and Expansion Status, using Pre/post-ACA Indicator; 47-state analytic sample.

Probability of PCP (Logistic)	**Whites Only (n=1,048, 152)**	**95% CI**	**Whites Only (n=1,048, 152)**	**95% CI**	**Blacks Only (n=121,844)**	**95% CI**	**Blacks Only (n=121,844)**	**95% CI**	**Hispanics Only (n=113,541)**	**95% CI**	**Hispanics Only (n=113,541)**	**95% CI**
Expansion Status												
Non-expansion	Ref		Ref		Ref		Ref		Ref		Ref	
Expansion	1.16**	(1.14, 1.19)	1.15**	(1.12, 1.19)	1.17**	(1.10, 1.24)	1.08	(0.98, 1.18)	1.17**	(1.10, 1.24)	1.09	(0.99, 1.20)
ACA												
Pre ACA	Ref		Ref		Ref		Ref		Ref		Ref	
Post ACA	0.88**	(0.86, 0.89)	0.87**	(0.84, 0.90)	0.95	(0.90, 1.00)	0.90*	(0.83, 0.97)	0.93*	(0.89, 0.98)	0.87*	(0.80, 0.95)
Interaction Term												
ACA*EXP			1.01	(0.97, 1.06)			1.13*	(1.01, 1.26)			1.11	(1.00, 1.23)
Other Variables												
PCP Supply												
Adequate	Ref		Ref		Ref		Ref		Ref		Ref	
Low Supply	0.88**	(0.86, 0.90)	0.88**	(0.86, 0.90)	0.85**	(0.80, 0.90)	0.85**	(0.80, 0.90)	0.85**	(0.80, 0.90)	0.85**	(0.80, 0.90)
ACA												
Pre ACA	Ref		Ref		Ref		Ref		Ref		Ref	
Post ACA	0.88**	(0.86, 0.89)	0.87**	(0.84, 0.90)	0.95	(0.90, 1.00)	0.90*	(0.83, 0.97)	0.93*	(0.89, 0.98)	0.87*	(0.80, 0.95)
Insurance												
Uninsured	Ref		Ref		Ref		Ref		Ref		Ref	
Insured	4.97**	(4.83, 5.11)	4.97**	(4.83, 5.11)	6.00**	5.64, 6.38)	6.00**	(5.63, 6.37)	5.48**	(5.20, 5.78)	5.48**	(5.20, 5.78)
Sex												
Male	Ref		Ref		Ref		Ref		Ref		Ref	
Female	1.96**	(1.92, 2.00)	1.96**	(1.92, 2.00)	1.99**	(1.89, 2.10)	1.99**	(1.89, 2.10)	1.94**	(1.85, 2.03)	1.94**	(1.85, 2.03)
Age												
18 to 44	Ref		Ref		Ref		Ref		Ref		Ref	
45 to 64	2.52**	(2.47, 2.57)	2.52**	(2.47, 2.57)	2.48**	(2.34, 2.63)	2.48**	(2.34, 2.63)	1.97**	(1.87, 2.08)	1.97**	(1.87, 2.08)
Education												
Less than HS	Ref		Ref		Ref		Ref		Ref		Ref	
HS Grad	1.19**	(1.14, 1.25)	1.19**	(1.14, 1.25)	1.24**	(1.13, 1.37)	1.24**	(1.13, 1.37)	1.39**	(1.30, 1.48)	1.39**	(1.30, 1.48)
Some College	1.34**	(1.28, 1.41)	1.34**	(1.28, 1.41)	1.40**	(1.27, 1.54)	1.40**	(1.27, 1.54)	1.64**	(1.53, 1.75)	1.64**	(1.52, 1.75)
College Grad	1.56**	(1.49, 1.63)	1.56**	(1.49, 1.63)	2.14**	(1.94, 2.37)	2.14**	(1.93, 2.37)	2.15**	(1.99, 2.31)	2.15**	(1.99, 2.31)
Diabetes Status												
No/Low Risk	Ref		Ref		Ref		Ref		Ref		Ref	
High Risk	1.20**	(1.18, 1.23)	1.20**	(1.18, 1.23)	1.20**	(1.13, 1.27)	1.20**	(1.13, 1.27)	1.11**	(1.06, 1.17)	1.11**	(1.06, 1.17)
Diabetes	3.10*	(2.92, 3.27)	3.10**	(2.92, 3.28)	2.85*	(2.53, 3.22)	2.89**	(2.54, 3.22)	2.75**	(2.47, 3.06)	2.75**	(2.47, 3.06)
Chronic Disease												
Count 0-5	1.34**	(1.31, 1.37)	1.34**	(1.31, 1.37)	1.33**	(1.25, 1.41)	1.33**	(1.25, 1.41)	1.37**	(1.28, 1.45)	1.36**	(1.28, 1.45)
Self Reported Health												
Healthy	Ref		Ref		Ref		Ref		Ref		Ref	
Unhealthy	1.04*	(1.01, 1.08)	1.04*	(1.01, 1.08)	1.04	(0.96, 1.12)	1.04	(0.97, 1.12)	1.03	(0.97, 1.10)	1.03	(0.97, 1.10)
Constant	0.31**	(0.30, 0.33)	0.31**	(0.30, 0.33)	0.23**	(0.20, 0.26)	0.24**	(0.21, 0.27)	0.18**	(0.17, 0.20)	0.19**	(0.17, 0.21)
F Statistic	2324**		2159**		449**		417**		543**		505**	

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Table AE-6.

Logistic Regression Models for the Odds of having a PCP Post-ACA by Race and Expansion Status, using Pre/post-ACA Indicator; 47-state analytic sample.

Probability of PCP (Logistic)	Whites Only (n=1,048, 152)	95% CI	Whites Only (n=1,048, 152)	95% CI	Blacks Only (n=121,844)	95% CI	Blacks Only (n=121,844)	95% CI	Hispanics Only (n=113,541)	95% CI	Hispanics Only (n=113,541)	95% CI
Expansion Status												
Non-expansion	Ref		Ref		Ref		Ref		Ref		Ref	
Expansion	1.16**	(1.14, 1.19)	1.15**	(1.12, 1.20)	1.17**	(1.10, 1.24)	1.08	(0.92, 1.18)	1.17**	(1.10, 1.24)	1.09	(1.00, 1.20)
Years												
2012	Ref		Ref		Ref		Ref		Ref		Ref	
2013	Ref		Ref		Ref		Ref		Ref		Ref	
2014	0.90**	(0.87, 0.93)	0.92**	(0.88, 0.96)	0.97	(0.90, 1.05)	0.94	(0.84, 1.05)	0.92*	(0.86, 0.99)	0.87*	(0.77, 0.97)
2015	0.91*	(0.88, 0.94)	0.89**	(0.85, 0.93)	0.95	(0.88, 1.04)	0.87*	(0.77, 0.97)	1.00	(0.93, 1.08)	0.98	(0.86, 1.11)
2016	0.88**	(0.85, 0.90)	0.88**	(0.84, 0.92)	0.96	(0.88, 1.04)	0.93	(0.83, 1.05)	0.92*	(0.86, 0.99)	0.84*	(0.74, 0.96)
2017	0.82**	(0.80, 0.85)	0.81**	(0.77, 0.85)	0.92*	(0.85, 1.00)	0.85*	(0.76, 0.95)	0.90*	(0.84, 0.97)	0.82*	(0.72, 0.94)
Interaction Terms												
2012*EXP			Ref				Ref				Ref	
2013*EXP			Ref				Ref				Ref	
2014*EXP			0.97	(0.92, 1.03)			1.07	(0.91, 1.25)			1.1	(0.95, 1.27)
2015*EXP			1.04	(0.98, 1.11)			1.23*	(1.05, 1.45)			1.04	(0.89, 1.21)
2016*EXP			1.00	0.95, 1.06)			1.06	(0.90, 1.24)			1.15	(0.98, 1.34)
2017*EXP			1.04	(0.98, 1.10)			1.18*	(1.01, 1.38)			1.15	(0.98, 1.35)
Other Variables												
Insurance												
Uninsured	Ref		Ref		Ref		Ref		Ref		Ref	
Insured	4.98**	(4.84, 5.11)	4.97**	(4.84, 5.11)	6.00**	(5.64, 6.38)	6.00**	(5.64, 6.40)	5.48**	(5.20, 5.78)	5.48**	(5.20, 5.78)
PCP Supply												
Adequate	Ref		Ref		Ref		Ref		Ref		Ref	
Low Supply	0.88**	(0.86, 0.90)	0.88**	(0.86, 0.90)	0.85**	(0.80, 0.90)	0.84**	(0.80, 0.90)	0.85**	(0.80, 0.90)	0.85**	(0.80, 0.90)
Sex												
Male	Ref		Ref		Ref		Ref		Ref		Ref	
Female	1.96**	(1.92, 2.00)	1.96**	(1.92, 2.00)	1.99**	(1.89, 2.10)	1.99**	(1.89, 2.10)	1.94**	(1.85, 2.03)	1.94**	(1.85, 2.03)
Age												
18 to 44	Ref		Ref		Ref		Ref		Ref		Ref	
45 to 64	2.52**	(2.47, 2.57)	2.52**	(2.47, 2.57)	2.48**	(2.34, 2.63)	2.48**	(2.34, 2.63)	1.97**	(1.87, 2.08)	1.97**	(1.87, 2.08)
Education												
Less than HS	Ref		Ref		Ref		Ref		Ref		Ref	
HS Grad	1.19**	(1.14, 1.25)	1.19**	(1.14, 1.25)	1.25**	(1.13, 1.37)	1.24**	(1.13, 1.37)	1.39**	(1.30, 1.49)	1.39**	(1.30, 1.49)
Some College	1.34**	(1.28, 1.41)	1.34**	(1.28, 1.41)	1.40**	(1.27, 1.54)	1.40**	(1.27, 1.54)	1.64**	(1.53, 1.75)	1.63**	(1.53, 1.750
College Grad	1.56**	(1.49, 1.64)	1.56**	(1.49, 1.64)	2.14**	(1.94, 2.37)	2.14**	(1.94, 2.37)	2.15**	(1.99, 2.32)	2.15**	(1.99, 2.32)
Diabetes Status												
No/Low Risk	Ref		Ref		Ref		Ref		Ref		Ref	
High Risk	1.20**	(1.18, 1.23)	1.20**	(1.18, 1.23)	1.20**	(1.13, 1.27)	1.20**	(1.14, 1.27)	1.11**	(1.06, 1.17)	1.11**	(1.06, 1.17)
Diabetes	3.10**	(2.93, 3.38)	3.10**	(2.93, 3.28)	2.86**	(2.54, 3.22)	2.86**	(2.54, 3.22)	2.75**	(2.48, 3.06)	2.75**	(2.48, 3.06)
Chronic Disease												
Count 0-5	1.34**	(1.31, 1.37)	1.34**	(1.31, 1.37)	1.33**	(1.25, 1.41)	1.33**	(1.25, 1.41)	1.36**	(1.28, 1.45)	1.36**	(1.28, 1.45)
Self Reported Health												
Healthy	Ref		Ref		Ref		Ref		Ref		Ref	
Unhealthy	1.04*	(1.01, 1.08)	1.04*	(1.01, 1.08)	1.04	(0.97, 1.12)	1.04*	(0.97, 1.12)	1.03	(0.97, 1.10)	1.03	(0.97, 1.10)
Constant	0.31**	(0.30, 0.33)	0.31**	(0.30, 0.33)	0.23**	(0.20, 0.26)	0.24**	(0.21, 0.27)	0.18**	(0.17, 0.20)	0.19**	(0.17, 0.21)
F Statistic	1894**		1515**		366**		292**		443**		355**	

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Discussion on Additional Regression Coefficients

To gain a better understanding of how the three race/ethnic models differ, **Table AE-7** provides a summary of logistic odds ratios for the demographic, health status and state level variables for each group, including the overall odds ratios. These coefficients are also compared with a single, overall model of PCP access from **Table AE-3**, which assumes equal coefficients across the three groups. Higher coefficients for one race/ethnic group indicate that certain variables have a larger effect in gaining access to a PCP.

Insurance coverage and college play a larger role in having a PCP for minorities than whites. Age appears to play a smaller role in having a PCP for Hispanics than either whites or blacks. The effects of health status or PCP supply on having a PCP vary little across race/ethnic groups.

Table AE-7.

Summary Table Comparing Overall Logistic Odds Ratios for Demographic, Health Status and State Level Variables to Odds Ratios by Racial/ethnic Subgroups.

	TABLE AE-3 ODDS RATIOS		TABLE AE-5 ODDS RATIOS BY RACE		
COVARIATE	**OVERALL**		**WHITES**	**BLACKS**	**HISPANICS**
Insured	5.88**		4.97**	6.00**	5.48**
Female	1.96**		1.96**	1.99**	1.94**
45-64	2.39**		2.52**	2.48**	1.97**
HS Grad	1.31**		1.19**	1.24**	1.39**
Some College	1.49**		1.34**	1.40**	1.64**
College Grad	1.78**		1.56**	2.14**	2.15**
High Risk	1.18**		1.20**	1.20**	1.11**
Diabetes	2.88**		3.10**	2.89**	2.75**
CD Count 0-5	1.36**		1.34**	1.33**	1.36**
Unhealthy	1.03*		1.04*	1.04	1.03
PCP Supply	0.81**		0.88**	0.85**	0.85**
Post-ACA	0.87**		0.87**	0.90*	0.87**
EXP	-		1.15**	1.08	1.09
ACA*EXP	-		1.01	1.13*	1.11

Notes:
P value <0.001 (**), P value <0.05 (*)

In **Table AE-7,** overall regression model taken from Table AE-3; Odds Ratios by Race taken from Table AE-5.

Evaluating ACA Effects for Complex PCP Regressions by Race and INS Status. In this section, a sensitivity analysis was conducted using complex regression models that included three key interaction terms: ACA*INS; ACA*Race; and ACA*INS*Race. The key coefficients for the regression models in Table AE-8 include:

- Post-ACA=1.00
- ACA*INS= 0.84
- ACA*Black= 1.05
- ACA*Hispanic= 1.00
- ACA*INS*Black= 1.26 (uninsured); 1.27 (insured)
- ACA*INS*Hispanic= 1.16 (uninsured); 1.22 (insured).

Table AE-8.

Complex Logistic Regression Models for the likelihood of having a PCP by INS, Race/Ethnicity, and Pre/Post-ACA; 47-state sample.

Probability of Having a PCP (n=1,283,537)	**Model 1 Odds Ratio**	**Model 2 Odds Ratio**	**Model 3 Odds Ratio**	**Model 4 Odds Ratio**	**Model 5 Odds Ratio**	**95% CI**	**Model 6 Odds Ratio**	**95% CI**
ACA								
Pre-ACA	Ref	Ref	Ref	Ref	Ref		Ref	
Post-ACA	1.03**	0.89**	0.90**	0.87**	0.98 (p= 0.325)	(0.94, 1.02)	1.00 (p=0.843)	(0.96, 1.05)
Insurance								
Uninsured		Ref	Ref	Ref	Ref		Ref	
Insured		5.57**	5.33**	5.33**	5.84**	(5.63, 6.05)	5.41**	(5.20, 5.63)
Race								
Whites			Ref	Ref	Ref		Ref	
Blacks			0.95*	0.89**	0.90**	(0.86, 0.94)	0.77**	(0.71, 0.84)
Hispanics			0.69**	0.66**	0.67**	(0.64, 0.70)	0.60**	(0.56, 0.65)
ACA*Race								
ACA*whites				Ref	Ref		Ref	
ACA*blacks				1.11**	1.09*	(1.03, 1.16)	1.05 (p=0.366)	(0.94, 1.18)
ACA*hispanics				1.08*	1.05 (p=0.09)	(0.99, 1.11)	1.00 (p=0.965)	(0.91, 1.10)
ACA*INS								
ACA*INS					0.86**	(0.82, 0.90)	0.84**	(0.80, 0.89)
ACA*INS*Race								
ACA*blacks (uninsured)							1.26**	(1.14, 1.39)
ACA*blacks (insured)							1.27**	(1.17, 1.38)
ACA*hisps (uninsured)							1.16*	(1.06, 1.28)
ACA*hisps (insured)							1.22**	(1.13, 1.31)
Other Variables								
Education								
Less than HS		Ref	Ref	Ref	Ref		Ref	
HS Grad		1.44**	1.31**	1.31**	1.31**	(1.27, 1.36)	1.31**	(1.26, 1.35)
Some College		1.66**	1.49**	1.49**	1.49**	(1.43, 1.54)	1.48**	(1.43, 1.54)
College Grad		2.02**	1.78**	1.78**	1.79**	(1.72, 1.85)	1.79**	(1.72, 1.85)
Age								
18 to 44		Ref	Ref	Ref	Ref		Ref	
45 to 64		2.46**	2.39**	2.39**	2.39**	(2.34, 2.43)	2.39**	(2.34, 2.43)
Sex								
Male		Ref	Ref	Ref	Ref		Ref	
Female		1.94**	1.96**	1.96**	1.96**	(1.92, 1.99)	1.96**	(1.92, 1.99)
Diabetes Status								
No/Low Risk		Ref	Ref	Ref	Ref		Ref	
High Risk		1.16**	1.18**	1.18**	1.18**	(1.15, 1.20)	1.18**	(1.16, 1.20)
Diabetes		2.890**	2.88**	2.88**	2.88**	(2.74, 3.02)	2.88**	(2.75, 3.03)
Chronic Disease								
Count 0-5		1.40**	1.36**	1.36**	1.36**	(1.33, 1.39)	1.36**	(1.33, 1.39)
Self Reported Health								
Healthy		Ref	Ref	Ref	Ref		Ref	
Unhealthy		1.01	1.03*	1.03*	1.03*	(1.00, 1.06)	1.03*	(1.001, 1.06)
PCP Supply								
Adequate Supply		Ref	Ref	Ref	Ref		Ref	
Low Supply		0.82**	0.81**	0.81**	0.81**	(0.80, 0.83)	0.81**	(0.80, 0.83)
Constant	2.79**	0.25**	0.30**	0.31**	0.29**	(0.28, 0.30)	0.31**	(0.29, 0.32)
F Statistic	16**	3576**	3070**	2686**	2537**		2102**	

Notes:

1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

As discussed in the text, the minority groups show different ACA effects from whites. The ACA effects are:

Table AE-9.

ACA Effects by Race for the Odds of having a PCP using Complex Logistic Regression Analysis; 47-state sample.

	Whites	**Blacks**	**Hispanics**
	Post ACA		
Insured	0.84	1.12	1.03
Uninsured	1.00	1.11	0.98

Notes

1. Insured whites: e{ln1.00 + ln0.84} = 0.84
2. Uninsured whites: 1.00
3. Insured blacks: e{ln1.0 + ln0.84 + ln1.05 + ln1.27}= 1.21
4. Uninsured blacks: e{ln1.0 + ln0.84 + ln1.05 + ln1.26}= 1.11
5. Insured Hispanics: e{ln1.0 + ln0.84 + ln1.0 + ln1.22}= 1.025
6. Uninsured Hispanics: e{ln1.0 + ln0.84 + ln1.0 + ln1.16} =0.975

These ACA effects are holding many influential demographic and health variables constant, including the baseline effect (5.41) of insurance. If a black or Hispanic person has insurance- their odds of having a PCP is much higher than their peer who is uninsured.

A sizable downward ACA effect occurred in the strength of insurance coverage resulting in having a PCP (-13%, Model 4). This decline was almost completely offset for uninsured Hispanics who experienced only a 2% decline in having a PCP, i.e., e{ln0.84 + ln1.16}= 0.98 and was reversed to a minor extent for insured Hispanics, i.e., 3% (Table AE-9).

APPENDIX AF

LOGISTIC REGRESSIONS FOR ODDS OF CHECKUP BY INS AND RACE

Introduction to Specific Aim 2-Health Care Access. This section begins with describing the impact of insurance on the odds of having a Checkup in the past year. Refer to Chapter 4, page 190 for in text discussion. Full regression models available in Table AF-1. Full regression models using time dummy variables are available in Table AF-2. After 2014, there was a 6% decline of in the report of having a Checkup in the past year from 2014 to 2017 among individuals who reported having insurance coverage.

Specific Aim 2a. Pre/Post-ACA Health Care Access Odds with ACA-Race Interactions. Refer to Chapter 4, page 201 for in-text discussion. Full regression models available in Table AF-3.

Specific Aim 2a. Annual ACA Checkup Odds Ratios with ACA-Race Interactions. Refer to Chapter 4, page 209 for in-text discussion. Full regression models in Table AF-4.

Specific Aim 2b. Pre/Post-ACA Odds Ratios for Checkup Controlling for Expansion Status by Race Group. Refer to Chapter 4, page 214 for in-text discussion. Full regression models in Table AF-5.

Specific Aim 2b. Annual ACA Checkup Odds Ratios Controlling for Expansion Status by Race Group. Full regression models using time variables are available in Table AF-6. Overall time tends for all races were not statistically significant, except for whites living in expansion states with a 7% increased likelihood of having a checkup when compared to whites in non-expansion states by 2017. Rates of having a checkup increased for both blacks and whites, however, Hispanics experienced a 3% decline in the likelihood of having a checkup in the past year when compared to non-expansion states by 2017.

Table AF-1.

Logistic Regression Models for the Odds of having a Checkup in the past year using pre/post-ACA indicator; 47-state Sample.

Probability of Checkup (n=1,283,537)	**Model 1 Odds Ratio**	**95% CI**	**Model 2 Odds Ratio**	**95% CI**	**Model 3 Odds Ratio**	**95% CI**	**Model 4 Odds Ratio**	**95% CI**
ACA								
Pre-ACA	Ref		Ref		Ref		Ref	
Post-ACA	1.10**	(1.08, 1.12)	1.10**	(1.09, 1.12)	1.01	(0.99, 1.03)	1.11**	(1.07, 1.16)
Insurance								
Uninsured					Ref		Ref	
Insured					3.49**	(3.41, 3.57)	3.75**	(3.63, 3.88)
ACA*INS								
ACA*INS							0.89**	(0.85, 0.92)
Other Variables								
Race								
Whites			Ref		Ref		Ref	
Blacks			1.81**	(1.76, 1.85)	2.02**	(1.97, 2.07)	2.02**	(1.97, 2.08)
Hispanics			1.00	(0.98, 1.02)	1.21**	(1.18, 1.24)	1.21**	(1.18, 1.24)
Education								
Less than HS			Ref		Ref		Ref	
HS Grad			1.35**	(1.31, 1.39)	1.13**	(1.10, 1.17)	1.13**	(1.10, 1.17)
Some College			1.42**	(1.38, 1.46)	1.10**	(1.07, 1.14)	1.11**	(1.07, 1.14)
College Grad			1.67**	(1.62, 1.72)	1.19**	(1.15, 1.22)	1.19**	(1.15, 1.22)
Age								
18 to 44			Ref		Ref		Ref	
45 to 64			1.66**	(1.64, 1.69)	1.57**	(1.55, 1.60)	1.57**	(1.55, 1.60)
Sex								
Male			Ref		Ref		Ref	
Female			1.51**	(1.49, 1.53)	1.49**	(1.47, 1.51)	1.49**	(1.47, 1.51)
Diabetes Status								
No/Low Risk			Ref		Ref		Ref	
High Risk			1.08**	(1.06, 1.10)	1.08**	(1.06, 1.09)	1.08**	(1.06, 1.10)
Diabetes			2.52**	(2.43, 2.61)	2.43**	(2.34, 2.51)	2.43**	(2.34, 2.51)
Chronic Disease								
Count 0-5			1.23**	(1.21, 1.25)	1.20**	(1.18, 1.22)	1.20**	(1.18, 1.22)
Self Reported Health								
Healthy			Ref		Ref		Ref	
Unhealthy			0.92**	(0.90, 0.94)	0.98	(0.96, 1.00)	0.98	(0.96, 1.00)
PCP Supply								
Adequate Supply			Ref		Ref		Ref	
Low Supply			0.91**	(0.89, 0.92)	0.98*	(0.96, 0.99)	0.98*	(0.96, 0.99)
Constant	1.70**	(1.68, 1.72)	0.69**	(0.67, 0.71)	0.32**	(0.30, 0.33)	0.30**	(0.89, 0.31)
F Statistic	158**		1229**		1827**		1706**	

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Table AF-2.

Logistic Regression Models for the likelihood of having a Checkup in the past year by INS Status using 2012-2017 Time Dummy Variables; 47-state analytic sample.

Probability of Having a Checkup (n=1,283,537)	**Model 1 Odds Ratio**	**95% CI**	**Model 2 Odds Ratio**	**95% CI**	**Model 3 Odds Ratio**	**95% CI**	**Model 4 Odds Ratio**	**95% CI**
ACA								
2012	Ref		Ref		Ref		Ref	
2013	Ref		Ref		Ref		Ref	
2014	1.09**	(1.07, 1.12)	1.10**	(1.07, 1.12)	1.03*	(1.01, 1.06)	1.09*	(1.03, 1.15)
2015	1.09**	(1.06, 1.11)	1.09**	(1.06, 1.11)	0.99	(0.97, 1.02)	1.12**	(1.06, 1.19)
2016	1.13**	(1.11, 1.16)	1.14**	(1.12, 1.17)	1.03*	(1.01, 1.05)	1.17**	(1.10, 1.25)
2017	1.08**	(1.06, 1.11)	1.08**	(1.06, 1.11)	0.98	(0.96, 1.00)	1.08*	(1.01, 1.15)
Insurance								
Uninsured					Ref		Ref	
Insured					3.49**	(3.41, 3.57)	3.75**	(3.63, 3.88)
ACA*INS								
2012*INS							Ref	
2013*INS							Ref	
2014*INS							0.94*	(0.88, 1.00)
2015*INS							0.86**	(0.80, 0.92)
2016*INS							0.85**	(0.80, 0.91)
2017*INS							0.89*	(0.83, 0.95)
Race								
Whites			Ref		Ref		Ref	
Blacks			1.81**	(1.76, 1.85)	2.02**	(1.97, 2.07)	2.02**	(1.97, 2.08)
Hispanics			1.00	(0.98, 1.02)	1.21**	(1.18, 1.24)	1.21**	(1.18, 1.24)
Education								
Less than HS			Ref		Ref		Ref	
HS Grad			1.35**	(1.31, 1.39)	1.13**	(1.10, 1.17)	1.13**	(1.10, 1.17)
Some College			1.42**	(1.38, 1.46)	1.10**	(1.07, 1.14)	1.11**	(1.07, 1.14)
College Grad			1.67**	(1.62, 1.72)	1.19**	(1.15, 1.22)	1.19**	(1.15, 1.22)
Age								
18 to 44			Ref		Ref		Ref	
45 to 64			1.66**	(1.64, 1.69)	1.57**	(1.55, 1.60)	1.57**	(1.55, 1.60)
Sex								
Male			Ref		Ref		Ref	
Female			1.51**	(1.49, 1.54)	1.49**	(1.47, 1.51)	1.50**	(1.47, 1.51)
Diabetes Status								
No/Low Risk			Ref		Ref		Ref	
High Risk			1.08**	(1.06, 1.10)	1.08**	(1.06, 1.09)	1.08**	(1.6, 1.09)
Diabetes			2.52**	(2.43, 2.61)	2.43**	(2.34, 2.52)	2.43**	(2.34, 2.52)
Chronic Disease								
Count 0-5			1.23**	(1.21, 1.25)	1.20**	(1.18, 1.22)	1.20**	(1.18, 1.22)
Self Reported Health								
Healthy			Ref		Ref		Ref	
Unhealthy			0.92**	(0.90, 0.94)	0.98	(0.96, 1.00)	0.98*	(0.96, 1.00)
PCP Supply								
Adequate Supply			Ref		Ref		Ref	
Low Supply			0.91**	(0.89, 0.92)	0.98*	(0.96, 1.00)	0.98*	(0.96, 0.99)
Constant	1.70**	(1.68, 1.72)	0.69**	(0.67, 0.71)	0.32**	(0.30, 0.33)	0.30**	(0.29, 0.31)
F Statistic	44**		1000**		1507**		1222**	

Notes:

1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Table AF-3.

Logistic Regression Models for the likelihood of having a Checkup in the past year by race/ethnicity, using pre/post ACA indicator; 47-state analytic sample.

Probability of Checkup (n=1,283,537)	Model 1 Odds Ratio	95% CI	Model 2 Odds Ratio	95% CI	Model 3 Odds Ratio	95% CI	Model 4 Odds Ratio	95% CI
ACA								
Pre-ACA	Ref		Ref		Ref		Ref	
Post-ACA	1.10**	(1.08, 1.12)	1.02	(1.00, 1.03)	1.01	(0.99, 1.03)	1.01	(1.00, 1.03)
Race								
Whites					Ref		Ref	
Blacks					2.02**	(1.97, 2.07)	2.03**	(1.94, 2.12)
Hispanics					1.21**	(1.18, 1.24)	1.22**	(1.17, 1.27)
ACA*Race								
ACA*whites							Ref	
ACA*blacks							0.99	(0.94, 1.05)
ACA*hispanics							0.99	(0.94, 1.04)
Other Variables								
Insurance								
Uninsured			Ref		Ref		Ref	
Insured			3.30**	(3.23, 3.37)	3.49**	(3.41, 3.57)	3.49**	(3.41, 3.57)
Education								
Less than HS			Ref		Ref		Ref	
HS Grad			1.11**	(1.07, 1.14)	1.13**	(1.10, 1.17)	1.13**	(1.10, 1.17)
Some College			1.07**	(1.03, 1.10)	1.10**	(1.07, 1.14)	1.10**	(1.07, 1.14)
College Grad			1.11**	(1.08, 1.15)	1.19**	(1.15, 1.22)	1.19**	(1.15, 1.22)
Age								
18 to 44			Ref		Ref		Ref	
45 to 64			1.52**	(1.50, 1.54)	1.57**	(1.55, 1.60)	1.57**	(1.55, 1.60)
Sex								
Male			Ref		Ref		Ref	
Female			1.51**	(1.49, 1.53)	1.49**	(1.47, 1.51)	1.49**	(1.47, 1.51)
Diabetes Status								
No/Low Risk			Ref		Ref		Ref	
High Risk			1.11**	(1.09, 1.13)	1.08**	(1.06, 1.09)	1.08**	(1.06, 1.09)
Diabetes			2.55**	(2.46, 2.64)	2.43**	(2.34, 2.51)	2.43**	(2.34, 2.51)
Chronic Disease								
Count 0-5			1.19**	(1.17, 1.21)	1.20**	(1.18, 1.22)	1.20**	(1.18, 1.22)
Self Reported Health								
Healthy			Ref		Ref		Ref	
Unhealthy			1.00	(0.97, 1.02)	0.98	(0.96, 1.00)	0.98	(0.96, 1.003)
PCP Supply								
Adequate Supply			Ref		Ref		Ref	
Low Supply			1.01	(0.99, 1.02)	0.98*	(0.96, 0.99)	0.98*	(0.96, 0.99)
Constant	1.70**	(1.68, 1.72)	0.38**	(0.37, 0.39)	0.32**	(0.30, 0.33)	0.32**	(0.30, 0.33)
F Statistic	158**		1945**		1827**		1600**	

Notes:

1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Table AF-4.

Logistic Regression Models for the likelihood of having a Checkup in the past year by race/ethnicity, using Time Dummies (2014-2017); 47-state analytic sample.

Probability of Checkup (n=1,283,537)	**Model 1 Odds Ratio**	**95% CI**	**Model 2 Odds Ratio**	**95% CI**	**Model 3 Odds Ratio**	**95% CI**	**Model 4 Odds Ratio**	**95% CI**
Year								
2012	Ref		Ref		Ref		Ref	
2013	Ref		Ref		Ref		Ref	
2014	1.09**	(1.07, 1.12)	1.03*	(1.01, 1.06)	1.03*	(1.01, 1.06)	1.03*	(1.01, 1.06)
2015	1.09**	(1.06, 1.11)	1.00	(0.97, 1.02)	0.99	(0.97, 1.02)	1.00	(0.98, 1.02)
2016	1.13**	(1.11, 1.16)	1.04*	(1.01, 1.06)	1.03*	(1.01, 1.05)	1.04*	(1.01, 1.06)
2017	1.08**	(1.06, 1.11)	0.98	(0.96, 1.01)	0.98	(0.96, 1.00)	0.98	(0.96, 1.00)
Race								
Whites					Ref		Ref	
Blacks					2.02**	(1.97, 2.07)	2.03**	(1.94, 2.12)
Hispanics					1.21**	(1.18, 1.24)	1.22**	(1.17, 1.27)
Year*Race								
2014*whites							Ref	
2014 *blacks							1.00	(0.92, 1.08)
2014*hispanics							1.01	(0.94, 1.08)
2015*whites							Ref	
2015 *blacks							0.97	(0.89, 1.05)
2015*hispanics							0.99	(0.92, 1.06)
2016*whites							Ref	
2016 *blacks							0.98	(0.90, 1.06)
2016*hispanics							0.99	(0.92, 1.06)
2017*whites							Ref	
2017 *blacks							1.03	(0.95, 1.12)
2017*hispanics							0.98	(0.91, 1.06)
Other Variables								
Insurance								
Uninsured			Ref		Ref		Ref	
Insured			3.30**	(3.23, 3.37)	3.49**	(3.41, 3.57)	3.49**	(3.41, 3.57)
Education								
Less than HS			Ref		Ref		Ref	
HS Grad			1.11**	(1.07, 1.14)	1.13**	(1.10, 1.17)	1.13**	(1.10, 1.17)
Some College			1.07**	(1.04, 1.10)	1.10**	(1.07, 1.14)	1.10**	(1.07, 1.14)
College Grad			1.11**	(1.08, 1.15)	1.19**	(1.15, 1.22)	1.19**	(1.45, 1.22)
Age								
18 to 44			Ref		Ref		Ref	
45 to 64			1.52**	(1.50, 1.54)	1.57**	(1.55, 1.60)	1.57**	(1.55, 1.60)
Sex								
Male			Ref		Ref		Ref	
Female			1.51**	(1.49, 1.53)	1.49**	(1.47, 1.51)	1.49**	(1.47, 1.51)
Diabetes Status								
No/Low Risk			Ref		Ref		Ref	
High Risk			1.11**	(1.10, 1.13)	1.08**	(1.06, 1.09)	1.08**	(1.06, 1.09)
Diabetes			2.55**	(2.46, 2.64)	2.43**	(2.34, 2.52)	2.43**	(2.34, 2.52)
Chronic Disease								
Count 0-5			1.19**	(1.17, 1.21)	1.20**	(1.18, 1.22)	1.20**	(1.18, 1.22)
Self Reported Health								
Healthy			Ref		Ref		Ref	
Unhealthy			1.00	(0.97, 1.02)	0.98	(0.96, 1.00)	0.98	(0.96, 1.00)
PCP Supply								
Adequate Supply			Ref		Ref		Ref	
Low Supply			1.01	(0.99, 1.02)	0.98	(0.96, 1.00)	0.98*	(0.96, 0.99)
Constant	1.70**	(1.68, 1.72)	0.38**	(0.37, 0.39)	0.32**	(0.30, 0.33)	0.31**	(0.30, 0.33)
F Statistic	44**		1559**		1507**		1026**	

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05 (*)
3. Svy weighted logistic regression models, values indicate odds ratios

Table AF-5.

Logistic Regression Models for the Odds of having a Checkup in the past year Post-ACA by Race and Expansion Status, using Pre/post-ACA Indicator; 47-state analytic sample.

Probability of Checkup (Logistic)	Whites Only (n=1,048, 152)	95% CI	Whites Only (n=1,048, 152)	95% CI	Blacks Only (n=121,844)	95% CI	Blacks Only (n=121,844)	95% CI	Hispanics Only (n=113,541)	95% CI	Hispanics Only (n=113,541)	95% CI
Expansion Status												
Non-expansion	Ref		Ref		Ref		Ref		Ref		Ref	
Expansion	0.91**	(0.90, 0.93)	0.90**	(0.87, 0.92)	0.94*	(0.89, 0.99)	0.91	(0.83, 0.99)	0.88**	(0.84, 0.93)	0.89*	(0.81, 0.97)
ACA												
Pre ACA	Ref		Ref		Ref		Ref		Ref		Ref	
Post ACA	1.01	(0.99, 1.02)	0.99	(0.96, 1.02)	1.01	(0.96, 1.06)	0.98	(0.92, 1.06)	1.02	(0.97, 1.06)	1.02	(0.94, 1.11)
Interaction Term												
ACA*EXP			1.03	(0.99, 1.06)			1.05	(0.95, 1.16)			1.00	(0.90, 1.10)
Other Variables												
Insurance												
Uninsured	Ref		Ref		Ref		Ref		Ref		Ref	
Insured	3.81**	(3.71, 3.91)	3.81**	(3.71, 3.91)	3.38**	(3.12, 3.58)	3.38**	(3.19, 3.58)	3.13**	(2.98, 3.29)	3.13**	(2.98, 3.29)
PCP Supply												
Adequate	Ref		Ref		Ref		Ref		Ref		Ref	
Low Supply	0.95**	(0.93, 0.96)	0.95**	(0.93, 0.96)	0.93*	(0.88, 0.98)	0.93*	(0.88, 0.98)	0.89**	(0.84, 0.94)	0.89**	(0.84, 0.94)
Sex												
Male	Ref		Ref		Ref		Ref		Ref		Ref	
Female	1.44**	(1.42, 1.46)	1.44**	(1.42, 1.46)	1.59**	(1.51, 1.67)	1.59**	(1.51, 1.67)	1.64**	(1.57, 1.72)	1.64**	(1.57, 1.72)
Age												
18 to 44	Ref		Ref		Ref		Ref		Ref		Ref	
45 to 64	1.62**	(1.59, 1.64)	1.62**	(1.59, 1.64)	1.54**	(1.46, 1.62)	1.54**	(1.46, 1.62)	1.42**	(1.35, 1.49)	1.42**	(1.35, 1.49)
Education												
Less than HS	Ref		Ref		Ref		Ref		Ref		Ref	
HS Grad	1.11**	(1.07, 1.15)	1.11**	(1.07, 1.15)	1.10*	(1.00, 1.20)	1.10*	(1.00, 1.20)	1.16**	(1.10, 1.24)	1.16**	(1.10, 1.24)
Some College	1.12**	(1.07, 1.16)	1.11**	(1.07, 1.16)	0.98	(0.89, 1.07)	0.98	(0.89, 1.07)	1.09*	(1.02, 1.16)	1.09*	(1.02, 1.16)
College Grad	1.18**	(1.13, 1.22)	1.18**	(1.13, 1.22)	1.08	(0.99, 1.19)	1.08	(0.99, 1.19)	1.24**	(1.16, 1.33)	1.24**	(1.16, 1.33)
Diabetes Status												
No/Low Risk	Ref		Ref		Ref		Ref		Ref		Ref	
High Risk	1.10**	(1.08, 1.12)	1.10**	(1.08, 1.12)	1.07*	(1.02, 1.13)	1.07*	(1.02, 1.13)	0.98	(0.93, 1.03)	0.98	(0.93, 1.03)
Diabetes	2.58**	(2.48, 2.68)	2.58**	(2.48, 2.68)	2.33**	(2.11, 2.57)	2.33**	(2.11, 2.57)	2.14**	(1.95, 2.36)	2.14**	(1.95, 2.36)
Chronic Disease												
Count 0-5	1.22**	(1.20, 1.24)	1.22**	(1.20, 1.24)	1.19**	(1.13, 1.25)	1.19**	(1.13, 1.25)	1.13**	(1.07, 1.19)	1.13**	(1.07, 1.19)
Self Reported Health												
Healthy	Ref		Ref		Ref		Ref		Ref		Ref	
Unhealthy	1.01	(0.99, 1.04)	1.01	(0.99, 1.04)	0.85**	(0.79, 0.91)	0.85**	(0.79, 0.91)	0.99	(0.94, 1.05)	0.99	(0.94, 1.05)
Constant	0.31**	(0.30, 0.33)	0.31**	(0.30, 0.33)	0.74**	(0.66, 0.83)	0.75**	(0.67, 0.85)	0.47**	(0.43, 0.51)	0.47**	(0.42, 0.51)
F Statistic	1569**		1457**		233**		217**		286**		265**	

Notes:

1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Table AF-6.

Logistic Regression Models for the Odds of having a Checkup in the past year Post-ACA by Race and Expansion Status, using 2014-2017 Time Dummies; 47-state analytic sample.

Probability of Checkup (Logistic)	Whites Only (n=1,048, 152)	95% CI	Whites Only (n=1,048, 152)	95% CI	Blacks Only (n=121,844)	95% CI	Blacks Only (n=121,844)	95% CI	Hispanics Only (n=113,541)	95% CI	Hispanics Only (n=113,541)	95% CI
Expansion Status												
Non-expansion	Ref		Ref		Ref		Ref		Ref		Ref	
Expansion	0.91**	(0.90, 0.93)	0.90**	(0.87, 0.92)	0.94*	(0.89, 0.99)	0.91*	(0.83, 0.99)	0.88**	(0.84, 0.93)	0.89*	(0.82, 0.97)
Years												
2012	Ref		Ref		Ref		Ref		Ref		Ref	
2013	Ref		Ref		Ref		Ref		Ref		Ref	
2014	1.03*	(1.01, 1.05)	1.03	(0.99, 1.07)	1.03	(0.96, 1.11)	1.02	(0.92, 1.13)	1.05	(0.98, 1.12)	1.00	(0.90, 1.11)
2015	0.99	(0.97, 1.02)	0.98	(0.95, 1.02)	0.97	(0.90, 1.04)	0.94	(0.84, 1.04)	1.00	(0.94, 1.07)	1.03	(0.92, 1.15)
2016	1.03*	(1.01, 1.05)	1.01	(0.97, 1.05)	1.02	(0.94, 1.10)	0.98	(0.88, 1.09)	1.04	(0.97, 1.11)	1.07	(0.95, 1.21)
2017	0.97*	(0.95, 1.00)	0.94*	(0.90, 0.97)	1.02	(0.94, 1.10)	1.004	(0.90, 1.12)	0.98	(0.91, 1.05)	0.97	(0.86, 1.10)
Interaction Terms												
2012*EXP			Ref				Ref				Ref	
2013*EXP			Ref				Ref				Ref	
2014*EXP			1.00	(0.96, 1.05)			1.03	(0.89, 1.19)			1.07	(0.94, 1.23)
2015*EXP			1.01	(0.97, 1.07)			1.07	(0.92, 1.24)			0.96	(0.83, 1.10)
2016*EXP			1.03	(0.98, 1.08)			1.07	(0.93, 1.25)			0.95	(0.82, 1.09)
2017*EXP			1.07*	(1.01, 1.12)			1.03	(0.88, 1.19)			1.01	(0.87, 1.17)
Other Variables												
Insurance												
Uninsured	Ref		Ref		Ref		Ref		Ref		Ref	
Insured	3.81**	(3.71, 3.91)	3.81**	(3.71, 3.91)	3.38**	(3.19, 3.59)	3.38**	(3.19, 3.59)	3.14**	(2.98, 3.30)	3.14**	(0.99, 3.30)
PCP Supply												
Adequate	Ref		Ref		Ref		Ref		Ref		Ref	
Low Supply	0.95**	(0.93, 0.96)	0.95**	(0.93, 0.97)	0.93*	(0.88, 0.98)	0.93*	(0.88, 0.98)	0.89**	(0.84, 0.94)	0.89**	(0.84, 0.94)
Sex												
Male	Ref		Ref		Ref		Ref		Ref		Ref	
Female	1.44**	(1.42, 1.46)	1.44**	(1.42, 1.46)	1.59**	(1.51, 1.67)	1.59**	(1.51, 1.67)	1.64**	(1.57, 1.72)	1.64**	(1.57, 1.72)
Age												
18 to 44	Ref		Ref		Ref		Ref		Ref		Ref	
45 to 64	1.61**	(1.59, 1.64)	1.62**	(1.59, 1.64)	1.54**	(1.46, 1.62)	1.54**	(1.46, 1.62)	1.42**	(1.35, 1.49)	1.42**	(1.35, 1.49)
Education												
Less than HS	Ref		Ref		Ref		Ref		Ref		Ref	
HS Grad	1.11**	(1.07, 1.16)	1.11**	(1.07, 1.16)	1.10*	(1.01, 1.20)	1.10*	(1.00, 1.20)	1.16**	(1.10, 1.24)	1.16**	(1.10, 1.24)
Some College	1.11**	(1.07, 1.16)	1.11**	(1.07, 1.16)	0.98	(0.90, 1.07)	0.98	(0.89, 1.07)	1.09*	(1.02, 1.16)	1.09*	(1.02, 1.16)
College Grad	1.18**	(1.13, 1.22)	1.18**	(1.13, 1.23)	1.08	(0.99, 1.19)	1.08	(0.99, 1.19)	1.24**	(1.16, 1.33)	1.24**	(1.16, 1.33)
Diabetes Status												
No/Low Risk	Ref		Ref		Ref		Ref		Ref		Ref	
High Risk	1.10**	(1.08, 1.12)	1.10**	(1.08, 1.12)	1.07*	(1.02, 1.13)	1.07*	(1.02, 1.13)	0.98	(0.94, 1.03)	0.98	(0.94, 1.03)
Diabetes	2.58**	(2.48, 2.68)	2.58**	(2.48, 2.68)	2.33**	(2.11, 2.58)	2.33**	(2.11, 2.58)	2.15**	(1.95, 2.36)	2.15**	(1.94, 2.36)
Chronic Disease												
Count 0-5	1.22**	(1.20, 1.24)	1.22**	(1.20, 1.24)	1.19**	(1.13, 1.25)	1.19**	(1.13, 1.25)	1.13**	(1.07, 1.19)	1.13**	(1.07, 1.19)
Self Reported Health												
Healthy	Ref		Ref		Ref		Ref		Ref		Ref	
Unhealthy	1.01	(0.99, 1.04)	1.01	(0.99, 1.04)	0.85**	(0.79, 0.91)	0.85**	(0.79, 0.91)	0.99	(0.94, 1.05)	0.99	(0.94, 1.05)
Constant	0.31**	(0.30, 0.32)	0.31**	(0.30, 0.33)	0.74**	(0.66, 0.83)	0.75**	(0.67, 0.85)	0.47**	(0.43, 0.51)	0.57**	(0.42, 0.51)
F Statistic	1278**		1023**		190**		152**		233**		187**	

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05 (*)
3. Svy weighted logistic regression models, values indicate odds ratios

Since baseline pre-ACA checkup rates are known from Part III, **Tables 35 and 36**, and the (estimated) change in the percent with a checkup due to the ACA is known (per the regression odds ratios, these values were used to calculate average odds ratios for persons living in expansion and non-expansion states by race group (**Table AF-7**).

Table AF-7.

Conversion of Marginal Odds Ratios for Checkup to Average Odds Ratios for Checkup in Non-expansion and Expansion States by Race.

EXP ODDS RATIOS W/ PRE-ACA %CKUP ODDS				
Row	**Odds**	**Whites**	**Blacks**	**Hispanics**
1	**NEXP-pre**	**1.709**	**2.740**	**1.268**
2	**EXP-pre**	**1.643**	**2.792**	**1.356**
		Non-EXP		
3	**Pre-ACA**	1.709	2.740	1.268
4	**Post-ACA**	1.692	2.685	1.293
5	**Post/Pre**	0.990	0.980	1.020
		EXP		
6	**Pre-ACA**	1.643	2.792	1.356
7	**Post-ACA**	1.464	2.490	1.231
8	**Post/Pre**	0.891	0.8918	0.9078

First, the pre-ACA percentages by Checkup and expansion status were converted to odds ratios using the following formula:

(7) OR= Percent insured/(1-percent insured)

- Example: [Non-expansion, whites, pre-ACA] = 1.709= (0.6309)/(1-0.6309).

The OR's in Rows 1 and 2 in **Table AF-7** become the base upon which logistic marginal effects are constructed. Rows 1 and 2 are reproduced in Rows 3 and 6 for comparison purposes in non-expansion and expansion states separately. Post-ACA Ors, or ACA effects, by expansion status (Rows 4 and 7) were calculated using the following formulas:

(8) OR[NEXP]= exp (LN(ACA OR) + LN(NEXP-pre))

- Example: [Non-expansion, whites, post-ACA] =1.692= Exp{(LN(1.709)+LN(0.99)}

(9) OR[EXP] = exp((LN(ACA OR) + LN(ACA*EXP OR) + LN(EXP-pre))

- Example: [Expansion, whites, post-ACA] =1.464= Exp{(LN(1.643) + LN(0.99)+ LN(0.90)}.

The EXP coefficient is not included in calculating OR(EXP) because it is already included in the pre-ACA baseline insurance rate.

Then Rows 5 and 8 show the post-ACA Checkup gains over the pre-ACA period. There were no gains in having a Checkup in the post-ACA period for any racial/ethnic group, or between expansion and non-expansion states given interaction terms that were not statistically significant. In general, blacks had greater odds in having a checkup when compared to the other two groups, with Hispanics being the least likely of the three groups to have a checkup in the past year.

In the descriptive data, 2-5% gains in having a checkup existed; however, when adjusting for other factors in the regression model, the overall effect of the ACA decreased and was found to be statistically insignificant. In the analysis differentiating between expansion status, the ACA was not a factor in changing the likelihood of having a checkup in the past year for all race groups in expansion and non-expansion states. Referring to the odds ratios in **Table AF-7,** blacks were more likely than whites or Hispanics to have a checkup in the past year in both expansion and non-expansion states.

To gain a better understanding of each racial/ethnic group and why blacks may have higher odds of having a checkup than whites or Hispanics, **Table AF-8** provides a summary of all variables included in the models for determining the likelihood of having a checkup by race and expansion status.

Table AF-8.

Summary Table Comparing Overall Logistic Odds Ratios for Demographic, Health Status and State-Level Variables for Checkup to Odds Ratios by Racial/ethnic Subgroups.

	TABLE AF-3 ODDS RATIOS		TABLE AF-5 ODDS RATIOS BY RACE		
COVARIATE	**OVERALL**		**WHITES**	**BLACKS**	**HISPANICS**
Insured	3.49**		3.81**	3.38**	3.13**
Female	1.49**		1.44**	1.59**	1.64**
45-64	1.57**		1.62**	1.54**	1.42**
HS Grad	1.13**		1.11**	1.10*	1.16**
Some College	1.10**		1.11**	0.98	1.09*
College Grad	1.19**		1.18**	1.08	1.24**
High Risk	1.08**		1.10**	1.07*	0.98
Diabetes	2.43**		2.58**	2.33**	2.14**
CD Count 0-5	1.20**		1.22**	1.19**	1.13**
Unhealthy	0.98		1.01	0.85**	0.99
PCP Supply	0.98*		0.95**	0.93*	0.89**
Post-ACA	1.01		0.99	0.98	1.02
EXP	-		0.90**	0.91	0.89*
ACA*EXP	-		1.03	1.05	1.00

Notes:

1. P value <0.001 (**), P value <0.05 (*)

In **Table AF-8,** see Table AF-3 for Overall Model; See Table AF-5 for Models by Race.

The summary table shows that the likelihood of having a checkup for blacks with a college education is no different than for blacks with less than a HS degree. Since it would be expected that higher education would lead to better preventive care access (as seen with whites and Hispanics), the fact that blacks at lower ends of the education spectrum have similar access to preventive care may led one to believe that this is leading to the greater odds in having a checkup, seen in **Table AF-8.** It's also interesting that blacks seem to be more aware of their health status given that the self-reported health variable in the black regression model is statistically significant, showing that those reporting poor health being less likely to have a checkup in the past year. However, for whites and Hispanics, there is no difference in the likelihood of having a checkup between those who report being healthy vs. unhealthy.

APPENDIX AG

LOGISTIC REGRESSIONS FOR ODDS OF PCP BY DIABETES RISK STATUS

Specific Aim 2a. Pre/Post-ACA PCP Odds with ACA-Risk Interactions. Refer to Chapter 4, page 216 for in-text discussion. Full regression models available in **Table AG-1**.

Specific Aim 2a. Annual ACA PCP Odds Ratios with ACA-Risk Interactions. Refer to Chapter 4, page 222 for in-text discussion. Full regression models in **Table AG-2**.

Specific Aim 2b. Pre/Post-ACA Odds Ratios for PCP Controlling for Expansion Status by Risk Group. Refer to Chapter 4, page 225 for in-text discussion. Full regression models in **Table AG-3**.

Specific Aim 2b. Annual ACA PCP Odds Ratios Controlling for Expansion Status by Risk Group. Full regression models using time variables are available in **Table AG-4**. Overall time tends for all diabetes risk groups were not statistically significant, except for the no/low risk group living in expansion states with a 10% increased likelihood of having a checkup when compared to the no/low risk group in non-expansion states by 2017. Rates of having a checkup increased for all groups, with the diabetes group experiencing a 19% increased likelihood in having a PCP when compared to the diabetes group in non-expansion states-however, this was not statistically significant.

Table AG-1.

Logistic Regression Models for the likelihood of having a PCP by Diabetes Risk, using pre/post ACA indicator; 47-state analytic sample.

Probability of Having a PCP (n=1,283,537)	**Model 1 Odds Ratio**	**95% CI**	**Model 2 Odds Ratio**	**95% CI**	**Model 3 Odds Ratio**	**95% CI**	**Model 4 Odds Ratio**	**95% CI**
ACA								
Pre-ACA	Ref		Ref		Ref		Ref	
Post-ACA	1.03**	(1.02, 1.05)	0.90**	(0.88, 0.91)	0.90**	(0.88, 0.91)	0.88**	(0.86, 0.90)
Diabetes Status								
No/Low Risk					Ref		Ref	
High Risk					1.18*	(1.16, 1.20)	1.16**	(1.13, 1.20)
Diabetes					2.88**	(2.74, 3.02)	2.56**	(2.37, 2.76)
ACA*Diabetes Risk								
ACA*no/low risk							Ref	
ACA*high risk							1.02	(0.98, 1.06)
ACA*diabetes							1.20**	(1.09, 1.32)
Other Variables								
Race								
Whites			Ref		Ref		Ref	
Blacks			0.99	(0.96, 1.02)	0.95*	(0.93, 0.98)	0.95*	(0.93, 0.98)
Hispanics			0.71**	(0.69, 0.73)	0.69**	(0.67, 0.71)	0.69**	(0.67, 0.71)
Education								
Less than HS			Ref		Ref		Ref	
HS Grad			1.29**	(1.25, 1.34)	1.31**	1.27, 1.36)	1.31**	(1.27, 1.36)
Some College			1.47**	(1.41, 1.51)	1.49**	(1.44, 1.54)	1.49**	(1.44, 1.54)
College Grad			1.71**	(1.65, 1.77)	1.78**	(1.72, 1.85)	1.78**	(1.72, 1.85)
Age								
18 to 44			Ref		Ref		Ref	
45 to 64			2.58**	(2.53, 2.63)	2.39**	(2.34, 2.43)	2.39**	(2.34, 2.43)
Sex								
Male			Ref		Ref		Ref	
Female			1.94**	(1.90, 1.97)	1.96**	(1.92, 1.99)	1.96**	(1.92, 1.99)
Insurance								
Uninsured			Ref		Ref		Ref	
Insured			5.36**	(5.24, 5.49)	5.33**	(5.21, 5.46)	5.33**	(5.21, 5.46)
Chronic Disease								
Count 0-5			1.41**	(1.39, 1.44)	1.36**	(1.33, 1.39)	1.36**	(1.33, 1.39)
Self Reported Health								
Healthy			Ref		Ref		Ref	
Unhealthy			1.17**	(1.14, 1.20)	1.03*	(1.00, 1.06)	1.03*	(1.00, 1.06)
PCP Supply								
Adequate Supply			Ref		Ref		Ref	
Low Supply			0.82**	(0.81, 0.84)	0.81**	(0.80, 0.83)	0.81**	(0.80, 0.83)
Constant	2.79**	(2.75, 2.83)	0.32**	(0.31, 0.34)	0.30**	(0.29, 0.33)	0.31**	(0.29, 0.32)
F Statistic	16**		3559**		3070**		2687**	

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Table AG-2.

Logistic Regression Models for the likelihood of having a PCP in the past year by Diabetes Risk, using Time Dummies (2014-2017); 47-state analytic sample.

Probability of Having a PCP (n=1,283,537)	**Model 1 Odds Ratio**	**95% CI**	**Model 2 Odds Ratio**	**95% CI**	**Model 3 Odds Ratio**	**95% CI**	**Model 4 Odds Ratio**	**95% CI**
Year								
2012	Ref		Ref		Ref		Ref	
2013	Ref		Ref		Ref		Ref	
2014	1.01	(0.99, 1.04)	0.91**	(0.89, 0.93)	0.91**	(0.89, 0.93)	0.90**	(0.87, 0.93)
2015	1.07**	(1.05, 1.10)	0.93**	(0.91, 0.96)	0.93**	(0.91, 0.96)	0.92**	(0.89, 0.96)
2016	1.05**	(1.02, 1.07)	0.89**	(0.87, 0.92)	0.89**	(0.87, 0.92)	0.87**	(0.84, 0.90)
2017	1.01	(0.99, 1.04)	0.86**	(0.83, 0.88)	0.85**	(0.83, 0.87)	0.84**	(0.81, 0.87)
Diabetes Status								
No/Low Risk					Ref		Ref	
High Risk					1.18**	(1.16, 1.20)	1.16**	(1.13, 1.20)
Diabetes					2.88**	(2.74, 3.02)	2.56**	(2.37, 2.76)
Year*Diabetes Status								
2014*no/low risk							Ref	
2014*high risk							1.02	(0.97, 1.08)
2014*diabetes							1.10	(0.97, 1.26)
2015*no/low risk							Ref	
2015*high risk							1.00	(0.95, 1.06)
2015*diabetes							1.21*	(1.04, 1.41)
2016*no/low risk							Ref	
2016*high risk							1.05	(0.99, 1.11)
2016*diabetes							1.22*	(1.06, 1.42)
2017*no/low risk							Ref	
2017*high risk							1.02	(0.96, 1.08)
2017*diabetes							1.29*	(1.11, 1.49)
Other Variable								
Race								
Whites			Ref		Ref		Ref	
Blacks			0.99	(0.96, 1.02)	0.95*	(0.93, 0.98)	0.95*	(0.93, 0.98)
Hispanics			0.71**	(0.69, 0.73)	0.69**	(0.67, 0.71)	0.69**	(0.67, 0.71)
Education								
Less than HS			Ref		Ref		Ref	
HS Grad			1.29**	(1.25, 1.34)	1.13**	(1.27, 1.36)	1.31**	(1.27, 1.36)
Some College			1.46**	(1.41, 1.51)	1.49**	(1.44, 1.54)	1.49**	(1.44, 1.54)
College Grad			1.71**	(1.66, 1.77)	1.79**	(1.72, 1.85)	1.79**	(1.72, 1.85)
Age								
18 to 44			Ref		Ref		Ref	
45 to 64			2.58**	(2.53, 2.63)	2.39**	(2.34, 2.43)	2.39**	(2.34, 2.43)
Sex								
Male			Ref		Ref		Ref	
Female			1.94**	(1.90, 1.97)	1.96**	(1.92, 1.99)	1.96**	(1.92, 1.99)
Insurance								
Uninsured			Ref		Ref		Ref	
Insured			5.37**	(5.24, 5.49)	5.34**	(5.22, 5.47)	5.34**	(5.22, 5.47)
Chronic Disease								
Count 0-5			1.41**	(1.38, 1.44)	1.36**	(1.33, 1.39)	1.36**	(1.33, 1.39)
Self Reported Health								
Healthy			Ref		Ref		Ref	
Unhealthy			1.17**	(1.14, 1.20)	1.03*	(1.00, 1.06)	1.03*	(1.00, 1.06)
PCP Supply								
Adequate Supply			Ref		Ref		Ref	
Low Supply			0.82**	(0.81, 0.84)	0.81**	(0.80, 0.83)	0.81**	(0.80, 0.83)
Constant	2.79**	(2.75, 2.83)	0.32**	(0.31, 0.34)	0.30**	(0.29, 0.32)	0.31**	(0.29, 0.32)
F Statistic	10**		2850**		2532**		1723**	

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Table AG-3.

Logistic Regression Models for the Odds of having a PCP by Diabetes Risk and Expansion Status, using Pre/post-ACA Indicator; 47-state analytic sample.

Probability of Having a PCP (n=1,283,537) Odds Ratios	**Low Risk**	**95% CI**	**Low Risk**	**95% CI**	**High Risk**	**95% CI**	**High Risk**	**95% CI**	**Diabetes**	**95% CI**	**Diabetes**	**95% CI**
Expansion Status												
Non-expansion	Ref		Ref		Ref		Ref		Ref		Ref	
Expansion	1.16**	(1.14, 1.19)	1.14**	(1.09, 1.19)	1.17**	(1.13, 1.21)	1.12**	(1.07, 1.18)	1.13*	(1.0, 1.24)	1.06	(0.91, 1.23)
ACA												
Pre ACA	Ref		Ref		Ref		Ref		Ref		Ref	
Post ACA	0.89**	(0.87, 0.91)	0.87**	(0.84, 0.90)	0.90**	(0.87, 0.93)	0.87**	(0.83, 0.92)	1.04	(0.95, 1.15)	0.99	(0.86, 1.14)
Interaction Term												
ACA*EXP			1.03	(0.98, 1.09)			1.06	(0.99, 1.13)			1.11	(0.92, 1.34)
Other Variables												
Insurance												
Uninsured	Ref		Ref		Ref		Ref		Ref		Ref	
Insured	5.11**	(4.95, 5.27)	5.11**	(4.95, 5.27)	5.45**	(5.25, 5.66)	5.45**	(5.24, 5.66)	6.20**	(5.60, 6.86)	6.19**	(5.60, 6.86)
PCP Supply												
Adequate	Ref		Ref		Ref		Ref		Ref		Ref	
Low Supply	0.87**	(0.85, 0.89)	0.87**	(0.85, 0.89)	0.86**	(0.83, 0.89)	0.86**	(0.83, 0.89)	0.91	(0.82, 1.01)	0.91	(0.82, 1.01)
Race												
Whites	Ref		Ref		Ref		Ref		Ref		Ref	
Blacks	0.97	(0.93, 1.01)	0.97	(0.94, 1.01)	0.95*	(0.91, 0.995)	0.95*	(0.91, 0.995)	0.86*	(0.77, 0.98)	0.86*	(0.77, 0.97)
Hispanics	0.72**	(0.70, 0.75)	0.72**	(0.70, 0.75)	0.65**	(0.62, 0.68)	0.65**	(0.62, 0.68)	0.56**	(0.50, 0.62)	0.56**	(0.50, 0.62)
Sex												
Male	Ref		Ref		Ref		Ref		Ref		Ref	
Female	1.98**	(1.94, 2.03)	1.98**	(1.94, 2.03)	1.97**	(1.91, 2.04)	1.97**	(1.91, 2.04)	1.52**	(1.38, 1.67)	1.52**	(1.38, 1.67)
Age												
18 to 44	Ref		Ref		Ref		Ref		Ref		Ref	
45 to 64	2.43**	(2.38, 2.49)	2.43**	(2.38, 2.49)	2.36**	(2.29, 2.43)	2.36**	(2.27, 2.43)	2.04**	(1.84, 2.26)	2.04**	(1.84, 2.26)
Education												
Less than HS	Ref		Ref		Ref		Ref		Ref		Ref	
HS Grad	1.29**	(1.23, 1.36)	1.29**	(1.23, 1.36)	1.32**	(1.26, 1.39)	1.32**	(1.26, 1.39)	1.24*	(1.09, 1.41)	1.24*	(1.09, 1.41)
Some College	1.45**	(1.38, 1.52)	1.45**	(1.38, 1.52)	1.53**	(1.45, 1.61)	1.53**	(1.45, 1.61)	1.47**	(1.29, 1.68)	1.47**	1.29, 1.68)
College Grad	1.73**	(1.64, 1.81)	1.73**	(1.64, 1.81)	1.91**	(1.81, 2.02)	1.91**	(1.81, 2.02)	1.93**	(1.66, 2.24)	1.93**	(1.66, 2.24)
Chronic Disease												
Count 0-5	1.38**	(1.34, 1.42)	1.38**	(1.34, 1.42)	1.41**	(1.36, 1.46)	1.41**	(1.36, 1.46)	1.11**	(1.05, 1.18)	1.11**	(1.05, 1.18)
Self Reported Health												
Healthy	Ref		Ref		Ref		Ref		Ref		Ref	
Unhealthy	1.00	(0.96, 1.05)	1.00	(0.96, 1.05)	1.08**	(1.04, 1.13)	1.08**	(1.04, 1.13)	0.92	(0.83, 1.02)	0.92	0.83, 1.02)
Constant	0.28**	(0.27, 0.30)	0.27**	(0.27, 0.30)	0.31**	(0.29, 0.33)	0.31**	(0.29, 0.34)	1.02	(0.84, 1.23)	1.05	(0.86, 1.29)
F Statistic	1838**		1707**		1214**		1128**		176**		163**	

Notes:

1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Table AG-4.

Logistic Regression Models for the Odds of having a PCP by Diabetes Risk and Expansion Status, using (2014-2017) Time Dummy Variables; 47-state analytic sample.

Probability of PCP (Logistic) (n=1,283,537)	Low Risk	95% CI	High Risk	95% CI	Diabetes	95% CI
Expansion Status						
Non-expansion	Ref		Ref		Ref	
Expansion	1.14**	(1.09, 1.19)	1.12**	(1.07, 1.18)	1.06	(0.91, 1.23)
Years						
2012	Ref		Ref		Ref	
2013	Ref		Ref		Ref	
2014	0.91**	(0.86,0.96)	0.91*	(0.85, 0.98)	0.92	(0.77, 1.11)
2015	0.91*	(0.86, 0.96)	0.88*	(0.82, 0.95)	1.00	(0.80, 1.25)
2016	0.87**	(0.83, 0.92)	0.86**	(0.80, 0.93)	1.07	(0.85, 1.35)
2017	0.80**	(0.75, 0.84)	0.83**	(0.77, 0.90)	0.97	(0.78, 1.20)
Interaction Terms						
2012*EXP	Ref		Ref		Ref	
2013*EXP	Ref		Ref		Ref	
2014*EXP	0.99	(0.93, 1.06)	1.01	(0.93, 1.11)	1.11	(0.86, 1.44)
2015*EXP	1.04	(0.97, 1.12)	1.10	(1.00, 1.20)	1.21	(0.90, 1.62)
2016*EXP	1.01	(0.94, 1.08)	1.11*	(1.01, 1.21)	0.95	(0.71, 1.27)
2017*EXP	1.10*	(1.02, 1.18)	1.04	(0.94, 1.14)	1.19	(0.90, 1.58)
Insurance						
Uninsured	Ref		Ref		Ref	
Insured	5.11**	(4.96, 5.28)	5.45**	(5.25, 5.66)	6.18**	(5.59, 6.84)
Other Varibles						
PCP Supply						
Adequate	Ref		Ref		Ref	
Low Supply	0.87**	(0.85, 0.89)	0.86**	(0.83, 0.89)	0.91	(0.82, 1.01)
Race						
Whites	Ref		Ref		Ref	
Blacks	0.97	(0.93, 1.01)	0.95*	(0.91, 0.99)	0.86*	(0.77, 0.98)
Hispanics	0.72**	(0.70, 0.75)	0.65**	(0.62, 0.68)	0.56**	(0.50, 0.62)
Sex						
Male	Ref		Ref			
Female	1.98**	(1.94, 2.03)	1.97**	(1.91, 2.04)	1.52**	(1.38, 1.67)
Age						
18 to 44	Ref		Ref		Ref	
45 to 64	2.43**	(2.38, 2.49)	2.36**	(2.29, 2.43)	2.04**	(1.84, 2.56)
Education						
Less than HS	Ref		Ref		rEF	
HS Grad	1.29**	(1.23, 1.36)	1.32**	(1.26, 1.40)	1.24*	(1.10, 1.41)
Some College	1.45**	(1.38, 1.52)	1.53**	(1.45, 1.62)	1.47**	(1.29, 1.69)
College Grad	1.73**	(1.65, 1.82)	1.91**	(1.81, 2.02)	1.93**	(1.66, 2.24)
Chronic Disease						
Count 0-5	1.38**	(1.34, 1.42)	1.41**	(1.36, 1.46)	1.11**	(1.05, 1.18)
Self Reported Health						
Healthy	Ref		Ref		Ref	
Unhealthy	1.00	(0.96, 1.05)	1.08**	(1.04, 1.13)	0.92	(0.83, 1.02)
Constant	0.29**	(0.27, 0.30)	0.31**	(0.29, 0.34)	1.05	(0.86, 1.29)
F Statistic	1199**		792**		115**	

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

To gain a better understanding of how the three diabetes group models differ, **Table AG-5** provides a summary of logistic odds ratios for the demographic, health status and state level variables for each group, including the overall odd ratios. These coefficients are also compared with a single, overall model of PCP (**Table AG-1**), which assumes equal coefficients across the three groups. Higher coefficients for one diabetes risk group indicates that certain variables have a larger effect in gaining access to a PCP.

A combination of being female, being 45 or older, being a college graduate, being minority, having a chronic disease and/or report of being unhealthy played a larger role in having a PCP for the two risk groups than those with reported diabetes. Insurance seemed to play the biggest role in having a PCP for individuals with reported diabetes (6.19, $p<0.001$), although the high-risk group and no/low risk groups also had larger regression coefficients, showing that insurance is the most important variable determining the likelihood of having a PCP.

Table AG-5.

Summary Table Comparing Overall Logistic Odds Ratios for Demographic, Health Status and State Level Variables to Odds Ratios by Diabetes Risk Status.

	TABLE AG-1 ODDS RATIOS		TABLE AG-3 ODDS RATIOS BY DIABETES RISK		
COVARIATE	OVERALL		NO/LOW	HIGH	DIABETES
Insured	5.33**		5.11**	5.45**	6.19**
Female	1.96**		1.98**	1.97**	1.52**
45-64	2.39**		2.43**	2.36**	2.04**
HS Grad	1.31**		1.29**	1.32**	1.24*
Some College	1.49**		1.45**	1.53**	1.47**
College Grad	1.78**		1.73**	1.91**	1.93**
Blacks	0.95*		0.97	0.95*	0.86*
Hispanics	0.69**		0.72**	0.65**	0.56**
CD Count 0-5	1.36**		1.38**	1.41**	1.11**
Unhealthy	1.03*		1.00	1.08**	0.92
PCP Supply	0.81**		0.87**	0.86**	0.91
Post-ACA			0.87**	0.87**	0.99
EXP	-		1.14**	1.12**	1.06
ACA*EXP	-		1.03	1.06	1.11

Notes:

1. Data source from PCP stepwise regressions, full model Table AG-1
2. Data source from full model stratified by race, see Table AG-3
3. P value <0.001 (**), P value <0.05 (*)

Evaluating ACA Effects for Complex PCP Regressions by Diabetes Risk and INS Status. In this section, a sensitivity analysis was conducted using complex regression models that included three key interaction terms: ACA*INS; ACA*Risk; and ACA*INS*Risk. The key coefficients for the regression models in **Table AG-6** include:

- Post-ACA=1.01
- ACA*INS= 0.85
- ACA*High-risk= 0.99

- ACA*Diabetes= 1.11
- ACA*INS*High-risk= 1.10 (uninsured); 1.11 (insured)
- ACA*INS*Diabetes= 1.29 (uninsured); 1.33 (insured)

Table AG-6.

Complex Logistic Regression Models for the Likelihood of having a PCP by INS, Diabetes Risk, and Pre/post-ACA; 47-state sample.

Probability of Having a PCP (n=1,283,537)	**Model 1 Odds Ratio**	**Model 2 Odds Ratio**	**Model 3 Odds Ratio**	**Model 4 Odds Ratio**	**Model 5 Odds Ratio**	**95% CI**	**Model 6 Odds Ratio**	**95% CI**
ACA								
Pre-ACA	Ref	Ref	Ref	Ref	Ref		Ref	
Post-ACA	1.03**	0.90**	0.90**	0.88**	0.99 p=0.807	(0.95, 1.04)	1.01 p=0.840	(0.95, 1.06)
Insurance								
Uninsured				Ref	Ref		Ref	
Insured				5.33**	5.86**	(5.65, 6.07)	5.59**	(5.33, 5.86)
Diabetes Status								
No/Low Risk			Ref	Ref	Ref		Ref	
High Risk			1.18*	1.16**	1.17**	(1.13, 1.21)	1.10*	(1.03, 1.17)
Diabetes			2.88**	2.56**	2.59**	(2.40, 2.80)	2.24**	(1.97, 2.53)
ACA*Risk								
ACA*no/low risk				Ref	Ref		Ref	
ACA*highrisk				1.02	1.01 p=0.553	(0.97, 1.05)	0.99 p=0.89	(0.91, 1.08)
ACA*diabetes				1.20**	1.17*	(1.07, 1.29)	1.11 p=0.205	(0.94, 1.32)
ACA*INS								
ACA*INS					0.85**	(0.82, 0.89)	0.85**	(0.80, 0.90)
ACA*INS*Risk								
ACA*no/low risk							Ref	
ACA*highrisk (uninsured)							1.10*	(1.02, 1.18)
ACA*highrisk (insured)							1.11*	(1.04, 1.18)
ACA*diabetes (uninsured)							1.29*	(1.10, 1.51)
ACA*diabetes (insured)							1.33**	(1.16, 1.52)
Other Variables								
Race								
Whites		Ref	Ref	Ref	Ref		Ref	
Blacks		0.99	0.99	0.95*	0.95*	(0.92, 0.98)	0.95*	(0.93, 0.98)
Hispanics		0.71**	0.71**	0.69**	0.69**	(0.67, 0.71)	0.69**	(0.67, 0.71)
Education								
Less than HS		Ref	Ref	Ref	Ref		Ref	
HS Grad		1.29**	1.29**	1.31**	1.31**	(1.27, 1.36)	1.31**	(1.26, 1.36)
Some College		1.47**	1.47**	1.49**	1.49**	(1.44, 1.54)	1.49**	(1.43, 1.54)
College Grad		1.71**	1.71**	1.78**	1.79**	(1.73, 1.85)	1.79**	(1.73, 1.85)
Age								
18 to 44		Ref	Ref	Ref	Ref		Ref	
45 to 64		2.58**	2.58**	2.39**	2.39**	(2.34, 2.43)	2.39**	(2.34, 2.43)
Sex								
Male		Ref	Ref	Ref	Ref		Ref	
Female		1.94**	1.94**	1.96**	1.96**	(1.92, 1.99)	1.96**	(1.92, 1.99)
Chronic Disease								
Count 0-5		1.41**	1.41**	1.36**	1.36**	(1.33, 1.39)	1.36**	(1.33, 1.39)
Self Reported Health								
Healthy		Ref	Ref	Ref	Ref		Ref	
Unhealthy		1.17**	1.17**	1.03*	1.03*	(1.00, 1.06)	1.03*	(1.00, 1.06)
PCP Supply								
Adequate Supply		Ref	Ref	Ref	Ref		Ref	
Low Supply		0.82**	0.82**	0.81**	0.81**	(0.80, 0.83)	0.81**	(0.80, 0.83)
Constant	2.79**	0.32**	0.32**	0.30**	0.29**	(0.27, 0.30)	0.30**	(0.28, 0.31)
F Statistic	16**	3559**	3559**	3070**	2540**		2061**	

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Individuals at high-risk and with diabetes have different ACA effects on PCP than the no/low risk group. The ACA effects are:

Table AG-7.

ACA Effects by Diabetes Risk for the Odds of having a PCP using Complex Logistic Regression Analysis; 47-state sample.

	No/Low	**High**	**Diabetes**
	Post ACA		
Insured	0.86	0.94	1.27
Uninsured	1.01	1.07	1.23

Notes

1. Insured no/low: exp{ln1.01 + ln0.85} = 0.84
2. Uninsured no/low: 1.01
3. Insured high-risk: exp{ln1.01 + ln0.85 + ln0.99 + ln1.11}= 0.94
4. Uninsured high-risk: exp{ln1.01 + ln0.85 + ln0.99 + ln1.26}= 1.07
5. Insured Diabetes: exp{ln1.01 + ln0.85 + ln1.11 + ln1.33}= 1.27
6. Uninsured Hispanics: exp{ln1.01 + ln0.85 + ln1.11 + ln1.29} =0.975

These ACA effects are holding many influential demographic and health variables constant, including the baseline effect (5.41) of insurance. Interesting to note, if a no/low risk or high-risk person has insurance- their odds of having a PCP is much lower than their peers with insurance. The opposite is true for individuals with diabetes, as the insured had a 3-percentage point higher likelihood of having a PCP than their uninsured peer.

APPENDIX AH

LOGISTIC REGERSSIONS FOR ODDS OF CHECKUP IN THE PAST YEAR BY

DIABETES RISK STATUS

Specific Aim 2a. Pre/Post-ACA Odds Ratios of Checkup with ACA-Risk Interactions. Refer to Chapter 4, page 216 for in-text discussion. Full regression models available in **Table AH-1**.

Specific Aim 2a. Annual ACA Odds Ratios of Checkup with ACA-Risk Interactions. Refer to Chapter 4, page 223 for in-text discussion. Full regression models in **Table AH-2**.

Specific Aim 2b. Pre/Post-ACA Odds Ratios for Checkup Controlling for Expansion Status by Risk Group. Refer to Chapter 4, page 229 for in-text discussion. Full regression models in **Table AH-3**.

Specific Aim 2b. Annual ACA Odds Ratios of Checkup Controlling for Expansion Status by Risk Group. Full regression models using time variables are available in **Table AH-4**. Overall time tends individuals living within expansion or non-expansion states were not statistically significant; however, the no/low risk group living in expansion states experienced a 10% increased likelihood of having a checkup in 2017 when compared to the no/low risk group in non-expansion states. The high-risk group in expansion states also saw a 11% increased likelihood of having a checkup over their peers in non-expansion states but declined by 2017.

Table AH-1.

Logistic Regression Models for the likelihood of having a Checkup by Diabetes Risk, using pre/post ACA indicator; 47-state analytic sample.

Probability of Checkup (n=1,283,537)	**Model 1 Odds Ratio**	**95% CI**	**Model 2 Odds Ratio**	**95% CI**	**Model 3 Odds Ratio**	**95% CI**	**Model 4 Odds Ratio**	**95% CI**
ACA								
Pre-ACA	Ref		Ref		Ref		Ref	
Post-ACA	1.10**	(1.08, 1.12)	1.01	(0.99, 1.03)	1.01	(0.99, 1.03)	1.01	(0.99, 1.03)
Diabetes Status								
No/Low Risk					Ref		Ref	
High Risk					1.08**	(1.06, 1.09)	1.08**	(1.05, 1.11)
Diabetes					2.43**	(2.34, 2.51)	2.28**	(2.15, 2.42)
ACA*Diabetes Risk								
ACA*no/low risk							Ref	
ACA*high risk							1.00	(0.96, 1.03)
ACA*diabetes							1.10*	(1.02, 1.18)
Other Variables								
Insurance								
Uninsured			Ref		Ref		Ref	
Insured			3.52**	(3.44, 3.60)	3.49**	(3.41, 3.57)	3.49**	(3.41, 3.57)
Race								
Whites			Ref		Ref		Ref	
Blacks			2.07**	(2.02, 2.13)	2.02**	(1.97, 2.07)	2.02**	(1.97, 2.07)
Hispanics			1.24**	(1.21, 1.27)	1.21**	(1.18, 1.24)	1.21**	(1.18, 1.24)
Education								
Less than HS			Ref		Ref		Ref	
HS Grad			1.12**	(1.09, 1.16)	1.13**	(1.10, 1.17)	1.13**	(1.10, 1.17)
Some College			1.15**	(1.12, 1.19)	1.10**	(1.07, 1.14)	1.10**	(1.07, 1.14)
College Grad			1.15**	(1.12, 1.19)	1.19**	(1.15, 1.22)	1.19**	(1.15, 1.22)
Age								
18 to 44			Ref		Ref		Ref	
45 to 64			1.68**	(1.65, 1.70)	1.57**	(1.55, 1.60)	1.57**	(1.55, 1.60)
Sex								
Male			Ref		Ref		Ref	
Female			1.47**	(1.45, 1.50)	1.49**	(1.47, 1.51)	1.49**	(1.47, 1.51)
Chronic Disease								
Count 0-5			1.25**	(1.23, 1.27)	1.20**	(1.18, 1.22)	1.20**	(1.18, 1.22)
Self Reported Health								
Healthy			Ref		Ref		Ref	
Unhealthy			1.09**	(1.07, 1.12)	0.98	(0.96, 1.00)	0.98	(0.96, 1.00)
PCP Supply								
Adequate Supply			Ref		Ref		Ref	
Low Supply			0.98	(0.97, 1.00)	0.98**	(0.96, 0.99)	0.98*	(0.96, 0.99)
Constant	1.70**	(1.68, 1.72)	0.33**	(0.31, 0.34)	0.32**	(0.30, 0.33)	0.32**	(0.30, 0.33)
F Statistic	158**		2050**		1827**		1598**	

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Table AH-2.

Logistic Regression Models for the likelihood of having a Checkup in the past year by Diabetes Risk, using Time Dummies (2014-2017); 47-state analytic sample.

Probability of Checkup (n=1,283,537)	**Model 1 Odds Ratio**	**95% CI**	**Model 2 Odds Ratio**	**95% CI**	**Model 3 Odds Ratio**	**95% CI**	**Model 4 Odds Ratio**	**95% CI**
Year								
2012	Ref		Ref		Ref		Ref	
2013	Ref		Ref		Ref		Ref	
2014	1.09**	(1.07, 1.12)	1.03*	(1.01, 1.06)	1.03*	(1.01, 1.06)	1.03*	(1.00, 1.06)
2015	1.09**	(1.06, 1.11)	1.00	(0.97, 1.02)	0.99	(0.97, 1.02)	1.00	(0.97, 1.03)
2016	1.13**	(1.11, 1.16)	1.03*	(1.01, 1.05)	1.03*	(1.01, 1.05)	1.02	(0.99, 1.05)
2017	1.08**	(1.06, 1.11)	0.98	(0.96, 1.00)	0.98	(0.96, 1.00)	0.97*	(0.94, 0.99)
Diabetes Status								
No/Low Risk					Ref		Ref	
High Risk					1.08**	(1.06, 1.09)	1.08**	(1.05, 1.11)
Diabetes					2.43**	(2.34, 2.52)	2.28**	(2.15, 2.42)
Year*Diabetes Status								
2014*no/low risk							Ref	
2014*high risk							0.99	(0.95, 1.04)
2014*diabetes							1.06	(0.97, 1.18)
2015*no/low risk							Ref	
2015*high risk							0.98	(0.93, 1.02)
2015*diabetes							1.11*	(1.01, 1.24)
2016*no/low risk							Ref	
2016*high risk							1.01	(0.96, 1.06)
2016*diabetes							1.12*	(1.00, 1.25)
2017*no/low risk							Ref	
2017*high risk							1.02	(0.97, 1.07)
2017*diabetes							1.1	(0.98, 1.23)
Other Variables								
Insurance								
Uninsured			Ref		Ref		Ref	
Insured			3.52**	(3.44, 3.60)	3.49**	(3.41, 3.57)	3.49**	(3.41, 3.57)
Race								
Whites			Ref		Ref		Ref	
Blacks			2.07**	(2.02, 2.13)	2.02**	(1.97, 2.07)	2.02**	(1.97, 2.07)
Hispanics			1.24**	(1.21, 1.27)	1.21**	(1.18, 1.24)	1.21**	(1.18, 1.24)
Education								
Less than HS			Ref		Ref		Ref	
HS Grad			1.12**	(1.09, 1.16)	1.13**	(1.10, 1.17)	1.13**	(1.10, 1.17)
Some College			1.09**	(1.06, 1.13)	1.10**	(1.07, 1.14)	1.10**	(1.07, 1.14)
College Grad			1.15**	(1.12, 1.19)	1.19**	(1.15, 1.22)	1.19**	(1.15, 1.22)
Age								
18 to 44			Ref		Ref		Ref	
45 to 64			1.68**	(1.65, 1.70)	1.57**	(1.55, 1.60)	1.57**	(1.55, 1.60)
Sex								
Male			Ref		Ref		Ref	
Female			1.47**	(1.45, 1.50)	1.49**	(1.47, 1.51)	1.49**	(1.47, 1.51)
Chronic Disease								
Count 0-5			1.25**	(1.23, 1.27)	1.20**	(1.18, 1.22)	1.20**	(1.18, 1.22)
Self Reported Health								
Healthy			Ref		Ref		Ref	
Unhealthy			1.09**	(1.07, 1.12)	0.98	(0.96, 1.00)	0.98	(0.96, 1.00)
PCP Supply								
Adequate Supply			Ref		Ref		Ref	
Low Supply			0.99*	(0.97, 1.00)	0.98*	(0.96, 0.99)	0.98*	(0.96, 0.99)
Constant	1.70**	(1.68, 1.72)	0.32**	(0.31, 0.34)	0.32**	(0.30, 0.33)	0.32**	(0.30, 0.33)
F Statistic	44**		1642**		1507**		1027**	

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Table AH-3.

Logistic Regression Models for the Odds of having a Checkup by Diabetes Risk and Expansion Status, using Pre/post-ACA Indicator; 47-state analytic sample.

Probability of Checkup (Logistic)	Low Risk (no interacton term)	95% CI	Low Risk (n=721,552)	95% CI	High Risk (no interaction term)	95% CI	High Risk (n=445,547)	95% CI	Diabetes (no interaction term)	95% CI	Diabetes (n=116,438)	95% CI
Expansion Status												
Non-expansion	Ref		Ref		Ref		Ref		Ref		Ref	
Expansion	0.90**	(0.88, 0.92)	0.89**	(0.86, 0.92)	0.92**	(0.90, 0.95)	0.91**	(0.87, 0.95)	0.92*	(0.86, 0.98)	0.89	(0.80, 1.00)
ACA												
Pre ACA	Ref		Ref		Ref		Ref		Ref		Ref	
Post ACA	1.00	(0.98, 1.03)	0.99	(0.96, 1.02)	1.00	(0.97, 1.03)	0.99	(0.95, 1.03)	1.10*	(1.02, 1.18)	1.07	(0.96, 1.20)
Interaction Term												
ACA*EXP			1.02	(0.98, 1.07)			1.02	(0.97, 1.08)			1.04	(0.90, 1.20)
Insurance												
Uninsured	Ref		Ref		Ref		Ref		Ref		Ref	
Insured	3.46**	(3.36, 3.57)	3.46**	(3.36, 3.57)	3.57**	(3.44, 3.70)	3.56**	(3.44, 3.70)	3.63**	(3.32, 3.96)	3.62**	(3.32, 3.95)
PCP Supply												
Adequate	Ref		Ref		Ref		Ref		Ref		Ref	
Low Supply	0.94**	(0.92, 0.96)	0.94**	(0.92, 0.96)	0.93**	(0.91, 0.96)	0.93**	(0.91, 0.96)	0.92*	(0.86, 0.96)	0.92*	(0.86, 0.99)
Race												
Whites	Ref		Ref		Ref		Ref		Ref		Ref	
Blacks	2.04**	(1.96, 2.11)	2.04**	(1.96, 2.11)	2.01**	(1.93, 2.09)	2.01**	(1.93, 2.09)	1.77**	(1.61, 1.95)	1.77**	(1.61, 1.95)
Hispanics			1.29**	(1.25, 1.34)	1.15**	(1.11, 1.20)	1.15**	(1.11, 1.20)	0.97	(0.88, 1.07)	0.97	(0.88, 1.07)
Sex												
Male	Ref		Ref		Ref		Ref		Ref		Ref	
Female	1.56**	(1.53, 1.59)	1.56**	(1.53, 1.59)	1.46**	(1.43, 1.50)	1.46**	(1.43, 1.50)	1.07	(1.00, 1.14)	1.07	(1.00, 1.14)
Age												
18 to 44	Ref		Ref		Ref		Ref		Ref		Ref	
45 to 64	1.51**	(1.48, 1.53)	1.51**	(1.48, 1.53)	1.67**	(1.63, 1.71)	1.67**	(1.63, 1.71)	1.56**	(1.44, 1.70)	1.56**	(1.44, 1.70)
Education												
Less than HS	Ref		Ref		Ref		Ref		Ref		Ref	
HS Grad	1.17**	(1.11, 1.22)	1.16**	(1.11, 1.22)	1.09**	(1.04, 1.14)	1.09**	(1.04, 1.14)	1.04	(0.94, 1.16)	1.04	(0.94, 1.16)
Some College	1.13**	(1.08, 1.18)	1.13**	(1.08, 1.18)	1.07*	(1.02, 1.12)	1.07*	(1.02, 1.12)	0.98	(0.88, 1.09)	0.98	(0.88, 1.09)
College Grad	1.20**	(1.15, 1.25)	1.20**	(1.15, 1.25)	1.19**	(1.14, 1.25)	1.19**	(1.14, 1.25)	1.06	(0.95, 1.18)	1.06	(0.95, 1.18)
Chronic Disease												
Count 0-5	1.22**	(1.20, 1.25)	1.22**	(1.19, 1.25)	1.24**	(1.21, 1.27)	1.24**	(1.21, 1.27)	1.05*	(1.00, 1.09)	1.04*	(1.00, 1.09)
Self Reported Health												
Healthy	Ref		Ref		Ref		Ref		Ref		Ref	
Unhealthy	1.00	(0.96, 1.03)	1.00	(0.96, 1.03)	1.02	(0.98, 1.06)	1.02	(0.98, 1.06)	0.78**	(0.73, 0.84)	0.78**	(0.73, 0.84)
Constant	0.33**	(0.31, 0.35)	0.33**	(0.32, 0.35)	0.36**	(0.34, 0.38)	0.36**	(0.34, 0.38)	1.23*	(1.06, 1.44)	1.25*	(1.07, 1.47)
F Statistic	968**		899**		713**		662**		109**		101**	

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Table AH-4.

Logistic Regression Models for the Odds of having a Checkup by Diabetes Risk and Expansion Status, using (2014-2017) Time Dummy Variables; 47-state analytic sample.

Probability of Checkup (Logistic)	Low Risk (no interacton term)	95% CI	Low Risk (n=721,552)	95% CI	High Risk (no interaction term)	95% CI	High Risk (n=445,547)	95% CI	Diabetes (no interaction term)	95% CI	Diabetes (n=116,438)	95% CI
Expansion Status												
Non-expansion	Ref		Ref		Ref		Ref		Ref		Ref	
Expansion	1.16**	(1.14, 1.19)	1.14**	(1.09, 1.19)	1.17**	(1.13, 1.21)	1.12**	(1.07, 1.18)	1.13*	(1.02, 1.24)	1.06	(0.91, 1.23)
Years												
2012	Ref		Ref		Ref		Ref		Ref		Ref	
2013	Ref		Ref		Ref		Ref		Ref		Ref	
2014	0.90**	(0.87, 0.93)	0.91**	(0.86, 0.96)	0.92**	(0.88, 0.96)	0.91*	(0.85, 0.98)	0.98	(0.86, 1.11)	0.92	(0.77, 1.11)
2015	0.93**	(0.90, 0.96)	0.91*	(0.86, 0.96)	0.93*	(0.89, 0.97)	0.88*	(0.82, 0.95)	1.10	(0.95, 1.28)	1.00	(0.80, 1.25)
2016	0.87**	(0.85, 0.91)	0.87**	(0.83, 0.92)	0.91**	(0.87, 0.96)	0.86**	(0.80, 0.93)	1.04	(0.90, 1.21)	1.07	(0.85, 1.35)
2017	0.84**	(0.81, 0.87)	0.80**	(0.75, 0.84)	0.85**	(0.81, 0.89)	0.83**	(0.77, 0.90)	1.06	(0.92, 1.22)	0.97	(0.78, 1.20)
Interaction Terms												
2012*EXP			Ref				Ref				Ref	
2013*EXP			Ref				Ref				Ref	
2014*EXP			0.99	(0.93, 1.06)			1.01	(0.93, 1.11)			1.11	(0.86, 1.44)
2015*EXP			1.04	(0.97, 1.12)			1.10	(1.00, 1.21)			1.21	(0.90, 1.62)
2016*EXP			1.01	(0.94, 1.08)			1.11*	(1.01, 1.21)			0.95	(0.71, 1.27)
2017*EXP			1.10*	(1.02, 1.18)			1.04	(0.94, 1.14)			1.19	(0.90, 1.58)
Other Variables												
Insurance												
Uninsured	Ref		Ref		Ref		Ref		Ref		Ref	
Insured	5.12**	(4.96, 5.28)	5.11**	(4.96, 5.28)	5.45**	(5.25, 5.67)	5.45**	(5.25, 5.66)	6.18**	(5.59, 6.85)	6.18**	(5.59, 6.84)
PCP Supply												
Adequate	Ref		Ref		Ref		Ref		Ref		Ref	
Low Supply	0.87**	(0.85, 0.89)	0.87**	(0.85, 0.89)	0.86**	(0.83, 0.89)	0.87**	(0.83, 0.89)	0.91	(0.82, 1.01)	0.91	(0.82, 1.01)
Race												
Whites	Ref		Ref		Ref		Ref		Ref		Ref	
Blacks	0.97	(0.93, 1.01)	0.97	(0.93, 1.01)	0.95*	(0.91, 0.995)	0.95*	(0.92, 0.99)	0.86*	(0.77, 0.98)	0.86*	(0.77, 0.98)
Hispanics	0.72**	(0.70, 0.75)	0.72**	(0.70, 0.75)	0.65**	(0.62, 0.68)	0.65**	(0.62, 0.68)	0.56**	(0.50, 0.62)	0.56**	(0.50, 0.62)
Sex												
Male	Ref		Ref		Ref		Ref		Ref		Ref	
Female	1.98**	(1.94, 2.03)	1.98**	(1.94, 2.03)	1.97**	(1.91, 2.04)	1.97**	(1.91, 2.04)	1.52**	(1.38, 1.67)	1.52**	(1.38, 1.67)
Age												
18 to 44	Ref		Ref		Ref		Ref		Ref		Ref	
45 to 64	2.43**	(2.38, 2.49)	2.43**	(2.38, 2.49)	2.36**	(2.29, 2.43)	2.36**	(2.29, 2.43)	2.04**	(1.84, 2.26)	2.04**	(1.84, 2.26)
Education												
Less than HS	Ref		Ref		Ref		Ref		Ref		Ref	
HS Grad	1.29**	(1.23, 1.36)	1.29**	(1.23, 1.36)	1.32**	(1.26, 1.40)	1.32**	(1.26, 1.40)	1.24*	(1.10, 1.41)	1.24*	(1.10, 1.41)
Some College	1.45**	(1.38, 1.52)	1.45**	(1.38, 1.52)	1.53**	(1.45, 1.62)	1.53**	(1.45, 1.62)	1.47**	(1.29, 1.68)	1.47**	(1.29, 1.69)
College Grad	1.73**	(1.64, 1.81)	1.73**	(1.65, 1.82)	1.91**	(1.81, 2.02)	1.91**	(1.81, 2.02)	1.93**	(1.66, 2.24)	1.93**	(1.66, 2.24)
Chronic Disease												
Count 0-5	1.38**	(1.34, 1.42)	1.38**	(1.34, 1.42)	1.41**	(1.36, 1.46)	1.41**	(1.36, 1.46)	1.11**	(1.05, 1.18)	1.11**	(1.05, 1.18)
Self Reported Health												
Healthy	Ref		Ref		Ref		Ref		Ref		Ref	
Unhealthy	1.00	(0.96, 1.05)	1	(0.96, 1.05)	1.08**	(1.04, 1.13)	1.08**	(1.04, 1.13)	0.92	(0.83, 1.01)	0.92	(0.84, 1.02)
Constant	0.28**	(0.27, 0.30)	0.29**	(0.27, 0.30)	0.31**	(0.29, 0.33)	0.31**	(0.29, 0.34)	1.02	(0.84, 1.23)	1.05	(0.86, 1.29)
F Statistic	1497**		1199**		987**		792**		143**		115**	

Notes:
1. Contains odds ratios for 47-state analytic sample
2. P values: p<0.001 (**); p<0.05(*)
3. Svy weighted logistic regression models, values indicate odds ratios

Since baseline pre-ACA Checkup rates are known from Part II, **Tables 39 and 40**, they can be used to calculate average odds ratios for persons living in expansion and non-expansion states by diabetes risk group (**Table AI-5)**.

Pre-ACA. First, the pre-ACA percentages for Checkup by diabetes risk and expansion status were converted to odds ratios using the following formula and rates from **Tables 39 and 40**:[17]

(10) OR-pre= Percent insured/(1-percent insured)

- Example: OR [Non-expansion, no/low risk, pre-ACA] = 0.6142/(1-0.6142)= 1.592.

The OR's in Rows 1 and 2 in **Table AI-5** become the base upon which logistic marginal ACA effects are constructed. Rows 1 and 2 are reproduced in Rows 3 and 6 for comparison purposes in non-expansion and expansion states separately.

Post-ACA. Post-ACA Ors, or ACA effects, by expansion status (Rows 4 and 7) were calculated using the following formulas:

(11) OR[NEXP]-post= exp{(ln(ACA OR) + ln(NEXP-pre)}

- Example OR [Non-expansion, no/low risk, post-ACA] = exp{ln(1.592) + ln(0.99)}= 1.576

(12) OR[EXP]-post = exp((ln(ACA OR) + ln(ACA*EXP OR) + ln(EXP-pre))

- Example OR [Expansion, whites, post-ACA] =exp{ln(1.514) + ln(0.99) + ln(0.89)=1.334.

---

[17] An alternative is to multiply mean values for each variable by race, times its corresponding logit coefficient, add the logit constant term, and exponentiate the sum.

The EXP coefficient is not included in calculating the post-ACA odds ratio, e.g, OR[EXP], because its effect is already included in the pre-ACA baseline insurance rate, EXP-pre. Then, Rows 5 and 8 show the post-ACA PCP gains over the pre-ACA period.

Table AH-5.

Conversion of Marginal Odds Ratios for Checkup to Average Odds Ratios for Checkup in Non-expansion and Expansion States by Diabetes Risk.

EXP ODDS RATIOS W/ PRE-ACA %CKUP ODDS				
Row	**Odds**	**Low Risk**	**High Risk**	**Diabetes**
1	**NEXP-pre**	**1.592**	**1.711**	**4.328**
2	**EXP-pre**	**1.514**	**1.675**	**4.274**
	Non-EXP			
3	Pre-ACA	1.592	1.711	4.328
4	Post-ACA	1.576	1.694	4.631
5	Post/Pre	0.990	0.990	1.070
	EXP			
6	Pre-ACA	1.514	1.675	4.274
7	Post-ACA	1.334	1.509	4.070
8	Post/Pre	0.8811	0.9009	0.9523

In the pre-ACA period, individuals with reported diabetes had greater odds of having a checkup in the past year, when compared to those at no/low risk or high-risk. For the analysis differentiating between expansion status, the ACA was not a factor in changing the likelihood of having a checkup in the past year for any diabetes risk group. Referring to the odds ratios in **Table AH-5,** individuals with reported diabetes were more likely than those at low or high-risk to have a checkup in the past year in both expansion and non-expansion states. The regression adjusted decrease in the likelihood of having a checkup in the past year was 10 % (0.90/0.99, **Table AH-5)** less for the high-risk in expansion states, compared to those in non-expansion states. The decrease in the report of checkups is due to the declining checkup/INS ratio.

To gain a better understanding of each diabetes risk group, **Table AH-6** provides a summary of all variables included in the models for determining the likelihood of having a checkup by diabetes risk and expansion status.

Table AH-6.

Summary Table Comparing Overall Logistic Odds Ratios for Demographic, Health Status and State-Level Variables for Checkup to Odds Ratios by Diabetes Risk Status.

	TABLE AH-1 ODDS RATIOS		TABLE AH-3 ODDS RATIOS BY DIABETES RISK GROUP		
COVARIATE	**OVERALL**		**NO/LOW**	**HIGH**	**DIABETES**
Insured	3.49**		3.46**	3.56**	3.62**
Female	1.49**		1.56**	1.46**	1.07
45-64	1.57**		1.51**	1.67**	1.56**
HS Grad	1.13**		1.16**	1.08**	1.04
Some College	1.10**		1.13**	1.07*	0.98
College Grad	1.19**		1.20**	1.19**	1.06
Blacks	2.02**		2.04*	2.01**	1.77**
Hispanics	1.21**		1.29**	1.15**	0.97
CD Count 0-5	1.20*		1.22**	1.24**	1.04*
Unhealthy	0.98		1.00	1.02	0.78**
PCP Supply	0.98*		0.94**	0.93**	0.92*
Post-ACA			0.99	0.99	1.07
EXP	-		0.89**	0.91**	0.89
ACA*EXP	-		1.02	1.02	1.04

Notes:

1. Data source from Checkup stepwise regressions, full model Table AG-1
2. Data source from full model stratified by race, see Table AH-3
3. P value <0.001 (**), P value <0.05 (*)

Insurance status is again, the most important variable determining the likelihood of having a Checkup in the past year as the regression coefficient is the largest in all diabetes risk groups. The next variable that is important is minority status, with blacks who are at low and high risk, having greatest odds of having a PCP, over whites. Also, college education increased the likelihood of having a PCP for the no/low and high-risk individuals, but was found to be statistically insignificant for individuals who reported having diabetes.

APPENDIX AI

NAMCS DESCRIPTIVES STATISTICS

Table AI-1.

Descriptive Statistics by Diabetes Risk for Full Sample.

	No/Low Risk				High-Risk				Diabetes				Unknown			
	Pre-ACA n=875	**Post-ACA** n=614	**Change (%)**	**p**	**Pre-ACA** n=1,738	**Post-ACA** n=1,408	**Change (%)**	**p**	**Pre-ACA** n=335	**Post-ACA** n=272	**Change (%)**	**p**	**Pre-ACA** n=2,101	**Post-ACA** n=1,631	**Change (%)**	**p**
Race/Ethnicity				0.2266				0.7843				0.4341				0.5961
Whites	79.16	71.96	-9.10%		69.79	66.54	-4.66%		71.49	61.29	-14.27%		63.27	58.58	-7.41%	
Blacks	7.27	6.97	-4.13%		15.00	17.08	13.87%		13.71	17.59	28.30%		11.67	11.14	-4.54%	
Hispanics	13.58	21.08	55.23%		15.21	16.38	7.69%		14.80	21.11	42.64%		25.06	30.28	20.83%	
Age				0.5824				0.1115				0.9886				0.8471
18 to 34	36.29	39.07	7.66%		24.22	21.61	-10.78%		13.49	12.70	-5.86%		59.66	60.10	0.74%	
35 to 44	17.98	18.57	3.28%		20.41	22.24	8.97%		16.36	15.24	-6.85%		15.17	15.64	3.10%	
45 to 54	23.87	25.44	6.58%		29.48	24.21	-17.88%		27.49	28.27	2.84%		12.28	12.99	5.78%	
55 to 64	21.86	16.92	-22.60%		25.88	31.95	23.45%		42.66	43.79	2.65%		12.89	11.26	-12.65%	
Gender				0.6497				0.4688				0.1098				0.6763
Male	24.96	26.92	7.85%		38.89	36.18	-6.97%		48.50	38.54	-20.54%		15.91	17.43	9.55%	
Female	75.04	73.08	-2.61%		61.11	63.82	4.43%		51.50	61.46	19.34%		84.09	82.57	-1.81%	
Chronic Disease				0.0922				0.1988				0.1783				0.5177
No chronic disease	83.68	89.35	6.78%		82.73	78.31	-5.34%		78.77	68.57	-12.95%		91.41	90.37	-1.14%	
At least 1 chronic disease	16.32	10.65	-34.74%		17.27	21.69	25.60%		21.23	31.43	48.05%		8.59	9.63	12.11%	
Expansion Status				0.9384				0.8661				0.1890				0.9804
Non-expansion	34.48	34.97	1.42%		37.99	37.07	-2.42%		48.96	39.74	-18.83%		39.82	40.00	0.45%	
Expansion	65.52	65.03	-0.75%		62.01	62.93	1.48%		51.04	60.26	18.06%		60.18	60.00	-0.30%	
Insurance Status				0.5048				0.7274				0.2626				0.4209
Private	77.68	76.52	-1.49%		71.84	70.12	-2.39%		71.20	54.35	-23.67%		63.65	53.92	-15.29%	
Medicaid	6.97	9.48	36.01%		7.27	10.62	46.08%		10.68	16.92	58.43%		22.22	26.75	20.39%	
Medicare	3.71	1.34	-63.88%		5.00	5.23	4.60%		9.79	13.23	35.14%		2.10	2.92	39.05%	
Self Pay	3.72	2.48	-33.33%		4.56	2.99	-34.43%		3.57	5.12	43.12%		4.41	6.94	57.37%	
Other	7.93	10.18	28.37%		11.33	11.05	-2.47%		4.77	10.38	117.61%		7.62	9.47	24.28%	

Note. Chi square calculated for pre-(2012-2013) vs. post-ACA (2014-2015) differences in outcomes by diabetes risk. 15-state group sample, survey weighted.
*p<0.05. **p<0.01. ***p<0.001

Table AI-2.

Descriptive Statistics by Diabetes Status for Non-expansion States.

	No/Low Risk				High-Risk				Diabetes				Unknown			
	Pre-ACA n=276	**Post-ACA** n=195	**Change (%)**	**p**	**Pre-ACA** n=630	**Post-ACA** n=460	**Change (%)**	**p**	**Pre-ACA** n=150	**Post-ACA** n=102	**Change (%)**	**p**	**Pre-ACA** n=732	**Post-ACA** n=544	**Change (%)**	**p**
Race/Ethnicity				0.8106				0.3754				0.6307				0.5404
Whites	71.71	66.89	-6.72%		61.14	55.27	-9.60%		65.81	55.55	-15.59%		52.93	44.26	-16.38%	
Blacks	10.15	9.90	-2.46%		16.97	26.42	55.69%		14.31	21.46	49.97%		18.13	15.81	-12.80%	
Hispanics	18.14	23.21	27.95%		21.89	18.32	-16.31%		19.88	22.99	15.64%		28.95	39.92	37.89%	
Age				0.1910				0.3719				0.6023				0.8305
18 to 34	34.02	32.62	4.12%		20.80	23.42	12.60%		9.26	15.92	71.92%		63.31	66.43	4.93%	
35 to 44	15.92	23.68	48.74%		22.49	23.74	5.56%		17.83	24.88	39.54%		12.55	13.00	3.59%	
45 to 54	23.60	27.90	18.22%		29.31	22.16	-24.40%		29.29	28.67	-2.12%		12.37	11.41	-7.76%	
55 to 64	26.46	15.79	-40.33%		27.40	30.68	11.97%		43.61	30.53	-29.99%		11.77	9.17	-22.09%	
Gender				0.7015				0.2129				0.3867				0.9287
Male	22.97	20.61	-10.27%		38.58	31.70	-17.83%		48.92	39.93	-18.38%		14.83	15.41	3.91%	
Female	77.03	79.39	3.06%		61.42	68.30	11.20%		51.08	60.07	17.60%		85.17	84.59	-0.68%	
Chronic Disease				0.0636				0.1993				0.2264				0.9023
No chronic disease	82.20	91.87	11.76%		83.48	76.06	-8.89%		77.97	60.95	-21.83%		91.23	90.88	-0.38%	
At least 1 chronic disease	17.80	8.13	-54.33%		16.52	23.94	44.92%		22.03	39.05	77.26%		8.77	9.12	3.99%	
Insurance Status				0.0425				0.0464				0.3594				0.3538
Private	79.82	66.13	-17.15%		75.01	65.13	-13.17%		69.69	53.79	-22.82%		60.89	47.5	-21.99%	
Medicaid	9.41	4.34	-53.88%		6.44	5.42	-15.84%		7.63	9.07	18.87%		24.11	35.26	46.25%	
Medicare	3.02	2.49	-17.55%		7.46	2.96	-60.32%		15.10	13.64	-9.67%		3.20	3.14	-1.88%	
Self Pay	1.93	3.81	97.41%		4.29	4.09	-4.66%		4.25	6.46	52.00%		5.64	3.51	-37.77%	
Other	5.82	23.22	298.97%		6.80	22.4	229.41%		3.33	17.05	412.01%		6.15	10.61	72.52%	

Note. Chi square calculated for pre-(2012-2013) vs. post-ACA (2014-2015) differences in outcomes by diabetes risk. Non-expansion group sample, survey weighted.
*p<0.05. **p<0.01. ***p<0.001

Table AI-3.

Descriptive Statistics by Diabetes Status for Medicaid Expansion States.

	No/Low Risk				**High-Risk**				**Diabetes**				**Unknown**			
	Pre-ACA n=599	**Post-ACA** n=419	**Change (%)**	**p**	**Pre-ACA** n=1,108	**Post-ACA** n=948	**Change (%)**	**p**	**Pre-ACA** n=185	**Post-ACA** n=170	**Change (%)**	**p**	**Pre-ACA** n=1,369	**Post-ACA** n=1,087	**Change (%)**	**p**
Race/Ethnicity				0.1510				0.5782				0.3979				0.8649
Whites	83.08	74.68	-10.11%		75.08	73.17	-2.54%		76.94	65.08	-15.41%		70.12	68.13	-2.84%	
Blacks	5.75	5.39	-6.26%		13.80	11.59	-16.01%		13.13	15.04	14.55%		7.40	8.02	8.38%	
Hispanics	11.17	19.93	78.42%		11.12	15.24	37.05%		9.93	19.87	100.10%		22.48	23.85	6.09%	
Age				0.7831				0.1594				0.3350				0.8488
18 to 34	37.48	42.53	13.47%		26.32	20.54	-21.96%		17.54	10.58	-39.68%		57.24	55.89	-2.36%	
35 to 44	19.07	15.82	-17.04%		19.14	21.36	11.60%		14.94	8.88	-40.56%		16.91	17.41	2.96%	
45 to 54	24.01	24.12	0.46%		29.59	25.41	-14.13%		25.77	28.01	8.69%		12.21	14.04	14.99%	
55 to 64	19.44	17.53	-9.83%		24.96	32.70	31.01%		41.75	52.53	25.82%		13.64	12.66	-7.18%	
Gender				0.4626				0.9577				0.1604				0.6029
Male	26.01	30.31	16.53%		39.07	38.82	-0.64%		48.10	37.63	-21.77%		16.62	18.77	12.94%	
Female	73.99	69.69	-5.81%		60.93	61.18	0.41%		51.90	62.37	20.17%		83.38	81.23	-2.58%	
Chronic Disease				0.3918				0.5259				0.4420				0.4380
No chronic disease	84.47	88.00	4.18%		82.26	79.63	-3.20%		79.54	73.60	-7.47%		91.54	90.03	-1.65%	
At least 1 chronic disease	15.53	12.00	-22.73%		17.74	20.37	14.83%		20.46	26.40	29.03%		8.46	9.97	17.85%	
Insurance Status				0.0020				0.0071				0.2684				0.3936
Private	76.55	82.1	7.25%		69.89	73.05	4.52%		72.64	64.73	-10.89%		65.48	58.20	-11.12%	
Medicaid	5.69	12.24	115.11%		7.78	13.68	75.84%		13.60	22.1	62.50%		20.97	21.07	0.48%	
Medicare	4.07	0.72	-82.31%		3.50	6.56	87.43%		4.70	12.96	175.74%		1.37	2.78	102.92%	
Self Pay	4.65	1.77	-61.94%		4.78	2.35	-50.86%		2.92	4.23	44.86%		3.59	9.23	157.10%	
Other	9.05	3.17	-64.97%		14.10	4.36	-69.08%		6.15	5.99	-2.60%		8.59	8.71	1.40%	

Note. Chi square calculated for pre-(2012-2013) vs. post-ACA (2014-2015) differences in outcomes by diabetes risk. Medicaid expansion group sample, survey weighted.
*p<0.05. **p<0.01. ***p<0.001

APPENDIX AJ

NAMCS LOGISTIC REGRESSION MODELS

Table AJ-1.

Multivariate Logistic Regression Models for the Pb (SCR) by Expansion Status and Race.

Probability of being Screened[a] **(n=8,974)**	**Model 1** (Odds Ratio)	**95% CI**	**Model 2** (Odds Ratio)	**95% CI**	**Model 3** (Odds Ratio)	**95% CI**	**Model 4** (Odds Ratio)	**95% CI**	**Model 5** (Odds Ratio)	**95% CI**	**Model 6** (Odds Ratio)	**95% CI**
ACA												
Pre-ACA	Ref		Ref		Ref		Ref		Ref		Ref	
Post-ACA	1.02	(0.61, 1.70)	1.02	(0.60, 1.71)	0.91	(0.57, 1.46)	1.10	(0.39, 3.12)	0.83	(0.35, 1.98)	0.64	(0.30, 1.36)
Expansion Status												
Non-expansion			Ref		Ref		Ref		Ref		Ref	
Medicaid Expansion			1.07	(0.57, 2.00)	1.13	(0.64, 1.99)	1.31	(0.87, 1.98)	1.25	(0.83, 1.89)	1.12	(0.72, 1.75)
Interaction Term												
ACA*nonEXP							Ref		Ref		Ref	
ACA*EXP							0.74	(0.23, 2.36)	0.81	(0.27, 2.42)	1.17	(0.46, 2.98)
Race												
Whites					Ref		Ref		Ref		Ref	
Blacks					0.98	(0.69, 1.41)	1.33	(0.95, 1.87)	0.99	(0.66, 1.48)	0.64	(0.34, 1.19)
Hispanics					1.44	(0.87, 2.36)	1.44	(0.87, 2.40)	1.04	(0.74, 1.45)	0.95	(0.58, 1.56)
Interaction Term												
ACA*whites									Ref		Ref	
ACA*blacks									1.81	(0.94, 3.48)	3.15*	(1.25, 7.93)
ACA*Hispanics									1.88	(0.82, 4.33)	3.29	(0.84, 12.79)
3-Way Interaction Term[b]												
whites*preACA*nonEXP											Ref	
B*Pre-ACA*EXP											2.00	(0.90, 4.42)
B*Post-ACA*EXP											0.88	(0.32, 2.43)
H*Pre-ACA*EXP											1.14	(0.58, 2.24)
H*Post-ACA*EXP											0.44	(0.11, 1.78)
Age												
18 to 34					Ref		Ref		Ref		Ref	
35 to 44					0.98	(0.69, 1.41)	0.98	(0.69, 1.41)	0.98	(0.68, 1.40)	0.99	(0.71, 1.39)
45 to 54					1.15	(0.82, 1.61)	1.16	(0.83, 1.61)	1.16	(0.83, 1.62)	1.16	(0.83, 1.62)
55 to 64					1.65**	(1.18, 2.32)	1.67**	(1.19, 2.33)	1.68**	(1.20, 2.34)	1.69**	(1.21, 2.36)
Gender												
Male					Ref		Ref		Ref		Ref	
Female					0.85	(0.59, 1.22)	0.85	(0.59, 1.22)	0.84	(0.59, 1.21)	0.84	(0.59, 1.21)
Diabetes Risk												
No/low Risk					Ref		Ref		Ref		Ref	
High Risk					1.45*	(1.05, 2.00)	1.45*	(1.06, 2.00)	1.46*	(1.06, 2.02)	1.46*	(1.06, 2.01)
Diabetes					2.82***	(1.79, 4.44)	2.84**	(1.81, 4.46)	2.82***	(1.79, 4.44)	2.82***	(1.77, 4.47)
Unknown					0.56*	(0.34, 0.91)	0.56*	(0.34, 0.91)	0.56*	(0.35, 0.91)	0.56*	(0.34, 0.91)
Chronic Disease												
No Disease					Ref		Ref		Ref		Ref	
At least 1 or more					1.17	(0.72, 1.90)	1.17	(0.73, 1.86)	1.19	(0.74, 1.91)	1.17	(0.74, 1.85)
Constant	0.13**	(0.11, 0.16)	0.13**	(0.08, 0.20)	0.10***	(0.06, 0.17)	0.09**	(0.05, 0.15)	0.10**	(0.06, 0.17)	0.11***	(0.06, 0.19)
F Statistic	0.95***		0.94		9.71***		8.91***		7.82***		6.59***	

Note. Logistic regressions for the Pb(SCR) by expansion status and race in 15-states (2012-2015); survey weighted data. Values indicate odds ratios.

[a]Diabetes Screening includes a glucose or HgbA1c test performed during a clinic visit using 2012-2015 data.

[b] Three-way interaction term includes interactions between race, ACA and expansion status. Referernce group: whies living in non-expansion states, pre-ACA.

*p<0.05. **p<0.01. ***p<0.001

Table AJ-2.

Multivariate Logistic Regression Models for the Pb(SCR) by Expansion Status and Diabetes Risk.

Probability of being Screened[a] (n=8,974)	Model 1 (Odds Ratio)	95% CI	Model 2 (Odds Ratio)	95% CI	Model 3 (Odds Ratio)	95% CI	Model 4 (Odds Ratio)	95% CI	Model 5 (Odds Ratio)	95% CI	Model 6 (Odds Ratio)	95% CI
ACA												
Pre-ACA	Ref		Ref		Ref		Ref		Ref		Ref	
Post-ACA	1.02	(0.61, 1.70)	1.02	(0.60, 1.71)	0.91	(0.57, 1.46)	1.10	(0.39, 3.12)	1.15	(0.33, 3.97)	1.55	(0.54, 4.43)
Expansion Status												
Non-expansion			Ref		Ref		Ref		Ref		Ref	
Medicaid Expansion			1.07	(0.57, 2.00)	1.13	(0.64, 1.99)	1.31	(0.87, 1.98)	1.30	(0.86, 1.96)	1.22	(0.52, 2.83)
Interaction Term												
ACA*nonEXP							Ref		Ref		Ref	
ACA*EXP							0.74	(0.23, 2.36)	0.74	(0.23, 2.37)	0.44	(0.11, 1.77)
Diabetes Risk												
No/low Risk					Ref		Ref		Ref		Ref	
High Risk					1.45*	(1.05, 2.00)	1.45*	(1.06, 2.00)	1.38	(0.86, 2.23)	1.08	(0.56, 2.08)
Diabetes					2.82***	(1.79, 4.44)	2.84**	(1.81, 4.46)	2.58**	(1.47, 4.56)	2.14*	(1.01, 4.49)
Unknown					0.56*	(0.34, 0.91)	0.56*	(0.34, 0.91)	0.70	(0.39, 1.24)	0.90	(0.44, 1.84)
Interaction Term												
ACA*no/low risk									Ref		Ref	
ACA*high risk									1.10	(0.59, 2.06)	1.00	(0.40, 2.53)
ACA*diabetes									1.18	(0.50, 2.80)	1.00	(0.34, 2.95)
ACA*unknown									0.55	(0.22, 1.43)	0.19*	(0.04, 0.86)
3-Way Interaction Term[b]												
NoRisk*preACA*nonEXP											Ref	
HR*Pre-ACA*EXP											1.43	(0.57, 3.58)
HR*Post-ACA*EXP											1.78	(0.72, 4.38)
Dia*Pre-ACA*EXP											1.39	(0.48, 4.04)
Dia*Post-ACA*EXP											1.83	(0.50, 6.75)
UnK*Pre-ACA*EXP											0.64	(0.22, 1.84)
Unk*Post-ACA*EXP											3.65	(0.80, 16.64)
Race												
Whites					Ref		Ref		Ref		Ref	
Blacks					0.98	(0.69, 1.41)	1.33	(0.95, 1.87)	1.33	(0.95, 1.85)	1.32	(0.94, 1.84)
Hispanics					1.44	(0.87, 2.36)	1.44	(0.87, 2.40)	1.44	(0.87, 2.39)	1.46	(0.89, 2.41)
Age												
18 to 34					Ref		Ref		Ref		Ref	
35 to 44					0.98	(0.69, 1.41)	0.98	(0.69, 1.41)	0.98	(0.68, 1.42)	0.98	(0.67, 1.43)
45 to 54					1.15	(0.82, 1.61)	1.16	(0.83, 1.61)	1.16	(0.83, 1.61)	1.15	(0.83, 1.60)
55 to 64					1.65**	(1.18, 2.32)	1.67**	(1.19, 2.33)	1.65**	(1.19, 2.29)	1.65**	(1.19, 2.29)
Gender												
Male					Ref		Ref		Ref		Ref	
Female					0.85	(0.59, 1.22)	0.85	(0.59, 1.22)	0.84	0.59, 1.20)	0.84	(0.59, 1.20)
Chronic Disease												
No Disease					Ref		Ref		Ref		Ref	
At least 1 or more					1.17	(0.72, 1.90)	1.17	(0.73, 1.86)	1.16	(0.73, 1.84)	1.16	(0.73, 1.84)
Constant	0.13**	(0.11, 0.16)	0.13**	(0.08, 0.20)	0.10***	(0.06, 0.17)	0.09**	(0.05, 0.15)	0.09**	(0.05, 0.16)	0.09***	(0.05, 0.18)
F Statistic	0.95***		0.94		9.71***		8.91***		7.19***		5.70***	

Note. Logistic regressions for the Pb(SCR) by expansion status and diabetes risk in 15-states (2012-2015); survey weighted data. Values indicate odds ratios.

[a]Diabetes Screening: Glucose or HgbA1c test during visit (2012-2015).

[b] Three-way interaction term: Diabetes risk, ACA and expansion status. Reference group:no/low risk for diabetes individuals living in non-expansion states in the pre-ACA period.

*p<0.05. **p<0.01. ***p<0.001

Table AJ-3.

Multivariate Logistic Regression Models for the Pb(DPE) by Expansion Status and Race.

Probability of Receiving Diabetes Prevention Education[a] **(n=8,974)**	**Model 1** (Odds Ratio)	**95% CI**	**Model 2** (Odds Ratio)	**95% CI**	**Model 3** (Odds Ratio)	**95% CI**	**Model 4** (Odds Ratio)	**95% CI**	**Model 5** (Odds Ratio)	**95% CI**	**Model 6** (Odds Ratio)	**95% CI**
ACA												
Pre-ACA	Ref		Ref		Ref		Ref		Ref		Ref	
Post-ACA	1.62*	(1.05, 2.49)	1.62*	(1.05, 2.50)	1.55	(0.98, 2.46)	2.54*	(1.09, 5.92)	1.89	(0.95, 3.79)	1.42	(0.78, 2.59)
Expansion Status												
Non-expansion			Ref		Ref		Ref		Ref		Ref	
Medicaid Expansion			0.83	(0.50, 1.38)	0.81	(0.48, 1.35)	1.29	(0.81, 2.08)	1.22	(0.76, 1.96)	1.19	(0.72, 1.95)
Interaction Term												
ACA*nonEXP							Ref		Ref		Ref	
ACA*EXP							0.44	(0.17, 1.12)	0.49	(0.20, 1.20)	0.77	(0.37, 1.61)
Race												
Whites					Ref		Ref		Ref		Ref	
Blacks					0.89	(0.59, 1.35)	0.87	(0.58, 1.31)	0.54**	(0.34, 0.86)	0.54	(0.28, 1.03)
Hispanics					0.93	(0.44, 1.97)	0.94	(0.45, 1.96)	0.60	(0.35, 1.04)	0.88	(0.29, 2.71)
Interaction Term												
ACA*whites									Ref		Ref	
ACA*blacks									2.20*	(1.08, 4.49)	2.92*	(1.09, 7.83)
ACA*Hispanics									2.05	(0.56, 7.57)	4.63	(0.71, 30.24)
3-Way Interaction Term[b]												
whites*preACA*nonEXP											Ref	
B*Pre-ACA*EXP											1.01	(0.40, 2.56)
B*Post-ACA*EXP											0.65	(0.24, 1.77)
H*Pre-ACA*EXP											1.19	(0.42, 3.37)
H*Post-ACA*EXP											0.23	(0.03, 1.53)
Age												
18 to 34					Ref		Ref		Ref		Ref	
35 to 44					0.83	(0.55, 1.24)	0.83	(0.56, 1.23)	0.82	(0.56, 1.20)	0.84	(0.59, 1.18)
45 to 54					0.73	(0.50, 1.05)	0.74	(0.52, 1.05)	0.74	(0.52, 1.04)	0.73	(0.52, 1.03)
55 to 64					0.76	(0.52, 1.12)	0.78	(0.54, 1.11)	0.78	(0.55, 1.09)	0.79	(0.57, 1.09)
Gender												
Male					Ref		Ref		Ref		Ref	
Female					1.11	(0.87, 1.43)	1.11	(0.86, 1.42)	1.10	(0.86, 1.41)	1.10	(0.86, 1.41)
Diabetes Risk												
No/low Risk					Ref		Ref		Ref		Ref	
High Risk					1.44*	(1.07, 1.92)	1.44*	(1.07, 1.94)	1.45*	(1.08, 1.94)	1.44*	(1.07, 1.95)
Diabetes					1.69	(0.96, 2.97)	1.72	(0.97, 3.06)	1.70	(0.95, 3.05)	1.71	(0.95, 3.08)
Unknown					0.51*	(0.27, 0.98)	0.51*	(0.27, 0.96)	0.51*	(0.27, 0.96)	0.50*	(0.28, 0.88)
Chronic Disease												
No Disease					Ref		Ref		Ref		Ref	
At least 1 or more					0.89	(0.60, 1.32)	0.88	(0.58, 1.33)	0.89	(0.58, 1.36)	0.87	(0.57, 1.33)
Constant	0.16***	(0.13, 0.21)	0.18***	(0.13, 0.26)	0.22***	(0.14, 0.35)	0.16***	(0.09, 0.28)	0.19***	(0.11, 0.32)	0.20***	(0.11, 0.34)
F Statistic	4.73*		2.72		6.74***		7.65***		7.66***		7.12***	

Note. Logistic regressions for the Pb(DPE) by expansion status and race in 15-states (2012-2015); survey weighted data. Values indicate odds ratios.

[a]Diabetes Prevention Education (DPE): at least 1 form of teaching (i.e. exercise, diet/nutrition or weight reduction) provided during visit using 2012-2015 data.

[b] Three-way interaction term includes interactions between race, ACA and expansion. Reference: whites living in non-expansion states in the pre-ACA period.

*p<0.05. **p<0.01. ***p<0.001

Table AJ-4.

Multivariate Logistic Regression Models for the Pb(DPE) by Expansion Status and Diabetes Risk.

Probability of Receiving Diabetes Prevention Education[a] (n=8,974)	Model 1 (Odds Ratio)	95% CI	Model 2 (Odds Ratio)	95% CI	Model 3 (Odds Ratio)	95% CI	Model 4 (Odds Ratio)	95% CI	Model 5 (Odds Ratio)	95% CI	Model 6 (Odds Ratio)	95% CI
ACA												
Pre-ACA	Ref		Ref		Ref		Ref		Ref		Ref	
Post-ACA	1.62*	(1.05, 2.49)	1.62*	(1.05, 2.50)	1.55	(0.98, 2.46)	2.54*	(1.09, 5.92)	1.63	(0.72, 3.70)	0.61	(0.20, 1.86)
Expansion Status												
Non-expansion			Ref		Ref		Ref		Ref		Ref	
Medicaid Expansion			0.83	(0.50, 1.38)	0.81	(0.48, 1.35)	1.29	(0.81, 2.08)	1.28	(0.79, 2.06)	0.75	(0.36, 1.52)
Interaction Term												
ACA*nonEXP							Ref		Ref		Ref	
ACA*EXP							0.44	(0.17, 1.12)	0.45	(0.18, 1.11)	2.08	(0.58, 7.41)
Diabetes Risk												
No/low Risk					Ref		Ref		Ref		Ref	
High Risk					1.44*	(1.07, 1.92)	1.44*	(1.07, 1.94)	1.21	(0.88, 1.67)	0.92	(0.55, 1.55)
Diabetes					1.69	(0.96, 2.97)	1.72	(0.97, 3.06)	1.16	(0.63, 2.14)	0.67	(0.30, 1.50)
Unknown					0.51*	(0.27, 0.98)	0.51*	(0.27, 0.96)	0.33***	(0.18, 0.61)	0.15***	(0.07, 0.30)
Interaction Term												
ACA*no/low risk									Ref		Ref	
ACA*highrisk									1.40	(0.80, 2.46)	3.46*	(1.18, 10.11)
ACA*diabetes									2.01	(0.73, 5.60)	3.14	(0.79, 12.48)
ACA*unknown									2.21	(0.62, 7.92)	14.91**	(2.32, 95.60)
3-Way Interaction Term												
no/low*preACA*nonEXP											Ref	
HR*Pre-ACA*EXP											1.51	(0.78, 2.91)
HR*Post-ACA*EXP											0.37	(0.13, 1.08)
DIA*Pre-ACA*EXP											2.45	(0.79, 7.57)
DIA*Post-ACA*EXP											1.28	(0.28, 5.82)
Unkn*Pre-ACA*EXP											3.32*	(1.17, 9.40)
Unkn*Post-ACA*EXP											12.69*	(0.02, 0.79)
Race												
Whites					Ref		Ref		Ref		Ref	
Blacks					0.89	(0.59, 1.35)	0.87	(0.58, 1.31)	0.87	(0.58, 1.31)	0.86	(0.59, 1.27)
Hispanics					0.93	(0.44, 1.97)	0.94	(0.45, 1.96)	0.93	(0.46, 1.90)	0.90	(0.47, 1.71)
Age												
18 to 34					Ref		Ref		Ref		Ref	
35 to 44					0.83	(0.55, 1.24)	0.83	(0.56, 1.23)	0.83	(0.57, 1.21)	0.86	(0.61,1.22)
45 to 54					0.73	(0.50, 1.05)	0.74	(0.52, 1.05)	0.73	(0.52, 1.04)	0.74	(0.53, 1.04)
55 to 64					0.76	(0.52, 1.12)	0.78	(0.54, 1.11)	0.78	(0.55, 1.10)	0.76	(0.55, 1.07)
Gender												
Male					Ref		Ref		Ref		Ref	
Female					1.11	(0.87, 1.43)	1.11	(0.86, 1.42)	1.10	(0.86, 1.42)	1.11	(0.86, 1.43)
Chronic Disease												
No Disease					Ref		Ref		Ref		Ref	
At least 1 or more					0.89	(0.60, 1.32)	0.88	(0.58, 1.33)	0.87	(0.57, 1.32)	0.88	(0.59, 1.30)
Constant	0.16***	(0.13, 0.21)	0.18***	(0.13, 0.26)	0.22***	(0.14, 0.35)	0.16***	(0.09, 0.28)	0.21***	(0.12, 0.36)	0.29***	(0.16, 0.54)
F Statistic	4.73*		2.72		6.74***		7.65***		6.53***		5.75***	

Note. Logistic regressions for the Pb(DPE) by expansion and diabetes risk in 15-states (2012-2015); survey weighted data. Values indicate odds ratios.

[a]Diabetes Prevention Education (DPE) includes at least 1 form of teaching (i.e. exercise, diet/nutrition or weight reduction) provided during a clinic visit in 2012-2015.

[b] Three-way interaction term includes interactions between race, ACA and expansion status. Reference group:no/low risk for diabetes individuals living in non-expansion states in the pre-ACA period.

*p<0.05. **p<0.01. ***p<0.001

Table AJ-5

Logistic Regression for the Pb(SCR), Stratified by Diabetes Risk Status for Years 2012-2015.

Probability of being Screened[a]	Low Risk (n=1,489)	95% CI	Low Risk (n=1,489)	95% CI	Low Risk (n=1,489)	95% CI	High-Risk (n=3,146)	95% CI	High-Risk (n=3,146)	95% CI	High-Risk (n=3,146)	95% CI	Diabetes (n=607)	95% CI	Diabetes (n=607)	95% CI	Diabetes (n=607)	95% CI
ACA																		
Pre-ACA	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
Post-ACA	0.89	(0.43, 1.86)	1.51	(0.53, 4.35)	1.17	(0.42, 3.26)	1.03	(0.56, 1.90)	1.57	(0.42, 5.86)	0.92	(0.36, 2.38)	1.12	(0.51, 2.46)	1.33	(0.39, 4.55)	1.39	(0.33, 5.93)
Expansion Status																		
Non-expansion	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref. 1.59	(0.69, 3.65)	Ref	
Medicaid Expansion	0.78	(0.36, 1.66)	1.20	(0.48, 2.97)	1.15	(0.46, 2.83)	1.31	(0.61, 2.82)	1.86*	(1.4, 3.32)	1.66	(0.95, 2.91)	1.37	(0.60, 3.11)			1.68	(0.71, 3.93)
Age																		
18 to 34	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
35 to 44	0.93	(0.33, 2.63)	0.90	(0.831, 2.59)	0.91	(0.33, 2.52)	1.01	(0.45, 2.30)	1.03	(0.46, 2.29)	0.98	(0.42, 2.25)	1.47	(0.44, 4.94)	1.48	(0.44, 5.00)	1.40	(0.40, 4.86)
45 to 54	0.74	(0.25, 2.22)	0.73	(0.23, 2.56)	0.72	(0.22, 2.33)	1.61*	(1.08, 2.42)	1.64*	(1.10, 2.44)	1.65*	(1.11, 2.45)	1.33	(0.46, 3.86)	1.36	(0.47, 3.92)	1.33	(0.46, 3.88)
55 to 64	1.37	(0.58, 3.24)	1.4	(0.61, 3.23)	1.47	(0.67, 3.25)	2.52***	(1.59, 3.99)	2.57***	(1.62, 4.07)	2.56***	(1.61, 4.08)	0.96	(0.33, 2.76)	0.99	(0.36, 2.76)	1.00	(0.34, 2.92)
Gender																		
Male	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
Female	0.63	(0.27 1.47)	0.62	(0.26, 1.46)	0.61	(0.26, 1.44)	0.77	(0.49, 1.21)	0.76	(0.48, 1.20)	0.74	(0.47, 1.17)	1.06	(0.63, 1.78)	1.07	(0.63, 1.80)	1.16	(0.68, 1.99)
Race																		
White	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
Black	0.63	(0.20, 1.98)	0.63	(0.20, 2.01)	0.62	(0.18, 2.08)	1.77	(0.98, 3.18)	1.72*	(1.03, 2.86)	1.15	(0.64, 2.05)	0.71	(0.19, 2.70)	0.71	(0.18, 2.73)	0.39	(0.12, 1.28)
Hispanic	1.87	(0.72, 4.87)	1.90	(0.75, 4.81)	1.10	(0.51, 2.39)	1.92	(0.80, 4.58)	1.96	(0.80, 4.80)	0.81	(0.42, 1.53)	0.65	(0.30, 1.40)	0.65	(0.30, 1.41)	1.18	(0.44, 3.20)
Chronic Disease																		
No Disease	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
At least 1 or more	0.85	(0.44, 1.63)	0.87	(0.45, 1.66)	0.89	(0.46, 1.72)	1.07	(0.57, 2.02)	1.05	(0.58, 1.92)	1.08	(0.60, 1.94)	1.97	(0.93, 4.16)	1.95	(0.93, 4.10)	1.94	(0.93, 4.03)
Interaction Term																		
ACA*Non-expansion			Ref		Ref				Ref		Ref				Ref		Ref	
ACA*Expansion			0.42	(0.10, 1.80)	0.44	(0.11, 1.82)			0.53	(0.12, 2.24)	0.64	(0.18, 2.28)			0.75	(0.15, 3.69)	0.72	(0.14, 3.65)
ACA*White					Ref						Ref						Ref	
ACA*Black					1.03	(0.08, 13.39)					2.17	(0.82, 5.75)					2.46	(0.30, 20.20)
ACA*Hispanic					2.56	(0.61, 10.73)					4.49*	(1.12, 17.97)					0.36	(0.08, 1.67)
Constant	0.18***	(0.09, 0.38)	0.14***	(0.06, 0.35)	0.16***	(0.06, 0.38)	0.10***	(0.05, 1.17)	0.07***	(0.04, 0.14)	0.10***	(0.05, 0.18)	0.24*	(0.06, 0.88)	0.21*	(0.05, 0.84)	0.20*	(0.05, 0.83)
F Statistic	1.68		1.67		1.67		3.89***		3.46***		3.57***		0.97		0.89		1.04	

Note. Logistic regressions for the Pb(SCR) by expansion status and race in 15-states (2012-2015); survey weighted data. Values indicate odds ratios.

[a]Diabetes Screening: Glucose or HgbA1c test performed during a clinic visit from 2012-2015.

*p<0.05. **p<0.01. ***p<0.001

Table AJ-6.

Logistic Regression for the Pb(DPE), Stratified by Diabetes Risk Status for Years 2012-2015.

Probability of Receiving DPE[a]	**Low Risk (n=1,489)**	**95% CI**	**Low Risk (n=1,489)**	**95% CI**	**Low Risk (n=1,489)**	**95% CI**	**High-Risk (n=3,146)**	**95% CI**	**High-Risk (n=3,146)**	**95% CI**	**High-Risk (n=3,146)**	**95% CI**	**Diabetes (n=607)**	**95% CI**	**Diabetes (n=607)**	**95% CI**	**Diabetes (n=607)**	**95% CI**
ACA																		
Pre-ACA	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
Post-ACA	1.00	(0.59, 1.73)	0.62	(0.20, 1.89)	0.47	(0.17, 1.34)	1.43*	(1.01, 2.03)	2.11**	(1.26, 3.54)	1.96*	(1.11, 3.45)	2.04	(0.76, 5.53)	1.84	(0.50, 6.78)	2.05	(0.48, 8.74)
Expansion Status																		
Non-expansion	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
Medicaid Expansion	1.10	(0.60, 2.02)	0.77	(0.37, 1.63)	0.73	(0.33, 1.53)	0.74	(0.52, 1.06)	1.07	(0.65, 1.75)	1.07	(0.66, 1.76)	1.90	(0.7, 5.11)	1.71	(0.56, 5.24)	1.77	(0.56, 5.59)
Age																		
18 to 34	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
35 to 44	0.70	(0.37, 1.31)	0.72	(0.38, 1.34)	0.67	(0.34, 1.29)	0.87	(0.58, 1.31)	0.89	(0.59, 1.32)	0.88	(0.60, 1.29)	0.39	(0.12, 1.26)	0.39	(0.12, 1.25)	0.38	(0.12, 1.24)
45 to 54	1.13	(0.62, 2.06)	1.15	(0.63, 2.10)	1.09	(0.63, 1.89)	0.71	(0.48, 1.05)	0.72	(0.49, 1.06)	0.73	(0.50, 1.08)	0.39	(0.15, 1.06)	0.39*	(0.15, 0.99)	0.38*	(0.15, 0.96)
55 to 64	1.09	(0.61, 1.92)	1.08	(0.61, 1.91)	1.07	(0.61, 1.88)	0.77	(0.50, 1.20)	0.78	(0.51, 1.21)	0.78	(0.51, 1.18)	0.43	(0.15, 1.22)	0.42	(0.16, 1.15)	0.42	(0.15, 1.16)
Gender																		
Male	Ref				Ref		Ref		Ref		Ref		Ref		Ref		Ref	
Female	1.31	(0.70, 2.48)	1.33	(0.70, 2.52)	1.31	(0.70, 2.45)	0.90	(0.66, 1.23)	0.89	(0.65, 1.22)	0.90	(0.65, 1.23)	1.14	(0.61, 2.14)	1.14	(0.60, 2.17)	1.17	(0.62, 2.22)
Race																		
White	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
Black	1.2	(0.38, 3.73)	1.19	(0.36, 3.94)	0.27*	(0.08, 0.86)	0.92	(0.58, 1.46)	0.90	(0.58, 1.39)	0.55*	(0.32, 0.93)	0.56	(0.21, 1.48)	0.56	(0.21, 1.47)	0.54	(0.16, 1.81)
Hispanic	0.84	(0.36, 1.94)	0.82	(0.37, 1.84)	0.78	(0.31, 1.99)	0.48*	(0.27, 0.86)	0.49*	(0.28, 0.88)	0.65	(0.34, 1.24)	0.83	(0.30, 2.25)	0.82	(0.30, 2.30)	1.17	(0.35, 3.84)
Chronic Disease																		
No Disease	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
At least 1 or more	0.73	(0.30, 1.33)	0.71	(0.38, 1.31)	0.73	(0.39, 1.35)	0.80	(0.47, 1.36)	0.8	(0.46, 1.38)	0.79	(0.45, 1.39)	1.18	(0.55, 2.54)	1.19	(0.56, 2.55)	1.17	(0.55, 2.50)
Interaction Term																		
ACA*Non-expansion			Ref		Ref				Ref		Ref				Ref		Ref	
ACA*Expansion			2.08	(0.58, 7.41)	2.34	(0.71, 7.74)			0.53	(0.26, 1.05)	0.54	(0.27, 1.09)			1.19	(0.19, 7.32)	1.13	(0.19, 6.85)
ACA*White					Ref						Ref						Ref	
ACA*Black					10.97*	(1.68, 71.49)					2.17	(0.98, 4.81)					1.04	(0.18, 6.01)
ACA*Hispanic					1.13	(0.25, 5.09)					0.61	(0.21, 1.77)					0.60	(0.10, 3.68)
Constant	0.18***	(0.08, 0.39)	0.22**	(0.09, 0.52)	0.25**	(0.11, 0.57)	0.43**	(0.27, 0.70)	0.34***	(0.21, 0.56)	0.35***	(0.22, 0.57)	0.31	(0.09, 1.09)	0.34	(0.09, 1.23)	0.31	(0.08, 1.24)
F Statistic	0.41		0.56		1.02		2.02*		2.01*		2.21**		1.03		0.94		1.05	

Note. Logistic regressions for the Pb(SCR) by expansion status and race in 15-states (2012-2015); survey weighted data. Values indicate odds ratios.

[a]Diabetes Prevention Education (DPE) includes at least 1 form of teaching (i.e. exercise, diet/nutrition or weight reduction) provided during a clinic visit using 2012-2015 data.

*p<0.05. **p<0.01. ***p<0.001

APPENDIX AK

COMPARING ACTUAL ACA GAINS WITH EQUALIZING HEALTH INSURANCE GAINS BY INCOME

Table AK-1.

Comparing Actual ACA Gains with Equalizing Health Insurance Gains by Income.

	2012 Sample (N)	%N	Total Pop[a]. (M)	%Change[b] (INS)	Actual Δ[c] (INS)	Equalizing %Change[d]	Equalizing Actual Δ (INS)	Remaining Uninsured[e]
U.S. Income Groups								
>400% FPL	96,601	42.84	60,314,541	1.26	759,963	1.26	759,963	0
139-400% FPL	81,414	36.11	50,839,357	9.36	4,758,564	25.14	12,781,014	8,022,451
100-138% FPL	17,460	7.74	10,897,165	19.96	2,175,074	56.00	6,102,412	3,927,338
<100% FPL	29,996	13.30	18,725,103	23.82	4,460,319	74.36	13,923,986	9,463,667
Analytic Sub Sample								
47 States	224,441	100	140,790,245	-	12,153,921	-	33,567,376	21,413,456

Note. Calculation of remaining uninsured by income group for 47-state weighted sample.

[a]Analytic Sample Total= 140,790,245 (47-state weighted analtyic sample).

[b]Percent Change (INS): % change in insurance post vs. pre-ACA (Table 28).

[c]Actual Change in INS: Total population* %Change INS.

[d]Equalizing % Change: Percentage point change required to achieve 95.83% insured rate of the >400% FPL group.

[e]Remaining Uninsured: Equalizing Actual Change- Actual Change in Insurance

Table AK-2.

Comparing Actual ACA Gains with Equalizing Health Insurance Gains by Income.

	2012 Sample (N)	%N	Total Pop. (M)	%Change (INS)	Actual Δ (INS)	Equalizing %Change	Equalizing Actual Δ (INS)	Remaining Uninsured
U.S. Income Groups								
>400% FPL	35,847	39.85%	22,340,976	1.13%	252,453	**Medicaid Not Available**		
139-400% FPL	34,090	37.90%	21,247,754	8.64%	1,835,806			
100-138% FPL	7,526	8.37%	4,692,446	17.62%	826,809	57.20	2,684,079	1,857,270
<100% FPL	12,486	13.88%	7,781,499	18.94%	1,473,816	48.20	3,750,683	2,276,867
Analytic Sub Sample								
19 States	89,949	100%	56,062,676	-	4,388,884	-	6,434,762	2,045,878

Note. Calculation of remaining uninsured by income group for 19 non-expansion states weighted sample.

[a]Analytic Sample Total= 140,790,245 (47-state weighted analtyic sample).

[b]Percent Change (INS): % change in insurance post vs. pre-ACA (Table 28).

[c]Actual Change in INS: Total population* %Change INS.

[d]Equalizing % Change: Percentage point change required to achieve 95.83% insured rate of the >400% FPL group.

[e]Remaining Uninsured: Equalizing Actual Change- Actual Change in Insurance

REFERENCES

Abdus, S., Mistry, K. B., & Selden, T. M. (2015). Racial and ethnic disparities in services and the patient protection and affordable care act. *American Journal of Public Health, 105*(S5), S668-S675.

Agency for Healthcare Research and Quality. (2010, December). The roles of patient-centered medical homes and accountable care organizations in coordinating patient care. Retrieved from: https://pcmh.ahrq.gov/sites/default/files/attachments/Roles%20of%20PCMHs%20And%20ACOs%20in%20Coordinating%20Patient%20Care.pdf

Agency for Healthcare Research and Quality. (2011, October). Primary care workforce facts and stats no. 1. Retrieved from: https://www.ahrq.gov/research/findings/factsheets/primary/pcwork1/index.html

Agency for Healthcare Research and Quality. (2014, October). Access to health care: National healthcare disparities report, 2011. Retrieved from: https://archive.ahrq.gov/research/findings/nhqrdr/nhdr11/chap9.html

Agency for Healthcare Research and Quality. (2016, March). The six domains of health care quality. Retrieved from: https://www.ahrq.gov/professionals/quality-patient-safety/talkingquality/create/sixdomains.html

Alcala, H. E., Chen, J., Langellier, B. A., Roby, D. H. & Ortega, A. N. (2017). Impact of the affordable care act on health care access and utilization among Latinos. *Journal of American Board of Medicine, 30*(1), 52-62.

Alliance to Reduce Disparities in Diabetes. (2011). About diabetes disparities. Retrieved from: http://ardd.sph.umich.edu/about_diabetes_disparities.html

American Academy of Family Physicians. (2019, April). Why primary care matters. Retrieved from: https://www.aafp.org/medical-school-residency/choosing-fm/value-scope.html

American Association of Diabetes Educators. (n. d.). The affordable care act and individuals with diabetes. Retrieved from: https://www.diabeteseducator.org/legacy/_resources/Advocacy/AADE_Affordable_Care_Act_Flyer.pdf

American Association of Nurse Practitioners. (2018, December 20). State practice environment. Retrieved from: https://www.aanp.org/advocacy/state/state-practice-environment

American Association of Nurse Practitioners. (2019). Nurse practitioners in primary care. Retrieved from: https://www.aanp.org/advocacy/advocacy-resource/position-statements/nurse-practitioners-in-primary-care

American Diabetes Association. (2018). Standards of medical care in diabetes-2018 abridged for primary care providers. Retrieved from: http://clinical.diabetesjournals.org/content/diaclin/36/1/14.full.pdf

American Diabetes Association. (2018). Statistics about diabetes. Retrieved from: http://www.diabetes.org/diabetes-basics/statistics/

American Medical Association. (2018). Prediabetes quality measures. Retrieved from: https://cdn.ymaws.com/thepcpi.site-ym.com/resource/resmgr/docs/announcements/AMA_Prediabetes_Measures_wit.pdf

American Nurses Association (ANA). (n.d.). Health system reform resources. Retrieved from: https://www.nursingworld.org/practice-policy/health-policy/health-system-reform/resources/

Anderman, T. (2018, November 23). What to know about narrow network health insurance plans. Retrieved from: https://www.consumerreports.org/health-insurance/what-to-know-about-narrow-network-health-insurance-plans/

Angrist, J. D. & Pischke, J. (2009). Mostly harmless econometrics. Princeton, NJ. Princeton University Press.

Aron, D. C. (2014). Quality indicators and performance measures in diabetes care. *Curr Diab Rep, 14*, 1-11.

Artiga, S., Foutz, J. & Damico, A. (2018, January 26). Health coverage by race and ethnicity: changes under the ACA. Retrieved from: https://www.kff.org/disparities-policy/issue-brief/health-coverage-by-race-and-ethnicity-changes-under-the-aca/

Asian Diabetes Prevention Initiative. (n.d.). Why are Asians at high risk? Retrieved from: http://asiandiabetesprevention.org/what-is-diabetes/why-are-asians-higher-risk

Assari, S., Lee, D. B., Nicklett, E. J., Lankarani, M. M., Piette, J. D., & Aikens, J. E. (2017). Racial discrimination in health care is associated with worse glycemic control among black men but not black women with type 2 diabetes. *Frontiers in Public Health, 5,* 1-9.

Bailey, P., Broaddus, M., Gonzales, S. & Hayes, K. (2017, June 1). African American uninsured rate dropped by more than a third under affordable care act. Retrieved from: https://www.cbpp.org/research/health/455-hispanic-american-uninsured-rate-dropped-by-more-than-a-third-under-affordable-care

Blavin, R., Zuckerman, S., Karpman, M. & Clemans-Cope, L. (2014, March 18). Why are Hispanics slow to enroll in ACA coverage? Insights from the health reform monitoring survey. Retrieved from: https://www.healthaffairs.org/do/10.1377/hblog20140318.037935/full/

Barr, D. A. (2014). Health disparities in the United States. Baltimore, MD: John Hopkins University Press.

Blackwell, D. L. & Clarke, T. C. (2018). State variation in meeting the 2008 federal guidelines for both aerobic and muscle-strengthening activities through leisure-time physical activity among adults aged 18-64: United States, 2010-2015. *National Health Statistics Reports;* No. 112. Hyattsville, MD: National Center for Health Statistics

Brown, D. W., Balluz, L. S., Heath, G. W., Moriarty, D. G., Ford, E. S., Giles, W. H. & Mokdad, A. H. (2003). Associations between recommended levels of physical activity and health-related quality of life findings from the 2001 behavioral risk factor surveillance system (BRFSS) survey. *Preventive Medicine, 37*(5), 520-528.

Brown, D. S. & McBride, T. D. (2015). Impact of the affordable care act on access to care for US adults with diabetes, 2011-2012. *Prev Chronic Dis,* 1-5.

Bruce, D. G., Davis, W. A., Cull, C. A. & Davis, T. M. E. (2003). Diabetes education and knowledge in patients with type 2 diabetes from the community. The fremantle diabetes study. *Journal of Diabetes and Its Complications*, 17, 82-89.

Boston University School of Public Health. (n.d.) B. Confidence intervals for the risk ratio (relative risk). Retrieved from: http://sphweb.bumc.bu.edu/otlt/MPH-Modules/BS/BS704_Confidence_Intervals/BS704_Confidence_Intervals8.html

Buettgens, M. & Kenney, G. M. (2016, July). What if more states expanded Medicaid in 2017? Changes in eligibility, enrollment, and the uninsured. Retrieved from: https://www.urban.org/sites/default/files/publication/82786/2000866-What-if-More-States-Expanded-Medicaid-in-2017-Changes-in-Eligibility-Enrollment-and-the-Uninsured.pdf

CATO Institute. (2019). Freedom in the 50 states. Retrieved from: https://www.freedominthe50states.org/

Centers for Disease Control and Prevention (CDC). (n.d.). Healthy weight, overweight, and obesity among U.S. adults. Retrieved from: https://www.cdc.gov/nchs/data/nhanes/databriefs/adultweight.pdf

Centers for Disease Control and Prevention (CDC). (n.d.). Prevention. Retrieved from: https://www.cdc.gov/pictureofamerica/pdfs/picture_of_america_prevention.pdf

Centers for Disease Control and Prevention (CDC). (2012, June 8). Methodologic changes in the behavioral risk factor surveillance system in 2011 and potential effects on prevalence estimates. Retrieved from: https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6122a3.htm

Centers for Disease Control and Prevention (CDC). (2013, August 15). The BRFSS data user guide. Retrieved from: https://www.cdc.gov/brfss/data_documentation/pdf/UserguideJune2013.pdf

Centers for Disease Control and Prevention (CDC). (2015, November 6). Scope and sample design. Retrieved from: https://www.cdc.gov/nchs/ahcd/ahcd_scope.htm

Centers for Disease Control and Prevention (CDC). (2016). Behavioral risk factor surveillance system. Weighting BRFSS data. Retrieved from: https://www.cdc.gov/brfss/annual_data/2016/pdf/weighting_the-data_webpage_content.pdf

Centers for Disease Control and Prevention (CDC). (2016, September 9). Hispanic health: Preventing type 2 diabetes. Retrieved from: https://www.cdc.gov/features/hispanichealth/

Centers for Disease Control and Prevention (CDC). (2017, March 29). About the ambulatory health care surveys. Retrieved from: https://www.cdc.gov/nchs/ahcd/about_ahcd.htm

Centers for Disease Control and Prevention (CDC). (2017, May 3). Ambulatory care use and physician office visits. Retrieved from: https://www.cdc.gov/nchs/fastats/physician-visits.htm

Centers for Medicare & Medicaid Services. (n.d.). Managed care. Retrieved from: https://www.medicaid.gov/medicaid/managed-care/index.html

Centers for Medicare & Medicaid Services. (2017, July 28). Core measures. Retrieved from:

Retrieved from: https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/QualityMeasures/Core-Measures.html

Cheney, C. (2019, May 1). More states pushing for autonomy in scope-of-practice battle. Retrieved from: https://www.healthleadersmedia.com/clinical-care/more-states-pushing-autonomy-scope-practice-battle

Chow, E. A., Foster, H., Gonzalez, V. & McIver, L. (2012). The disparate impact of diabetes on racial/ethnic minority populations. *Clinical Diabetes, 30,* 130- 133.

Chukwueke, I., & Cordero-MacIntyre, Z. (2010). Overview of type 2 diabetes in Hispanic Americans. *Int J Body Compos Res, 8,* 77-81.

Cole, M. B., Galarraga, O., Wilson, I. B., Wright, B. & Trivedi, A. N. (2017). At federally funded health centers, Medicaid expansion was associated with improved quality of care. *Health Affairs, 36*(1), 40-48.

Colen, C.G., Ramey, D.M., Cooksey, E.C. & Willaims, D.R. (2018). Racial disparities in health among nonpoor African Americans and Hispanics: The role of acute and chronic discrimination. *Social Science & Medicine, 199,* 167-180.

Collins, S. R., Robertson, R. Garber, T. & Doty, M. M. (2012). The income divide in health care: How the affordable care act will help restore fairness to the U.S. health system. *Commonwealth Fund Publication 1579, 3, 1-21.*

Collins, S. R., Gunja, M.Z., Doty, M. M. & Bhupal, H. K. (2018, May 10). Americans' confidence in their ability to pay for health care is falling. Retrieved from: https://www.commonwealthfund.org/blog/2018/americans-confidence-their-ability-pay-health-care-falling

Cromwell, J., Healy, D., Seeley, E., Trebino, D., & Cromwell G. (2013*). The Nation's Health Care Bill: Who Bears the Burden?* Triangle Park, NC: Research Triangle Institute.

Cunningham, P. J. (2011, March). State variation in primary care physician supply: Implications for health reform' Medicaid expansions. Retrieved from: https://www.rwjf.org/content/dam/farm/reports/issue_briefs/2011/rwjf69759

CVSHealth. (2019). A day in the life of a minute clinic nurse practitioner. Retrieved from: https://cvshealth.com/about/our-offerings/a-day-in-the-life-of-a-minute-clinic-nurse-practitioner

Decker, S. L. (2012). In 2011 nearly one-third of physicians said they would not accept new Medicaid patients, but rising fees may help. *Health Affairs, 31,* 1673-1679.

Decker, S. L., Kostova, D., Kenney, G. M., & Long, S. K. (2013). Health status, risk factors, and medical conditions among persons enrolled in Medicaid vs uninsured low-income adults potentially eligible for Medicaid under the affordable care act. *JAMA, 309,* 2579-2586.

Decker, S. L., Brandy, J. L. & Sommers, B. D. (2017). Medicaid expansion coverage effects grew in 2015 with continued improvements in coverage quality. *Health Affairs, 36*(5), 819-825.

Derose, S. F. & Petitti, D. B. (2003). Measuring quality of care and performance from a population health care perspective. *Annu. Rev. Public Health, 24,* 363-384.

Deshpande, A. D., Harris-Hayes, M. & Schootman, M. (2008). Epidemiology of diabetes and diabetes-related complications. *Journal of the American Physical Therapy Association, 88*(11), 1254-1264.

Diez Roux, A. V. (2012). Conceptual approaches to the study of health disparities. *Annual Review of Public Health*, *33*, 41-58.

Doty, M. M., Blumenthal, D., & Collins, S. R. (2014). The affordable care act and health insurance for Latinos. *JAMA*, *312*(17), 1735-1736.

Doty, M. M. & Collins, S. R. (2017, January 19). Millions more Latino adults are insured under the affordable care act. Retrieved from: http://www.commonwealthfund.org/publications/blog/2017/jan/more-latino-adults-insured

Elgar, F. & Stewart, J. M. (2008). Validity of self-report screening for overweight and obesity: Evidence from the Canadian community health survey. *Canadian Journal of Public Health*, *99*(5), 423-427.

Escarce, J. J. & Kapur, K. (2006). Hispanics and the future of America. Chapter 10 Access to and quality of health care. Retrieved from: https://www.ncbi.nlm.nih.gov/books/NBK19910/

FamiliesUSA. (2018, January). A 50-state look at Medicaid expansion. Retrieved from: http://familiesusa.org/product/50-state-look-medicaid-expansion

Fawcett, J. & Ellenbecker, C. (2015). A proposed conceptual model of nursing and population health. *Nursing Outlook, 63*(3), 288-298.

Fawcett, J., & Russell, G. (2001). A conceptual model of nursing and health policy. *Policy, Politics, and Nursing Practice, 2*, 108-116.

Frey, W. H. (2018). The US will become ‘minority white’ in 2045, census projects. Retrieved from: https://www.brookings.edu/blog/the-avenue/2018/03/14/the-us-will-become-minority-white-in-2045-census-projects/

Garfield, R., Damico, A. & Orgera, K. (2018). The coverage gap: uninsured poor adults in states that do not expand Medicaid. Retrieved from: https://www.kff.org/medicaid/issue-brief/the-coverage-gap-uninsured-poor-adults-in-states-that-do-not-expand-medicaid/

Getzen, T. (2010). Health economics and financing. 4th ed. Hoboken, N.J.: Wiley.

Gildner, T. E., Barrett, T. M., Liebert, M. A., Kowal, P. & Snodgrass, J. J. (2015). Does BMI generated by self-reported height and weight measure up in older adults from middle-income countries? Results from the study on global AGEing and adult health (SAGE). *BMC Obesity, 2*(44), 1-13.

Goldstein, A. (2019, April 24). Americans are more focused on health costs than Medicare-for-all, poll shows. Retrieved from: https://www.washingtonpost.com/national/health-science/americans-eager-for-congress-to-shield-them-from-health-care-costs-poll-shows/2019/04/24/696a72da-669c-11e9-a1b6-b29b90efa879_story.html?noredirect=on&utm_term=.07ac762b5e66

Graf, N. (2017, May 16). Today’s young workers are more likely than ever to have a bachelor’s degree. Retrieved from: http://www.pewresearch.org/fact-tank/2017/05/16/todays-young-workers-are-more-likely-than-ever-to-have-a-bachelors-degree/

Grant, R. L. (2014). Converting an odds ratio to a range of plausible relative risks for better communication of research findings. *BMJ,* 348, f7540. Retrieved from: https://www.bmj.com/content/348/bmj.f7450.full.print

Green, A. (2013, December). What this year's health insurance open enrollment season means for you. Retrieved from: http://www.aarp.org/health/health-insurance/info-09-2013/health-insurance-open-enrollment.html

Griffith, K., Evans, L., & Bor, J. (2017). The affordable care act reduced socioeconomic disparities in health care access. *Health Affairs, 36*(8), 1503-1510.

Gurwitz, J. H., Sykora, K., Mamdani, M., Streiner, D. L., Garfinkel, S., Normand, S. T., Anderson, G. M. & Rochon, P. A. (2005). Reader's guide to critical appraisal of cohort studies: 1. Role and design. *BMJ, 330,* 895-897.

Harvard Health Publishing. (2006, October). In brief: Black women may be more vulnerable to insulin resistance. Retrieved from: https://www.health.harvard.edu/newsletter_article/In_Brief_Black_women_may_be_more_vulnerable_to_insulin_resistance

Hayman, L. L. & Worel, J. N. (2016). Reducing disparities in cardiovascular health. Social determinants matter. *Journal of Cardiovascular Nursing, 31*(4), 288-290.

Havranek, E. P., Mujahid, M. S., Barr, D. A., Blair, I. V., Cruz-Flores, S., Davey-Smith, G., Dennison-Himmelfarb, C. R., Lockwood, D. W., Rosal, M. & Yancy, C. W. (2015). Social determinants of risk and outcomes for cardiovascular disease. A scientific statement from the American heart association. *Circulation*, 132, 873-898.

HealthCare.gov. (n.d.). Preventive care benefits for adults. Retrieved from: https://www.healthcare.gov/preventive-care-adults/

Herman, W. H. & Cefalu, W. T. (2015). Health policy and diabetes care: Is it time to put politics Aside? *Diabetes Care, 38*, 743-745.

Heiman, H. J. & Artiga, S. (2015, November 5). Beyond health care: The role of social determinants in promoting health and health equity. Retrieved from: http://kff.org/disparities-policy/issue-brief/beyond-health-care-the-role-of-social-determinants-in-promoting-health-and-health-equity/

Higgins, T. (2019, June 28). Supreme court to decide whether Trump can terminate Obama-era DACA program. Retrieved from: https://www.cnbc.com/2019/06/28/supreme court-to-decide-whether-trump-administration-can-end-daca.html#MainContent

Hing, E., Shimizu, IM. & Talwakar, A. (2016). Nonresponse bias in estimates from the 2012 national ambulatory medical care survey. Retrieved from: https://www.cdc.gov/nchs/data/series/sr_02/sr02_171.pdf

Holden, C. D., Chen, J., & Dagher, R. K. (2015). Preventive care utilization among the uninsured by race/ethnicity and income. *American Journal of Preventive Medicine, 48*(1), 13-21.

Hogan, D. R., Danaei, G., Ezzati, M., Clarke, P. M., Jha, A. K. & Saloman, J. A. (2015). Estimating the potential impact of insurance expansion on undiagnosed and uncontrolled chronic conditions. *Health Affairs, 39*(9), 1554- 1562.

Hosmer, D. W., Lemeshow S. & Sturdivant, R. (2013). *Applied logistic regression*. Hoboken, New Jersey: John Wiley & Sons, Inc.

Howden, L. M. & Meyer, J. A. (2011, May). Age and sex composition: 2010. 2010 census briefs. Retrieved from: https://www.census.gov/prod/cen2010/briefs/c2010br-03.pdf

Institute for Healthcare Improvement. (2017). IHI triple aim initiative. Retrieved from: http://www.ihi.org/Engage/Initiatives/TripleAim/Pages/default.aspx

Institute for Healthcare Improvement. (2018). Health equity. Retrieved from: http://www.ihi.org/Topics/Health-Equity/Pages/default.aspx

Institute for Healthcare Improvement. (2018). How to reduce implicit bias. Retrieved from: http://www.ihi.org/communities/blogs/how-to-reduce-implicit-bias

Institute of Medicine (IOM). (1999). To err is human: building a safer health system. Retrieved from http://iom.nationalacademies.org/~/media/Files/Report% 20Files/1999/To-Err-is Human/To%20Err%20is%20Human%201999%20% 20report%20brief.pdf

Institute of Medicine (IOM). (2013). Report brief: U.S. health in international perspective: Shorter lives, poorer health. Retrieved from: https://www.nap.edu/catalog/13497/us-health-in-international-perspective-shorter-lives-poorer-health

Institute for Research and Poverty. (2016). Who is poor? Retrieved from: https://www.irp.wisc.edu/faqs/faq3.htm

Isaacs, S. L. & Schroeder, S. A. (2004). Class- the ignored determinant of the nation's health. *The New England Journal of Medicine,* 351, 1137-1142. Retrieved from: https://www.nejm.org/doi/full/10.1056/NEJMsb040329

Jacobs, L. R. & Callaghan, T. (2013). Why states expand Medicaid: Party, resources, and history. *Journal of Health Politics, Policy and Law, 38*(5), 1023-1049.

Joslin Diabetes Center. (2016). One in two Asian Americans develop diabetes or pre-diabetes in their lifetime. Retrieved from: https://aadi.joslin.org/en/diabetes-mellitus-in-asian-americans

Joslin Diabetes Center. (2017). What is pre-diabetes? Retrieved from: http://www.joslin.org/info/what_is_pre_diabetes.html

Kaiser Family Foundation. (2011, May). Medicaid's role for Hispanic Americans. Retrieved from: https://kaiserfamilyfoundation.files.wordpress.com/2013/01/8189.pdf

Kaiser Family Foundation. (2012, February 1). Health insurance coverage in America, 2010. Retrieved from: https://www.kff.org/uninsured/report/health-insurance-coverage-in-america-2010/

Kaiser Family Foundation. (2012, May 1). *Health care costs: A primer*. Retrieved from: http://kff.org/report-section/health-care-costs-a-primer-2012-report/

Kaiser Family Foundation. (2012, August). A guide to the supreme court's decision on the ACA's Medicaid expansion. Retrieved from: https://kaiserfamilyfoundation.files.wordpress.com/2013/01/8347.pdf

Kaiser Family Foundation. (2013, March). Health coverage by race and ethnicity: The potential impact of the Affordable Care Act. Retrieved from: https://www.kff.org/disparities-policy/issue-brief/health-coverage-by-race-and-ethnicity-the-potential-impact-of-the-affordable-care-act/

Kaiser Family foundation. (2018). Distribution of total population by federal poverty level. Retrieved from: https://www.kff.org/other/state-indicator/distribution-by-fpl/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D

Kaiser Family Foundation. (2018). Population distribution by age. Retrieved from: https://www.kff.org/other/state-indicator/distribution-by-age/?current Timeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D

Kaiser Family Foundation. (2018). Population distribution by gender. Retrieved from: https://www.kff.org/other/state-indicator/distribution-by-gender/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D

Kaiser Family Foundation. (2018). Population distribution by race/ethnicity. Retrieved from: https://www.kff.org/other/state-indicator/distribution-byraceethnicity/?current Timeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort %22:%22asc%22%7D

Kaiser Family Foundation. (2018, March 28). The effects of Medicaid expansion under the ACA: Updated findings from a literature review. Retrieved from: https://www.kff.org/medicaid/issue-brief/the-effects-of-medicaid-expansion-under-the-aca-updated-findings-from-a-literature-review-march-2018/

Kaiser Family Foundation. (2018, April 27). Status of state action on the Medicaid expansion decision. Retrieved from: https://www.kff.org/health-reform/state-indicator/state-activity-around-expanding-medicaid-under-the-affordable-care-act/?current Timeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort %22:%22asc%22%7D

Kaiser Family Foundation. (2018, November 20). Explaining health care reform: Questions about health insurance subsides. Retrieved from: https://www.kff.org/health-reform/issue- brief/explaining-health-care-reform-questions-about-health/

Kaiser Family Foundation. (2018, December 7). Key facts about the uninsured population. Retrieved from: https://www.kff.org/uninsured/fact-sheet/key-facts-about-the-uninsured- population/

Kaiser Family Foundation (2019). Compare proposals to replace the affordable care act. Retrieved from: https://www.kff.org/interactive/proposals-to-replace -the-affordable-care-act/

Kaiser Family Foundation. (2019, May 15). Compare Medicare-for-all and public plan proposals. Retrieved from: https://www.kff.org/interactive/compare-medicare-for-all-public-plan-proposals/?gclid=EAIaIQobChMI8uXT8Y3W4wIVh56fCh0xgQ ibEAAYASAAEgJWxPD_BwE

Kaiser Health News. (2012, September 13). Number of uninsured Americans drops by 1.3 million. Retrieved from: https://khn.org/morning-breakout/census-numbers-2/

Karter, A.J., Schillinger, D., Adams, A.S., Moffet, H.H., Liu, J., Adler, N.E. & Kanaya, A. M. (2013). Elevated rates of diabetes in pacific islanders and Asian subgroups. *Diabetes Care*, *41*(4), 574-579.

Kaufman, H. W., Chen, Z., Fonseca, V. A. & McPhaul, M. J. (2015). Surge in newly identified diabetes among Medicaid patients in 2014 within Medicaid expansion states under the affordable care act. *Diabetes Care, 38*(5), 833-837.

Keisler, H.J. (2012). Elementary calculus an infinitesimal approach. Mineola, NY. Dover Publications, Inc.

Keith, K. (2018, December 15). Federal judge strikes down entire ACA; Law remains in effect. Retrieved from: https://www.healthaffairs.org/do/10.1377/hblog20181215.617096/full/

Kieffer, E.C., Carman, W.J., Gillespie, B.W., Nolan, G.H., Worley, S.E. & Guzman, J.R. (2001). Obesity and gestational diabetes among African-American women and Latinas in Detroit: implications for disparities in women's health. *Journal of the American Medical Women's Association, 56*(4), 181-7.

Kliff, S. (2019, January 23). Under Trump, the number of uninsured Americans has gone up by 7 million. Retrieved from: https://www.vox.com/2019/1/23/18194228/trump-uninsured-rate-obamacare-medicaid

Krogstad, J. M. & Fry, R. (2014, April 24). More Hispanics, blacks enrolling in college, but lag in bachelor's degrees. Retrieved from: http://www.pewresearch.org/fact-tank/2014/04/24/more-hispanics-blacks-enrolling-in-college-but-lag-in-bachelors-degrees/

Kodjack, A. (2019, February 21). CVS looks to make its drugstores a destination for health care. Retrieved from: https://www.npr.org/sections/healthshots/2019/02/21 /695216345/cvs-looks-to-make-its-drugstores-a-destination-for-health-care

Kominski, G. F., Nonzee, N. J., & Sorensen, A. (2017). The affordable care act's impacts on Access to insurance and health care for low-income populations. *Annual Review of Public Health*, 38, 489-505.

Ku, L., Jones, K., Shin, P., Bruen, B. & Hayes, K. (2011). The states' next challenge-securing primary care for expanded Medicaid populations. *The New England Journal of Medicine, 364,* 493-495.

Laiteerapong, N., Karter, A. J., John, P. M., Schillinger, D., Moffet, H. H., Liu, J. Y., Adler, N., Chin, M. H., & Huang, E. S. (2013). Ethnic differences in quality of life in insured older adults with diabetes mellitus in an integrated delivery system. *The American Geriatrics Society,* 61, 1103-1110.

Larson, J. S. & Winn, M. (2010). Health policy and exercise: A brief BRFSS study and recommendations. *Health Promotion Practice, 11*(2), 268-274.

Lau, D. T., McCaig, L. F. & Hing, E. (2016). Toward a more complete picture of outpatient, office-based health care in the US. *American Journal of Preventive Medicine, 51*(3); 403-409.

Liasson, M., Tottenberg, N. & Montagne, R. (2015, June 25). Breaking down the supreme court ruling on Obamacare subsidies. Retrieved from: https://www.npr.org/2015/06/25/417435290/breaking-down-the-supreme-court-ruling-on-obamacare-subsidies

Lin, C. J., DeRoo, L. A., Jacobs, S. R. & Sandler, D. P. (2012). Accuracy and reliability of self-reported weight and height in sister study. *Public Health Nutrition, 15*(6), 989-999.

Lofquist, D., Lugaila, T., O'Connell, M. & Feliz, S. (2012, April). Households and families: 2010. Retrieved from: https://www.census.gov/prod/cen2010/briefs/c2010br-14.pdf

Lopez, G. & Krogstad, J. M. (2017, September 25). Key facts about unauthorized immigrants enrolled in DACA. Retrieved from: https://www.pewresearch.org/fact-tank/2017/09/25/key-facts-about-unauthorized-immigrants-enrolled-in-daca/

Mainous, A. G. & Schatz, D. A. (2019). Is it time to prioritize diabetes prevention in practice? *The Journal of the American Board of Family Medicine, 32*(4); 457-459.

Mainous, A. G., Tanner, R. J. & Baker, R. (2012). Prediabetes diagnosis and treatment in primary care. *The Journal of the American Board of Family Medicine, 29*; 283-285.

Matias Bacong, A., Holub, C., Porotesano, L. (2016). Comparing obesity-related health disparities among Native Hawaiians/Pacific Islanders, Asians, and whites in reinforcing the need for data disaggregation and operationalization. *Hawaii Journal of Medicine & Public Health, 75*(11), 337-344.

Mahon, M. and Fox, B. (2014, June 16). US health system ranks last among eleven countries on measures of access, equity, quality, efficiency, and healthy lives. Retrieved from: http://www.commonwealthfund.org/publications/press-releases/2014/jun/us-health-system-ranks-last

Mayo Clinic. (2017, August 2). Prediabetes. Retrieved from: https://www.mayoclinic.org /diseases-conditions/prediabetes/diagnosis-treatment/drc-20355284

McKenna, R. M., Langellier, B. A. & Alcala, H. E. (2018). The affordable care act attenuates financial strain according to poverty level. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing, 55:*1-14.

McLaughlin, S. (2010). Traditions and diabetes prevention: a healthy path for native americans. *Diabetes Spectrum, 23*(4), 272-277.

Medicaid Enrollment and CHIP Payment and Access Commission (MACPAC). (2019). Medicaid enrollment changes following the ACA. Retrieved from: https://www.macpac.gov/subtopic/medicaid-enrollment-changes-following-the-aca/

Meigs, J. B. & Stafford, R. S. (2000). Cardiovascular disease prevention practices by U.S. physicians for patients with diabetes. *Journal of General Internal Medicine, 15,* 220-228.

Mendes, E. (2011, January 18). In U.S., 16.4% of adults uninsured in 2010. Retrieved from: https://news.gallup.com/poll/145661/adults-uninsured-2010.aspx

Miilunpalo, S., Vuori, I, Oja, P., Pasanen, M. & Urponen, H. (1997). Self-rated health status as a measure: The predictive value of self-reported health status on the use of physician services and on mortality in the working-age population. *Journal of Clinical Epidemiology, 50*(5), 517-528.

Mitri, J. & Gabbay, R. A. (2016). Measuring the quality of diabetes care. *American Journal of Managed Care, 22*(4), SP147-SP148.

McNeely, M.J. & Boyko, E. J. (2004). Type 2 diabetes prevalence in Hispanic Americans. *Diabetes Care.27*(1), 66-69.

National Association of Chronic Disease Directors. (n.d.). Why public health is necessary to improve healthcare. Retrieved from: https://cdn.ymaws.com/www.chronicdisease.org /resource/resmgr/white_papers/cd_white_paper_hoffman.pdf

National Center for Health Statistics. (1974). National ambulatory medical care survey; background and methodology. United States 1967-72. Retrieved from: https://www.cdc.gov/nchs/data/series/sr_02/sr02_061.pdf

National Center for Health Statistics. (1988). Sample design, sampling variance, and estimation procedures for the national ambulatory medical care survey. Retrieved from: https://www.cdc.gov/nchs/data/series/sr_02/sr02_108.pdf

National Center for Health Statistics. (2015, November 6). NAMCS scope and sample design. Retrieved from: https://www.cdc.gov/nchs/ahcd/ahcd_scope.htm

National Congress of American Indians. (2018). Health care. Retrieved from: http://www.ncai.org/policy-issues/education-health-human-services/health-care

National Conference of State Legislatures. (2019). Preventive services covered under the affordable care act. Retrieved from: http://www.ncsl.org/research/health/hispanic-health-benefit-exchanges-b.aspx

The National DPP. (2019). Quality metrics. Retrieved from: https://coveragetoolkit.org /quality-metrics/

National Institute of Diabetes and Digestive and Kidney Diseases. (2009, August). Prediabetes and insulin resistance. Retrieved from: https://www.niddk.nih.gov/health-information/diabetes/overview/what-is-diabetes/prediabetes-insulin-resistance

National Institute of Diabetes and Digestive and Kidney Diseases. (2017, August). Overweight & obesity statistics. Retrieved from: https://www.niddk.nih.gov/health-information/health-statistics/overweight-obesity

O'Brien, M. J., Alos, V., Davey, A., Bueno, A. & Whitaker, R. C. (2014). Acculturation and the prevalence of diabetes in US Latino adults, national health and nutrition examination survey 2007-2010, *Public Health Research, Practice, and Policy, 11*, 140-142.

Office of Disease Prevention and Promotion. (2017). Health people 2020 foundation health measure report. Health-related quality of life and well-being. Retrieved from: https://www.healthypeople.gov/sites/default/files/HRQoLWBFullReport.pdf

Office of the Assistant Secretary for Planning and Evaluation. (2011, September). Overview of the uninsured in the United States: A summary of the 2011 current population survey. Retrieved from: https://aspe.hhs.gov/basic-report/overview-uninsured-united-states-summary-2011-current-population-survey

Office of the Assistant Secretary for Planning and Evaluation. U.S. Department of Health & Human Services. (n.d). 2017 poverty guidelines. Retrieved from: https://aspe.hhs.gov/2017-poverty-guidelines#guidelines

Ollstein, A. (2017). Exclusive: Trump administration abandons Latino outreach for Obamacare sign-ups. Retrieved from: https://talkingpointsmemo.com/dc/trump-hhs-abandons-latino-outreach-on-obamacare

Ortega, A. N., Rodriguez, H. P. & Bustamante, A. V. (2015). Policy dilemmas in Latino health care and implementation of the affordable care act. *Annual Review of Public Health, 36*, 525-544.

Passel, J. S., Cohn, D. & Hugo Lopez, M. (2011, March 24). Hispanics account for more than half of nation’s growth in past decade. Retrieved from: http://www.pewhispanic.org /2011/03/24/474ispanic474-account-for-more-than-half-of-nations-growth-in-past-decade/

Passel, J.S. & Cohn, D. (2014, November 18). Unauthorized immigrant totals rise in 7 states, fall in 14. Retrieved from: http://www.pewhispanic.org/2014/11/18/unauthorized-immigrant-totals-rise-in-7-states-fall-in-14/#decrease-in-unauthorized-immigrants-from-mexico

Peek, M. E., Cargill, A., Huang, E.S. (2007). Diabetes health disparities. A systematic review of health care interventions. *Med Care Res Rev..64,*101-156.

Pension Rights Center. (n.d.). Income of today’s older adults. Retrieved from: http://www.pensionrights.org/publications/statistic/income-today%E2%80%99s-older-adults

Pew Research Center. (2008, August 13). Hispanics and health care in the United States. Retrieved from: http://www.pewhispanic.org/2008/08/13/hispanics-and-health-care-in- the-united-states-access-information-and-knowledge/

Pierannunzi, C., Hu, S. S. & Balluz, L. (2013). A systematic review of publications assessing reliability and validity of the behavioral risk factor surveillance system (BRFSS) 2004-2011. *BMC Medical Research Methodology*, *13*(49), 1-14.

Pollitz, K., Tolbert, J. & Diaz, M. (2018, September 24). Data note: further restrictions in navigator funding for federal Marketplace states. Retrieved from: https://www.kff.org/health-reform/issue-brief/data-note-further-reductions-in-navigator-funding-for-federal-marketplace-states/

Polit, D. F. & Beck, C. T. (2017). *Nursing research generating and assessing evidence for nursing practice. (10th ed.).* Wolters Kluwer: Philadelphia: PA.

Radwin, L. (2002). Refining the quality health outcomes model: differentiating between client trait and state characteristics. *Nursing Outlook, 50*(4), 168-169.

RealClear Opinion Research. (2019, May 15). New poll shows health care is voters top concern. Retrieved from: https://www.realclearpolitics.com/real_clear_opinion_research/new_poll_shows_health_care_is_voters_top_concern.html

Riaz, H., Khan, M.S., Siddiqi, T.J. (2018). A systematic review and meta-analysis of mendelian randomization studies. *JAMA Network Open, 1*(7).

Robbins, J.M., Vaccarino, V., Zhang, H. & Kasl, S.V. (2001). Socioeconomic status and type 2 diabetes in African American and non-Hispanic white women and men: evidence from the third national health and nutrition examination survey. *American Journal of Public Health, 91*(1), 76-83.

Rouse, S. M. (2017). Opinion: Latinos need a voice. Where is it? Retrieved from: https://www.nbcnews.com/think/news/opinion-latinos-need-voice-where-it-ncna771701

Rudowitz, R. (2016, December). Medicaid financing: The basics. Retrieved from: http://files.kff.org/attachment/Issue-Brief-Medicaid-Financing-The-Basics

Russell, G. E., & Fawcett, J. (2005). The conceptual model for nursing and health policy revisited. *Policy, Politics, and Nursing Practice, 6*, 319-326.

Sanchez, G. R., Pedraza, F. I. & Vargas, E. D. (2015). Research brief. The impact of the affordable care act on Latino access to health insurance. Retrieved from: http://healthpolicy.unm.edu/sites/default/files/ACA_2015_Research_Brief_FINAL.pdf

Sharma, A. I., Dresden, S. M., Powell, E. S., Kang, R. & Feinglass, J. (2017). Emergency department visits and hospitalizations for the uninsured in Illinois before and after affordable care act insurance expansion. *Journal of Community Health, 42,* 591-597.

Shealy, K.M., Wu, J., Waites, J., Taylor, N.A. & Sarbacker, G.B. (2019). Patterns of diabetes screening and prediabetes treatment during office visits in the US. *Journal of the American Board of Family Medicine, 32,* 209-2017.

Shi, Q., Fonseca, V., Krousel-Wood, M., Zhao, Y., Nellans, F. P., Luo, Q & Shi, L. (2016). Will the affordable care act (ACA) improve racial/ethnic disparity of eye examination among US working-age population with diabetes? *Current Diabetes Reports, 16*(50).

Smith, E. (2012, June 28). Timeline of the health care law. Retrieved from: https://www.cnn.com/2012/06/28/politics/supreme-court-health -timeline/index.html

Social Security Administration. (n.d.). Medicaid information. Retrieved from: https://www.ssa.gov/disabilityresearch/wi/medicaid.htm

Sofer, D. (2017). VA grants most APRNs full practice authority. *American Journal of Nursing, 117*(3), 14.

Sommers, B. D., Baicker, K., & Epstein, A. M. (2012). Mortality and access to care among adults after state Medicaid expansions. *The New England Journal of Medicine, 367*(11), 1025-1034.

Sommers, B. D., Gunja, M. Z., Finegold, K., & Musco, T. (2015). Changes in self-reported insurance coverage, access to care, and health under the affordable care act. *JAMA, 314*(4), 366-374.

Sommers, B.D, Blendon, R.J, Orva, E.J., & Epstein, A.M. (2016). Changes in utilization and health among low-income adults after Medicaid expansion or expanded private insurance. *JAMA Internal Medicine*, *176*(10), 1501-1509.

State Health Access Data Assistance Center. (2009). "REI: Measurement of Race, Ethnicity, and Immigrant Groups in Federal Surveys." Issue Brief #16. Minneapolis, MN: University of Minnesota. Retrieved from: http://www.shadac.org/sites/default/files/publications/IssueBrief16.pdf

Statista. (n.d.). Average number of people per household in the United States from 1960 to 2017. Retrieved from: https://www.statista.com/statistics/183648/average-size-of-households-in-the-us/

Stolberg, S.G., & Pear, R. (2010, March 3). Obama signs health care overhaul bill, with a flourish. Retrieved from: http://www.nytimes.com/2010/03/24/health/policy/24health.html

The Cook Political Report. (2018). Introducing the 2017 cook political report partisan voter index. Retrieved from: https://cookpolitical.com/introducing-2017-cook-political-report-partisan-voter-index

Thomas, L. (1999). Clinical practice guidelines. *Evidence-Based Nursing, 2,* 38-39.

Tozzi, J. (2018, October 8). Employees' share of health costs continues rising faster than wages. Retrieved from: https://www.insurancejournal.com/news/national/2018/10/08/503575.htm

Tumin, M. M. (1953). Some principles of stratification: A critical analysis. *American Sociological Review, 18*(4), 387-394.

United States Census Bureau. (n.d.). Educational attainment. Retrieved from: https://www.census.gov/newsroom/cspan/educ/educ_attain_slides.pdf

United States Department of Health and Human Services, Health Resources and Services Administration, National Center for Health Workforce Analysis. (2016). Retrieved from: https://bhw.hrsa.gov/sites/default/files/bhw/health-workforce-analysis/research/projections/primary-care-state-projections2013-2025.pdf

United States Department of Health and Human Services, Office of Minority Health (2016, May 11). Retrieved from: https://minorityhealth.hhs.gov/omh/browse.aspx?lvl=4&lvlid=33

United States Department of Health and Human Services, Office of Minority Health. (2017, August 25). Retrieved from: https://minorityhealth.hhs.gov/omh/browse.aspx?lvl=4&lvlID=25

Van Doorslaer, E. & Jones, A. M. (2003). Inequalities in self-reported health: validation of a new approach to measurement. *Journal of Health Economics, 22*(1), 61-87.

Warne, D. & Frizzell, L. B. (2014). American Indian health policy: Historical trends and contemporary issues. *American Journal of Public Health, 104*(3), S263-S267.

Weintraub, W. S., Daniels, S. R., Burke, L. E., Franklin, B. A., Goff, D. C., Hayman, L. L., Lloyd-Jones, D., Pandey, D. K. Sanchez, E. J., Parsons Schram, A., & Whitsel, L. P. (2011). Value of primordial and primary prevention for cardiovascular disease. A policy statement from the American heart association. *Circulation,* 124, 967-990.

Welford, C., Murphy, K. & Casey, D. (2011). Demystifying nursing research terminology. Part 1. *Nurse Researcher, 18*(4), 38-43.

Wherry, L. R. & Miller, S. (2016). Early coverage access, utilization, and health effects associated with the affordable care act Medicaid expansions. *Annals of Internal Medicine, 164,* 795-803.

White, R.O., Beech, B.M. & Miller, S. (2009). Health care disparities and diabetes care: Practical considerations for primary care providers. *Clinical Diabetes, 27*(3), 105-112.

Wu, J. Ward, E. & Lu, Z. K. (2018). Addressing lifestyle management during visits involving patients with prediabetes: NAMCS 2013-2015. *Journal of General Internal Medicine*, *34*.

Xue, Y., Smith, J. A. & Spetz, J. (2019). Primary care nurse practitioners and physicians in low-income and rural areas, 2010-2016. *JAMA, 321*(1).

Young. K. (2019, February 15). Utilization and spending trends in medicaid outpatient prescription drugs. Retrieved from: https://www.kff.org/medicaid/issue-brief/utilization-and-spending-trends-in-medicaid-outpatient-prescription-drugs/

Zajacova, A. & Dowd, J. B. (2011). Reliability of self-rated health in US adults. *American Journal of Epidemiology, 174*(8), 977-983.

Zegers, C. & Cuellar, N. (2019, June 21). Deferred action for childhood arrivals (DACA) recipients eligibility to take the NCLEX. Retrieved from: https://www.nursingworld.org/~49cb1c/globalassets/ana/leadership--governance/ma/background-document-fri-dialogue-forum-2-daca-and-nlex.pdf

Zeytinoglu, M. & Huang, E. S. (2015). Diabetes and aging: Meeting the needs of a burgeoning epidemic in the United States. *Health Systems & Reform, 1*(2), 128-141.