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Improving Cervical Cancer Screening Rates among Hispanic Women in Rural Northern New Mexico Through SMS Text Messaging: A Quality Improvement Project

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Abstract

Description of the Problem: Cervical Cancer Screening rates among Hispanic women are low compared with non-Hispanic white women (Cadet et al., 2017). The organization in which this improvement project will be implemented, whose primary population is Hispanic, had a significantly lower cervical cancer screening rate of approximately 19% in 2021 among its existing patients who meet the criteria for cervical cancer screenings.

Aim and objectives: The aim of this quality improvement project was to increase cervical cancer screening rates among Hispanic female patients aged 23 – 65 years old in Rural Northern New Mexico using short messaging system (SMS)/text message. The culturally and linguistically tailored SMS/text message was developed in accordance with the Health Belief Model.

Methods: The implementation of the project intervention consisted of a pre-planning phase and an intervention phase using the Model for Improvement (Langley et al., 2009). This included collaboration with stakeholders. The SMS/text messages were sent to the sample population (n= 263) using the study organization's electronic health record platform. The satisfaction, acceptance, and attitude about the use of SMS/text messaging were evaluated using a patient survey.

Findings: The baseline percentage adherence rate for those within the sample having completed a CCS was 25.2% before implementing the intervention. Post-implementation adherence rate was 30%, which was statistically significant (p=0.01). 82.35% (n=14) of survey respondents indicated that they were satisfied with the message.

Introduction

Cervical cancer is preventable and can be identified with regular recommended screenings. Current recommended screening guidelines vary, although the majority indicate cytology testing, also known as Papanicolaou (PAP) testing, every three years for women 21–30 years old and PAP/cytology testing along with human papillomavirus (HPV) co-testing every five years or high-risk primary HPV testing alone for women 30–65 years old (American College of Obstetricians and Gynecologists, 2021). These screenings allow for early detection and treatment of cervical cancer, thus decreasing morbidity and mortality. Since the 1950s, regular cervical cancer screenings (CCS) have been recommended and encouraged, resulting in an approximate 60% reduction in cervical cancer deaths in the U.S. (Rosenberg, 2019). Despite the decrease in mortality, cervical cancer remains one of the most common cancers diagnosed in women in the U.S. (Kurani et al., 2020).

Problem Description

While cervical cancer is common cancer, overall screening rates among women remain lower than the target goal of 84.3% set by Healthy People 2030 (Office of Disease Prevention and Health Promotion, n.d.). According to the National Cancer Institute (2020), the screening rate for all women in 2018 was 81.1%. However, healthcare disparities contribute to lower CCS rates among different groups of women resulting in a higher risk for death from cervical cancer (Saraiya et al., 2013). Healthcare disparities are defined as discrepancies in disease prevalence and access to services among populations due to sociodemographic factors (Agency for Healthcare Research and Quality, n.d.). Low socioeconomic status, those living in rural areas, and ethnicity are examples of healthcare disparities that limit access to services such as cervical cancer screenings.

Populations such as Hispanic/Latinas are disproportionately affected by cervical cancer mortality compared to non-Hispanic White women (Cadet et al., 2017). Hispanic/Latina is defined as a "person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race" according to the U.S. Office of Management and Budget (OMB) (United States Census Bureau, 2020). Hispanic/Latina women are less likely to be screened for cervical cancer throughout the U.S. and have higher cervical cancer incidences than white women (Cadet et al., 2017; Chen et al., 2018). Johnson et al. (2020) found the incidence of cervical cancer to be higher at 9.3 per 100 000 persons among Hispanic/Latina women than the incidence rate of 7.2 per 100 000 persons among white women. According to the U.S. Department of Health and Human Services Office of Minority Health (2020), the likelihood of a cervical cancer diagnosis among Hispanic/Latina women is 40% more than that of white women.

Local Problem

This quality improvement (Q.I.) project was implemented at a Federally Qualified Health Center (FQHC), located in a highly rural county in Northern New Mexico. According to the United States Census Bureau (n.d.-a; n.d.-b), the area has a high percentage of those living in poverty and is comprised of a larger Hispanic population compared to the general population (Appendix A, Table 1). An FQHC is a federally designated health center that provides healthcare for medically underserved populations and areas which, according to the Health Resource Service Administration [HRSA], (n.d.-b), is defined as "having too few primary care providers, high infant mortality, high poverty or a high elderly population". The FQHC reported screening rate in 2019 for cervical cancer was 51.44 % which is well below the national average and significantly lower than Healthy People 2030 goal (HRSA, n.d.-a). This underscores the

importance of efforts to increase CCS rates in this setting. Furthermore, women served by the organization where this quality improvement project took place are at a disadvantage due to a lack of access to care because of living in a rural setting where most patients are Hispanic. Of note and worrisome, this organization had a critically low CCS rate of (approximately 19%) in 2021 among total existing patients who meet the criteria for CCS. This rate is much lower than published data from other FQHCs (51.44% in 2019) (HRSA, n.d.), making the problem much more compelling for the site to intervene and mitigate.

Several studies have explored and evaluated causes for low CCS rates and subsequent higher cervical cancer incidence rates among Hispanic women and those living in rural areas (Shelton et al., 2016; Akinlotan et al., 2017; Yu et al., 2019). A study performed by Shelton et al. (2016) found low levels of social capital correlated with low CCS rates among Hispanic women. Pedersen et al. (2017) described social capital as the ability to function socially through learned behaviors that enable resource utilization et al. (2017) performed a study that identified cultural values, language barriers, and diminished knowledge of cervical cancer as barriers to participation in cervical cancer screenings. Finally, a study completed by Yu et al. (2019) found a correlation between rurality and cervical cancer incidence rates among Hispanic women. While these studies demonstrate the evidence available that appraised causes of lower CCS rates, few have been done that evaluated established evidence-based interventions that aim to increase these rates. There is a clear need for initiatives that address the low CCS rates among underserved women.

Available Knowledge

A PRISMA-based review of the literature was undertaken to identify the most effective evidence-based interventions found to increase CCS adherence rates among women, which can be implemented in the clinical setting. Readers may refer to the PRISMA diagram (Appendix B, Figure 1) found in the appendix. The search strategy utilized CINAHL, UMBrella, and Pubmed databases using cervical cancer, screening, intervention, and Hispanic or Latina as keywords. However, this initial search generated only a limited number of articles citing two interventions, both of which were not feasible within the organization in which the Quality Improvement Project was implemented. The terms Hispanic and Latina were removed, and that search generated 448 articles. Articles were assessed for pertinent topic and full text, of which 361 articles were excluded. Peer-reviewed, academic journals, English language, female population, and articles less than ten years old were inclusion criteria applied to the remaining 88 articles. An additional 75 articles were excluded. Ultimately 13 articles were appraised for the literature review based on their prospect for implementation within the organization and their applicability and feasibility of increasing CCS rates. Participant selection, scope, purpose, and applicability were domains of appraisal applied to the 13 articles.

Several interventions which had a positive impact on increasing CCS rates were identified in the literature. However, there are limited studies that identified specific interventions aimed at increasing screening rates among Latina/Hispanic women. While some of the studies reviewed did not fit the population targeted in this quality improvement project, two interventions were identified in the literature focused on Hispanic women. Providing education using Promatoras, which is the Spanish term for community health workers (Byrd et al., 2013; McDonough et al., 2016; Thompson et al., 2017), and providing culturally tailored health

education using a kiosk (Valdez et al., 2018) targeted at Hispanic women were found to increase CCS rates. However, these interventions were not selected based on their applicability and feasibility of applying to the site chosen for the quality improvement project. While the study organization employs Promatoras, the positions were vacant throughout the quality improvement project duration. Furthermore, the organization did not have kiosks available to patients.

Additional interventions were identified in the literature that increased CCS rates, although they were not specifically aimed at Hispanic women. This includes the use of short messaging service (SMS), also known as text messaging (Adler et al., 2019; Firmino-Machado et al., 2019; Firmino-Machado et al., 2018; Ganta et al., 2017; Lee et al., 2014; Rashid et al., 2013), self-sampling (Aarnio et al., 2020; Carrasquillo et al., 2018), and invitation to test in the form of a letter (Tavasoli et al., 2016). CCS adherence rate was the outcome measured in all studies. Table 2 (Appendix C) summarizes the studies' significant findings and overall quality and the description of the samples sorted by the interventions.

In a study performed by Adler et al. (2019), higher CCS rates among study participants were found in the intervention group who received text message reminders compared to the control group (43% vs. 36%). Of note and importance to this project, this study included an oversample of minority subjects (52%). Two additional randomized control trials reported statistically significant findings on CCS for those who received text messaging reminders compared to usual care (39.0% vs. 25.7%; $p<0.001$), (Firmino-Machado et al., 2019; Firmino-Machado et al., 2018). Ganta et al. (2017) reported an increased completion rate of cervical cancer screenings from 2.5% before the use of text/SMS reminders to 11.8% ($p<0.0001$) after the use of this intervention. Similarly, Lee et al. (2014) observed an increase in participants' intent to get screened for cervical cancer within one year from 63% before receiving reminders and

education by text/SMS messaging to 87% after receiving the text/SMS messages. Finally, Rashid et al. (2013) found that women who received a reminder by text message were more likely to complete a CCS than those who received a standard letter or those who received a registered letter (32.9%, 23.6%, 23.04%, respectively; $p<0.05$).

The remainder interventions identified in the studies were self-sampling (Aarnio et al., 2020; Carrasquillo et al., 2018), and an invitation to test in the form of a letter (Tavasoli et al., 2016). Self-sampling is a patient obtained specimen that employs primary HPV screening and not cytology. During the initiation of this quality improvement project, the reporting guidelines for an FQHC, including the organization in which this Q.I. project was implemented, had specific measures required for funding and included CCS by cytology which required a provider to obtain a cervical sample. As a result, this intervention was not a feasible intervention prospect in the organization. Moreover, an invitation to test in the form of a letter was the standard operating procedure or usual care for the organization. Therefore that intervention was identified as not relevant.

Of the interventions evaluated, reminders and education via text or SMS messaging emerged as the most viable intervention for the organization. Studies that evaluated this intervention demonstrated reliable evidence. Six studies (Adler et al., 2019; Firmino-Machado et al., 2019; Firmino-Machado et al., 2018; Ganta et al., 2017; Lee et al., 2014; Rashid et al., 2013) examined the effects of reminders and education via text messages on CCS adherence rates and showed the positive impact. These studies assessed SMS text messaging as an intervention and demonstrated I to II level of evidence in accordance with the John Hopkins Appraisal of Evidence Tool. Three of the six studies were randomized control trials which attested to the strength of the evidence.

The positive impact of text or SMS messaging education and reminders on CCS rates made it an appropriate evidence-based intervention to implement in the host organization. In addition, the SMS text messaging appeared to be more cost and time effective in relation to the usual standard care of mailing out letters within the organization, which had implications for feasibility and sustainability. According to Hall et al. (2015), text messaging is ideal in the health care setting due to its ability to reach a larger audience, frequent use, low cost, and ability to be tailored. Furthermore, given the implications of the COVID 19 pandemic on healthcare throughout the duration of the quality improvement project, such as limited capacity, stay-at-home orders, and social distancing, the use of text messaging appeared timely. Therefore, the purpose of the proposed project was to implement the use of short messaging system (SMS)/text messaging for education and reminders to improve CCS adherence rates among underserved Hispanic women at a small rural FQHC in Northern New Mexico and ultimately to improve CCS rates and patient care outcomes while addressing health inequities and inequalities.

Rationale

A common theory or framework that informed the intervention was not easily identifiable in the literature examined in this review. However, an applicable theory determined to be a favorable model to guide health messaging to increase CCS was the Health Belief Model (HBM). The theory was developed to address health behaviors in relation to the lack of utilization of preventive health interventions such as screenings (Glanz, Burke, & Rimer, 2018). This framework, which aims to describe healthcare decisions, is composed of six concepts based on perception or belief and subsequent action. These concepts are perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cue to action, and self-efficacy. This model was used to develop an intervention to address patients' perceptions and behaviors related

to CCS, which can, in turn, impact adherence rates for cervical cancer screenings, a preventive service.

Perceived susceptibility, perceived severity, perceived benefits, and perceived barriers served as the foundation for the message development. The message informed patients that they were at risk *(perceived susceptibility)* for developing cervical cancer (*perceived severity),* which could be caught early (*perceived benefits)* through a quick CCS test at reduced or no cost (*perceived barriers*). The SMS/text message itself exemplified the c*ue to action* component of the HBM, which LaMotre (2019) described as the utilization of a prompt to encourage the decision-making process and initiate a recommended health action. The self-efficacy component of the HBM was addressed and evaluated through a subsequent survey that took place after the intervention period.

The Model for Improvement was utilized to guide the change process (Langley et al., 2009). Components of the model assisted in appraising the contextual elements of the intervention affecting change. The system in which the change occurred, variation that affected expected outcomes, and individual influence were considered when identifying and implementing the chosen evidence-based intervention for existing patients at the organization where the Quality Improvement project was implemented.

This theoretical framework consisted of three essential questions and a procedural guide that directed change and improvement. The improvement process was evaluated by asking, "what are we trying to accomplish?", "How will we know change is an improvement?", and "what changes can we make that will result in improvement?" (Langley et al., 2009, p. 24). The

Plan, Study, Do, Act (PDSA) cycle served as a methodological strategy that guided this change project's development, implementation, and evaluation.

Specific Aims

The aim of this quality improvement project was to improve the current percentage of CCS adherence rate among the sample of Hispanic female patients 23 – 64 years of age among the study organization. The percentage rate among the sample population was 25.2%. This goal was achieved by developing and implementing an evidence-based intervention identified in the literature. The intervention identified and selected for this Q.I. project was the use of (SMS)/text messaging technology which provided education and served as a reminder or prompt on cervical cancer screenings. Furthermore, addressing health inequities and inequalities was also central to this project, ensuring the message was culturally and linguistically appropriate. To meet this goal, the following specific aims were included with targeted Hispanic women participants:

- Develop and test culturally appropriate and linguistically tailored SMS/text messages in accordance with the Health Belief Model framework
- Assess the satisfaction, acceptance, and attitude about SMS/text messages via patient perception/attitude survey
- Examine the effectiveness of the intervention by evaluating the CCS rate before and after the intervention

Methods

Context

The organization in which this QI project was implemented consists of four primary care clinics and three school-based health centers (SBHCs). It is an FQHC designated by HRSA, a branch of the federal government, to provide primary care to a medically underserved population. This designation provides federal funds that are allocated to provide that care. In addition to providing funding, HRSA identifies quality measures on which it bases funding. These quality measures emanate from evidence-based guidelines set forth by the Centers for Medicaid and Medicare Services (CMS). CCS is one of 17 quality indicators/measures that have been identified as screening or preventive services that improve health status and reduce adverse health outcomes, morbidity, and mortality for patients. Thus, increasing cervical screening rates had implications for patient outcomes and funding.

An external mapping tool (Figure 2, Appendix D) was constructed to illustrate the many resources and relationships contributing to the ability to perform cervical cancer screenings in this setting for women ages 23-64 years old. The New Mexico Department of Health, Medicaid, Medicare, and commercial insurance provide additional funding for cervical cancer screenings. The external mapping tool also demonstrated other necessary resources surrounding cervical cancer screenings, such as patients, providers, medical assistants, and Promatoras.

Throughout this project, the organizations' standard practice for providing patients with reminders regarding cervical cancer screenings employed the use of a letter sent to patients via the post office. Additionally, opportunistic reminders occurred at scheduled visits where patients were instructed to follow up for a CCS exam. Once a patient presented to the clinic for the

cervical cancer screening, the medical assistant prepared the equipment and patient. The provider then completed the screening in accordance with guidelines set forth by professional organizations and then documented it in the electronic health record (EHR). The specimen was sent out to the lab, and results were received and documented. The Chief Operations Officer (COO) collected and reported data abstracted from the EHR in accordance with Centers for Medicare and Medicaid Services and organizational guidelines.

Low CCS rates among its population was an identified problem at the organization where the project was implemented. Factors contributing to low rates within this organization were numerous and were identified in a cause-and-effect diagram (figure 3, appendix E). The causes were grouped by people, environment, materials, methods, and equipment. The "people" involved are the patient, the provider, and staff, all of whom may have had some degree of knowledge and time deficit which potentially interfered with completing cervical cancer screenings resulting in low rates. Lack of access as demonstrated by limited funding (those that are uninsured, underinsured, or cannot afford co-pays), transportation issues, personal circumstances such as timing (women may be menstruating at the appointment time, unable to take time off work, or no child-care) or discomfort (physical and emotional) due to the intimate nature of the exam may have also prevented the completion of cervical cancer screenings.

While many of the causes leading to low CCS rates had human origin, operational problems in the environment, material, methods, and equipment were also identified as sources influencing this problem. Environmental considerations such as appointment timing, staffing concerns, and possible clinic emergencies may also have contributed to low screening rates. Furthermore, the appropriate materials were not available or not stocked, such as lab supplies, cotton swabs, etc. Moreover, the EHR platform may have presented a problem as errors can

occur in selecting the appropriate test, incorrect documentation of results, or may have been disabled. Finally, the screening method may have been completed incorrectly, and a correct sample may not have been obtained. These person, systems, and environmental constraints may have led to low CCS rates within this organization.

While several factors contributing to low CCS rates were identified, those addressed by the intervention identified in this quality improvement project focused on patient-specific perceptions and barriers in accordance with the Health Belief Model (HBM). This message content served to address perceived susceptibility and severity of cervical cancer and identify the benefits of completing a CCS. The text message represented the cue to action, which served as a prompt for the patient to schedule a cervical cancer screening. However, actual and potential factors that encourage and inhibit the likelihood of successful implementation of this project exists. These elements are identified and displayed in the force field analysis (Figure 4, Appendix F).

The most compelling driver for change was the need to decrease morbidity and mortality associated with cervical cancer by identifying it early through recommended screenings. Additional drivers included increasing CCS rates and measures to meet the Health Resources and Services Administration (HRSA) benchmark and procure funding as an FQHC. Furthermore, implementing this intervention was feasible within the organization as the technology was available within the EHR. Moreover, the intervention was more cost-effective when compared with the usual care of sending out letters or printing education. The change was supported by addressing health disparities through increased access to information and patient awareness among a medically underserved population, as confronting health inequity and inequality was central to this project. Likewise, the utilization of an automated system facilitated HIT progress.

It proved to be a valuable tool in addressing other healthcare needs of the entire population within the organization in the future.

Change itself was a restraining force since it required effort, time, cost, and dedication to gain new knowledge and skills. Time and cost associated with needed training hindered the use of other staff in implementing this project as these resources are limited in the organization and were required elsewhere. Resources were also limited in some patients who did not have access to the technology needed for the intervention. If the technology was available to patients, some chose not to utilize it. Further possible restraining forces involved staff who may not have understood their roles or may not have bought into the project. Finally, technology was not free from problems, and the systems involved malfunctioned at times. While adversities to change existed and actually or potentially interfered with that change, the evidence supported the feasibility of text/SMS messaging as an intervention that positively impacts CCS rates.

Interventions

Pre-planning

A logic model (Appendix G, Figure 5) provided a framework for the pre-planning phase of the Plan, Study, Do, Act (PDSA) cycle used to implement this initiative. Multiple internal and external resources were available to the team leader, resulting in a diverse team being consulted for the project. Several activities guided and prepared the team leader for implementing the intervention. Before the sampling period, these activities took place, assuming that any pre-planning changes would be reflected in the chosen sample.

The team leader attended two training sessions provided by the New Mexico Primary Care Association (NMPCA), a non-profit organization consisting of 19 Community Primary Health Care Center organizations throughout New Mexico, including the study organization. The training facilitated the utilization of the health information technology (HIT) process available through the study organizations' EHR software in creating and disseminating text messages within the available platform. The study organization's chief information technology was consulted regularly for ongoing process concerns.

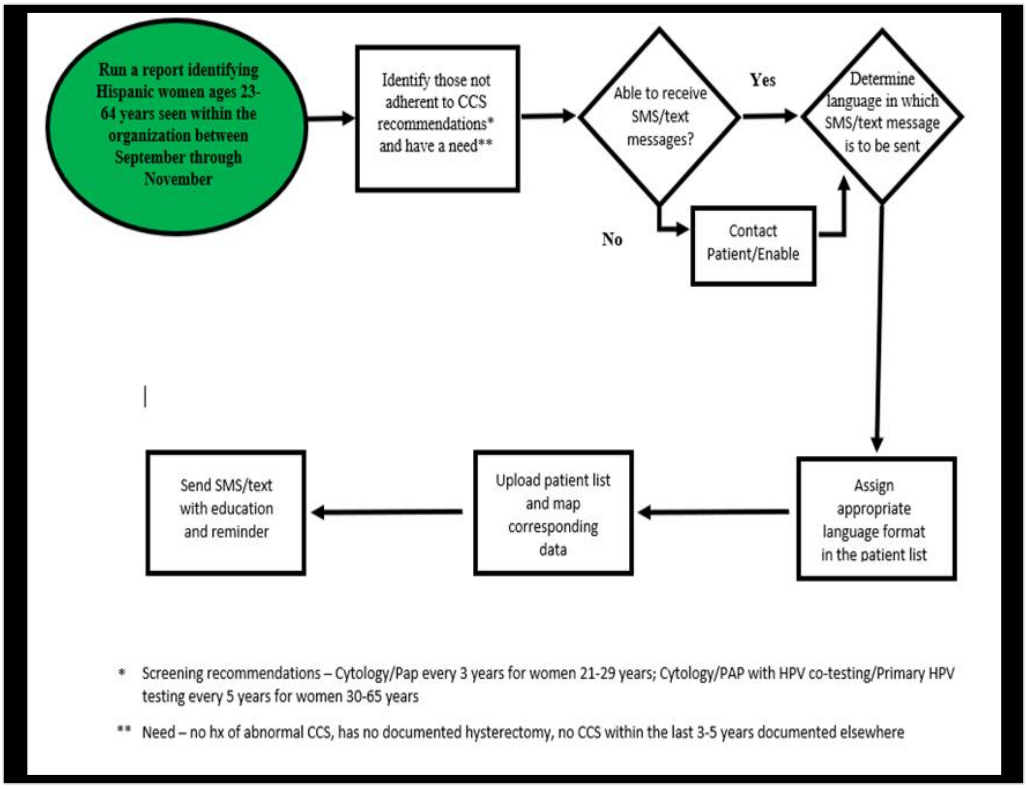
A linguistically tailored and culturally appropriate SMS text message was created based on current CCS guidelines in accordance with the health belief model (HBM). The construction took place through stakeholder involvement in the development and translation of the text message in accordance with guidelines set forth by the Agency for Healthcare Research and Quality's (AHRQ) Consumer Assessment of Healthcare Providers and Systems (CAHPS) on translation in healthcare (Consumer Assessment of Healthcare Providers and Systems (CAHPS), 2017). The process involved forward and backward translation by two bilingual individuals and was reviewed by two additional bilingual individuals. A total of four bilingual individuals will be recruited to translate and validate the message from English to Spanish and Spanish to English. Once created, the message was sent to the Chief Medical Officer and Chief Executive Officer for content approval and was deemed that no necessary revisions were needed.

The EHR platform reporting system was assessed for reliability in preparation for the project. It was found that data was not captured correctly as many CCS tests ordered by providers were outdated, were not mapped/coded correctly within the EHR, or did not reflect screening guidelines and recommendations. The chief information technology officer was consulted and, together with the team leader, removed any outdated CCS testing orders from the

EHR, ensuring that only appropriate tests were available for provider selection. Furthermore, appropriate mapping and coding for the tests were completed. Finally, since many of the ordered tests did not reflect updated screening guidelines, the team leader compiled and sent out a document that identified and referenced updated CCS guidelines as a reminder to providers.

Implementation

A flow chart (Figure 6) is presented below, which provides readers with a visual depiction of the intervention process. The flow chart also served as a tool that identified specific activities in the form of actions and decisions. The process started with running an automated report in BridgeIT, a health information technology (HIT) data warehouse reporting tool available to Federally Qualified Health Centers (FQHCs) through the Primary Care Association of New Mexico. Data was not extracted through the EHR as it did not have the availability to customize the search based on demographic data. The sample population was obtained through judgment sampling, also known as purposive sampling. The study participants were recruited over a specific time frame of three



months preceding the intervention period. This timeframe was selected as the intervention period was three months. The report identified Hispanic women ages 23 – 64 years old seen within the study organization in September, October, and November 2021. This was performed by the team leader and the organization's COO. The team leader then identified subjects who were not compliant with CCS guidelines and performed chart reviews on each patient to determine the need for the screening. The selected subjects were women ages 23- 29 years old who had not had a CCS via cytology in the previous three years and women 30 – 64 years who had not had cytology with co-testing or primary HPV testing in the previous five years. If the patient had an identified need for a CCS, the team leader determined if the patient was able to receive text messages through the EHR. If not able to receive text messages or there was no mobile phone number on file, attempts were made to contact the patient and obtain a mobile number, and the patient was enabled within the EHR to receive SMS/text messages. If the patient was amenable to the process, the team leader updated the mobile number so the patient would be able to receive the message. If the patient did not have a mobile number, could not be reached, or declined study participation, this was reflected in the attrition rate.

Once it was determined that the study subject was able to receive text/SMS messages, the linguistically tailored educational information message conveyed risk (perceived susceptibility) for developing cervical cancer (perceived severity), which could be caught early (perceived benefits) through a quick CCS test at reduced or no cost (perceived barriers) via text/SMS message. Also included in the text message was a request for the patient to call a dedicated number and extension (link provided) or any study organization clinic to schedule an appointment for the cervical cancer screening, report outside results, or add to an existing appointment. The EHR technology did confirm receipt of the text message. A dedicated number

was created for the study in which participants were able to connect with the team leader immediately or leave a secure voicemail for a return call. The dedicated number was embedded in the text message as a link, and the participant could tap and be connected immediately. If a CCS was done elsewhere, the team leader obtained applicable information, and the results were documented appropriately.

Evaluation of the Interventions

The Plan-Study-Do-Act (PDSA) Cycle was the chosen framework that provided a methodological approach to assessing the impact of the intervention. The framework consisted of process evaluation in the form of rapid cycles that allowed reiterative testing of the proposed intervention on a small scale. This process allowed the team leader to identify opportunities for process modification. Additionally, it established whether the aim of this quality improvement project, which was to improve the percentage of CCS rate among the sample population from 25.2%, was accomplished.

The specific sub-aims of the improvement initiative were to develop and test a culturally appropriate and linguistically tailored educational message and reminder in accordance with the Health Belief Model framework and to assess the satisfaction, acceptance, and attitude about the use of SMS text messages and its contents via patient perception/attitude survey. The survey was done to examine the effectiveness of the intervention in addition to the outcome of the CCS rate. The evaluation plan measured progress towards these aims.

Measures and Analysis

Measures chosen for studying the processes and outcomes of implementing short messaging system (SMS)/text messaging education and reminders to increase CCS rates were identified in the measures table (Table 3), which provided readers with a framework for expected outcomes and the operational definitions associated with those outcomes in how the process and effects of the intervention were evaluated or measured. These specific measures were chosen based on the feasibility of the operations, availability of data collected, and the processes to operationalize the outcome. Data was collected from the BridgeIT data warehouse, the study organizations' EHR platform, and participant surveys.

Table 3: Measures Table

Expected Outcome(s)*	How will you operationalize/measure the outcome?	Where will you get the information	Will you have a Comparison Group?	Analysis
Develop and validate a culturally appropriate and locally tailored message and reminder in accordance with the Health Belief Model framework	Coordinate with members of the population being studied and staff to develop a message on cervical cancer screening according to the Health Belief Model. Binary variable: accomplished/not accomplished	evidence-based practice guidelines, Hispanic Women ages 23-64, staff	No	Qualitative, descriptive
Assess the satisfaction, acceptance, and attitude about the use of SMS text messages content via a patient perception/attitude survey	Patients will complete a survey that evaluates the intervention's effectiveness and demographic information.	Patient survey completed using Qualtrics. It consists of 3 CCS specific questions, seven demographic questions, and one open-ended question	No	Aggregate mean scores from the satisfaction survey
Examine the effectiveness of the intervention	change and percent improvement will be used to evaluate the change score before and after the intervention for those having received a cervical cancer screening compared with those who have not	Electronic Health Record (EHR)	No	The proportion of completed screens

Sub sub-aims were analyzed throughout the study period using binary (accomplished/not accomplished) variables, percentages, time series charts, and survey results. The development of an SMS text message was evaluated by a binary variable, which determined whether this was accomplished or not accomplished. Percentage and time series charts were used to identify the target population within the age group as having a CCS completed. Finally, patient perception/attitude was measured regarding the effectiveness of the intervention in accordance with the Health Belief Model by completing a satisfaction survey.

Percent improvement was used to evaluate the change score before and after the intervention for those having received a CCS compared with those who had not. These were used to evaluate the overall aim of the study, which was to increase CCS rates from the pre-intervention percentage rate. A post-intervention evaluation identified the number of study participants who completed a CCS (numerator) compared with the total number of patients identified with a need for CCS seen within the three-month intervention timeframe (denominator) was to be evaluated.

Ethical Considerations

Ethical concerns regarding protected health information were considered when determining the feasibility of this quality improvement project. The SMS text messaging system was integrated into the EHR and, therefore, compliant with the Health Insurance Portability and Accountability Act (HIPAA) and used for other functions within the organization. As a result, patients could receive SMS text messages safely and securely through this platform. There was no formal process for reviewing projects at the study organization where this QI project occurred. The ethical review complied with the standards set by UMass Boston.

The specific aim of this initiative was to improve the delivery of care in accordance with the established evidence-based practice that did not override clinical decision-making or current standards of practice. The criteria for quality improvement of this project were confirmed through the use of a clinical quality improvement checklist guideline (Figure 6, Appendix H). The study was a quality improvement project; it did not meet the definition of human subject research because it was not designed to generate generalizable knowledge findings, but rather it provided immediate and continuous improvement feedback in the local setting in which the project was carried out. The University of Massachusetts Boston institutional review board (IRB) had determined that quality improvement projects did not need to be reviewed by the IRB. While the study organization required no formal documentation, it was discussed with and approved by its COO, Chief Medical Officer (CMO), and Chief Executive Officer (CEO).

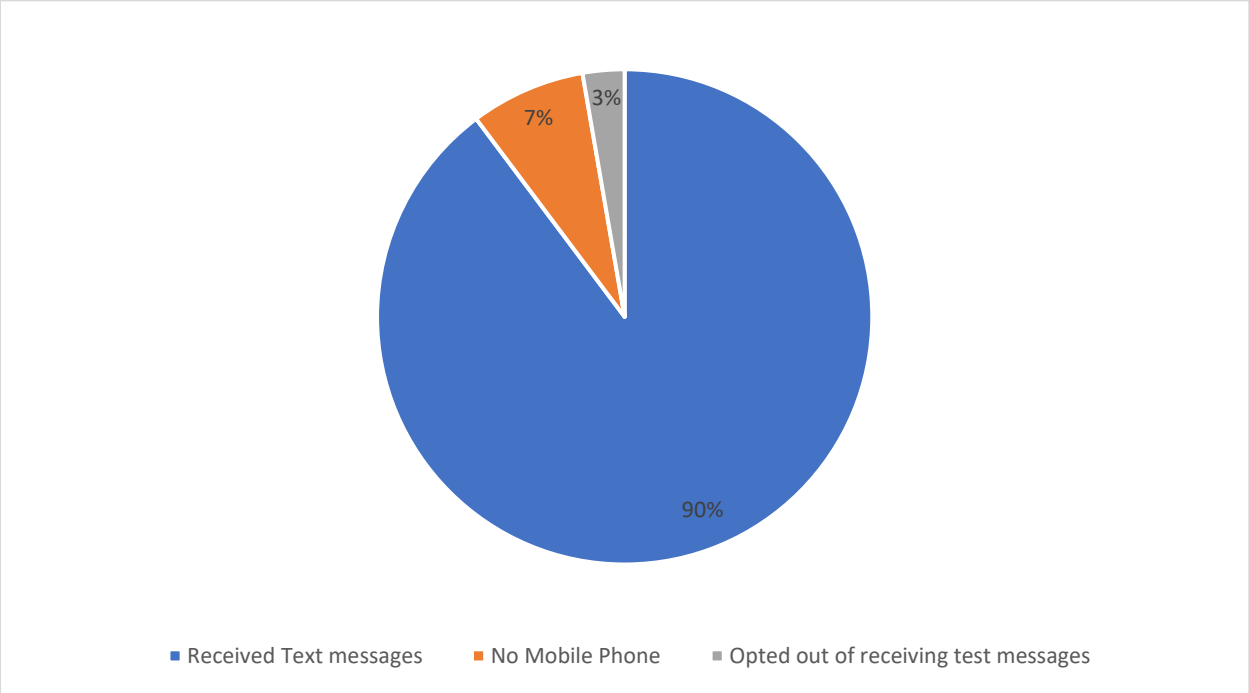
Results

Recruitment

A judgment-based sampling approach was used in selecting the sample population for this study. While this non-probability sampling has limitations such as bias, Perla et al. (2013) ascertain this type of purposive sampling is more compatible with quality improvement. A specified time was chosen as the criteria for sample selection. Since the improvement study period was three months, the team leader decided this time frame would provide similar conditions to the intervention period. Therefore, the sample was selected from those seen during the preceding three months within the study organization. Of all the female patients (n=606) aged 23 to 64 seen at the study organization from September 1, 2021, to November 30, 2021.

Since Hispanic women within this age group were the target population for this study, these patients (n=442) were extracted from this population construct and assessed for eligibility. Those with a hysterectomy (n=50) were excluded. The remaining 393 patients served as the denominator to determine the baseline adherence rate of the accessible population. Baseline numerators (n=99) are those within the accessible population that were adherent to CCS guidelines before initiating the intervention, which provided a baseline adherence rate of 25.2%. The remaining patients (n=293) that were non-adherent to CCS recommendations served as the recruited sample. However, there were patients without a mobile phone to receive text messages (n=22) and patients who declined to receive text messages (n=8). After attrition and refusal considerations, the actual sample for the study was n=263. According to the EHR platform, the exact percentage of patients reached by SMS/text message was 90%, demonstrated in Table 4.

Table 4: Patient Reach



Sample Characteristics

While the final sample (n=263) consisted of Hispanic females aged 23-64 years, additional demographic information was identified (Table 5). The mean age of the sample was 45.3 years, and the age group that represented the majority of the sample population was 40-49 years. While the entire sample consisted of self-identifying Hispanic women, the majority identified English as their primary language (92.1%), while 7.8% identified Spanish as their primary language.

Table 5: Demographics

Demographic	Characteristic	Count (N)	Percentage (%)
Gender	Female	281	100%
Ethnicity	Hispanic	281	100%
Age	21-29	28	9.9%
	30 -39	66	23.4%
	40-49	78	27.7%
	50-59	69	24.5%
	60-65	40	14.2%
Language	English	259	92.1%
	Spanish	22	7.8%

Evolution of the Intervention

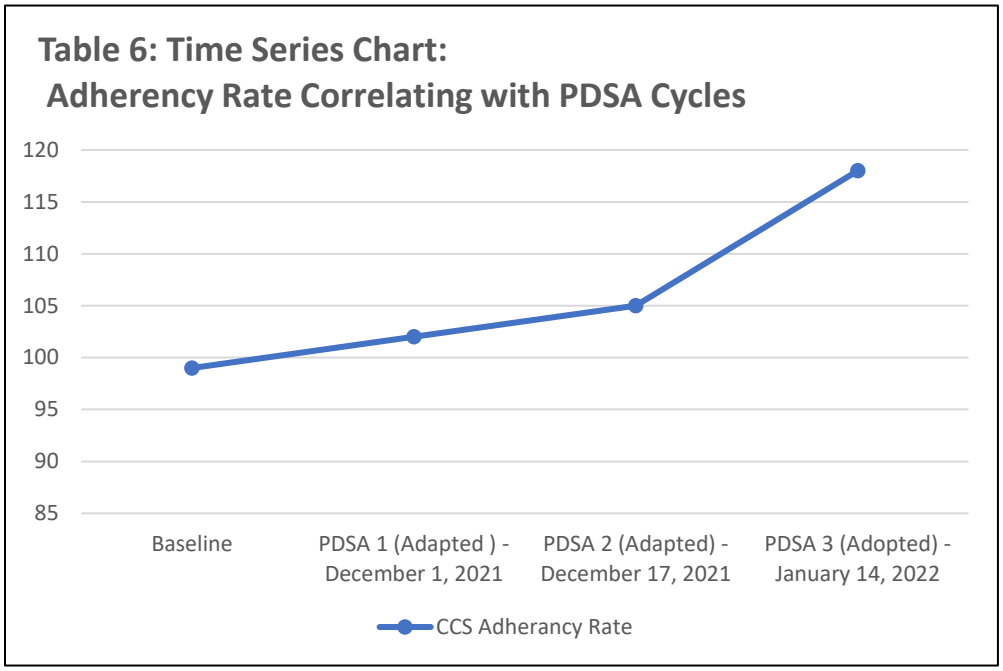
The initial outcome of this quality improvement project was to develop and test a culturally and locally tailored educational message and reminder that would be sent out as a text message to sample patients in the study. This was accomplished, and the outcome results can be referred to in Appendix I, Figure7. The text/SMS message was created based on the Health

Belief Model and derived from evidence-based literature. The premise of the *perceived susceptibility and perceived severity* components of the message while addressing the cultural appropriateness was based on two constructs; there was found to be a higher death rate from and prevalence of cervical cancer among women residing in rural areas (Yu et al., 2019) and a higher incidence of cervical cancer among Hispanic women when compared to white women (Chen et al., 2018; Johnson et al., 2020; U.S. Department of Health and Human Services Office of Minority Health, 2020). The *perceived benefits* component of the message was based on current CCS guidelines (American College of Obstetricians and Gynecologists, 2021). Finally, a locally tailored aspect of the message addressed *perceived barriers* by describing low to no-cost screenings, which the study organization provides as a Federally Qualified Health Center (FQHC).

Once the message composition was completed, translation took place in accordance with guidelines set forth by the Agency for Healthcare Research and Quality's (AHRQ) Consumer Assessment of Healthcare Providers and Systems (CAHPS) on translation in healthcare (Consumer Assessment of Healthcare Providers and Systems (CAHPS), 2017). Four bilingual individuals were recruited, two staff members and two patients, who translated and validated the message using forward and backward translation from English to Spanish and Spanish to English.

Three Plan-Study-Do-Act (PDSA) cycles were used to evaluate the intervention process and identify needed modifications. Table 6 demonstrated the PDSA cycles and correlated these cycles with change over time. The initial plan for the intervention was to employ two-way texting through the EHR in which the patients would receive the planned message and be able to respond directly via SMS/text message.

However, during the first PDSA cycle, it was identified that the technological platform used for this quality improvement project did not have a two-way testing capability. Therefore, in accordance with the PDSA framework, the process was adapted to utilize one-way text messaging requesting the patient call the clinic. As part of this adaptation, a dedicated extension with voicemail was assigned for this project and included in the text message as a link on which the recipient could tap on and be directly connected to the extension. The updated text message also included instructions to leave a secure voicemail on this line for a callback or to call any clinic that was part of the study organization to schedule their cervical cancer screening, report outside results, or add to an existing appointment. Unfortunately, as a result, the response rate could not be evaluated.



Contextual Elements

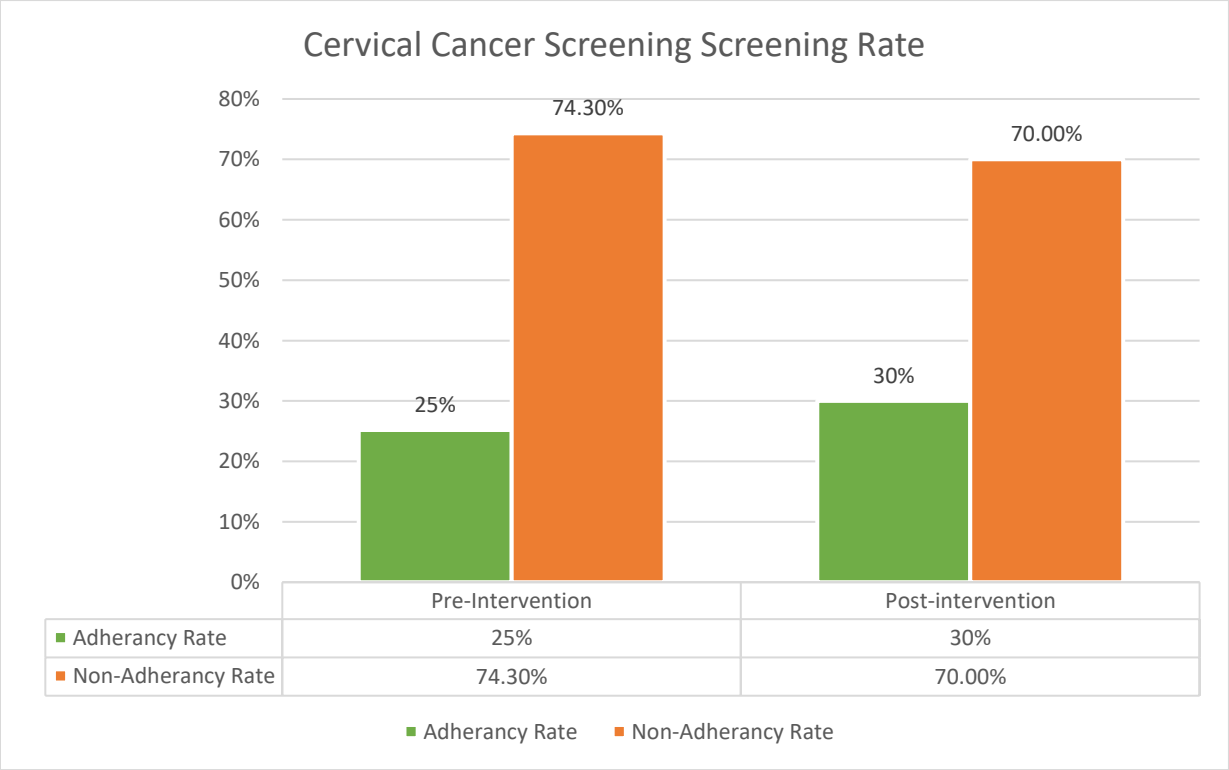
Many influential circumstances interacted with the intervention. One cannot implement any healthcare initiative today without identifying the COVID epidemic as impacting the intervention. Of the recruited sample, many patients were seen within the study organization only for COVID-related care such as testing and immunizations and received their preventive care outside of the study organization. Patients may have also been hesitant to complete

recommended preventive care screenings. A study performed by Laing and Johnston (2021) found that CCS rates decreased by 7.5% and attributed this to the COVID pandemic.

Results of the Analysis

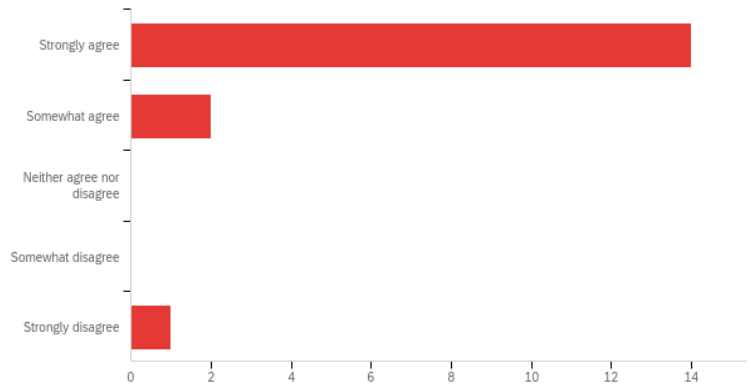
Change and percent improvement was used to evaluate the change score before and after the intervention for those having received a CCS compared with those who have not. The baseline percentage adherence rate for those within the sample having completed a CCS was 25.2% prior to implementing the intervention. Post-implementation adherence rate was 30%, which was statistically significant (p=0.01). Table 6 demonstrated the percent change of pre-and post-implementation CCS rates.

Table 6: Percent Change



A web-based patient survey was completed using Qualtrics web-based system and sent to the sample population using SMS/text messaging (n=263) to determine the effectiveness of the intervention by assessing patient satisfaction, acceptance, and attitude. The survey consisted of three topic-specific questions, seven demographic questions, and one open-ended question. The respondents (n=17) answered the topic-related questions; however, not all answered the demographic questions. No respondents answered the open-ended question. The aggregate mean score from one question using a 5-point rating scale was analyzed to assess the satisfaction with the use of SMS text message content. Table 7 provides readers with a visual depiction of the survey results on satisfaction.

Table 7: Satisfaction Results



Answer	%	Count
Strongly agree	82.35%	14
Somewhat agree	11.76%	2
Neither agree nor disagree	0.00%	0
Somewhat disagree	0.00%	0
Strongly disagree	5.88%	1
Total	100%	17

Acceptance and attitude were evaluated by asking the sample population if they had made an appointment for a CCS and, if not, were asked why using multiple choice answers. Of those who responded to the questions (n=17), 17.65% reported they had made an appointment for a CCS, whereas 82.35% (n=14) reported that they had not made an appointment for a CCS. Not all respondents (n=14) reported they had not scheduled a CCS. The number of those (n=8)

who gave reasons for not having scheduled a screening were time, did not feel it was needed, and other, which can be found in Table 8. Demographic data were examined to determine if this correlated with topic-specific responses.

Answer	Time	Cost	Lack of insurance	Transportation	I feel I do not need it	Physical or Emotional Discomfort	Fear	Other
%	25.00%	0.00%	0.00%	0.00%	25.00%	0.00%	0.00%	50.00%
Count	2	0	0	0	2	0	0	4

Discussion

Summary

The overall aim of this study was to increase CCS rates among Hispanic women aged 23-64 years using SMS/text messaging reminders and education. Pre- and post-implementation percent change demonstrated an improved adherence rate among cervical screening within the sample. This was achieved through the development and dissemination of an SMS/text message which served as a cue to action and informed patients that they were at risk *(perceived susceptibility)* for developing cervical cancer (*perceived severity)*, which could be caught early (*perceived benefits)* through a quick CCS test at reduced or no cost (*perceived barriers*) and survey which evaluated the patients' self-efficacy in accordance with the Health Belief Model.

Interpretation

This quality improvement project demonstrated the positive impact SMS/text messaging had on improving CCS rates, as evidenced by the increase in rates among the sample population (p=0.01). Various other studies identified similar findings in which SMS/text messaging proved

to be a viable intervention for improving health outcomes. For example, Crombie et al. (2018) found that the use of text messaging was beneficial from a cost perspective in reaching a large study sample. The use of SMS/text messaging as an education reminder in this study aligned with the recommendations for use presented by The Center for Research in Implementation Science and Prevention at the University of Colorado (2018). The impact of SMS/technology is especially important for the study organization and the population it serves as it addresses health inequity. Furthermore, Health Information Technology (HIT) is essential to quality improvement among FQHCs, according to HRSA (n.d.-c).

Limitations

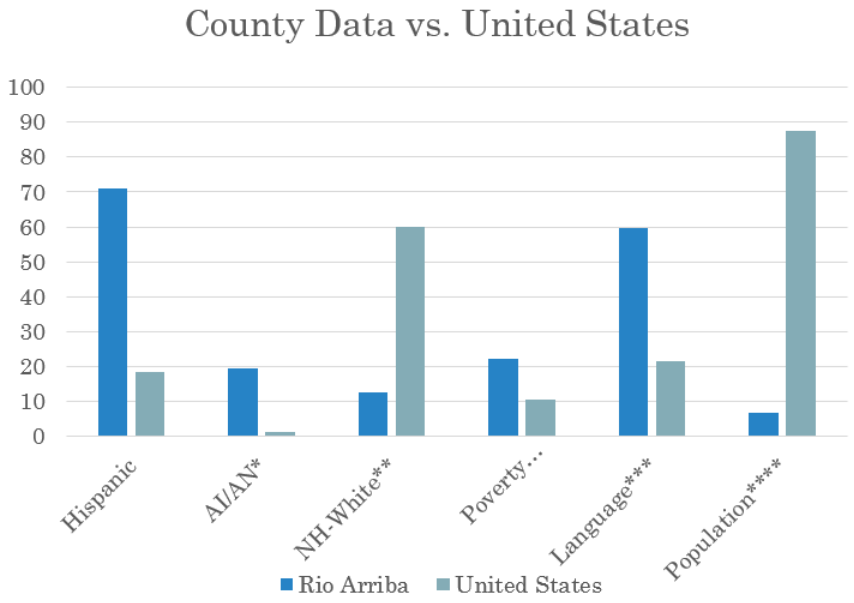
There were several limitations evident in this study. There was a 10% attrition rate among the sample population, demonstrating limited internal validity (Polit & Beck, 2018). While this rate is high, it is on the lower end of the threshold for the threat to internal validity. Additionally, since this was a quality improvement project, it is challenging to ascertain a direct correlation between the intervention and the outcome as confounding variables may have affected CCS completion within the study period. However, given the homogeneity of the study sample, a considerable amount of confounding control was obtained, which accounted for adjustments in the demonstrated limitations. Conversely, the level of homogeneity may have limited the generalizability of the study findings. Furthermore, a judgment-based or purposive sampling approach lends to the limitations by allowing for bias which can skew the results (Polit & Beck, 2018). Finally, the short study duration may not have allotted an adequate timeframe for study subjects to complete CCS, which has low response rates in both CCS and survey participation.

Conclusions

This study has demonstrated the usefulness of SMS/text messaging as an educational reminder to increase CCS rates among Hispanic women at the study organization in Northern New Mexico. Additionally, the sample population studied demonstrated the importance of addressing health inequities among underserved patients in healthcare. Since the intervention was cost-effective and built into the electronic medical record platform (EMR), it exhibited sustainable intervention that can be utilized for other preventive care indications such as colon cancer screenings and breast cancer screenings. While SMS/text messaging technology and its applications in health care are limitless, further research is needed.

Appendix: A

Table 1: County vs. U.S. Demographics (United States Census Bureau. (n.d.-a; n.d.-b).

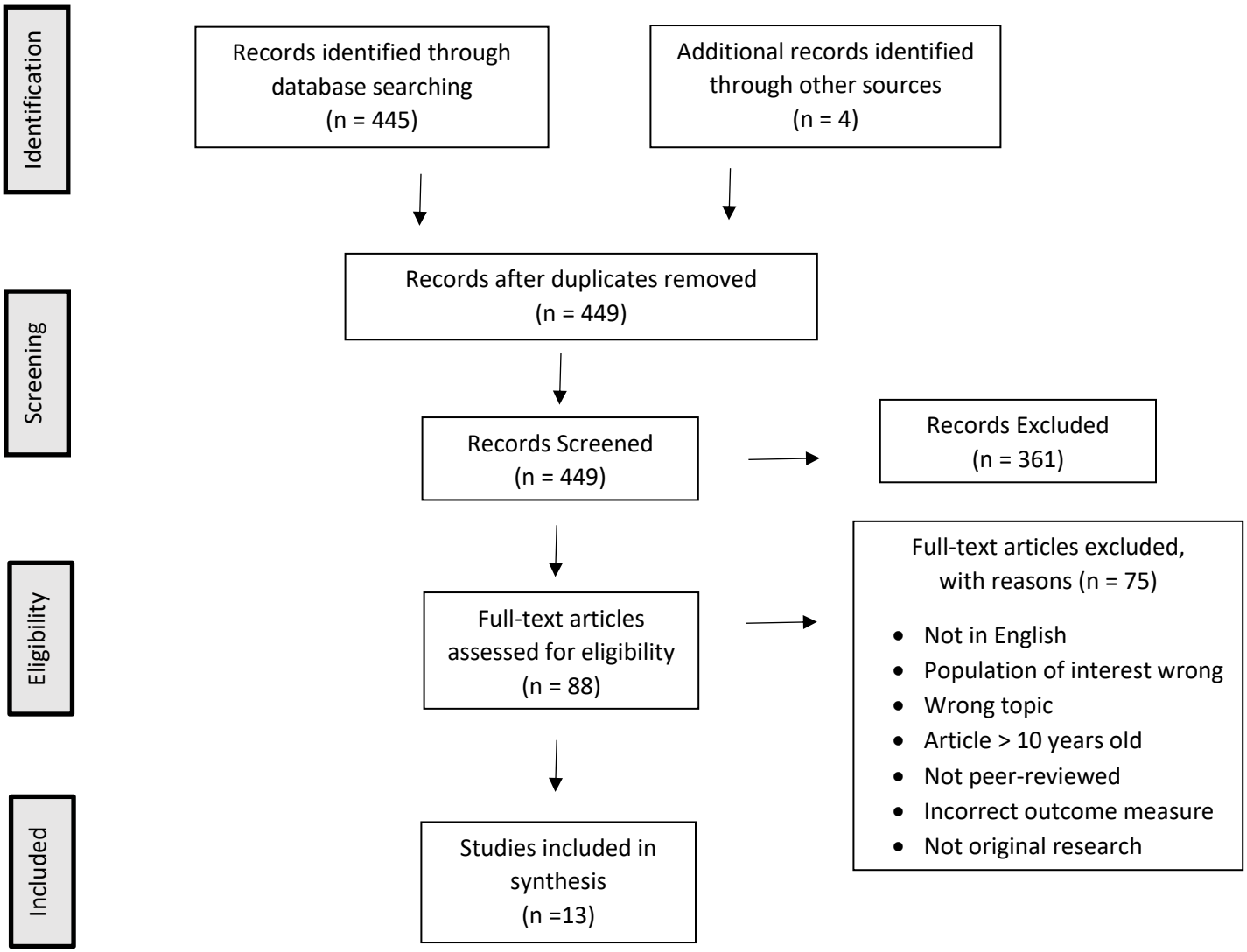


	Rio Arriba	United States
Hispanic	71.1%	18.5%
AI/AN*	19.4%	1.3%
NH-White**	12.8%	60.1%
Poverty%	22.1%	10.5%
Language***	59.7%	21.6%
Population per square mile****	6.9	87.4

*AI/AN – American Indian/Alaskan Native
**NH-White – Non-Hispanic White
***Language primarily spoken inside the home other than English
****Population per square mile

Appendix: B

Figure 1: External Mapping Tool/PRISMA Diagram



Appendix: C

Table 2: Evidence Summary Table – Among women ages 23 -64 years of age, what are the most effective interventions that can increase cervical cancer screening adherence rates?

Number of Studies	Summary of Significant Findings	Overall Quality	Description of Sample; Sample size
A. Adler et al., (2019). B. Firmino-Machado et al., (2019). C. Firmino-Machado et al. (2018). D. Ganta et al., (2017). E. Lee et al., (2014). F. Rashid et al., (2013).	All studies found text messaging positively impacted cervical cancer screening rates.	A. I, C B. I, A C. I, A D. II, A E. III, B F. II, C	A. N=95, 52% minority B. N=1220 C. N=1220 D. N=30 E. N=485, Korean American F. N=1106, Asian Pacific
G. Valdez et al., (2018).	Culturally tailored health education increased cervical cancer screening rates	G. I, A	G. N=943
H. Aarnio et al., (2020). I. Carrasquillo et al., (2018).	Higher cervical cancer screening rate among patients who participated in self-sampling vs. Pap screening	H. I, A I. I, A	H. N =36,390 I. N=601; 59% Hispanic
J. Byrd et al., (2013). K. McDonough et al., (2016). L. Thompson et al., (2017).	Education using Promatoras, which is the Spanish term for community health workers, had a statistical significance in increasing cervical cancer screening adherence rates	J. II, A K. II, A L. I, A	J. N= 613, Mexican K. N=5,211; various Latina origin L. N=443
M. Tavasoli et al., (2016).	Invitation to test in the form of a letter improved cervical cancer screening rates	M. II, A	M. N=229,455

Appendix D

Figure 2: External Mapping Tool

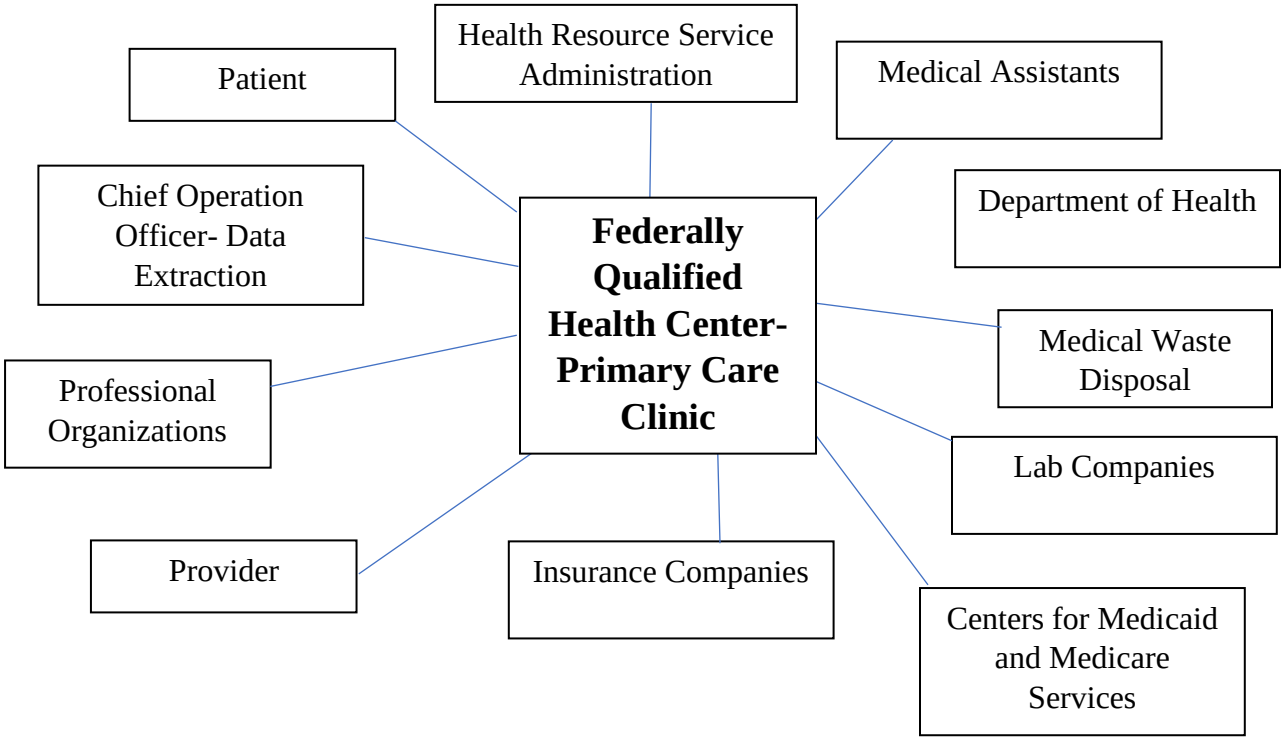
The external context of the clinical microsystem in which the Quality Improvement project will take place

1. Clinical microsystem name: Federally Qualified Health Center – Primary Care Clinic

2. Subpopulation of patients: Female Patients ages 21 – 65 years

3. Specific Healthcare Needs:

   a. Primary Care
   b. Preventative Care
   c. Screening for cervical cancer
   d. Education

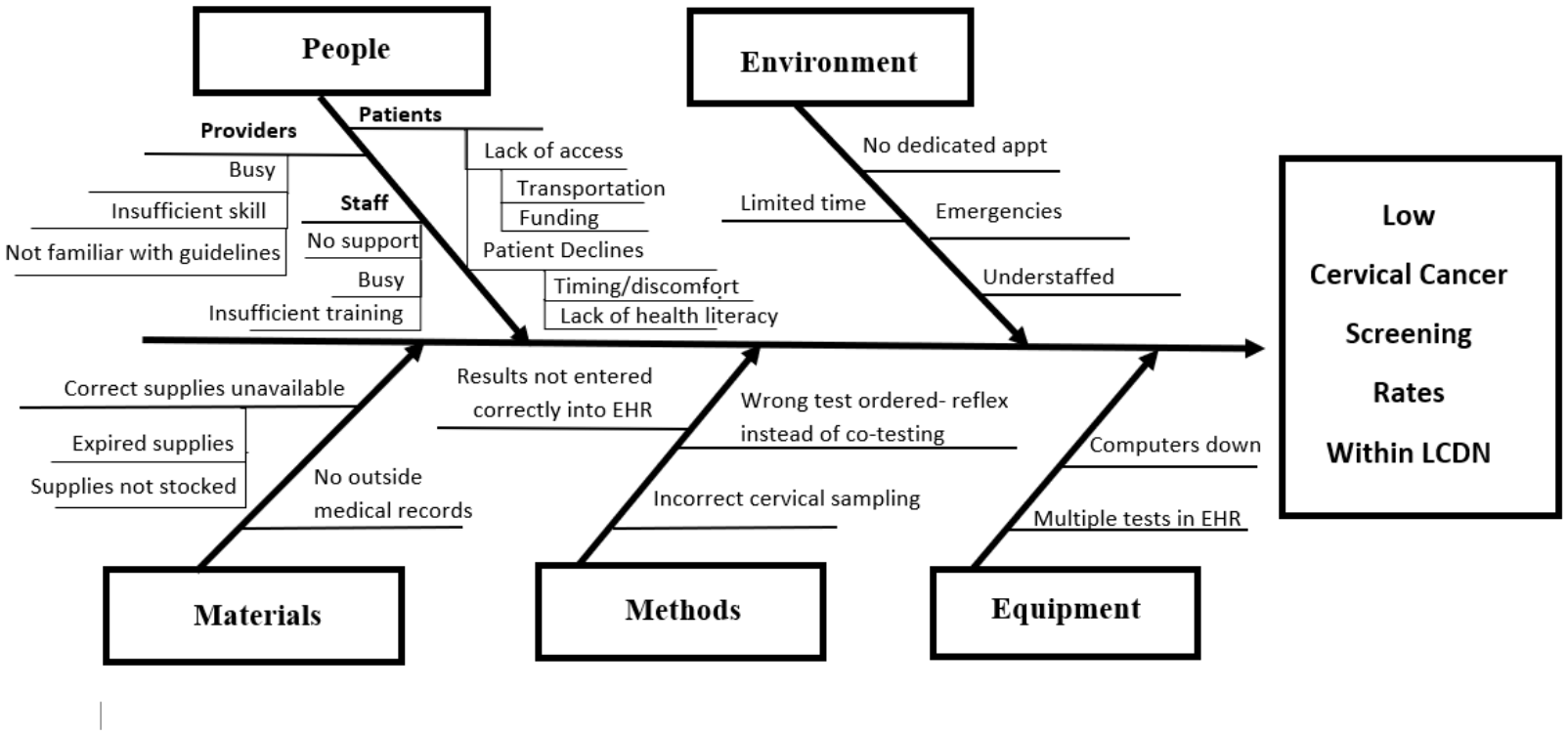


Improvement ideas:

Increase cervical cancer screening rates, increase cervical cancer screening guideline awareness among providers, Increase patient education regarding cervical cancer screenings

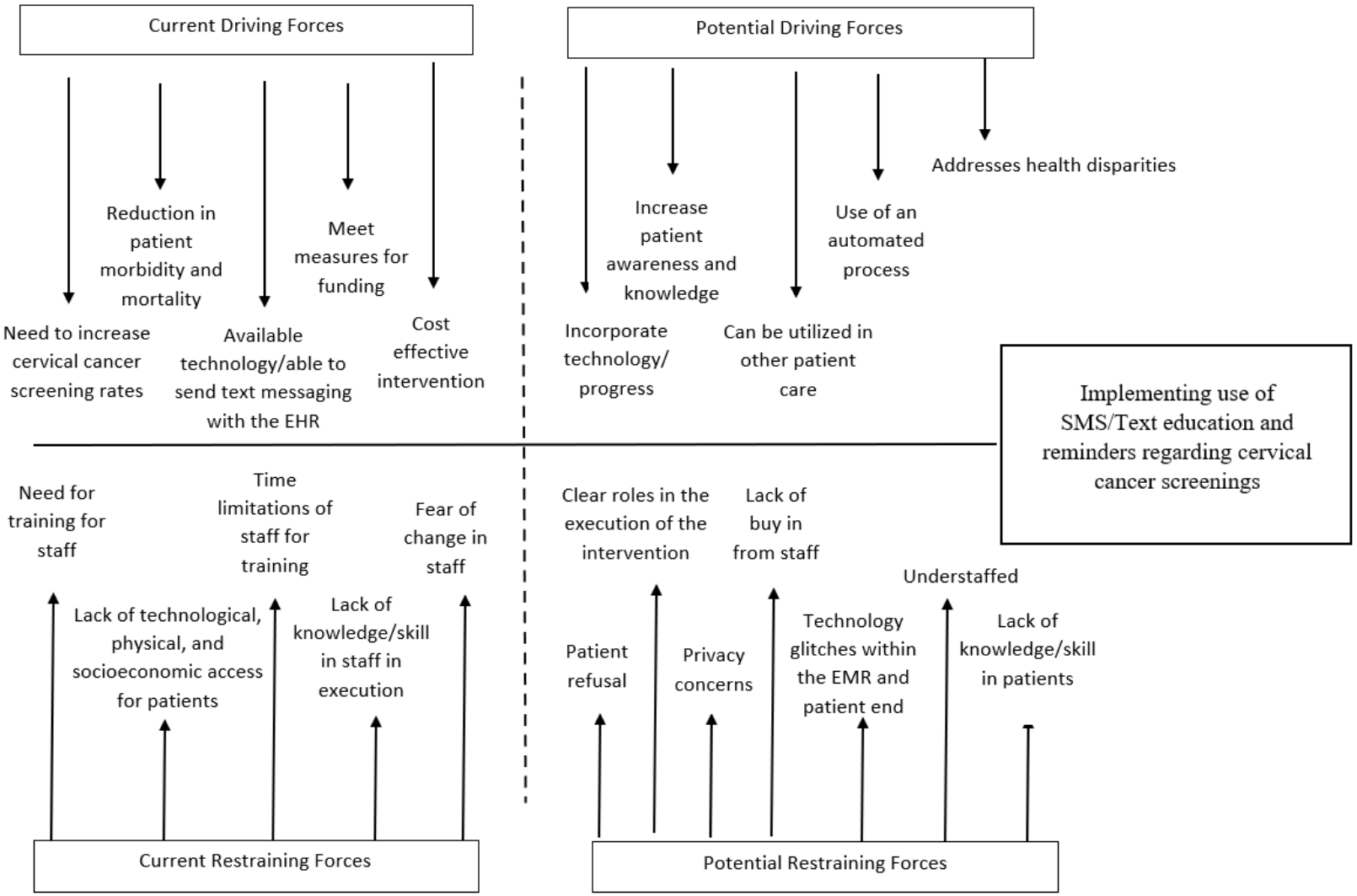
Appendix: E

Figure 3: Cause and Effect Diagram



Appendix: F

Figure 4: Force Field Analysis

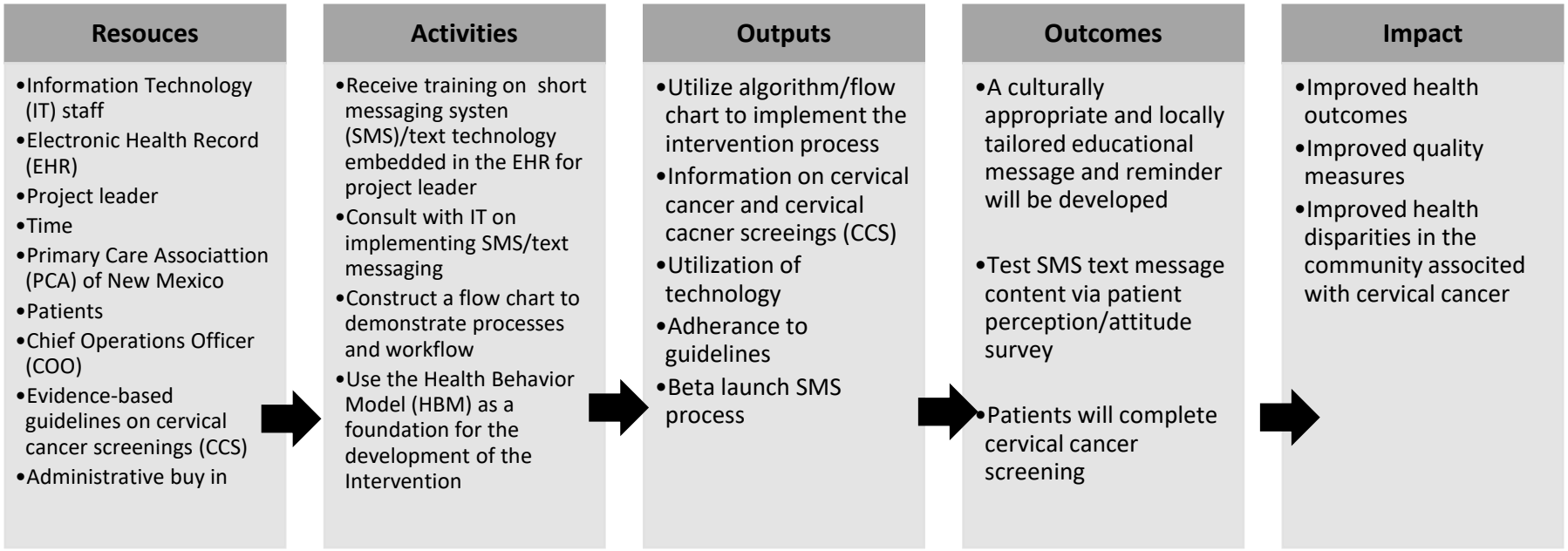


Appendix: G

Figure 5: Logic Model

Purpose- The purpose of this project is to improve cervical cancer screening rates among underserved women using short messaging system (SMS)/text messaging education and reminders in order to improve patient care outcomes and measures.

Problem - The cervical cancer screening (CCS) screening rates among the underserved women with health disparities at the rural Federally Qualified Health Center (FQHC) in which this quality improvement (QI) project will be implemented has a low screening rate of approximately 25% among its' existing eligable patients.



Assumptions

- Cervical cancer screening rates are lower among underserved women, augmenting health and healthcare disparities among this population.
- Federally Qualified Health Centers (FQHCs) provide healthcare to underserved populations
- Implementating use of short messaging system (SMS)/text messaging education and reminders on cervical cancer screenings will increase screening rates within the organization.

Appendix: H

Figure 6: Clinical Quality Improvement Checklist

CLINICAL QUALITY IMPROVEMENT CHECKLIST		
Date: 11/29/2020	**Project Leader: Adriana Gonzales**	
Project Title: Implementation of Short Messaging System/Text education and reminders to increase the percentage of cervical cancer screening		
Institution where the project will be conducted: Las Clinicas del Norte		
Instructions: Answer YES or NO to each of the following statements about Q.I. projects.	**YES**	**NO**
The specific aim is to improve the process or delivery of care with established/ accepted practice standards or to implement change according to mandates of the health facilities' Quality Improvement programs. There is no intention of using the data for research purposes.	**X**	
The project is **NOT** designed to answer a research question or test a hypothesis and is **NOT** intended to develop or contribute to generalizable knowledge.	**X**	
The project does **NOT** follow a research design (e.g., hypothesis testing or group comparison [randomization, control groups, prospective comparison groups, cross-sectional, case control]). The project does **NOT** follow a protocol that overrides clinical decision-making.	**X**	
The project involves the implementation of established and tested practice standards (evidence-based practice) and/or systematic monitoring, assessment or evaluation of the organization to ensure that existing quality standards are being met. The project does **NOT** develop paradigms or untested methods or new untested standards.	**X**	
The project involves the implementation of care practices and interventions that are consensus-based or evidence-based. The project does **NOT** seek to test an intervention that is beyond current science and experience.	**X**	
The project has been discussed with the QA/QI department where the project will be conducted and involves staff who are working at or patients/clients/individuals who are seen at the facility where the project will be carried out.	**X**	
The project has **NO** funding from federal agencies or research-focused organizations and is not receiving funding for implementation research**.**	**X**	
The clinical practice unit (hospital, clinic, division, or care group) agrees that this is a Q.I. project that will be implemented to improve the process or delivery of care.	**X**	
The project leader/DNP student has discussed and reviewed the checklist with the project Course Faculty. The project leader/DNP student will **NOT** refer to the project as research in any written or oral presentations or publications.	**X**	
ANSWER KEY: If the answer to **ALL** of these questions is **YES**, the activity can be considered a Clinical Quality Improvement activity that does not meet the definition of human research. **UMB IRB review is not required**. **Keep a dated copy of the checklist in your files.** If the answer to ANY of these questions is NO, the project must be submitted to the IRB for review.		

Appendix: I

Figure 7: Text message in English and Spanish based on Health Belief Model

	Perceived Susceptibility	***Perceived Severity***	***Perceived Benefits***	***Perceived Barriers***
English	As a woman you are at risk for getting cervical cancer	This can be severe or deadly if not caught early	It can be prevented if caught early through screening tests	We can help you get screened at little or no cost to you even without insurance
Spanish	Como mujer, tiene un mayor riesgo de contraer cáncer de cuello uterino	Esto peude ser grave o mortal si no se detecta a tiempo	Puede prevenirse previamente si se detecta a tiempo a traves de pruebas de deteccion	Podemos ayudarlos a hacerse la puerba de deteccion con poco o ningun costo para usted incluso sin seguro medico

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