Childhood Obesity in Massachusetts:
The Importance of Metrics and Communication in Cafeteria School Policy

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*Note: This is a working paper, and as such, any feedback to the author would be greatly appreciated. You may contact the author Andre Sanchez at andre.sanchez001@umb.edu or at his personal email at asancho@gmail.com.

Introduction

Obesity has become an epidemic amongst American youth in the 21st century, and is spreading into other developed nations such as the UK and Australia, as well as developing nations such as India (Bhardwaj, 2008). It is estimated that nationwide, childhood obesity affects around 17% of American children (Center For Disease Control, 2011). Obesity has been linked to many health disorders, including but not limited to, heart disease and diabetes. Subsequently, this rise in childhood obesity is having a severe impact on the healthcare services sector in America, with some studies suggesting childhood obesity in the United States could cost as much as 11 billion annually for children with private insurance and 3 billion for children on Medicare (Thomson Medstat, 2006). An important question parents, teachers, and researchers have often asked, is "How can we reduce childhood obesity?" More specifically, how does school cafeteria policy towards obesity potentially effect student obesity rates? Can schools implement certain policies with dramatic reductions in childhood obesity? When looking at obesity rates within the states of Massachusetts, why do schools in regions that have similar socio-economic conditions (the most often cited causes of childhood obesity) have vastly different childhood obesity rates?

When a school district decides that it is going to reduce childhood obesity, it is essentially undertaking a project. In order for a project to succeed, project management theory states that metrics must be established that are measurable (Doran, 1981). In addition, these measurable metrics must be effectively communicated to the target audience. What metrics do the schools set with regards to child food consumption, and how are these metrics communicated to both children and, more importantly, to parents? Could the way that a school delivers consumption metrics to parents have an effect on Childhood Obesity? We will look at what we define as factors that are ***internal*** to the school system (i.e. physical education and

cafeteria offerings on school-grounds) and factors that are ***external*** to the school system (i.e. food and exercise that are performed off school grounds). How can measuring **internal factors** and communicating them to parents affect **external factors**? Is the communication and metric system that Arlington, a district with an obesity rate of 4.6% more effective than a city like that of Newton, a city which has a childhood obesity rate of 9%?

Background

The Obesity Epidemic

Figure 1 - National Childhood Obesity Rate, 2006, Source: Center for Disease Control

The United States has, historically, had a problem with obesity (See figure 1). In the past 50 years, obesity statistics have shown that a growing number of US citizens can be defined as overweight or obese. According to the Center for Disease Control, as of 2008, the obesity rate nationwide amongst adults in the United States is 26.1%, with some states reporting rates of obesity as high as 32.8% (Hitti, 2009). However, what previously was a problem that was specific to adults has also affected children in recent years (Center for Disease Control, 2011). Some alarming health statistics exist within the United States regarding childhood obesity.

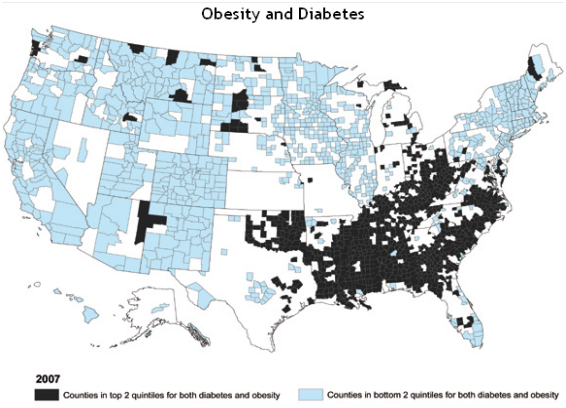


Figure 2 - The Link between Obesity and Diabetes, Source: Center for Disease Control, 2011

Obese children and adolescents are more likely to become obese as adults. For example, one study found that approximately 80% of children who were between the ages of 10 and 15 were obese adults at age 25 years. Results from the 2007-2008 National Health and Nutrition Examination Survey (NHANES), using measured heights and weights, indicate that an estimated 17 percent of children and adolescents ages 2-19 years are obese. Among pre-school age children 2-5 years of age, obesity increased from 5 to 10.4%

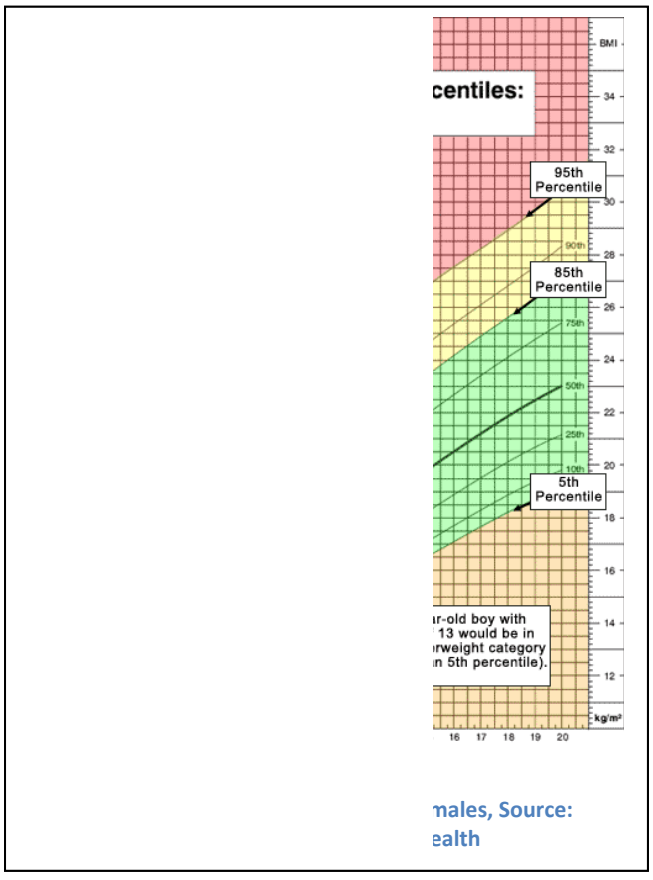
between 1976-1980 and 2007-2008 and from 6.5 to 19.6% among 6-11 year olds. Among adolescents aged 12-19, obesity increased from 5 to 18.1% during the same period. (Center For Disease Control, 2011).

Obesity and Its Effects on Health

Many studies have been published on the negative health effects of being overweight and obese. When children have lifestyles which involve high-calorie diets and inadequate exercise, it becomes more difficult for the pancreatic islet cells to secrete insulin, and as a result, children who are overweight or obese develop what is typically referred to as insulin resistance. Overweight and Obese children that develop insulin resistance are typically susceptible to chronic diseases such as type 2 diabetes, cardiovascular disease, hypertension, and high cholesterol. (Fox, 2004) (Freedman, 1999). Figure 2 shows the correlation between obesity rates in US counties and the rate of diabetes. (Center for Disease Control, 2011)

The Cost of Childhood Obesity

The costs linked to obesity have been widely documented. It is estimated that by 2018, Adult obesity will account for 21% of healthcare spending, and cost the United States about $344 Billion dollars annually. (Hellmich, 2009) (United Health Foundation, APHA, PP, 2009)



What is the clinical definition of Obesity?

How do we define obesity? Obesity is determined by calculating an individual's Body Mass Index, or BMI. A BMI is determined using three factors; Age, height, and weight. The height and weight can be used to determine a person's density using the following equation: $$BMI = \frac{\text{mass (kg)}}{(\text{height(m)})^2}$$

This BMI calculation, which is typically a number that falls in between 10 and 35, is then used with a gender-specific child BMI chart.

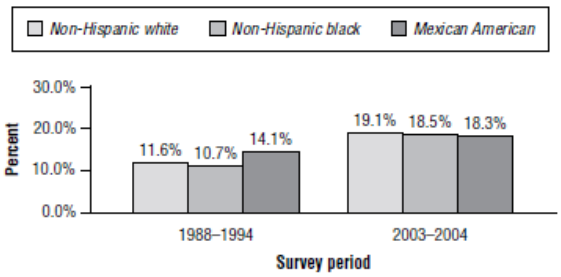
Obesity in children can be defined as any child who exceeds a BMI of 95%. Children are classified as being overweight if their BMI lies between 85% - 95%. Figure 3 shows a BMI chart for adolescent males between the ages of 2 and 20.

Factors Affecting Childhood Obesity

Childhood Obesity has been a growing concern among parents, school administrators, and healthcare professionals in the recent decade. Many papers have discussed the factors which may play a role in causing childhood obesity. We will discuss them below.

Race & Genetics

A lot of data collected by researchers shows that there are strong correlations between race and childhood obesity. Studies have shown that in the largest increase in childhood obesity between 1998 and 2005 came from non-Hispanic whites and African Americans, whereas the smallest increase came from Mexican-American teens (See figure 4a), (Wexler, 2008). Another study conducted by the University of Virginia (using data gleaned from a National Health and Nutrition Survey) revealed the strong link between race and obesity. According to the study, the latest data from the National Health and Nutrition Evaluation Survey 2007–2008 reveal rates of adolescent females (12–19 years old) who are either overweight/obese or frankly obese are 46.3/29.2% in non-Hispanic blacks and 42.1/17.5% in Hispanic females, compared with 29.9/14.5% in non-Hispanic white females. The ethnic differences in BMI elevations less apparent in adolescent males, although there is a trend toward increased rates among Hispanic adolescent males, with overweight/obesity and



Prevalence of teenaged boys who are overweight by race/ethnicity, 1988–94 and 2003–04

Note: Sex- and age-specific body mass index (BMI) >= 95th percentile based on the Centers for Disease Control and Prevention (CDC) growth charts.

SOURCE: "Adolescent Boys: Prevalence of Overweight by Race/Ethnicity (Aged 12–19 Years)—National Health and Nutrition Examination Surveys," in *Overweight Prevalence*, Centers for Disease Control and Prevention, Division of Nutrition, Physical Activity, and Obesity, National Center for Chronic Disease Prevention and Health Promotion, May 22, 2007, http://www.cdc.gov/nccdphp/dnpa/obesity/childhood/prevalence.htm (accessed October 10, 2007)

Figure 4a - Link between Ethnicity and Overweight Teenage Boys (Wexler, 2008)

obesity rates of 42.7/25.5% in Hispanics, compared with 33/19.8% among non-Hispanic blacks and 32.6/16.7% in non-Hispanic white adolescent males. (DeBour, 2011)

In addition, children from African American and Hispanic households have higher incidences of childhood obesity than children from non-Hispanic white backgrounds (see figure 4b). (DeBour, 2011)

Table 1. Ethnic differences in incidence of Type 2 diabetes.

Ethnic group	Incidence rate in each age group (95% CI)	
	10–14 years old	*15–19 years old*
Non-Hispanic white	3.0 (2.3–4.0)	5.6 (4.5–6.9)
African–American	22.3 (18.1–27.5)	19.4 (15.3–24.5)
Hispanic	8.9 (6.4–12.3)	17.0 (13.3–21.8)

The table shows incidence rates (and confidence intervals) of diabetes (2002–2003) per 100,000 person-years by age group and race/ethnicity.
Adapted with permission from [9].

Figure 4b - The Correlation between Race and Prevalence of Type 2 Diabetes amongst 10-19 year olds. (DeBour, 2011)

Income

Another factory typically cited as a cause of childhood obesity is that poorer families lack a substantial income to maintain a proper diet. Studies have shown that there is a positive correlation between neighborhoods with low income and higher rates of obesity (Black, 2008) (Jason P. Block, 2004). Typically, the cause of this is that foods which are higher in nutritional value (such as fruits, vegetables, and whole grains) tend to be more expensive per calorie than fatty laden processed foods, leading families to choose meals which focus more on high caloric intake, rather than nutritional value. (Judy Putnam, 2002)

Fast Food Density

The rise of the fast food restaurant industry has also been blamed for the increase in childhood and adult obesity. Studies have shown that Fast-food restaurant density and a higher ratio of fast-food to full-service restaurants are associated with an individual having a higher probability of being obese. In contrast, areas with a higher density of full-service restaurants (i.e. Restaurants with "table service") are typically associated with individuals who have lower BMI's. (Mheta, 2008) (Li, 2009) (Jason P. Block, 2004)

Open Park Space

Another argument researchers have made for the rise in childhood obesity is limited access to parks. Parks access plays a large role in how much exercise a child obtains. Studies have shown that neighborhoods which have lower park densities also have higher rates of childhood obesity. (Michele D. Kipke, 2007) (Babey, 2005)

Exercise

Studies have shown that 150 minutes of exercise per week for Elementary students and 225 minutes per week for middle/high school students is "optimal". 30 minutes a day for all students is "adequate", with 60 minutes per day being "ideal" (American Heart Association, 2009). A trend appears to be developing amongst youth as well with regards to physical inactivity. One study discusses how Physical inactivity has risen amongst California youth, leading to an increase in obesity". "[A national decline] in daily participation in physical education classes has dropped significantly in recent years from 41.6% in 1991 to 28.4% in 2003. Increased emphasis on academic testing has resulted in reductions in recess and school-based physical education. (Babey, 2005)

Methodology

Massachusetts as a Model

In order to effectively determine some of the factors which contribute to childhood obesity, we must narrow our scope of obesity from a nationwide level to a state-specific level. We have chosen to focus on Childhood obesity in Massachusetts, as there is more statewide obesity data available for Massachusetts.

Massachusetts Obesity Study

One particularly interesting data set is a paper recently published by the Massachusetts Department of Health which measured obesity rates at public schools in 80 school districts within Massachusetts for 1st, 4th, 7th and 10th grade males and females. This study includes 109,674 students, which represent 38% of students enrolled in grades 1,4,7 and 10. Using a BMI index specific for children, the study calculated whether the student in a district is underweight (BMI<5%), normal, overweight (BMI>85%) or obese (BMI>95%). (Health, 2009). This study will be our measure of how obese the children are in each city in Massachusetts.

Income

Since obesity has been heavily correlated with household income and race, we have also compared this childhood obesity data to available U.S. Census 2000 data, to see if indeed race, household income and obesity tend to be correlated (United States Census Bureau, 2001). We will be using per capita income to determine how "wealth" is measured in a household. In addition, we will look at city specific unemployment rates as provided by the Massachusetts Labor and Workforce Development Center to measure how unemployment has changed from 2000-2011 (Massachusetts Labor and Workforce Development, 2011).

Fast Food Locations

We can also, using certain mapping tools, determine how other factors may be affecting obesity rates in these counties, such as the amount of fast food restaurants in the area. Fast Food is defined as restaurant with an emphasis on minimal table service, low cost, and fast serving time (Talwar, 2003). For simplicity we will be using restaurants with the largest market share, which is measured by the number of branch/franchise locations within the United States. Fast food chains with the biggest market share in the United States include Subway, McDonalds, Starbucks, Pizza Hut, Burger King, Dunkin Donuts, Wendy's, Taco Bell, Kentucky Fried Chicken, and Dominoes. (EZLocal Business Search Engine, 2010)

Park Density

Using Google mapping tools, we can determine how many parks are located within city limits for each district in the childhood obesity study. Parks are defined as any parcel of land that is either

a) Defined by the city as a "park" and receives funds & appropriations from the city as such

b) Parcel administered by the U.S. Fish & Wildlife service and reserves federal funds

c) Parcel administered by the US Forest Service or

d) Parcel of land administered by the US National Park Service (Google, 2011).

A Park is considered within a city if it resides within defined city limits or if said park is located directly adjacent to the city limits.

Health Education

When this paper discusses health education with regards to adolescents, we will primarily focus on two components of health which impact children and adolescents the most in a Public school setting. According to the Journal of American Medical Association, children spend at least 35 hours a week in school. As such, the JAMA has shown that the areas of health that are the most influential on grade K-12 children are District School Cafeteria standards and District Physical Education standards. (Carter, 2002).

Two School-district Comparison

Using our combined childhood obesity, census, fast food density, and park density data we can then determine if two school districts with similar socio-economic factors have significantly different obesity rates. This can help us determine why, city X, which has a similar household income and racial makeup to city Y, has a significantly different rate of childhood obesity.

Limitations of Study

Many limitations exist with this study. This study does not take into account Genetic factors which may contribute to variations in obesity rates within the cities, although when comparing cities racial makeup was used as a metric when comparing cities with "similar" socio-economic backgrounds. Other limitations include census data errors, non-reporting of school dropouts, and differences in schools due to students commuting between school districts.

Raw Data

First we compare childhood rates of obesity with racial makeup, household income, and per capita income. With this data we can see if there are two districts with similar racial-economic factors and significantly different rates of childhood obesity.

An important note is that some districts were excluded from this data set. This was either due to insufficient census data or data from the obesity study which combined two or more districts due to small size. Of particular interest are the city districts of Arlington and Newton, due to their similar population, park, and fast food densities, as well as their similar socio-economic conditions.

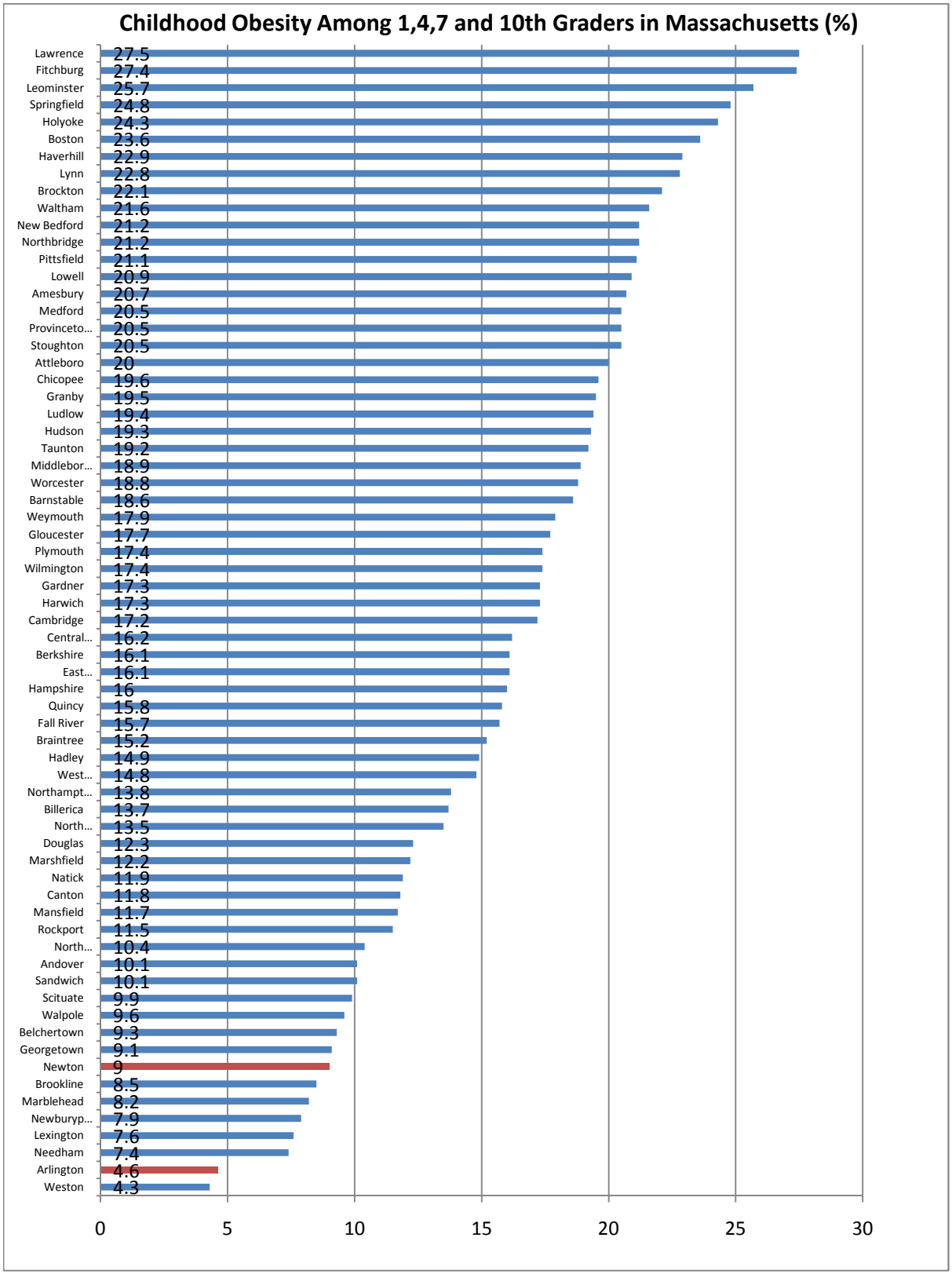


Figure 5 - Obesity Rate by City in MA, 2009, Source: Massachusetts Department of Health (Health, 2009)

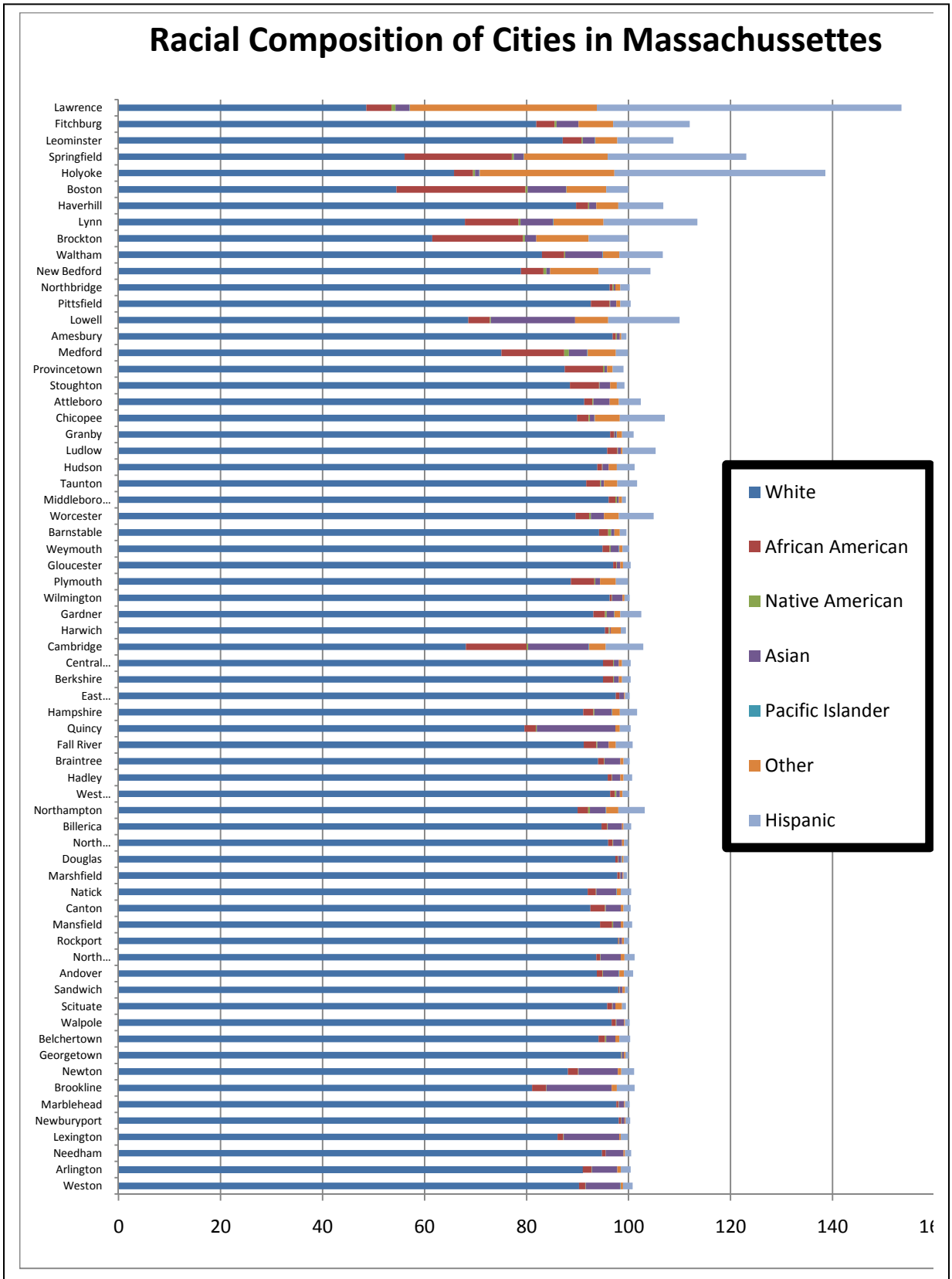


Figure 6 - Racial Composition by City in Massachusetts, Source: United States Census, 2000

City	Sample Size	% Obese & Overweight*	% Overweight	% Obese	Median Household Income**	Per Capita Income**	Pop.	% White	% Afr. Amer.	% Nat. Amer.	% Asian	% Pac. Isl.	% Other	% Hispanic
Weston	539	13	8.7	4.3	$153,918	$79,640	11469	90.3	1.20	0.1	6.8	0.1	0.4	
Arlington	1379	9.6	4.9	4.6	$64,344	$34,399	42389	91	1.70	0.1	5	0	0.7	
Needham	1437	19.2	11.8	7.4	$88,079	$44,549	28911	94.8	0.70	0	3.5	0	0.3	
Lexington	1862	21.6	14	7.6	$96,825	$46,119	30355	86.1	1.10	0.1	10.9	0	0.3	
Newburyport	645	24.7	16.7	7.9	$58,557	$34,187	17189	98.1	0.40	0.1	0.6	0	0.2	
Marblehead	1029	23.3	15.2	8.2	$73,698	$46,738	20377	97.6	0.40	0.10	1.00	0	0.2	
Brookline	1685	21.7	13.1	8.5	$66,711	$44,327	57107	81.1	2.70	0.1	12.8	0	1	
Newton	3235	23.1	14.1	9	$86,052	$45,708	83829	88.1	2.00	0.1	7.7	0	0.7	
Georgetown	461	29.1	20	9.1	$76,260	$28,846	7377	98.5	0.10	0.1	0.4	0	0.3	
Belchertown	816	28.9	19.6	9.3	$40,250	$18,485	2626	94.1	1.30	0.2	1.8	0	0.8	
Walpole	1145	27.8	18.2	9.6	$59,744	$29,669	5867	96.7	0.80	0.1	1.5	0	0.2	
Scituate	694	22.2	12.2	9.9	$62,392	$29,845	5068	95.8	1.00	0.1	0.5	0	1.3	
Sandwich	1091	23.6	13.6	10.1	$56,184	$30,817	3058	98	0.20	0.1	0.5	0	0.5	
Andover	1771	24.6	14.6	10.1	$60,040	$34,760	7900	93.8	1.10	0.1	3.1	0.1	0.9	
North Andover	1320	28	17.7	10.4	$72,728	$34,335	27202	93.7	0.70	0.1	4	0	0.7	
Rockport	295	27.1	15.6	11.5	$47,360	$29,506	5606	97.9	0.20	0.1	0.5	0	0.4	
Mansfield	1484	26.1	14.5	11.7	$51,082	$25,693	7320	94.4	2.40	0.2	1.5	0	0.5	
Canton	903	27.4	15.5	11.8	$69,260	$33,510	20775	92.5	2.90	0.1	3	0	0.5	
Natick	1265	28.4	16.5	11.9	$69,755	$26,538	32170	92	1.60	0.1	3.9	0.1	0.8	
Marshfield	1406	23.4	11.2	12.2	$60,037	$25,656	4246	97.8	0.50	0.1	0.4	0	0.2	
Douglas	487	26.5	14.2	12.3	$67,210	$23,036	7045	97.4	0.50	0.1	0.6	0.1	0.3	
North Attleborough	973	33	19.5	13.5	$59,371	$25,974	27143	96	0.90	0.1	1.7	0	0.4	
Billerica	1879	33.6	19.9	13.7	$67,799	$24,953	38981	94.7	1.10	0.1	2.8	0	0.3	
Northampton	798	29.1	15.3	13.8	$41,808	$24,022	28978	90	2.10	0.3	3.1	0.1	2.4	
West Bridgewater	344	36.3	21.5	14.8	$55,958	$23,701	6634	96.4	0.90	0.3	0.7	0	0.5	
Hadley	174	34.5	19.5	14.9	$51,851	$24,945	4793	95.9	0.80	0.1	1.6	0	0.6	
Braintree	1637	29.4	14.2	15.2	$61,822	$28,667	33698	94	1.20	0.1	3.1	0	0.6	
Fall River	2957	30.8	15.2	15.7	$29,014	$16,118	91938	91.2	2.50	0.2	2.2	0	1.4	
Quincy	2432	32.2	16.4	15.8	$47,121	$26,001	88025	79.6	2.20	0.2	15.4	0	0.9	
Hampshire	406	30	14	16	$46,098	$21,685	152251	91.1	2.00	0.2	3.4	0.1	1.5	
East Longmeadow	851	33.4	17.3	16.1	$62,680	$27,659	14100	97.5	0.70	0	0.9	0	0.2	
Berkshire	366	31.7	15.6	16.1	$39,047	$21,807	134953	95	2.00	0.1	1	0	0.6	
Central Berkshire	438	33.6	17.4	16.2	$39,047	$21,807	134953	95	2.00	0.1	1	0	0.6	
Cambridge	1236	33.3	16.1	17.2	$62,062	$43,624	101355	68.1	11.90	0.3	11.9	0.1	3.2	
Harwich	376	33.5	16.2	17.3	$41,552	$23,063	12386	95.4	0.70	0.2	0.2	0	2	
Gardner	750	32.1	14.8	17.3	$37,334	$18,624	20770	93.1	2.30	0.3	1.4	0.1	1.2	
Wilmington	1173	32.4	15	17.4	$70,652	$25,835	21363	96.3	0.40	0.1	2	0	0.4	
Plymouth	2610	35.5	18.2	17.4	$55,615	$24,789	472822	88.7	4.60	0.2	0.9	0	3.1	
Gloucester	915	31.8	14.1	17.7	$47,722	$25,595	30273	97	0.60	0.1	0.7	0	0.5	
Weymouth	1860	38.8	20.9	17.9	$51,665	$24,976	53988	94.9	1.40	0.2	1.6	0.1	0.6	
Barnstable	1576	38.4	19.8	18.6	$45,933	$25,318	222230	94.2	1.80	0.6	0.6	0	1.1	
Worcester	2806	36.2	17.4	18.8	$47,874	$22,983	750963	89.6	2.70	0.3	2.6	0	2.9	
Middleborough	824	37.7	18.8	18.9	$52,755	$20,246	19941	96.1	1.30	0.3	0.4	0	0.6	
Taunton	2515	38.5	19.2	19.2	$42,932	$19,899	55976	91.7	2.70	0.2	0.6	0	2.6	
Hudson	601	35.1	15.8	19.3	$55,053	$25,167	14388	93.9	0.90	0.1	1.2	0	1.6	
Ludlow	954	37.9	18.6	19.4	$55,717	$20,105	21209	95.8	2.00	0.1	0.6	0	0.3	
Granby	339	38.9	19.5	19.5	$51,250	$21,631	1344	96.4	0.70	0.1	0.4	0.1	1	
Chicopee	2139	40.3	20.8	19.6	$35,672	$18,646	54563	89.9	2.30	0.2	0.9	0.1	4.9	
Attleboro	825	37.5	17.5	20	$50,807	$22,660	42060	91.3	1.60	0.2	3.2	0	1.8	
Stoughton	1198	38.7	18.2	20.5	$57,838	$25,480	27149	88.5	5.70	0.1	2.1	0	1.3	
Provincetown	44	34.1	13.6	20.5	$32,731	$26,878	3192	87.5	7.50	0.3	0.5	0	1.1	
Medford	967	38.5	18	20.5	$52,476	$24,707	55765	75.1	12.30	0.90	3.6	0.1	5.5	
Amesbury	781	35.2	14.5	20.7	$50,037	$22,657	12327	96.9	0.60	0.2	0.6	0	0.3	
Lowell	2995	37.6	16.7	20.9	$39,142	$17,557	105167	68.6	4.20	0.2	16.5	0	6.5	
Pittsfield	318	34	12.9	21.1	$35,655	$20,549	45793	92.6	3.70	0.1	1.2	0	0.8	
Northbridge	353	35.7	14.4	21.2	$50,457	$22,515	13182	96.3	0.60	0.2	0.3	0	1	
New Bedford	3457	37.2	15.9	21.2	$27,569	$15,602	93768	78.9	4.40	0.6	0.7	0	9.5	
Waltham	1385	40.1	18.6	21.6	$54,010	$26,364	59226	83	4.40	0.2	7.3	0.1	3.2	
Brockton	4230	40.3	18.1	22.1	$39,507	$17,163	94304	61.5	17.80	0.4	2.2	0	10.3	
Lynn	2572	39.9	17.1	22.8	$37,364	$17,492	89050	67.9	10.5	0.40	6.4	0.1	9.8	
Haverhill	2113	40.7	17.7	22.9	$49,833	$23,280	58969	89.7	2.40	0.2	1.4	0	4.3	
Boston	9841	44.1	20	23.6	$39,629	$23,353	589141	54.5	25.30	0.4	7.5	0.1	7.8	
Holyoke	1063	45	20.7	24.3	$30,441	$15,913	39838	65.8	3.70	0.4	0.8	0.1	26.4	
Springfield	4964	43.6	18.8	24.8	$30,417	$15,232	152082	56.10	21	0.4	1.9	0.1	16.4	
Leominster	1823	42	16.3	25.7	$44,893	$21,769	41303	87.1	3.70	0.2	2.4	0.1	4.3	
Fitchburg	1417	46.2	18.8	27.4	$37,004	$17,256	39102	81.9	3.60	0.4	4.3	0	6.8	
Lawrence	2564	46.6	19.1	27.5	$27,983	$13,360	72043	48.6	4.90	0.8	2.7	0.1	36.7	
Total	109674													
Average of Data Set		34.30	16.90	17.30	$54,084.82	$26,626.72	69721.87	88.64	3.23	0.21	2.96	0.03	3.00	5.2
Standard Deviation		7.54	3.00	5.58	$19,201.05	$10,189.58	126908.82	11.53	4.72	0.17	3.58	0.05	5.94	9.4

Figure 7 - Per Capita Income, Race, and Childhood Obesity Rate by City, Source: US 2000 Census, Massachusetts Department of Public Health (Health, 2009)

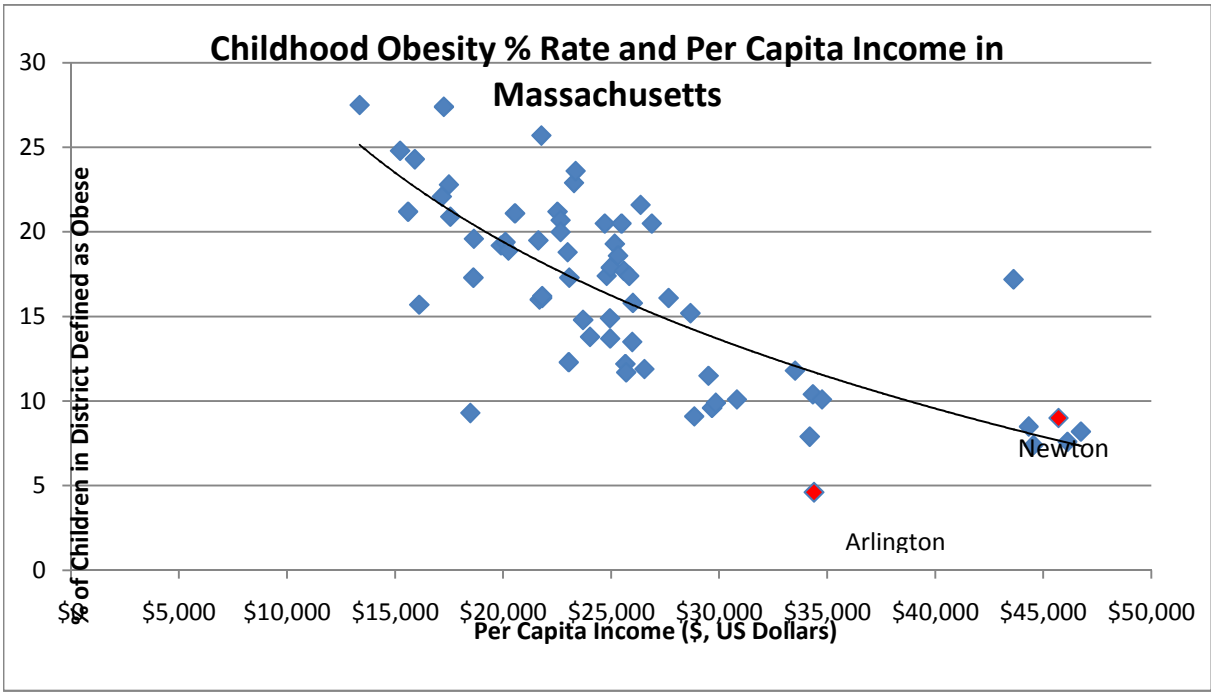


Figure 5 - Per Capita Income vs. % Of Children reported as Obese, Souce: Massachusetts Childhood Obesity Study, US Census Data 2000 (Health, 2009)

REGRESSION OUTPUT

Regression Data for Complete Childhood Obesity Data set

Note: Weston was excluded due to its unusually high per capita income (i.e. Outlier)

Regression Statistics	
Multiple R	0.718683552
R Square	0.516506047
Adjusted R Square	0.508951454
Standard Error	3.800973591
Observations	66

	Lower 95%	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Standard Error	25.95385332	32.43055963	25.95385332	32.43055963
Observations	-0.000617022	0.000376889	-0.00061702	-0.000376889

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	987.7659301	987.7659301	68.36980451	1.08435E-11
Residual	64	924.6336154	14.44740024		
Total	65	1912.399545			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	29.19220648	1.621016711	18.00857837	9.52923E-27
X Variable 1	-0.000496955	6.01015E-05	-8.268603541	1.08435E-11

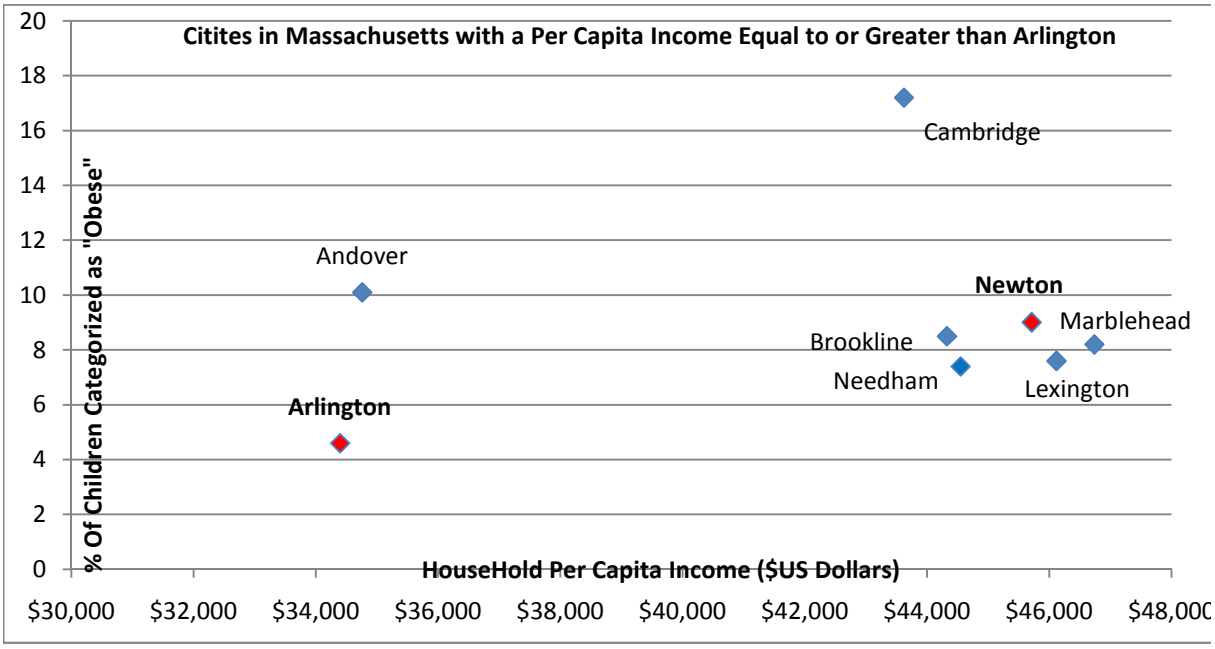


Figure 9 - Cities in MA with a Per Capita Income Equal to or Greater than Arlington, Souce: Massachusetts Childhood Obesity Study, US Census Data 2000 (Health, 2009)

REGRESSION OUTPUT

Regression Data for cities in Massachusetts that have per capita income's equal to or greater than Arlington

Note: Weston was excluded due to its unusually high per capita income (i.e. Outlier)

Regression Statistics	
Multiple R	0.185098506
R Square	0.034261457
Adjusted R Square	-0.126694967
Standard Error	3.872610849
Observations	8

Upper 95%	*Lower 95.0%*	*Upper 95.0%*
33.93085527	-27.2465659	33.93085527
0.000849735	-0.00058013	0.000849735

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	3.192311254	3.192311254	0.212861694	0.660786003
Residual	6	89.98268875	14.99711479		
Total	7	93.175			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	3.342144691	12.50094504	0.267351363	0.798150959	-27.24656588
X Variable 1	0.000134802	0.000292178	0.461369368	0.660786003	-0.000580132

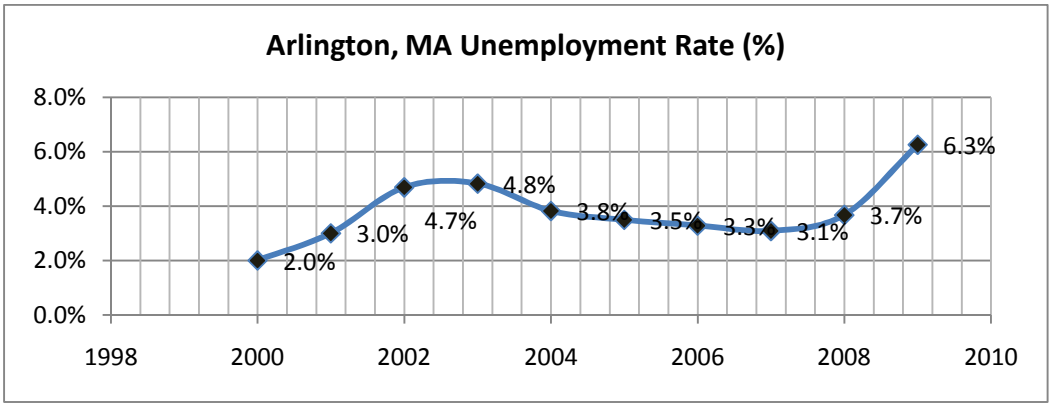


Figure 10 - Arlington Unemployment Rate, Massachusetts Workforce & Development (Massachusetts Labor and Workforce Development, 2011)

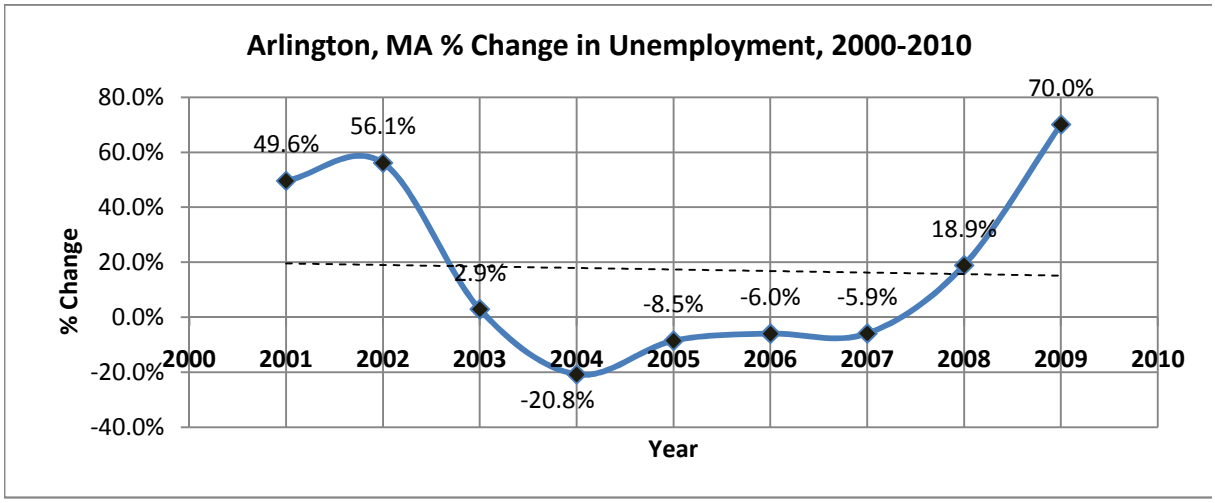


Figure 11 - Arlington Change in Unemployment, 200-2010, Massachusetts Workforce & Development (Massachusetts Labor and Workforce Development, 2011)

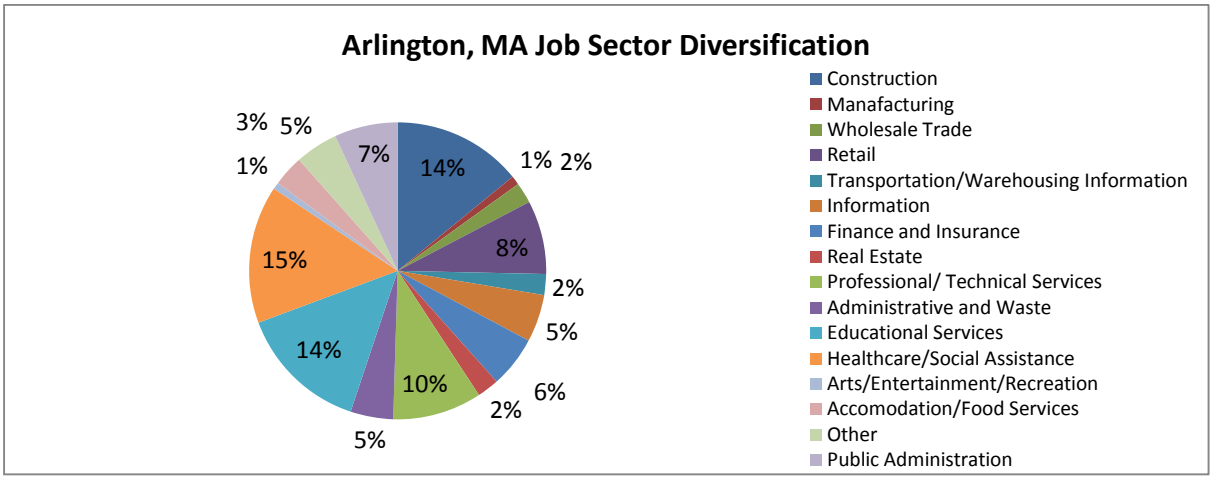


Figure 12 - Arlington Job Diversification, 2010, Massachusetts Workforce Development (Massachusetts Labor and Workforce Development, 2011)

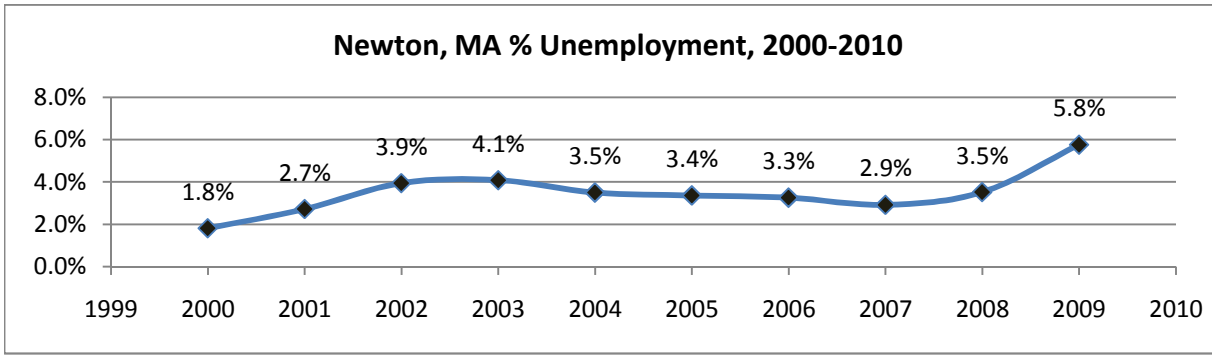


Figure 13 - Newton % Unemployment, 2000-2010, Massachusetts Workforce Development (Massachusetts Labor and Workforce Development, 2011)

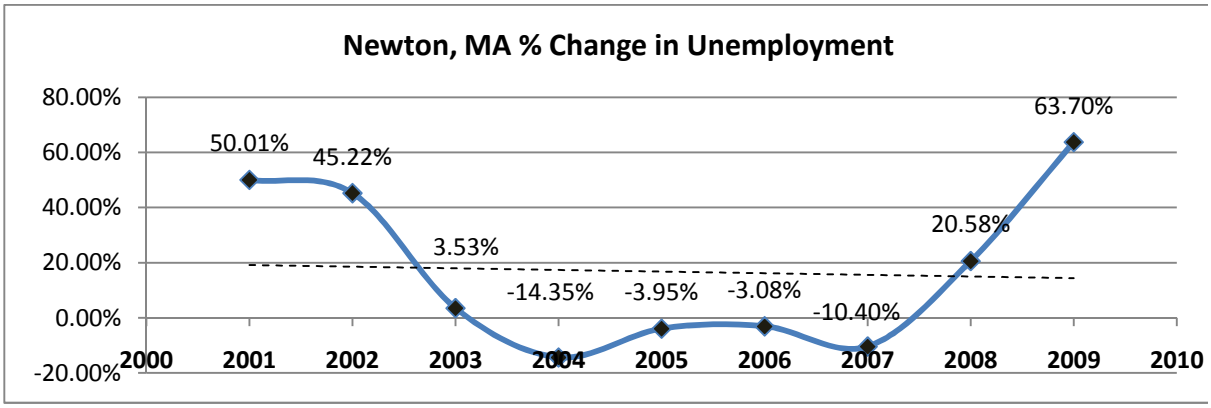


Figure 14 - Newton, MA Change in Unemployment, 2000-2010, Massachusetts Workforce Development (Massachusetts Labor and Workforce Development, 2011)

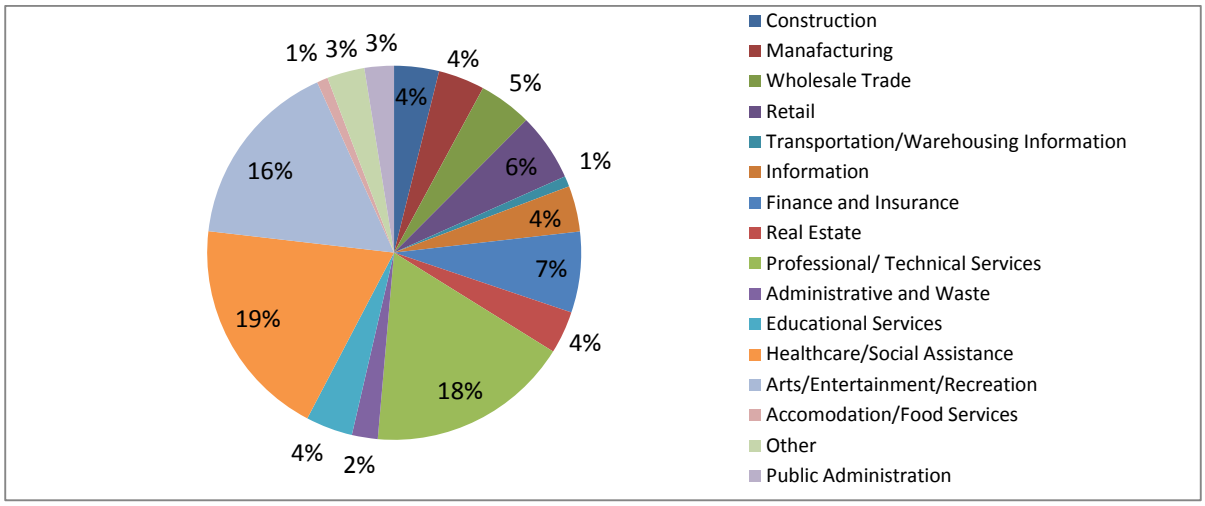


Figure 15 - Newton, MA Sector Diversification, 2010, Massachusetts Workforce Development (Massachusetts Labor and Workforce Development, 2011)

City of Newton	
Zip Codes: 02458, 02459, 02460, 02461, 02462, 02464, 02465, 02467, 02468, 02495	
City Size (square miles)	18.2
Population (2008)	82139
Population Density (2008) p.p.s.m.	4513
Fast Food Restaurants	**Qty**
Subway	2
McDonalds	2
Starbucks	5
Pizza Hut	0
Burger King	0
Dunkin Donuts	5
Wendy's	0
Taco Bell	1
KFC	1
Domino's	0
Total Fast Food Chains	14
Fast Food Chains per Square Mile	0.8
People per Fast Food Chain	5867.1
City Parks	42
City Parks per square mile	3.68
People per Park	1226

Figure 16 - Population, Park, and Fast Food Density in Newton, MA, 2008, Source: Google Earth, Population Data from Massachusetts Workforce & Development Data (Massachusetts Labor and Workforce Development, 2011)

City of Arlington	
Zip Codes: 02474-02476	
City Size (Square Miles)	5.5
Population (2008)	40993
Population Density (2008) p.p.s.m.	7453
Fast Food Restaurants	**Qty**
Subway	0
McDonalds	0
Starbucks	1
Pizza Hut	0
Burger King	0
Dunkin Donuts	4
Wendy's	0
Taco Bell	0
KFC	0
Domino's	0
Total Fast Food Chains	5
Fast Food Chains per Square Mile	0.9
People per Fast Food Chain	8199
City Parks	20
City Parks per Square Mile	3.64
People per Park	2050

Figure 17 - Population, Park, and Fast Food Density in Arlington, MA, 2008, Source: Google Earth, Population Data from Massachusetts Workforce & Development Data (Massachusetts Labor and Workforce Development, 2011)

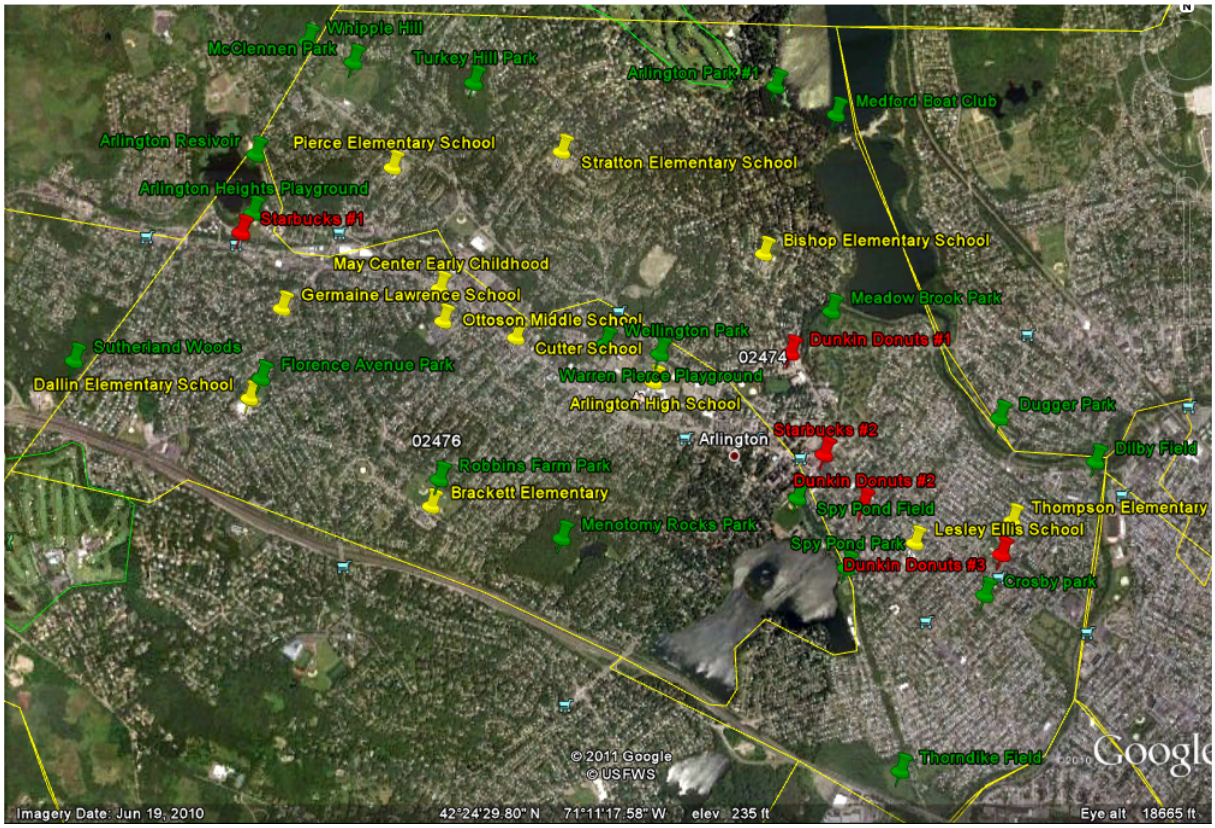


Figure 18 - Map of Arlington, MA Parks, Fast Food Chains, and Local Public Schools

Legend
Yellow Marker = Public School
Green Marker = Park
Red Marker = Fast Food Chain (As defined in our Methodology section)
All data is accurate as of March 2011; Country Clubs were excluded from being labeled as "parks" since they are not necessarily accessible by all of the public. City Borders Outlined in Yellow.

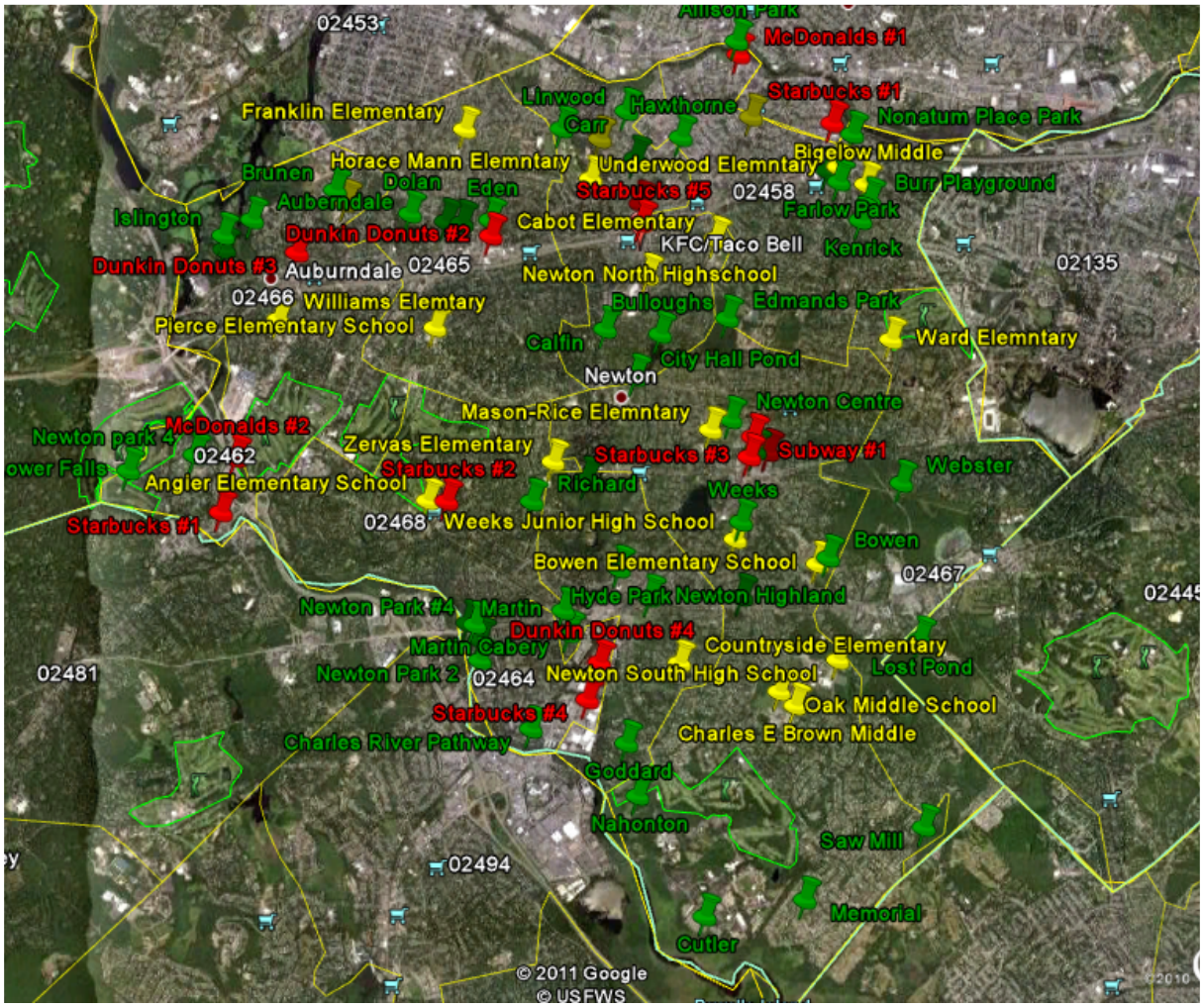


Figure 19 - Map of Newton, MA Parks, Fast Food Chains, and Public Schools.

Legend
Yellow Marker = Public School
Green Marker = Park
Red Marker = Fast Food Chain (As defined in our Methodology section)
All data is accurate as of March 2011; Country Clubs were excluded from being labeled as "parks" since they are not necessarily accessible by all of the public. City Borders Outlined in Yellow.

Physical Education Standards for Newton & Arlington

Physical Education standards also play a role in how much exercise students receive and how obese they may be. However, both Arlington and Newton school districts follow Massachusetts standards with regards to physical education. Massachusetts state education standards are outlined below. (NASPE & AHA, 2010) (Arlington School District, 2011) (Newton Public School District, 2006)

State of Massachusetts Physical Education Standards

Amount of Required Physical Education: Massachusetts mandates physical education in grades K-12, but it does not require daily recess in elementary school. The state requires high schools to provide students with physical education. Compliance with physical education law is monitored during the coordinated program review that is conducted with all school districts on a rotating basis every six years. A school that does not require physical education in every grade is required to develop corrective action plans.
High School Graduation Requirements: State law does not specify the number of physical education credits required for graduation.
Substitutions: The state permits school districts or schools to allow students to substitute other activities for their required physical education credit. Local school officials have discretion to determine whether and how a student, particularly at the high school level, may meet the physical education requirement through an organized program of instructed physical activity. This discretion is similar to the authority of school officials to permit students to fulfill the requirements of an academic course by taking a course elsewhere that the officials deem to be equivalent.
Substitutions: Exemptions/Waivers: Individual school districts may grant waivers or exemptions.
State Standards: The state has developed its own standards for physical education. The Massachusetts Comprehensive Health Curriculum Framework was last revised in 1999. [See State Standards for Physical Education chart for details.]
State Curriculum: The state does not require the use of specific curricula for elementary, middle school/junior high or high school physical education. Local school districts decide their own physical education curricula, which may include commercial curricula.
Class Size: The state does not mandate a teacher-to-student ratio comparable to other curricular areas
Online Physical Education Courses: The use of online physical education courses is up to individual school districts.
State Comprehensive Assessment Test: The state does not have a required comprehensive assessment test for graduation that includes physical education.
Fitness Testing: The state does not require the use of a particular fitness test protocol.
State Comprehensive Assessment Test: The state does not have a comprehensive assessment test for graduation.
Education Report Card: The state has an education report card for each school, but physical education is not included as one of the subject areas.

Body Mass Index (BMI): The state has a newly-adopted policy which requires collection of students' BMI or height and weight in grades 1, 4, 7 and 10. BMI data will be reported directly and confidentially to a parent or legal guardian, and without identifiers to the Massachusetts Department of Public Health. These requirements shall be met by June 30, 2010, by public school systems receiving direct funding from the department for school nursing services, and by June 30, 2011, by all other public schools.
Certification/Licensure of Physical Education Teachers: The state requires certification or licensure of physical education teachers at the elementary, middle school/junior high and high school levels. Elementary classroom teachers (generalists) may teach required elementary school physical education classes, as they are tested in the licensure exam for the content area of physical education.
Professional Development of Physical Education Teachers: There is a requirement for professional development continuing education hours or credits for maintaining licensure.
National Board Certification (NBC): The state does not actively encourage physical education teachers to become certified through the NBC process.

District Physical Education Coordinator: The state does not require each school district to have a licensed physical educator serving as a PE coordinator.

Cafeteria Offerings for Arlington & Newton

Both Arlington & Newton take similar approaches with regards to setting school food standards. However, Newton and Arlington pursue different strategies with regards to food purchasing. While Newton has used private vendors to handle food purchasing, Arlington is a member of a Group Purchasing Organization which helps it buy in volume. (Newton Public Schools, 2010) (Ramsey, 2011).

Newton Public School Offerings Standards

Four component breakfast:
Protein - 1ounce
Fruit /vegetable - ½ cup
Grains - 1 slice
Milk - 8 ounces

Five component lunch:
Protein -
- 2 ounces for elementary
- 3 ounces for secondary

Grains - 8 servings a week
Fruit - ¾ cup
Vegetable - ¾ cup
Milk - 8 ounces

Offer vs. Serve: Allows students to select a minimum of three out of four components at breakfast and three out of five at lunch.

Source: Newton Public Schools (Newton Public Schools, 2011)

Arlington Public School Offering Standards

1) ensure that the school breakfast and lunch programs meet or exceed all dietary guidelines for the National School Lunch and Breakfast Programs.

2) encourage the Food Service Director to seek to offer attractive appetizing healthy meals that are low in sugar, saturated fat, *trans* fat, and salt, and high in fruits, low-fat dairy, vegetables and whole grains.

3) for all foods and beverages sold or provided on school property, other than the school breakfast and lunch programs, direct principals to work with school councils, school food service, teachers, and parents to encourage food and beverages choices that conform to the "Massachusetts A La Carte Food & Beverage Standards to Promote a Healthier School Environment."

Source: Arlington Nutrition and Wellness Policy, (Arlington Public Schools, 2006)

Despite differences in purchasing and offerings, Arlington and Newton are still subject to meeting federal guidelines with regards to breakfast and lunch nutrition standards, listed in the figure below (See Figure 20).

Table 3: Summary of Proposed Meal Requirements[14]

Meal Pattern	Breakfast			Lunch		
	Grades K-5	Grades 6-8	Grades 9-12	Grades K-5	Grades 6-8	Grades 9-12
	Amount of Food[a] Per Week (Minimum Per Day)					
Fruits (cups)[b]	5 (1)	5 (1)	5 (1)	2.5 (0.5)	2.5 (0.5)	5 (1)
Vegetables (cups)[bc]	0	0	0	3.75 (0.75)	3.75 (0.75)	5 (1)
Dark green	0	0	0	0.5[d]	0.5[d]	0.5[d]
Orange	0	0	0	0.5[d]	0.5[d]	0.5[d]
Legumes	0	0	0	0.5[d]	0.5[d]	0.5[d]
Starchy	0	0	0	1	1	1
Other	0	0	0	1.25[d]	1.25[d]	2.5[d]
Grains[e] (oz eq)	7-10 (1)	8-10 (1)	9-10 (1)	9-10 (1)	9-10 (1)	12-13 (2)
Meats/Meat Alternates (oz eq)	5 (1)	5 (1)	7-10 (1)	8-10 (1)	9-10 (1)	10-12 (2)
Milk[f] (cups)	5 (1)	5 (1)	5 (1)	5 (1)	5 (1)	5 (1)
Other Specifications: Daily Amount Based on the Average for a 5-Day Week						
Min-max calories (kcal)[gh]	350-500	400-550	450-600	550-650	600-700	750-850
Saturated fat (% of total calories) g	< 10	< 10	< 10	< 10	< 10	< 10
Sodium (mg)[i]	≤ 430	≤ 470	≤ 500	≤ 640	≤ 710	≤ 740
Trans fat	Nutrition label must specify zero grams of trans fat per serving.					

Figure 20 - Federal School Breakfast and Lunch Guidelines, Department of Agriculture (Agriculture, 2011)

Interview with Food Service Director, Arlington

Interview with Denise Hunt Boucher
Food Service Director, Town of Arlington
896 Mass Ave, Arlington, MA 02476
Tel – 781-316-3643, Fax – 781-316-3644
Date: Friday April 8th, 2011, Approximately 2:30-3pm

Q: How has Arlington managed such a low rate of obesity? What plays the biggest role?

A: Factors cited include "Parent involvement". Arlington parents take a more active role in student health than most other schools that Mrs. Boucher worked at, and parents pushed (along with administration) for an "online tracking" toolset. In addition, there is an emphasis on "Outdoor time" as well as a low rate of bussing within the Arlington school district. "Most kids walk to and from school". Snacks are also not typically offered in elementary and middle schools, despite the fact that they can generate extra revenue. High schools however, do have vending machines/snacks. Mynutrikids.com (Arlington Website which tracks child eating habits) is also used "by over 50% of the parents whose children are enrolled". All Arlington high schools, middle schools and half of the elementary schools (4) are enrolled in Mynutrikids.com. Mrs. Boucher also stated that about "50% of the children in the Arlington district" are enrolled in Mynutrikids.com

Q: Are there any other districts that use online food tracking tools?

A: Andover, Redding, Belmont, Concord, and Lexington all use online tracking tools.

Q: What exactly is Mynutrikids.com?
A: Website that allows parents to track meals consumed by students. However, while calories are tracked for some foods, not all foods can track Caloric info due to the fact that there are a myriad of vendors which provide food to the Arlington school district. In October of 2011, Arlington will change to 1 vendor, which will allow the district to track caloric info more accurately.

The Website is designed to track what a child has eaten in the course of four weeks, however Mrs. Boucher has fielded requests by some parents to print out what a student has eaten over an entire academic school year (September through June). Limitations to the website include cafeteria workers not inputting the specific meal the child has eaten (i.e. at the register inputting "meal" rather than "Hamburger with Fries")

Q: How was Mynutrikids.com implemented? Was it a mandated change?

A: Arlington, as well as the other districts in Massachusetts that implemented web-tracking tools, were not mandated by the state to do so. Every district that implemented it did so to reduce the need for manual tracking of how much a student spends (which is very cumbersome and laborious on the schools part). With mynutrikids.com, Arlington simply has a student present their student ID number, and the meal is automatically "debited" from their account. In the past, Arlington implemented a manual system which required someone to manually subtract a meals cost from a student's account. Essentially, online meal tracking was implemented by the schools independently to reduce school workload.

Q: What has been the reaction from parents?

A: Overwhelmingly positive. Many parents use the online tracking tool (~50% of currently enrolled students are enrolled in the program, and 50% of those students have parents that "regularly" check mynutrikids.com). Therefore, roughly 25% of children in the Arlington school district are enrolled and have parents that "regularly check" their child's eating pattern.

Interview with Director of Food & Nutrition in Newton: In Progress

Two City Comparison

First we want to use Arlington as a basis of comparison and see if there are similar cities which have a similar or greater per capita income, and b) a similar population density and ethnic makeup. Marblehead, Lexington, Needham, Brookline, Cambridge, Andover, and Newton were considered due to the fact that they all had households with per-capita incomes similar or higher to that of Arlington (eliminating counties which have higher obesity rates and lower-per-capita incomes). After careful analysis using population, ethnicity, and per capita income as metrics, the city of Newton most closely resembles the demographics of Arlington. Arlington and Newton have similar racial demographics (with over 88% of residents self-identifying as "white"), similar per-capita incomes, similar park densities and similar fast food densities.

When we look at the data for Arlington and Newton, we see a couple of interesting things with regards to Childhood obesity. First and foremost, Arlington has an obesity rate of 4.6% versus 9% for Newton. In addition, Newton has a substantially larger number of students defined as "overweight" at 14.1%, versus 4.9% for Newton. Note that thought the sample sizes are different, each sample represents at least 70% of the students in grades 1, 4, 7 and 10. (Health, 2009)

School District	Sample Size (n)	% Overweight	% Obese
Arlington	1379	4.90%	4.60%
Newton	3235	14.10%	9.00%
% Difference		-9.20%	-4.40%

Table 1 - Percentage of Overweight & Obese Children in Arlington & Newton (Health, 2009)

When looking at the typical metrics used to explain childhood obesity however, the two cities are remarkably similar. When looking at ethnicities, the city of Arlington, the racial demographics are as follows;

City Name	Population	White	African American	Native American	Asian	Pacific Islander	Other	Hispanic
Arlington	42389	91.00%	1.70%	0.10%	5.00%	0.00%	0.70%	1.90%
Newton	83829	88.10%	0.20%	0.10%	7.70%	0.00%	0.70%	2.50%
% Change		2.90%	1.50%	0.00%	-2.70%	0.00%	0.00%	-0.60%

Table 2 - Population Demographics of Arlington & Newton, Source: US Census 2000 (United States Census Bureau, 2001)

The biggest racial deviation comes from the Asian demographic, which typically has not been associated with increasing rates of childhood obesity (DeBour, 2011). Looking at Per Capita Income Data, Newton actually has a higher Per Capita Income of $45,708 and household income of $86,052 versus Arlington, which has a Per Capita Income of $34,499 per year and a household income of $64,344 (United States Census Bureau, 2001). In addition, Newton historically has a lower historical rate of unemployment compared to Arlington (Massachusetts Labor and Workforce Development, 2011). Studies have shown that neighborhoods with less income should have a lower rate of obesity (Jason P. Block, 2004), whereas the data suggests that the opposite is occurring. Newton, despite its similar racial makeup and higher per-capita income, has a larger childhood obesity & overweight rate.

Fast Food densities within the cities of Arlington and Newton also provide some interesting insight. Newton, has more fast food chains than Arlington, however when looking at the density of Fast food chains, both cities are remarkably similar, with Newton containing 0.8 Fast food chains per square mile, while Arlington has 0.9 Fast food chains per square mile. However when looking at fast food chains per person, Newton has 5857 citizens per fast food chain, whereas Arlington has 8199 citizens per fast food chain.

Both Newton and Arlington also have very similar park densities. Arlington has a slightly lower density of parks within its city limits (3.64 city parks per square mile), whereas the city of Newton contains 3.68 city parks per square mile. However, when looking at city population, Arlington only has 1 park per 2050 citizens, while Newton has approximately 1 park per 1226 people.

Hypothesis

The reason that Arlington has such an incredibly low rate of obesity compared to Newton despite having similar socio-economic, park density, fast food chain density, and district policies with regards to physical education and cafeteria food standards is due to Arlington's ability to use internet based "consumption tracking" tools.

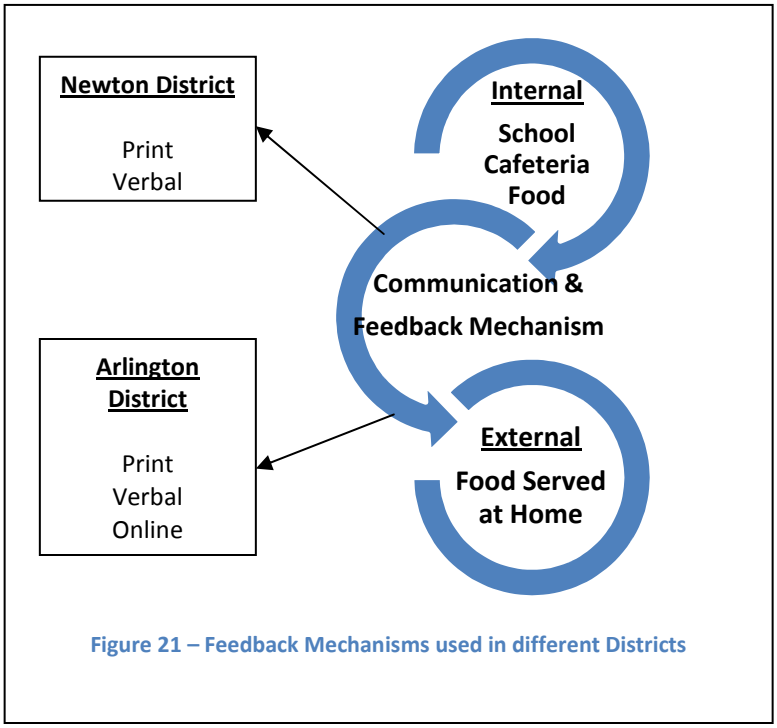


Figure 21 – Feedback Mechanisms used in different Districts

Studies have shown that internet delivered feedback mechanisms may help people suffering from obesity through self-monitoring and individualized feedback and support. (Saperstein, 2007)

The online tools that the Arlington school district implements with regards to food intake contains several traits mentioned in the aforementioned study, including a) a self-monitoring method b) individualized feedback, and c)a support system with recipes and USDA listed guidelines. Arlington's online tools (specifically, Mynutrikids.com) allows a parent to track their child's food intake over a long period of time (Typically 30 days, However up to 9 months if requested through the Arlington Food Service Director), is dynamic and therefore can be updated as last minute changes are made to meal offerings, and allows the parent to see how school provided cafeteria food options measure up to USDA standards with regards to caloric intake and nutritional value. (MyNutriKids, 2011), (Boucher, 2011)

Listed below is a list of the different communication and feedback mechanisms that each school uses to communicate children's on campus food consumption to parents (See table below).

Communication & Feedback Mechanism	Positives	Negatives
Print (Utilized by Arlington & Newton)	1) Easily Distributable 2) Tangible form of Info 3) Can be accessed Online (PDF) from both Arlington and Newton websites 4) Relatively cheap to implement	1) Static Metric (Printed in advance, can't adjust to last minute food changes) 2) No caloric or nutritional metrics listed. 3) Does not measure how intake relates to USDA Guidelines 4) Lists choices that a child has on a particular day, but does not list what child chose
Verbal (Utilized by Arlington & Newton)	1) Convenient 2) No cost to implement	1) Is subject to parental actually asking child 2) Not a written record, therefore is subject to parental memory recall ability 3) Does not measure caloric or USDA metrics 4) Can be miscommunicated to parent, either intentionally or not
Online (Utilized by Arlington)	1) Convenient 2) Easily accessible online 3) Measures on-campus intake of food dynamically (can account for changes in menu) 4) Uses metrics to allow parent and child to observe caloric intake and nutritional value of food regarding USDA Standards 5) Tracks meals eaten on campus for 4 weeks (up to 9 months if requested)	1) More expensive to implement than other options. 2) 1.75 "service fee" charged to parent every time money is put onto card, however Arlington waives this fee for parents.

Figure 22- The Advantages and Disadvantages of Feedback/Communication Mechanisms; Print, Verbal, and Online

A dynamic online website (such as Arlington's mynutrikids.com) in addition to communicating metrics associated with obesity such as caloric and nutritional value of a meal, allows parents to adjust family meals at home based on a child's caloric and nutritional intake at school.

Newton on the other hand relies strictly on verbal and written communication of food menus and metrics to parents. Printed media has several limitations, including a lack of nutritional/caloric intake printed on take home printed media, and fails to account for changes that may occur once the printing of the monthly cafeteria food occurs. Printed menus also fail to account for choices that a child has made during that day among menu options. For example, on any given school day, 3 entrees may be listed, but a child may only choose 1. This choice will not be reflected in the printed menu (i.e. It is not dynamic, and cannot adjust to options, see figure 23 below).

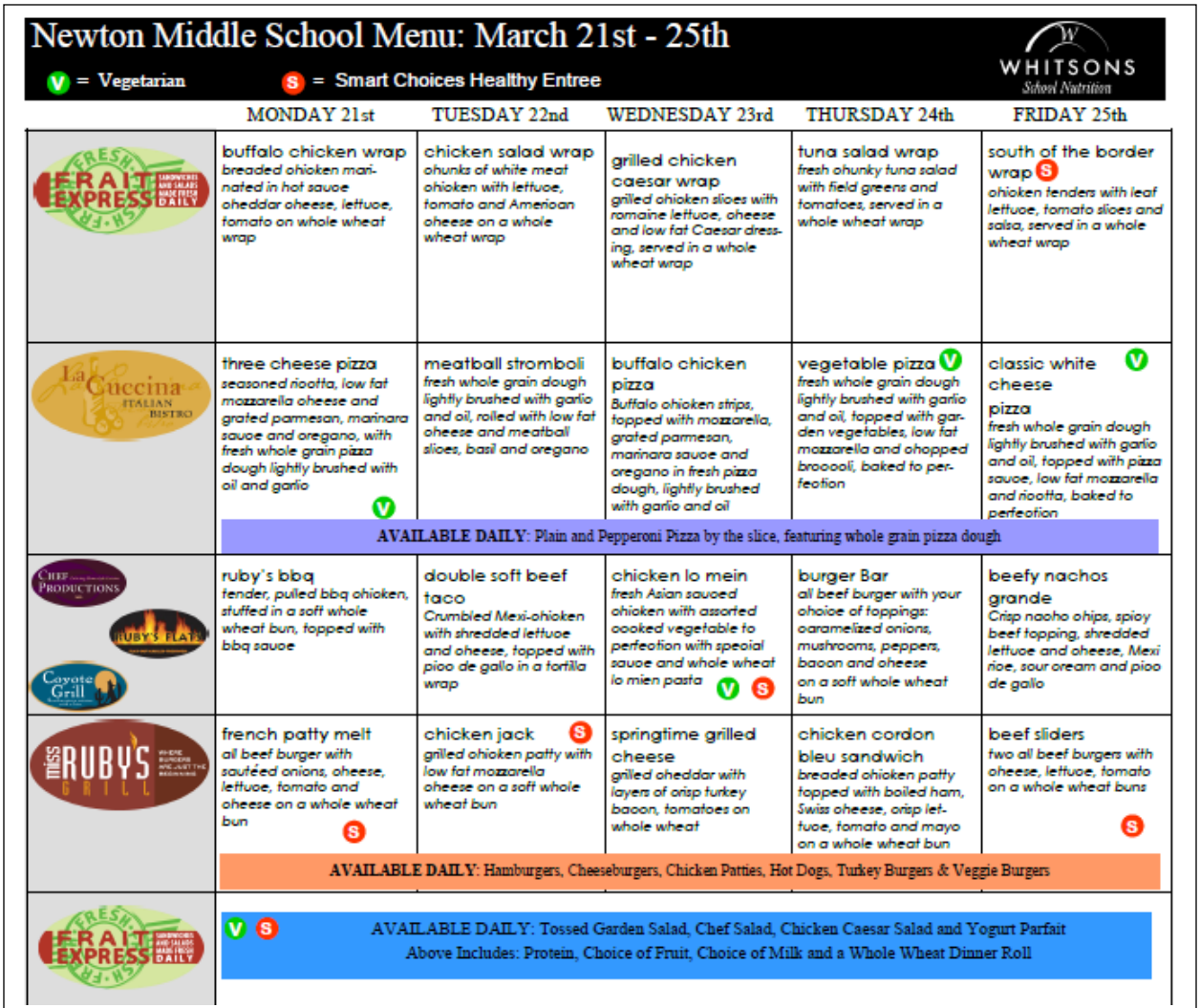


Figure 23 - Newton School District Sample Menu, March 21st - 25th, Source: Newton Public Schools (Newton Public Schools, 2011)

Verbal communication of a child's nutritional intake also has several limitations, including; potential lapses in accuracy, lack of nutritional information, and a failure on the part of the parents to recall a child's previously consumed meals.

Arlington's use of online tools poses several advantages to that of traditional mediums of communication (such as print media and verbal communications) that school districts such as Newton implement.

A preliminary survey (consisting of both Massachusetts and Non-Massachusetts residents) revealed that 80% of respondents found out that what their children ate at school by verbally communicating with the child, whereas 20% only used "online" tools, despite the fact that 60% of respondents had children who ate 2 or more meals per week on campus. It is important however to keep in mind this preliminary survey only

consisted of five sample subjects. In order to gain a significant sample size, it is essential to acquire funding to incentivize parents of both Arlington & Newton school districts to participate.

Next Steps

Next steps of the research include obtaining large samples of respondents of parents whose children attend Arlington and Newton school districts in order to see what primary feedback and communication methods parents from both schools use. What is the average number of meals consumed on campus by children in Arlington vs. Newton? How many parents in Arlington actually use the online web tools provided by the district? Why doesn't Newton implement an online tracking system? Do parents who use online provided web tools (i.e Arlington) actually adjust the diet at home based on feedback from the website? Listed below is a sample survey which will distribute to parents in Arlington, Newton, and other respondents in the Massachusetts area who have children which eat school provided lunches.

Sample Survey

1. Which School District does your child attend?

- [ ] Arlington, MA Public School District
- [ ] Newton, MA Public School District
- [ ] Other MA Public School District
- [ ] Public School District Outside MA
- [ ] Private School in MA
- [ ] Private School Outside MA
- [ ] Homeschooled

2. What is the Age and Gender of Your child? (i.e. 12/m if subject is 12 years old and male)

3. How much does your child weigh (Approximately, in pounds)?

4. How tall is your child (Approximately, in inches)?

5. How many times a week does your child eat school provided breakfast?

- [ ] 0
- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] 5

6. How many times a week does your child eat school provided lunch?

- [ ] 0
- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] 5

7. How do you determine what meals your child has eaten at school?

- [ ] I don't
- [ ] Speaking with your child

- ☐ Talking with School administration
- ☐ Using online school provided resources
- ☐ Using school provided lunch menu
- ☐ Other

8. How do you determine the nutritional value (i.e Caloric intake) of school provided meals your child has eaten on school campus?

- ☐ I don't
- ☐ Asking my child
- ☐ Using school provided printed materials
- ☐ Using online school provided resources
- ☐ Using my own judgment
- ☐ other

9. The school district my child attends does an adequate job of communicating to me what foods will be served in the school's cafeteria.

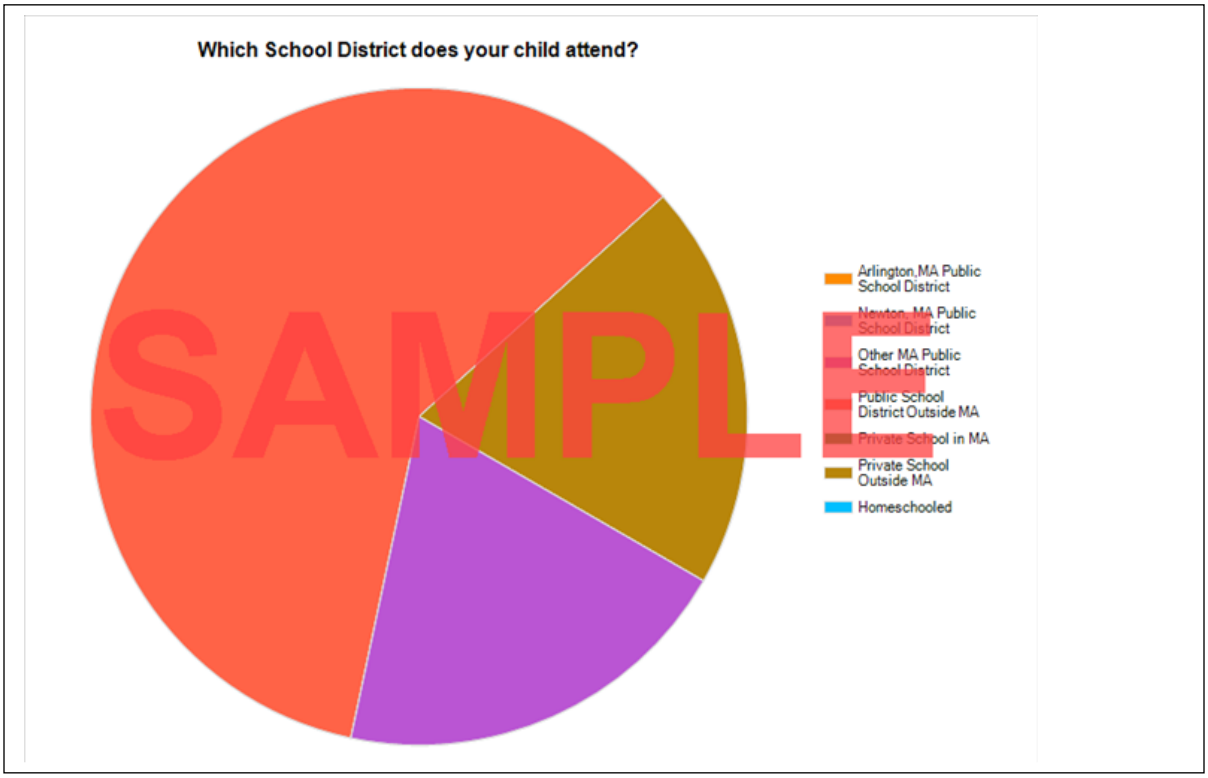
- ☐ don't care
- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly disagree

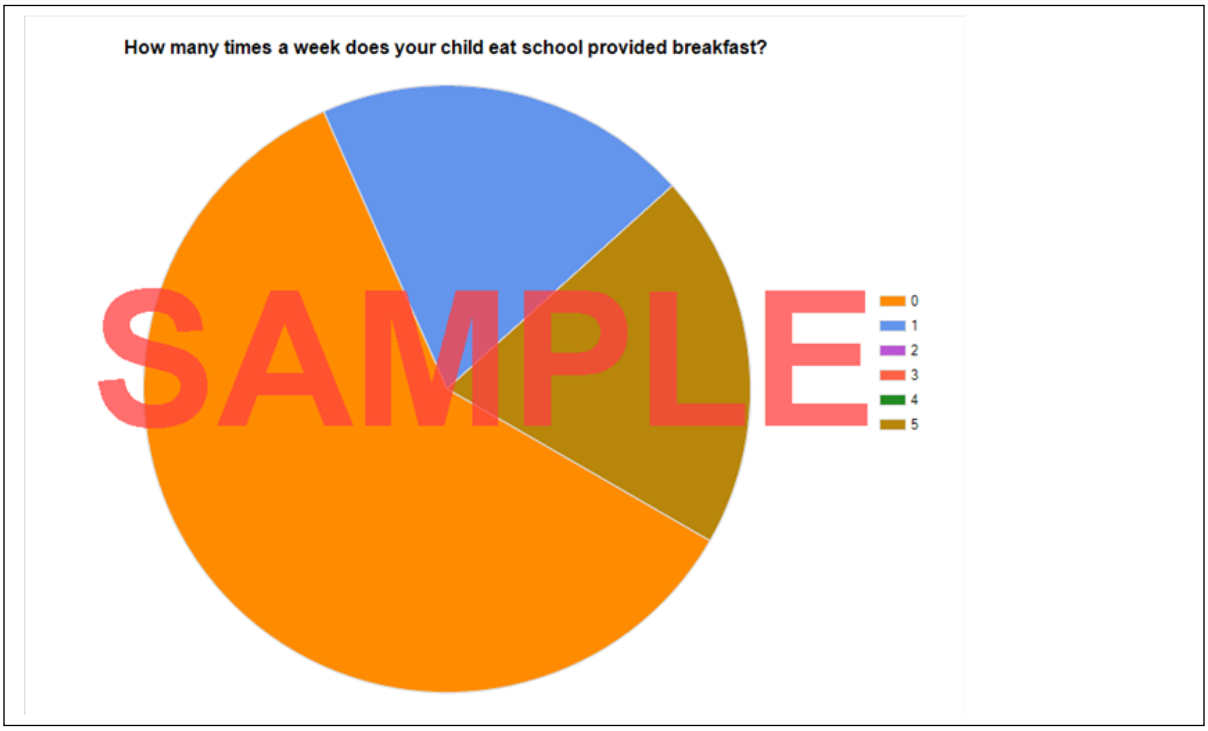
10. I adjust my child's diet at home depending on what food they consume at school

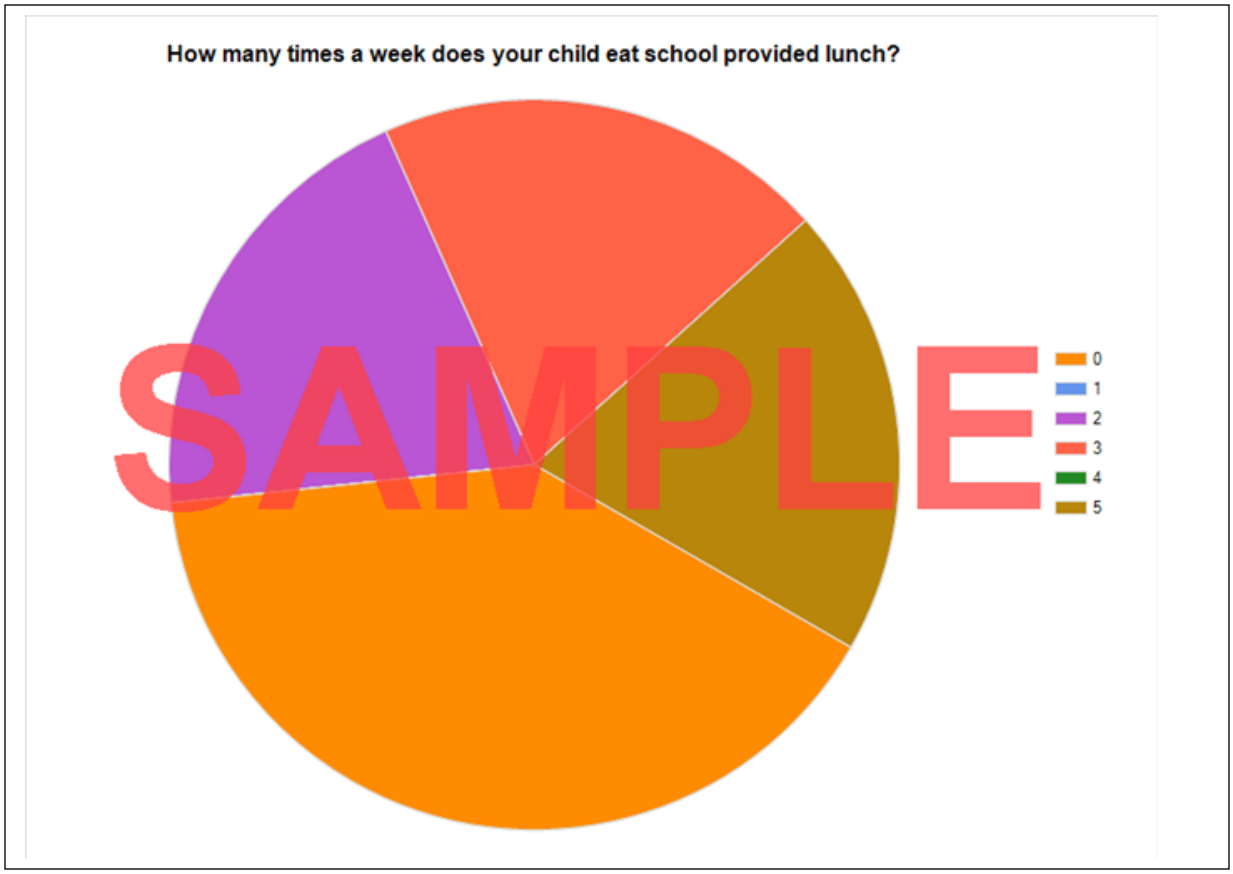
- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly disagree

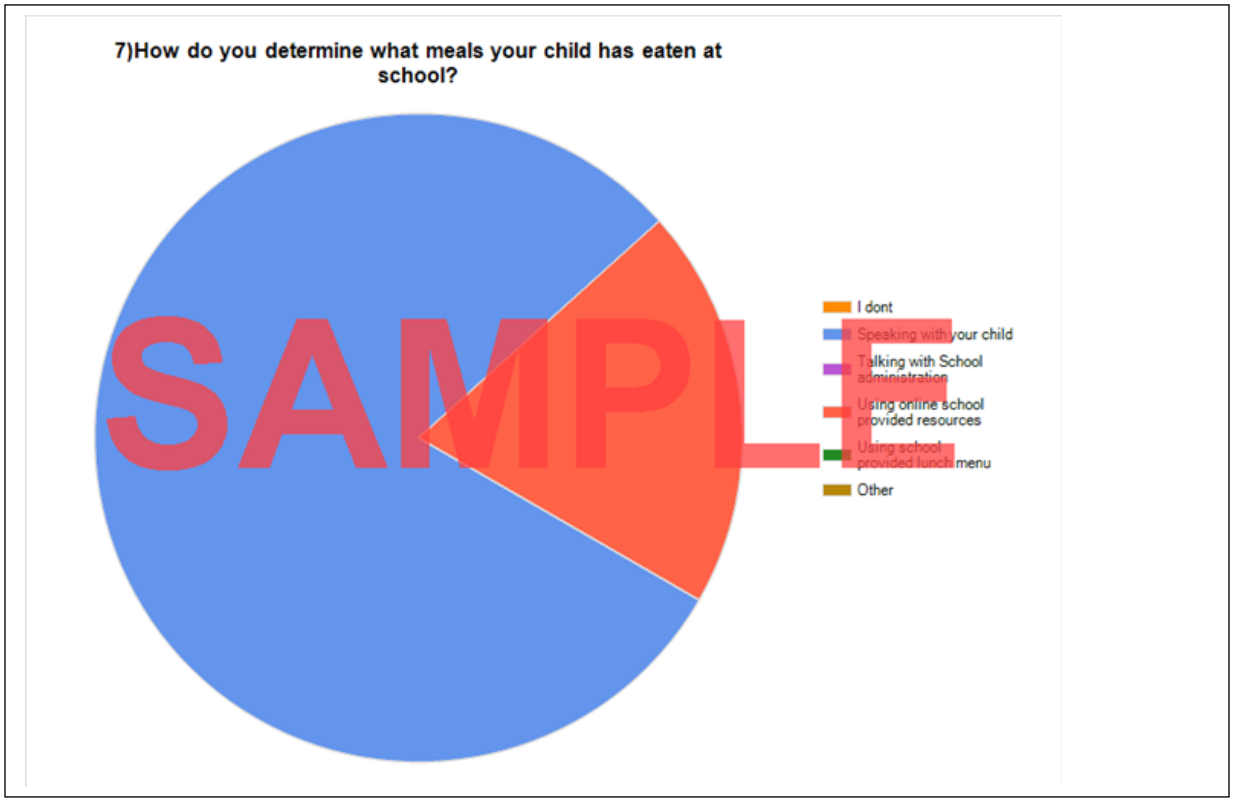
Sample Survey Responses

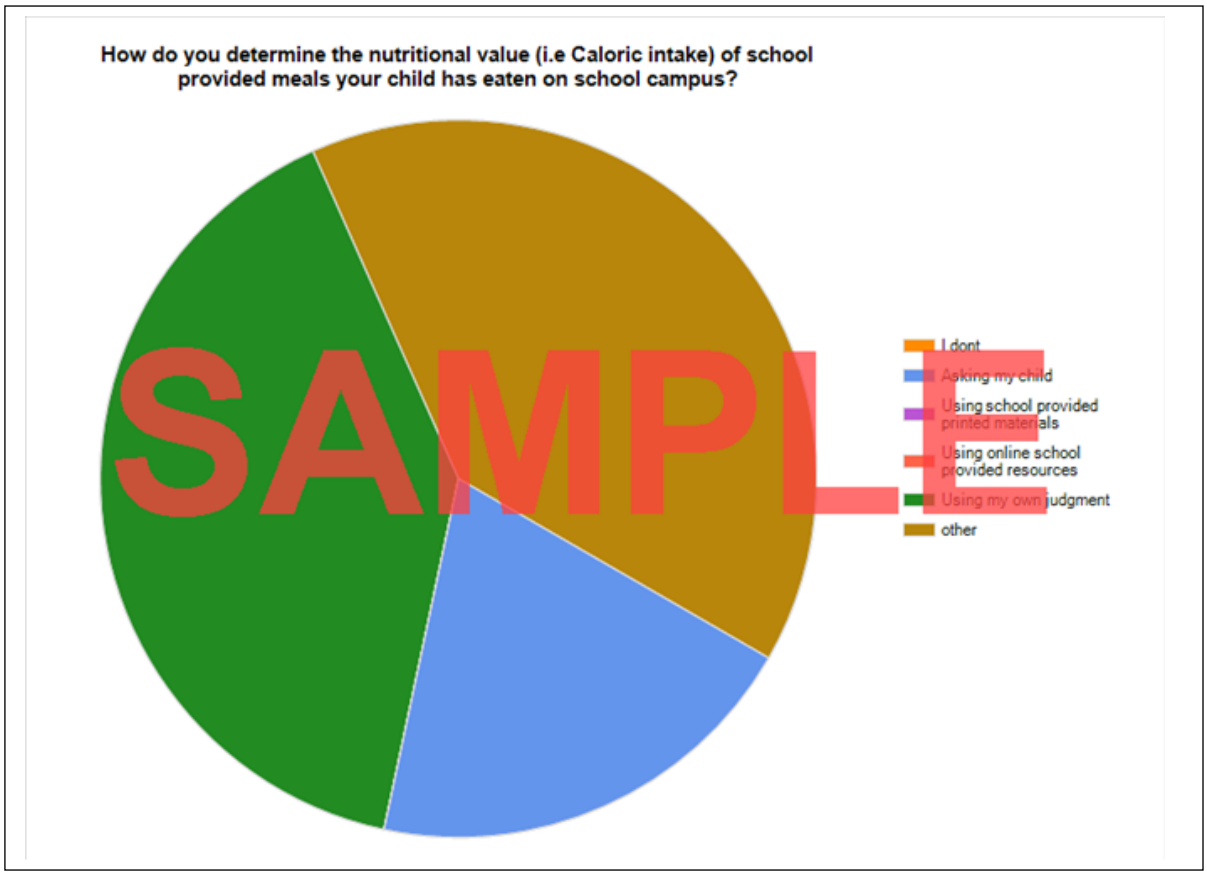
Note: Demo Version of SurveyMonkey.com is used because of a lack of funding to pay $199 annual fee for use of analytical software. Preliminary Survey Data (n=5 respondents).

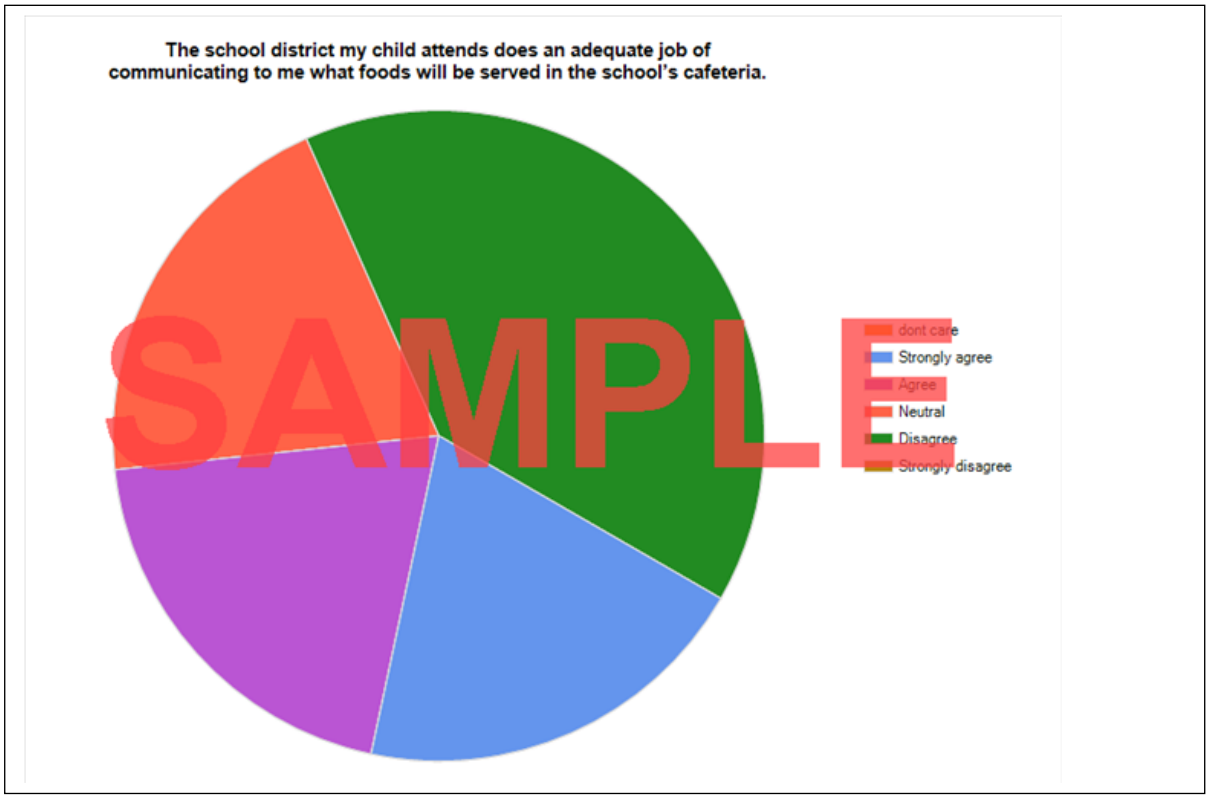


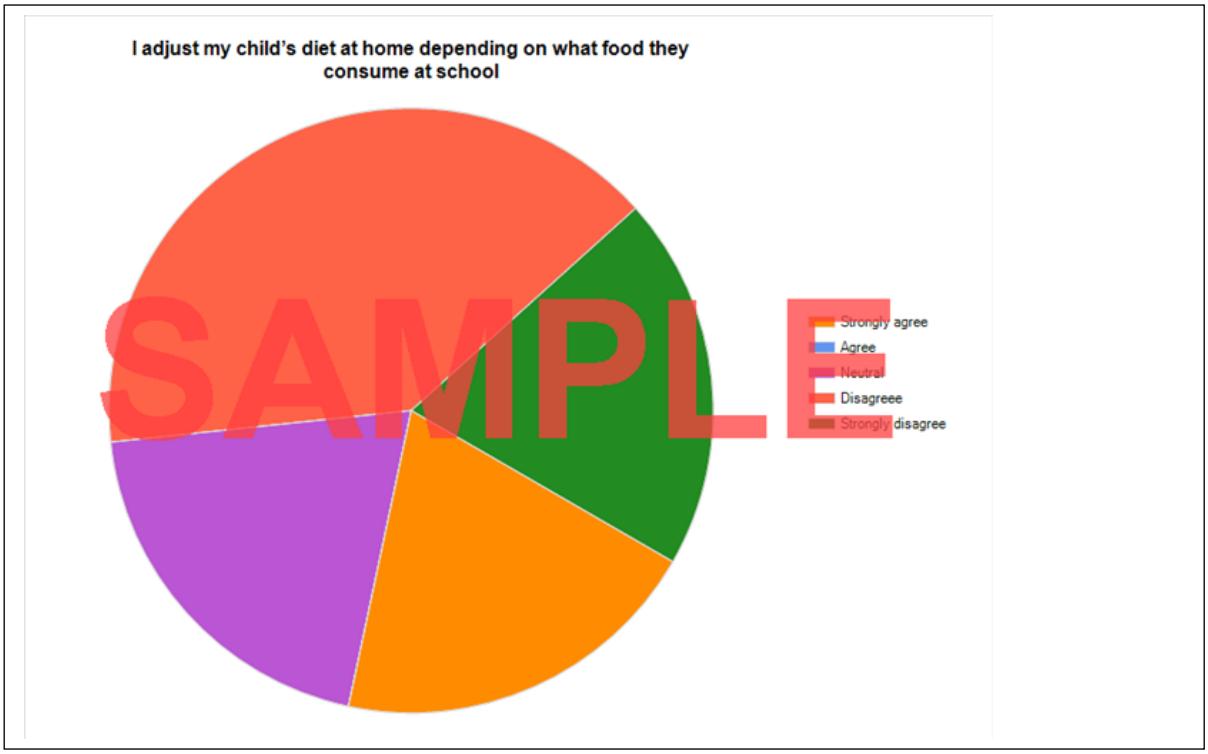



How many times a week does your child eat school provided lunch?
0
1
2
3
4
5
SAMPLE


7)How do you determine what meals your child has eaten at school?
I dont
Speaking with your child
Talking with School administration
Using online school provided resources
Using school provided lunch menu
Other
SAMPL


How do you determine the nutritional value (i.e Caloric intake) of school provided meals your child has eaten on school campus?
I dont
Asking my child
Using school provided printed materials
Using online school provided resources
Using my own judgment
other
SAMPL


The school district my child attends does an adequate job of communicating to me what foods will be served in the school's cafeteria.
dont care
Strongly agree
Agree
Neutral
Disagree
Strongly disagree
SAMPL


I adjust my child's diet at home depending on what food they consume at school
SAMPLE
Strongly agree
Agree
Neutral
Disagreee
Strongly disagree

Bibliography

Massachusetts Labor and Workforce Development. (2011, March). Retrieved March 29, 2011, from Arlington & Newton: http://www.mass.gov/?pageID=elwdhomepage&L=1&L0=Home&sid=Elwd

Agriculture, D. o. (2011). *Federal Register*. Washington D.C: United States Federal Government.

American Heart Association. (2009). *Learning for Life: Physical Education in Public School*. American Heart Association.

Arlington Public Schools. (2006, September 26). *Nutrition and Wellness Policy Goals*. Retrieved April 14, 2011, from Arlington Public Schools: http://www.arlington.k12.ma.us/asc/policies/jlce-e.pdf

Arlington School District. (2011). *Arlington School District Physical Education Standards*. Retrieved April 4, 2011, from Arlington School District: 2011

Babey. (2005). *Health Policy in Brief*. Los Angeles: UCLA.

Bhardwaj, S. (2008). Childhood obesity in Asian Indians: a burgeoning causeof insulin resistance, diabetes and sub-clinical. *Asia Pac J Clin Nutr*, 172-175.

Black, J. L. (2008). Neighborhoods and Obesity. *Nutrition Reviews*, 2-20.

Boucher, D. H. (2011, April 8). Arlington Food Service Director. (A. J. Sanchez, Interviewer)

Carter, R. C. (2002). The Impact of Public Schools on Childhood Obesity. *Journal of American Medical Association*, 288.

Center For Disease Control. (2011, March 3). *Childhood Overweight & Obesity*. Retrieved 3 23, 2011, from Center for Disease Control: http://www.cdc.gov/obesity/childhood/index.html

Center for Disease Control. (2011, March 3). *United States Obesity Trends*. Retrieved 3 23, 2011, from Center for Disease Control and Prevention: http://www.cdc.gov/obesity/data/trends.html#State

DeBour, M. D. (2011). Ethnicity, obesity and the Metabolic Syndrom. *Expert Reviews Endocrinal Metabolism*, 279-298.

Doran, G. (1981). There's a S.M.A.R.T. way to write management's goals and objectives. *Management Review, Volume 70, Issue 11*, 35-36.

EZLocal Business Search Engine. (2010, July 7). *10 largest Fast Food Chains in U.S. by Location*. Retrieved March 29, 2010, from EZLocal: http://ezlocal.com/blog/post/10-Largest-Fast-Food-Chains-in-the-US.aspx

Fox, R. (2004). Adult Obesity: A Paediatric Challenge. *Journal of the Royal Society of Medicine*, 39-49.

Freedman, D. S. (1999). The Relation of Overweight to Cardiovascular Risk Factors Among Children and Adolescents: The Bogalusa Heart Study. *Pediatrics Vol 103 No. 6*, 1175-1182.

Google. (2011, March NA). *Using Layers in Google Earth*. Retrieved March 29, 2011, from Google: http://earth.google.com/support/bin/static.py?page=guide.cs&guide=22370&printable=1

Health, M. D. (2009). *The Status of Childhood Weight in Massachusetts*. Boston: Massachussetts Department of Health.

Hellmich, N. (2009, November 19). *Rising obesity will cost U.S. health care $344 billion a year*. Retrieved 3 23, 2011, from U.S.A. Today: http://www.usatoday.com/news/health/weightloss/2009-11-17-future-obesity-costs_N.htm

Hitti, M. (2009, July 8th). *How Fat is Your State?* Retrieved March 23, 2011, from Web MD & Center for Disease Control: http://www.webmd.com/diet/news/20090708/how-fat-is-your-state

Jason P. Block, M. M. (2004). Fast Food, Race/Ethnicity, and Income. *American Journal of Preventitive Medicine*, 211-217.

Judy Putnam, J. A. (2002). U.S. Per Capita Food Supply Trends. *Economic Research Service, USDA*, 3-15.

Li, F. (2009, March 9). *Fast-Food Density And Neighborhood Walkability Linked To Residents' Weight And Waist Size*. Retrieved April 1, 2011, from ScienceDaily: http://www.sciencedaily.com/releases/2009/03/090303161431.htm

Mheta, N. K. (2008). Weight Status and Restaraunt Availability. *American Journal of Preventive Medicine*, 127-133.

Michele D. Kipke, P. (2007). Food and Park Environments: Neighborhood-level Risks for Childhood Obesity in East Los Angeles. *Journal of Adolescent Health*, 325-333.

MyNutriKids. (2011, NA NA). *What is MyNutrikids.com?* Retrieved April 1, 2011, from MyNutriKids.com: https://www.mynutrikids.com/LearnMore/LearnMore.aspx#mynutrition

NASPE & AHA. (2010). *State Profile: Massachussetts*. Retrieved April 4th, 2011, from American Alliance for Health, Physical Education, Recreation & Dance: http://www.aahperd.org/naspe/publications/upload/Massachusetts-profile.pdf

Newton Public School District. (2006, June). *Newton School District Wellness Policy*. Retrieved April 6, 2011, from Newton Public Schools: www3.newton.k12.ma.us

Newton Public Schools. (2010, November). *Whitsons School Nutrition Joins Newton Public Schools*. Retrieved April 14, 2011, from Newton Public School: http://www3.newton.k12.ma.us/sites/default/files/Whitson_Newton_Press_Release_letter_11_15_10_0.pdf

Newton Public Schools. (2011, April). *Newton Public School Food Services*. Retrieved April 14, 2011, from Newton Public School: http://www3.newton.k12.ma.us/sites/default/files/foodservices/NPSbrochure3.doc

Ramsey, L. (2011, April). *Food Service Director*. Retrieved April 2011, from GPO's Strength in Numbers: http://www.foodservicedirector.com/operations-feature-stories/gpos-strength-in-numbers.html

Sanchez, A. J. (2011, April 1). *Survey monkey*. Retrieved April 1, 2011, from Childhood Obesity Study: http://www.surveymonkey.com/s/P9WLFZ5

Sanchez, A. J. (2011). *Survey on Childhood Obesity*. Boston: University of Massachusetts, Boston.

Saperstein, S. (2007). The Impact of Internet Use for Weight Loss. *International Association for the Study of Obesity*, 459-465.

Talwar, J. (2003). *Fast Food, Fast Track: Immigrants, Big Business, and the American Dream*. Westview Press.

Thomson Medstat. (2006). *Childhood Obesity: Costs, Treatment Patterns, Disparities in Care,and Prevalent Medical Conditions*. New York: Thomson Reuters.

United Health Foundation, APHA, PP. (2009). *America's Health Rankings, 2009*. St. Paul, Minnesota: United Health Foundation.

United States Census Bureau. (2001). *United States Census 2000*. Washington D.C.: United States Census Bureau.

Wexler, B. (2008). *Weight in America: Obesity, Eating Disorders, and Other Health Risks*. Information Plus.