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You are Not What You Eat: The Myth of School Food and Child Obesity

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Abstract of the Dissertation

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Childhood obesity is a hot topic in the research and policy literature, as well as in the popular press. However, much of the present research concentrates on one or a few variables, rather than adequately assessing the underlying structures that inherently complicate the childhood obesity epidemic. Using a logistic regression examining the school food environment in the 8th grade wave of the ECLS-K data set, this study's findings supports past research that shows poor, Hispanic and Black children that receive federally subsidized school meals are more likely to be obese. However, competitive foods available in vending machines did not impact obesity levels. The author posts that a social determinants of health theoretical approach, will expand the current obesity research paradigm to truly answer the question "why are poor children fat?" In order to make a dent in population level obesity prevalence, a social determinants approach needs to be adopted. This theoretical frame will hopefully cause a paradigmatic shift in policy and research. Once policy and research are altered, the social structures that cause the detrimental effects of the social and health gradient among the US population will follow suit.

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List of Abbreviations

ADA- American Dietetic Association
BMI – Body Mass Index
CCD- Common Core of Data
CDC – Centers for Disease Control and Prevention
CDSH – Committees on the Social Determinants of Health Social Determinants of Health
CFBAI - Children's Food and Beverage Advertising Initiative
CHIP – Children's Health Insurance Program
DHSS- Department of Health and Human Services
ECLS-K – Early Childhood Longitudinal Study- Kindergarten
FMS – Field Management System
FSP – Food Stamp Program
GNP – Gross National Product
HFA – Health for All
HFCS – High Fructose Corn Syrup
IES – Institute for Education Science
MDG – Millennium Development Goals
NCDs – Non Communicable Diseases
NCES – National Center for Education Statistics
NHANES – National Health and Nutrition Examination Survey
NSLP – National School Lunch Program
OCED – Organization for Economic Co-operation and Development
PAC – Political Action Committee
PSS – Private School Survey
PSU – Primary Sampling Unit
RDA – Recommended Daily Allowance
SBP – School Breakfast Program
SDH – Social Determinants of Health
SES – Socio Economic Status
SNAP – Supplemental Nutrition Assistance Program
SNDA – School Nutrition Dietary Assessment
USDA – United States Department of Agriculture
WHO – World Health Organization
WIC – Women, Infant and Children

Chapter 1: Statement of the Problem

> Obesity is an important health issue, but complex and ill understood. Simple assumptions, and correspondingly simple solutions, have not so far curbed its progression (Voss, Hosking, Metcalf, Jeffrey & Wilkin, 2008, p. 472.)

It is difficult to read a newspaper or watch the news without hearing about childhood and adult obesity. At this point, there is not a city in the US free of overweight individuals. In fact, obesity is now a worldwide problem. It is recognized as a serious contributor to the global epidemic rise in Non Communicable Diseases. Some have begun to refer to obesity as a pandemic (Swinburn, Sacks, Hall, McPherson, Finegood, Moodie & Gortmaker, 2011). Even in developed countries that have managed to slow down the growth rate of childhood obesity in recent years, the rates show discrepancies based on incomes. Poorer children's prevalence rates are disproportionately higher than better off children (Levi, Segal, Laurent, Lang & Rauburn, 2012). For the United States, obesity has become a national security issue. Obesity is one of the most frequent reasons people are disqualified from military service (National Conference of State Legislators, 2013). Many people do not recognize their weight status, especially as weight status increases (Paeratakul, Williamson, Ryan & Bray, 2002).

The future of today's children hangs in the balance. Overweight and obesity has been documented at younger and younger ages. Obesity is not defined until age 2, by a high Body Mass Index (BMI). This means that many children may be obese by the time they reach toddler age (Irigoyen, Glassman, Chen & Findley, 2008). The statistics on the 1 million children enrolled in Head Start are also disturbing. Almost one third of these children are overweight or obese (Health Affairs, 2010b). More women are becoming pregnant while obese, and remaining so throughout the pregnancy. More fetuses are exposed to gestational diabetes, and are thus preselected to develop type 2 diabetes (Kessler, 2009). And, more mothers have the risk of

forming gall stones, (Kessler, 2009) which may lead to pancreatitis, a serious disease (Ko, 2006). Maternal smoking during pregnancy has also been associated with an increased risk of childhood obesity (Caprio, Daniels, Drewnowski, Kaufman, Palinkas, Rosenblook, & Schwimmer, 2008, Esposito, Fisher, Mennella, Hoelscher & Huang, 2009). A number of theorists argue that obesity risks begin in the prenatal period (Esposito, et al, 2009, Franklin Wen, Redsell, Swift, Yang & Glazebrook, 2012), and that high infant birth weight and rapid weight gain in the first year of life can drastically alter future obesity trajectories (Caprio, et al, 2008). There seems to be a positive effect on weight status if children are breastfed (Franklin Wen, et al, 2012), but it may only be for children whose mothers' BMI are over 25 (Esposito, et al, 2009). While the rate of obesity has increased over time, the rate of severe obesity has also increased (Biro & Wien, 2010, Caprio, et al, 2008). The first chapter of this dissertation will help outline why childhood obesity is an important issue of study.

1.1 Health Effects

The deleterious health effects of childhood obesity will last well into adulthood, and may cause a vastly shortened and medically plagued life span compared to someone of a healthy weight (Datar & Sturm, 2006, Irigoyen, et al, 2008, Judge & Jahns, 2007, Krebs, Himes, Jacobson, Nicklas, Guilday, & Styne, 2007, Ogden, Lamb, Carroll & Flegal, 2012, & Wang, McPherson, Marsh, Gortmaker, & Brown, 2011). Obesity during teen years predisposes youth to health consequences as a young adult. In high income countries, it is estimated that the decreased life expectancy as a result of obesity ranges from .08 to 7 years of life lost (Biro & Wien, 2010). Smoking amplifies the ill health effects, "... an 18-year-old white male who is normal weight and does not smoke can expect to live to age 81 years. However, were he to

smoke and be in the obese III category, his life expectancy would be only 60 years, a difference of 21 years" (Finkelstein, et al, 2009, p. 6).

Some of the detrimental and immediate health impacts for children can include diabetes, an increase in cardiovascular risk factors and diseases, excessive growth and early sexual maturation, respiratory system damage, sleep apnea with associated hypertension and a number of orthopedic issues (Levi, et al, 2012, & Oude Luttikhis, Baur, Jansen, Shrewsbury, O'Malley, Stolk & Summerbell, 2009). Children who are obese are twice as likely to die by 55 compared with children that have a BMI in the healthy range (Levi, et al, 2012). In adults, the Metabolic syndrome is a cluster of risk factors that raises the risk of heart disease, stroke, and diabetes, among other health issues. The risk factors are abdominal obesity, high triglyceride levels, low HDL cholesterol, high blood pressure, and high fasting blood sugar (National Heart, Lund & Blood Institute, 2011). Metabolic syndrome has a nebulous definition in children. In children, abdominal obesity is the strongest risk factor that most likely predicts developing the syndrome (Biro & Wien, 2010). Approximately 910,000 American children aged 12-19, or 4.2% of American teenagers are thought to have Metabolic syndrome (Rigby, Kumanyika, & James, 2004). As children's BMIs increase, so does the rate of Metabolic syndrome, especially among males and Hispanics compared to Whites (Biro & Wien, 2010).

Concurrently, the rate of diabetes prevalence is skyrocketing. If the current trajectories don't slow down or level off, thirty percent of all children and almost half of Black and Hispanic children born at the turn of the century will develop the disease. By 2050, the number of people who develop the disease is expected to reach 50 million (Morrill & Chinn, 2004). Researchers have found that with every 5 kg/m^2 increase in BMI, there is a parallel increase in risk for men of esophageal cancer by 52%, and colon cancer by 24%. Obese women increase their risk of

endometrial cancer by 24%, gall bladder cancer by 59% and postmenopausal breast cancer by 12% (Wang, et al, 2011). Because of the current and past obesity trajectories, we are going to face an unprecedented reality in the near future of, "… a growth in the proportion of people living with chronic disabilities" (Wang, et al, 2011, p. 816). Some estimates claim that a kilogram increase in BMI will lead to a 4.5% increase in Type 2 diabetes risk (Wallach & Rey, 2009).

Beyond the purely medical concerns are a number of social and psychological issues including, low body and self-esteem, depression, stigmatization, parental judgment, and disordered eating (Krebs, et al, 2007). Overweight children also may be more likely to be both victims and perpetrators of bullying (Judge & Jahns, 2007), and the rate of victimization increases as BMI increases (Puhl, Luedicke, & Heuer, 2011). Overweight children may also encounter greater frequency and intensity of emotional distress. Obesity in childhood may manifest into more psychopathology later in life (Crothers, Kehle, Bray & Theodore, 2009). Alarmingly, stereotypes about overweight children are already present in childhood, and adolescents are experiencing weight-based discrimination (Puhl, et al, 2011). Children with poor nutrition are more likely to be absent from school, have worse classroom behavior, and have concentration and problem solving issues (Moag-Stahlberg, 2011).

1.2 Obesity over the lifespan

The longer obesity lasts in childhood, the greater that child's risk of being obese is in adulthood (Krebs, et al, 2007). The older the child is when obesity begins, the greater the chance they will be obese in later life (Ma & Frick, 2011). Specifically, children that stay obese after 6 years of age, "… are 50 percent more likely to be obese as adults, and among overweight tweens and teens ages 10 to 15, 80 percent were obese at age 25" (Levi, et al, 2012, p. 5). This childhood

obesity leads to an increased risk of morbidity and mortality in adulthood (Miech, Kumanyika, & Stettler, 2006, & National Heart Lung and Blood Institute, 2007). Even obesity in very young children is correlated with obesity in adulthood (Anderson & Butcher, 2006). It is also not clearly understood why some children will manifest disease, while others will not (National Heart Lung & Blood Institute, 2007).

1.3 Obesity Costs

Obesity is also very costly, and has morphed into an economic issue, burdening employers, workers, tax-payers and the entire health care system (Englehard, Garson, & Dorn, 2009, Paxson, Donahue, Orleans & Grisso, 2006, Trust for America's Health, 2009, Wang, McPherson, Marsh, Gortmaker & Brown, 2011). For adults, obesity leads to a loss of productivity, in both absenteeism and "presenteeism," increased sick time, and escalated health care costs (Englehard, et al, 2009, Paxson, et al, 2006, & Trust for America's Health, 2009). Some estimate that an obese employee loses an average of 20 workdays per year compared to non-obese employees (Englehard, et al, 2009).

The bulk of the costs seem to impact those between the ages of 40 to 49 (Anderson, Martinson, Crain, Pronk, Whitebird, Fine & O'Conor, 2005). However, childhood obesity also costs hundreds of billions of dollars annually (Levi, et al, 2012). Between 1979-1981 children's obesity related hospital costs were $35 million. Between 1997-1999, these expenditures ballooned up to $127 million. Obesity related hospitalizations for children doubled between 1999 and 2005. Childhood obesity health care costs jumped from $125.9 million in 2001 to $237.6 million in 2005, expressed in 2005 dollars (Levi, et al, 2012).

Obesity related costs have also caused insurance premiums to rise for the non-obese. Between 1987 and 2001, one third of the increase in healthcare expenditures were obesity

related, and half of this was taxpayer funded through Medicaid and Medicare (Englehard, et al, 2009). Interestingly, there is even a disparity in lifetime medical outlays lost to obesity. This disparity is based on overall life expectancy. Those with the highest life expectancies, white nonsmokers, cost the most versus those with the lowest life expectancies, black smokers. (Ma & Frick, 2011). In other words, Whites are costing society the most money when they are obese. They live long enough to develop obesity related diseases requiring a high intensity of care.

Studies have shown that reducing the Type 2 diabetes and high blood pressure rates by 5 percent, could reduce health care costs by $5 billion (Levi, Segal & Juliano, 2009). Also, achieving a 5% reduction in obesity related heart, kidney disease, and stroke prevalence would save another $19 million annually (Levi, Segal & Juliano, 2009). Other researchers have a model showing that a 1 percentage point reduction in obesity prevalence levels among 0-6 year olds would yield a $1.7 billion cost saving, $1.4 billion for 7-12 year olds, or $1.7 billion for 13-17 year olds (Ma & Frick, 2011). For the most part, discussions of healthcare and healthcare reform have largely ignored that the bulk of health care cost increases are related to obesity (Levi, et al, 2009, & Ornish, 2009,). Thus far, comprehensive insurance reimbursement has been left out of the equation for lifestyle interventions. Meanwhile, lifestyle interventions are also seen as the frontline answer to the rising tide of obesity around the world (Ornish, 2009).

If obesity prevalence continues at the current growth rates, projections indicate that by 2030, 50-51% of men and 52-54% of women will be obese. That equates to 65 million more obese adults by 2030 compared to 2010, and 24 million of these people will be over the age of 60. This means that age related illness will also impact health and costs related to health. This greatly increases future projections of obesity costs over the next few decades. Between 2020

and 2030 costs are expected to balloon from $28 billion to $66 billion annually (Wang, et al, 2011).

1.4 Global Impact

Obesity is now recognized as a worldwide phenomenon, bordering on epidemic in many regions (Caprio, et al, 2008). As the world has become more of a "global community," it seems that the US has outsourced its dietary habits and comorbidities (Rigby, et al, 2004, Caprio, et al, 2008). Hunger is still a major problem in developing nations, with an estimated 1 billion people without access to proper calorie intake. Another 1 billion people have available calories, but not proper nutrients. Even when ample food is available, people are not healthier. Of the 1 billion estimated overweight or obese, at least 300 million are obese. One hundred fifty-five million school-aged children are either overweight or obese. Even more frightening, as worldwide obesity levels rise, so do morbid obesity levels (Rigby, et al, 2004).

In 2011, for the first time in its history, the United Nations General Assembly convened a high level meeting to focus on a health issue: Non Communicable Diseases (NCDs). NCDs were found to account for two thirds of international deaths and, cost $6 trillion dollars. Those in poverty are more likely to develop an NCD and die at an earlier age than those not in poverty (Pittman, 2011). Global obesity levels function as a "tipping point" (Swinburn, et al, 2011, p. 805). Initially, as caloric intake increases, those who are low-income gain in their health status. Then, as population based income increases, those with lower incomes mimic what happened in the US: they have the highest obesity prevalence, and more health issues (Smith, Craig, Raja, McNeill & Turner, 2013). In these countries, the first people to bear the burden of higher obesity prevalence are high SES groups in urban areas. As the tipping point hits, the disease burden shifts to low SES groups (Swinburn, et al, 2011). Part of this phenomenon might manifest

because people who were previously malnourished have modified their metabolism to horde nutrients and food in order to add to fat reserves. This "acquired metabolism" does not simply disappear (Prentice, 2005). Developing countries that are dealing with very high obesity rates as they switch diets might be facing this challenge. Their obesity rates are rising faster than when rates increased in developed countries (Misra & Khurana, 2008).

In higher income countries, unfortunately, income inequality exacerbated obesity levels, increased consumption, and diabetes mortality. In these countries, when models controlled for consumption, the significant relationship between income inequality and obesity worsened. This relationship degraded more for men than women (Pickett, Kelly, Brunner, Lobstein & Wilkinson, 2005). Like the US, international studies confirm that abdominal fat, increased BMI and sedentary lifestyles were all associated with income inequality (Pickett, et al, 2005).

Current research and intervention points the finger at individual failures. The assumption on individual liability should be re-evaluated. Living in rich nations does not automatically make the populace voracious eaters nor can they be considered solely victims who fall prey to clever marketing ploys (Jebb & Prentice, 1995). There are other forces at play impacting individuals and the overall population. Development goals of raising developing nations' income levels should not be abandoned. However, it cannot be denied that levels of obesity run parallel to increasing wealth (Levine, 2011). The future economic burden that this obesity and comorbidity will have on developing nations, and the global community, cannot be ignored (Wang, et al, 2011).

1.5 Study Aim

The study of obesity, and childhood obesity, specifically, is at a crucial point. The aim of this study is to understand whether or not the current research paradigm can adequately assess

and interpret the childhood obesity epidemic by performing a school food environment analysis. If this school based analysis is insufficient, this dissertation will question, whether or not, we need to embrace a more holistic lens for examination of childhood obesity. This theoretical frame is the social determinants of health perspective that advocates for population based changes at the macro level. Hopefully, it will also help to explain, in part, the answer to the bothersome question of many: "if they are poor children, then why are they fat?" And perhaps change the fundamental questions we are asking from person centered to the overall environment.

Often, simple solutions to the epidemic are postulated: children should eat less, eat healthier, and exercise more. These suggestions do not appear to consider the fact that obesity is an exceedingly complex issue and there is a lack of promising prevention models (Kaufman & Karpati, 2007). While there are a number of prevention and treatment guidelines, they are not based on robust science (Oude Luttikhis, et al, 2009). Despite wide recognition that a reduction in calories is needed, it seems inordinately difficult for most people to achieve. Any number of barriers can present themselves on a daily basis (Gruber & Haldeman, 2009). Poor children experience a number of policies throughout their early life that directly influence diet: Women Infant and Children Program (WIC), Supplemental Nutrition Assistance Program (SNAP), formerly the Food Stamp Program, National School Lunch Program, School Breakfast Program and the Summer Food Service Program and the Child and Adult Care Food Program (Hofferth & Curtin, 2005). At this point, we understand the types of foods people should eat and the amount of physical activity people should be doing to remain healthy. But we lack the tools to make these activities and consumption patterns a reality. Theorists and lay people have regularly opined about the potential causes of obesity and put forth ideas about what the solutions may be.

Yet, there is a paucity of evidence that effectively assesses the myriad causes and properly apportions fault (Peters, 2006) as multi-factorial. Without incorporating these varying causes, solutions will be narrow, short-sighted and prone to fail.

In summary, childhood obesity is a serious problem of epidemic proportion. There are a number of grave health effects that impact both children and adults. This country and the world need to critically investigate and employ effective solutions to the problem. This will save lives, health care expenditures and, potentially, economies.

In the next section, the literature on childhood obesity will be explored. Following sections will address the numerous policies that impact the epidemic, including a more in depth section on the school environment, will be presented. Since the school environment is considered a key place for intervention in childhood obesity, it will be used as the environment of interest. The Social Determinants of Health theory (SDH) will be introduced next. Then the SDH theory will be presented by using a logistic regression of the school food environment. The dissertation will conclude with chapters on findings and policy implications.

Chapter 2: Literature Review

Chapter 2 will address the literature on childhood obesity. Overall prevalence rates, demographic disparities in these rates, and the link between poverty, food insecurity, family impact, and obesity will be described. The global impact of obesity will be presented as further cause for alarm. The multiple causes of obesity, as cited in the literature, will be introduced. The current research base, data issues and national response will conclude the chapter. All of these subjects are presented to help support the need for a Social Determinants of Health (SDH) analysis.

2.1 Prevalence Rates

Overweight and obesity are the physical manifestation of taking in a larger number of calories than the body burns off (Anderson & Butcher, 2006 & Nestle, 2002). In addition to eating too much, people do not exercise enough to make up for the excess caloric intake (Crister, 2003, Delpeuch, Maire, Monnier, & Holdsworth, 2009, & Nestle, 2002). Obesity has also been shown to follow a gradient, mimicking the "health status gradient" (Cohen, Finch, Bower, & Sastry, 2005). The concept of a health gradient is introduced in the Social Determinants of Health literature. The BMI distribution continues to widen with the heaviest getting even heavier. Further, obesity is not evenly distributed across socio-demographic groups. For people who are already at higher risk, "… the conditions appear to be right for their disease to flourish" (Anderson & Butcher, 2006, p. 24).

The astonishing jump in childhood obesity prevalence over the last 30 years has received a great deal of national attention. During this time period, prevalence has increased more than 100% (Crothers, et al, 2009). The Centers for Disease Control and Prevention (CDC) monitors childhood overweight and obesity through the National Health and Nutrition Examination

Survey (NHANES). NHANES is the only nationally representative data that has historically tracked a number of health indicators. NHANES I was conducted between 1971-1974, NHANES II from 1976-1980, NHANES III between 1988-1994, and since then NHANES was conducted per year between 1999-2012. NHANES collects actual anthropometric measurements in a laboratory visit (Centers for Disease Control & Prevention, 2013b). There were no reported changes in childhood overweight and obesity prevalence rates between NHANES I and II, but there was an increase between NHANES II and III and between NHANES III and the late 1990s through the early 2000s (Ogden, Flegal & Carroll, 2002). There is no other data set with availability to longitudinally analyze childhood overweight and obesity (Sturm, 2005a).

In 2006, the same year as the data used in the present study, the U.S. childhood obesity rates for children between ages 2 and 5 was 12.4%, and between 6 and 11 year olds was roughly 17% (Centers for Disease Control and Prevention, 2009). By 2010, 16.9% of 2-19 year olds were obese and 31.7% were overweight or obese. Thus, 12 million children were obese and 23 million children were overweight or obese (Levi, et al, 2012, National Conference of State Legislators, 2013, & Ogden, Carroll, Kit, & Flegal, 2012). In high school students, there was an upward trend in obesity prevalence between 1999 and 2011. High school students' obesity prevalence rose to 13% from 10.6% and overweight was 15.2% up from 14.2% (Levi, et al, 2012). Between 1988 and 1994, and again between 2005 and 2008, obesity increased at all income levels, and across genders (Ogden, et al, 2010). However, overall obesity prevalence rates did not change between 2001-2002 and 2009-2010. This means that obesity rates may be leveling off, in some populations (Federal Interagency forum on Child and Family Statistics, 2012). Yet, they still remain too high.

In the most recent study on preschool obesity levels, there was a statistically significant downward trend in 19 states (Centers for Disease Control and Prevention, 2013a). The largest decrease was in the Virgin Islands, which dropped from 13.6% to 11.0% between 2008 and 2011. Five states had an absolute reduction of over 1% (Florida, Georgia, Mississippi, New Jersey and South Dakota) while another 19 states had an absolute reduction that ranged between .3 and 2.6 percentage points. The relative decrease was 1.8-19.1%. Twenty-one states had no significant trend. Three states had a positive trend. In total, ten states had prevalence rates over 15% with the highest rate in Puerto Rico at 17.9%. Six states had rates under 12% with the lowest in Hawaii at 9.2%. There have been a number of policy changes over this time period, which may have influenced prevalence rates. One of the most impactful was the federal WIC change to make the foods provided align with the USDA Dietary Guidelines, in addition to the national Let's Move campaign and other widely publicized events (Centers for Disease Control and Prevention, 2013a).

Examining obesity trajectories between Kindergarten and 8th grade, researchers found that obesity rose between Kindergarten and 5th grade. This was the peak period for both boys and girls, and then prevalence decreased a bit by 8th grade. The majority of children that were overweight/obese were consistently so, and were that way by Kindergarten. None of the children changed status, "… from the overweight/at risk to the normal weight category over time" (Balisteri & Van Hook, 2011, p. 615). Between Kindergarten and 3rd grade, SES, gender, race, neighborhood and family factors all affected obesity trajectories (Balisteri & Van Hook, 2011).

Obesity prevalence rates varied locally, state by state, and regionally throughout the country (Bass, 2013, Bethell, Simpson, Stumbo, Carle & Gombojav, 2010, Levi, et al, 2012, & Singh, Kogan, & Van Dyck, 2000). States with the highest obesity prevalence were

disproportionately located in the South and Midwest (Levi, et al, 2012). Children between the ages of 10 and 17 had the highest prevalence rates in the South central states, ≥ 18%, and the lowest in the Mountain states, 11.4%. Children in West Virginia, Kentucky, Texas, Tennessee and North Carolina were two times more likely to be obese than children in Utah. There were no significant differences found between boys and girls. A great deal of the state and regional disparities discovered were due to individual characteristics, 55%, and state and regional disparities, 25%. These included race/ethnicity, household socioeconomic status, neighborhood social capital, TV usage, recreational computer use, and physical activity. Area poverty rates added another 18% variability to obesity prevalence (Singh, et al, 2000).

In a telephone survey conducted as part of the Gallup-Healthways Well-Being Index, some of the above findings were mirrored in adults. The survey used self-reported height and weight. The ten states with the lowest obesity rates were Colorado (18.7%), Massachusetts (21.5%), Montana (22%), Connecticut (22.7%), California (23.1%), Utah (23.9%), Arizona (24.1%), Rhode Island (24.3%), New Jersey (24.4%), and Washington (24.4%). The lowest rates were found in the West and Northeast. The ten states with the highest obesity rates were West Virginia (33.5%), Mississippi (32.2%), Arkansas (31.4%), Louisiana (30.9%), Alabama (30.4%), Kentucky (29.7%), Tennessee (29.6%), Ohio (29.5%), Oklahoma (29.2%), and Iowa (29%), with the highest rates in the South and Midwest. According to their findings, the national obesity rate maintained itself between 2011 and 2012 at 26.2%. This was higher than 2008, when the rate was 25.5%. While most states remained unchanged, New Jersey, Georgia and North Carolina's rates increased. Delaware's rate decreased (Bass, 2013). America's Health Rankings found that in 2010, Vermont, New Hampshire, Connecticut, Massachusetts and Hawaii were the healthiest states. Mississippi was last, and Louisiana, Oklahoma, Arkansas and Alabama were in the

bottom 5. Mississippi has been in the bottom 3 since the rankings were started in the 1990s. For the first time ever "… not a single state has a prevalence of obesity less than 20.0 percent" (America's Health Rankings, 2011, p. 35). Drawing a darker picture regarding the nation's health, "even though overall quality is improving; access and disparities are not improving" (America's Health Rankings, 2011, p. 11). Life expectancy mirrored some of these disparities with the lowest life expectancy in the Deep South and Appalachia. States with higher life expectancies were those on the coasts and the Mountain states. These disparities are not simply about location, but rather, express something about the characteristics of the populations and their surroundings (Panel on Understanding Cross-National Health Differences Among High-Income Countries, Woolf, & Aron (Eds.), 2013). Even compared to other countries, the most disadvantaged Americans had mortality rates greater than some OCED countries with the highest international mortality rates (Panel on Understanding Cross-National Health Differences Among High-Income Countries, et al, 2013).

These population based prevalence rates are disturbing, and while they may regionally differ, they are still far too high across the board. Some of the aforementioned surveys (Bass, 2013, Bethell, et al, 2010, Levi, et al, 2012, Singh, et al, 2000) used self-report measures of height and weight. This may mean that these rates are under reported (Kuczumarski, Kuczmarski and Najjar, 2001, Palta, Prineas, Berman and Hannan, 1982, Stunkard, & Albaun, 1981), and that estimates are conservative. Because childhood obesity tracks into adulthood (Gordon-Larsen, The & Adair, 2010), it is imperative that interventions impact children appropriately.

2.2 **Disparity in Prevalence Rates**

The greatest prevalence of overweight and obesity was found in African Americans, Latinos, American Indians and Alaska Natives, and among low-income youth (Center for

Disease Control and Prevention, 2009, Crothers, et al, 2009, Gable, Britt-Rankin, Krull, & Guthrie, 2008). Even among very young children, studies indicated that racial disparities existed between prevalence levels. These disparities were exacerbated in more obesogenic environments (Irigoyen, et al, 2008). Between 1990 and 2010, Black males and females and Mexican-American males and females were significantly more likely to be obese than their White counterparts. During this time period, there was a significant increase in adolescent males, but not females (Ogden, et al, 2012). Between 2003 and 2007, "the magnitude of racial/ethnic disparities in obesity and overweight prevalence increased markedly…" (Singh, Saihpush, & Kogan, 2010, p. 44).

Black and Hispanic children also had a higher level of inactivity than their White peers. In both the US and Canada, there were, "…substantial inverse socioeconomic gradients in childhood physical activity" (Singh, Kogan, Siahpush, & Van Dyck, 2008, p. 214). Racial gaps in obesity prevalence widened as children aged. Children of immigrant parents had higher levels of overweight and obesity. Children of newer immigrants were more likely to enter the "always overweight/obese" category earlier and to sustain this status throughout the school years examined (Balisteri & Van Hook, 2011).

The rate of obesity among African American high school students was almost twice that of White high school students (Levi, et al, 2012). Disturbingly, the rate of increase in overweight Black and Hispanic children is growing much faster than overweight White children. (Crothers, et al, 2009). Obesity prevalence was also higher in these minority groups. Nevertheless, Whites' obesity prevalence rates are starting to catch up, and may be eclipsing racial and ethnic differences (Caprio, et al, 2008).

These disparities continued into adulthood. Between 2006 and 2008, 35.7% of non-Hispanic Blacks were obese. This group had a 51% greater prevalence rate than non-Hispanic Whites. Meanwhile, 28.7% of Hispanics were obese and had a 21% greater prevalence rate than non-Hispanic Whites. Non-Hispanic Whites had a 23.7% prevalence rate. Non-Hispanic Black women had the highest prevalence rate, 39.2%, followed closely by non-Hispanic Black men, 31.6%. Hispanic women's rate was a full ten percentage points lower than their Black counterparts, 29.4%. Hispanic men were a few percentage points lower than their Black counterparts, 27.8%. Non-Hispanic White men's rate was 25.4%, while non-Hispanic White women were below everyone else at 21.8%. Out of the four Census regions, non-Hispanic Black women had the greatest prevalence rates in the South. The South's rate was followed closely by the Midwest, the West, and finally the Northeast. While there were some minor differences among other race/ethnic groups, the regional differences indicated that the larger prevalence levels were in the South and West (Pan, Galuska, Sherry, Hunter, Rutledge, Dietz & Balluz, 2009). Adult obesity trajectories were also alarming. Like children, prevalence levels mirrored race/ethnic disparities, especially among adults who were extremely obese. Of the extremely obese, a BMI $\geq$ 35 or BMI grade 3, BMI $\geq$ 40, non-Hispanic White men had a prevalence rate of 10.5% and non-Hispanic Black men, 14.4%. Non-Hispanic White women had a rate of 16.6%, and non-Hispanic Black women ranged all the way up to 27.9%. Between 1999 and 2008, obesity trajectory levels increased in adults (Flegal, Carroll, Ogden, & Curtin, 2010).

For the past 9 years, the Trust for America's Health has published a national summary report entitled, "F as in Fat." It combines statistical analysis from a number of data sets to report on prevalence levels and trajectories throughout the 50 contiguous states, Alaska and Hawaii. The report aims to provide a snapshot of the current and future health prospects of the nation.

The results have been frightening and disappointing. In the most recently published report, the authors concluded that Americans have bifurcated futures. One future will lead to those that are overweight or obese and develop associated adverse health consequences. The other will be for those of a healthy weight, who will lead an entirely different life. Projections indicated that if adult obesity prevalence levels remained at the same rate, 44% of adults in every state will be obese by 2020. By 2020, 60% of adult residents in 13 states will be obese. Even more disturbing, new cases of Type 2 diabetes, coronary heart disease, stroke, hypertension and arthritis could increase by 10 times between 2010 and 2020 and then double again by 2030. By 2030, obesity related health care costs could increase by more than 10% in 23 states and 20% in 9 states.

However, if the average BMI was decreased by just 5%, this would translate into a 9-14% reduction in states' obesity rates by 2030. This decline would lead to a significant drop in disease rates and healthcare expenditure (Levi, et al, 2012).

All the news was not negative – over the past few years, a few cities reduced prevalence levels. Importantly, those cities made early and comprehensive plans and interventions to tackle rising obesity rates (Levi, et al, 2012). Buttressing the bad news regarding disease and obesity prevalence levels were reports that only a few private insurance companies covered obesity interventions. Medicaid and SCHIP, or other state employee insurance plans also did a sub-par job in covering obesity treatment. This pattern has continued, despite the fact that Medicare recognized obesity as a disease in 2004. Perhaps hampering coverage expansion is the stipulation that obesity interventions will only be covered if they are supported by evidence and have demonstrable outcomes. In addition, Medicaid did not set a national standard for obesity treatment, but permitted states vast flexibility to decide what services they will or will not cover

(National Conference of State Legislators, 2013). Coverage may change in the near future, as the American Medical Association declared obesity a disease in 2013. The hope is that this designation will help reduce the stigma associated with obesity, raise awareness about obesity's causes, and change reimbursement schemes (Pollack, 2013).

The evidence presented thus far indicates that Black and Hispanic populations within the United States have much higher prevalence rates than Whites. Again, some of these studies used self-reported measures for height and weight (Pan, et al, 2009, & Singh, et al, 2010), indicating that estimates may be conservative. Overweight and obesity are impacting subpopulations of children and adults that experience significant disadvantages (Iceland, & Wilkes, 2002, Jaret, Reid, & Adelman, 2003, Massey & Denton, 1993, & Wilson, 1987). This will mean that their future health status is being placed in further jeopardy.

2.3 **Poverty and Obesity:**

In 2011, there were 73.9 million children in the United States. This was 1.5 million more than there were in 2000. The number of children is projected to rise to 101.6 million by 2050, and comprise 24% of the total population. By 2023, less than half of the nation's children will be Non-Hispanic White. By 2050, 39% of children are expected to be Hispanic, while non-Hispanic White will drop to 38%. Between 1980 and 2009, the number of children born to single mothers increased 50%. In 2010, 22% of 0-17 year olds lived in poverty, up from of 16% in 2000-2001. Adding to the discrepancy in 2010, "about 20 percent of Black, non-Hispanic children, 15% of Hispanic children and 5% of White, non-Hispanic children lived in families with incomes below one-half of the poverty threshold …" (Federal Interagency Forum on Child and Family Statistics, 2012, p. 6).

A number of researchers have shown correlations between poverty and obesity. That is, as poverty deepened, so did obesity rates (Chambers, Duarte, & Yang, 2009, Kaufman & Karpati, 2007, Levi, et al, 2012, Menifield, Doty, & Fletcher, 2008, Mojtahedi, Boblick, Rimmer, Rowland, Jones, & Braunschweig, 2008, Nanney, Bohner & Friedrichs, 2008, Nanney & Davey, 2008, & Tonorezos, Karpati, Wang & Barr, 2008). Put another way, as income increased, obesity decreased, creating an inverse relationship between socioeconomic status and obesity.

Other researchers disagree with the assessment that the majority of obese children are found in households with lower income levels (Ogden, et al, 2012). While almost 12 million children and adolescents were obese, another 12 million live in households between 130% and 350% of the poverty level. In other words, equal numbers of children that were obese were in households with incomes at or below 130% of the poverty line, and in families that earned more than that (Ogden, et al, 2012).

Many low-income families faced exceedingly hard decisions every day. Families deal with, "the concept of 'time poverty'," at meal time (Caprio, et al, 2008, p. 2214). "Time poverty" forces families to choose between money for food and time spent with their family (Caprio, et al, 2008). This supports the research that shows that the largest disparities in prevalence rates existed between those living in poverty and those who made 400% of the poverty line. Between 2003 and 2007, the gap between publicly and privately insured children also increased (Bethell, et al, 2010). Other studies confirm that the largest differences in prevalence rates for children were between those in low-income households and those at other income levels (Miech, et al, 2006 & Singh, et al, 2010). Analyzing prevalence rates over time in 12-17 year olds, children in low-income households had consistently higher prevalence rates than children in other income

households (Miech, et al, 2006). Families with incomes at 350% of the federal poverty level had a child obesity rate of 11.9% for boys and 12.0% for girls. Children in families with an income level of 130% of the federal poverty level had a male obesity rate of 21.1% and a female rate of 19.3%. For non-Hispanic White boys, the relationship between poverty level and obesity was significant. This means that there were different levels of obesity at different levels of income. Interestingly, the same could not be said of non-Hispanic Black and Mexican-American children (Ogden, et al, 2012). These results unmask the complexity of obesity, which will be expanded in chapter 4.

Examining inequality indices and obesity, researchers found that there were significant disparities between higher and lower levels of income, education and employment (Singh, et al, 2010). Likewise, the income gradient increased between 2003 and 2007 (Singh, et al, 2010). Other studies also supported that as SES decreases, the odds of persistent overweight increased (Gable, et al, 2008). Children who were Hispanic, low income, and had parents with low educational attainment, were more likely to be overweight/obese at younger ages. There was also some indication that SES did not impact the genders equally. Boys' prevalence rates were affected by parental educational levels while girls were dually influenced by both parental educational and income levels (Singh, et al, 2008).

Yet, a multitude of variables influenced the degree of the association between poverty and obesity: "the double-edged sword of hunger and poor availability of healthy food is, however, unlikely to be the only reason as to why obesity tracks with poverty" (Levine, 2011, p. 2667). These other variables include, but are not limited to age, gender, race, population and geographic location, household instability, area poverty (Wang & Zhang, 2006, & Chambers, et al, 2009), and educational level of household head (Ogden, et al, 2012). It is unclear if these

changes were mirrored among children, as many of the variables have only been modeled in adults (Wang & Zhang, 2006). Complicating the issue is that these associations can remain statistically significant among certain age, race/ethnic, and gender subgroups (Barlow and Executive Committee, 2007, & Chambers, et al, 2009). Further, these associations may change over time (National Heart, Lung and Blood Institute, 2007). The relationship between obesity and socioeconomic status may be bidirectional, and other variables may also impact either obesity or socioeconomic status, or both (Paeratakul, et al, 2002). All of these variables also coexist and interact in different ways, especially in different states (Bethell, et al, 2010).

Some researchers agree that SES impacts health, but don't concur about how it links to childhood obesity (Caprio, et al, 2008). The data on SES may not truly convey the complexity of the situation. For instance, focusing only on income (Caprio, et al, 2008) or segregation (Tighe, Needle, & Hawkins, under review), ignores the social gradient of access to power and other privileges available to certain subgroups. SES and social class are variables that are incorporated in every aspect of daily living, and have a cumulative effect on health. The component parts of SES are sometimes treated as "confounding factors" rather than specific variables to analyze, thereby negating their overall impact on health (Caprio, et al, 2008). When studying childhood obesity in particular, "measures of accumulated wealth and access to resources and services are usually not included … causal relations between SES factors and obesity rates cannot be convincingly inferred from cross-sectional studies" (Caprio, et al, 2008, p. 2213). And perhaps the larger question is: if there is a reduction in poverty, will this also have the effect of reversing obesity and sedentary activity levels (Levine, 2011)?

Again, children from specific and disadvantaged subgroups are experiencing childhood obesity at higher rates than more advantaged children. Poor children face a multitude of barriers

to experiencing good health throughout their lifespan. Combined with the information presented previously regarding the rise in prevalence rates, and the demographics of children who are overweight or obese, we are facing a public health crisis. Many of the above mentioned studies use income as a sole indicator of SES (Miech, et al, 2006), area or neighborhood poverty (Chambers, et al, 2009, & Tonorezos, Karpati, Wang, & Barr, 2008), or in home observations (Kaufman & Karpati, 2007) perhaps diminishing or confounding the true relationship between poverty and obesity. Despite these methodological issues, it seems clear that poverty and obesity are related.

2.4 Food Insecurity and Meal Patterns

Food security is an issue that creates a paradox: while poor families struggle to feed themselves regularly, and don't have consistent and ready access to food, children and adults are overweight or obese (Kaufman & Karpati, 2007). People ask a constant and nagging question: "well, if they are poor and cannot afford food, why are they fat?" This seemingly simple question is very hard to answer, as this literature review demonstrates.

As income increases, food insecurity decreases (Federal Interagency Forum on Child and Family Statistics, 2012). Of families with incomes below the poverty line, 44% lived in households that were food insecure. Painting a bleaker picture, in 2009, 45% of children lived in, "inadequate housing, crowded housing, and/or a housing cost burden of more than 30 percent of household income" (Federal Interagency Forum on Child and Family Statistics, 2012, p. 11). Hispanics had the highest levels of food insecurity, while Blacks had the lowest. Both of these groups were significantly heavier than other children. Poor health was also linked to higher food insecurity. Household food insecurity score was not a predictor of children's weights (Bhargava, Jollifee, & Howard, 2008). Poor families in these studies received multiple income based

programs and supports. It is difficult to parse out individual program effects and this may complicate research on food insecurity and obesity.

Researchers posit that obesity and hunger may co-exist in low-income families. This presents a unique challenge to families and communities who are striving to balance the prevention of hunger and overweight (Hofferth & Curtin, 2005). Compounding this difficulty, parental reports of their children's height and weight were used in this study. This may well mean that obesity could be underestimated in poor communities.

Food insecurity and hunger definitions weren't operationalized until the mid 1990's. This has impacted the breadth and depth of research on food security (Cook, & Frank, 2008), and its connection to obesity. Obfuscating food security and obesity studies, particularly, is the presence of food insecurity in a wide range of socioeconomic groups. Hispanic and Blacks are much more likely to be food insecure, and have children living in their food insecure households (Powell & Chriqui in Cawley, 2011). These same families have increased obesity and poverty rates, therefore, children living in these households experience multiple disadvantages.

The ECLS-K database, also used in the present study, assessed food security of respondent families using the USDA Food Security Survey. Researchers used food security status to assess its impact on childhood overweight and obesity (Jyoti, Frongillo, & Jones, 2005, & Rose & Bodor, 2006). Rose and Bodor (2006), found that household food insecurity in Kindergarten, as measured by the USDA Food Security survey, was not associated with higher overweight prevalence. In fact, the relationship was inverse. Incorporating the first grade year, the researchers mirrored the same inverse relationship between household food insecurity and weight status.

Jyoti, Frongillo, and Jones (2005), examined whether food insecurity in kindergarteners resulted in poorer development, and its impact on overall development. Girls who were food insecure at kindergarten had increased weight status by third grade. Girls also exhibited weight gain regardless of food security status, perhaps indicating that food security status had little effect on overall weight status. In boys, there did seem to be a link between food insecurity and weight status. Boys in households that remained food insecure gained more weight than boys in households that transitioned from food insecure to secure. They also gained more weight than those that went from food secure to food insecure. In boys, rather than in girls, the manifestation of weight status issues happened very quickly (Jyoti, et al, 2005). The food stamp program (FSP) has been examined as a moderator of the relationship between food insecurity, material hardship and child outcomes. Researchers found that there were no significant changes in weight as a result of the FSP (Frongillo, Jyoti & Jones, 2006).

There was also a clear "obesity paradox: … trade off food quality for quantity to prevent household members, especially children, from feeling persistently hungry" (Powell & Chriqui in Cawley, 2011, p. 195). The food that families who were food insecure could afford was energy dense and nutrient sparse. Despite this fact, families used these cheaper foods to simply thwart hunger pangs. Adults in these food insecure households rationed their own food in order to feed children first (Powell & Chriqui in Cawley, 2011). They also gave their children the healthier foods (Chambers, et al, 2009). Caregivers faced an even more taxing choice during extreme temperatures. Should they pay for heat or air conditioning, or feed their children? Infants and toddlers were especially susceptible and investigators realized that food insecurity for this cohort was an "invisible epidemic (Powell & Chriqui in Cawley, 2011, p. 203)." Food insecurity for

very young children is rampant, dangerous and can acutely and negatively threaten children's health and development.

Briefly, many families gained access to their benefits at the beginning of the month. They usually dealt with a "splurge" of food and money at this time. By the middle of the month**,** families were struggling to make ends meet. This budget shortfall led to food scarcity. Some families obtained "credit" at local stores, which were corner stores or bodegas. Typically, these stores did not consistently supply fresh and cheap produce (Kaufman & Karpati, 2007). For these families, their diets mimicked disordered eating patterns known as "binging" during those periods when they could obtain food easily (Hofferth & Curtin, 2005, Kaufman & Karpati, 2007, & Metallinos-Katsaras, Must & Gorman, 2012).

Children that were classified as being in households that were consistently food insecure and also reported an increase in hunger status, had 22% greater odds of childhood obesity versus children that were consistently food secure. Maternal weight status acted as a modifier to the above relationship (Metallinos-Katsaras, et al, 2012).

Gibson (2004), showed that 5 years of food stamp receipt increased a girl's probability of being overweight by 42.8%. Impacting the robustness of these findings, the standard error and confidence interval of these predictions were very large. Also, boys that obtained food stamps for of the entirety of the 5 year period studied, had a 28.8% decreased probability of being overweight. The author cautioned that the relationship could be easily confounded with other variables such as long-term poverty and changes in the family environment. In short, it was not clear that food stamps were, or were not, the direct cause of changes in overweight prevalence (Gibson, 2004). In addition, the base year measurements used in this study were child self-reported height and weight.

Different investigations found that food stamp receipt did not impact childhood overweight. Because of multiple feeding programs, researchers had difficulty parsing out the singular effects of one program versus the others on weight status (Hofferth & Curtin, 2005). However, critics argue that previous literature claiming food assistance programs contributed to obesity status because of monthly "binging," used cross-sectional data (Bhargava, et al, 2008). Additionally, it only assessed adults and did not incorporate enough confounding variables to be a conclusive study. For instance, may being overweight exacerbate food shortages by increasing overconsumption (Bhargava, et al, 2008)?

While the data seems far from conclusive, with studies lacking methodological rigor, and a paucity of nuanced analyses, the findings still are troubling. A large number of children and families from a variety of socioeconomic backgrounds rely on SNAP. If SNAP is exacerbating obesity, solutions need to be put forth. The relationship between families receiving SNAP and obesity needs to be adequately explored. It seems clear that a singular social welfare program receipt's impact on obesity is far from the whole story. Multiple factors impact children and families, program receipt is only one of these influences.

2.5 **Family Impact**

Both children and parents had roles in deciding what foods a child would consume. The impacts on children's eating habits were, "intractably interrelated and children's practices are clearly influenced by the spaces they inhabit" (Rawlins, 2009, p. 1084). Through observation, interviews with families and analysis of health education advice, Rawlins (2009), found that a number of factors affected daily decisions about when, where and how to eat. These variables included parenting practices, health information, and family togetherness practices (Rawlins, 2009). Children preferred some food choices over others, and the best predictor was overall taste.

Salty and sweet foods are also high in sugar and fat content, and were therefore natural attractors. These preferences were generally formed by the time children were toddlers. A number of the toddler-aged eating behaviors copied the unhealthy habits of the adults in their lives. Not everything about appetite related behaviors is well understood, especially how the child's environment can supersede internal signals regulating appetite (Esposito, et al, 2009).

Maternal work status also affected obesity trends. In 2007, 71% of mothers with children under 18 participated in the labor force. The assumption of much of the literature was that mothers who worked had less time to devote to food preparation. They used fast or prepared food for children's meals, rather than cooking from scratch (ConAgra Foods Foundation, 2012, & Ogden, et al, 2010). If mothers' time spent at work was not offset by a partner who cooked from scratch, or got the children involved in physical activity, the children participated in more sedentary activity and had less caloric requirements. Mothers that worked nonstandard hours may have missed key parts of the day such as meals, homework and bed times. All of these factors impacted the creation of healthy family routines. Working mothers may have difficulty committing to weekend and afterschool activities. Work, "may also interfere with the time they would spend engaging in physical activity with their children" (Morrissey, Kalil & Dunifon, 2011, p. 68). While useful, this study didn't adequately sample low-income and minority families. The majority of respondents were more highly educated than those with missing data, and more likely to be White (Morrissey, Kalil & Dunifon, 2011). This means that the findings may differ for low-income and minority subgroups.

Less educated employees (Ogden, et al, 2010), and Black men and women (Presser, 2003) worked these non-standard hours. Typically, they were employed in the food prep, serving, cashiers, orderlies, retail and home health aide fields. Over time, schedules changed

(Presser, 2003), and parents generally had varied employment status (Ogden, et al, 2010). Inconsistent schedules, low-wage employment, and nonstandard work hours and days contributed to employment disadvantage among workers (Presser, 2003). Children of mothers whose work status changed had higher BMIs (Ogden, et al, 2010). These families were more likely to be low-income compared to those that remained employed over time. These children were more likely to be Black, had less educated mothers, and had fathers that did not work full time. Children of mothers that continuously worked over their lifetimes had higher BMIs than those of stay at home mothers (Ogden, et al, 2010).

United States population demographics have changed over the past 30 years, because of high rates of immigration (Massey, 1995 & Smith & Edmonston, 1997). Immigration itself can impact health status differentially depending upon country of origin (Ghazal Read, J. & Emerson, M. O., 2005). These demographic changes are accompanied by great variation in diets. It is important to assess prevalence rates among immigrant families. A systematic review of the literature on acculturation found that most of the studies conducted used data from the Southwest and California. These studies sampled adults, used self-reported food frequency questionnaires, and did not dissect differences between the many Hispanic subgroups. Overall, no relationship was found between acculturation and increased fat or energy intake (Ayala, Baquero & Klinger, 2008). Those who were less acculturated drank full fat milk and used fat when cooking while the more acculturated ate higher amounts of fast food, snacks and added fats (Ayala, et al, 2008).

A qualitative study examining Mexican-origin women's food-related decisions in South Texas, found that their primary food decisions were made with their children in mind (Johnson, Sharkey & Dean, 2011). This population had some of the highest obesity (Ogden, Carroll, Curtin, McDowell, Tabak, & Flegal, 2006) and diabetes (Umpierrez, Gonzalez, Umpierrez, &

Pimentel, 2007) rates in the nation. The women frequently leveraged whatever resources they had on hand to provide meals for their children (Johnson, Sharkey & Dean, 2011). The researchers stressed that the mothers were seen as the person in charge of food related decision-making and caregiving within the family (Johnson, Sharkey & Dean, 2011). As this research was qualitative, it cannot be extrapolated to other populations.

In a study using phone interviews, immigrants had higher levels of physical inactivity and lower levels of physical activity (Singh, Kogan, Siahpush & Van Dyck, 2008). This self-report measure may include potential bias, and under-reporting of activity and inactivity levels. In another study, immigrant children scored higher on mental health outcomes than native born children (Crosnoe, 2006). However, advantage was cancelled out once physical health was taken into account. Health factors seemed to have a predictive power for Black non-immigrant children on academic achievement. Children with worse health outcomes had lower academic achievement scores (Crosnoe, 2006). Interestingly, different races/ethnicities and genders more effectively self-categorized as overweight than others. Women and Whites were more adept at recognizing overweight status than men, Blacks and Hispanics (Paeratakul, et al, 2002).

Immigrants from some areas feel that overweight and obesity is a sign of health and wealth (Cogan, J., Bhalla, S., Sefa-Dedeh, A. & Rothblum, 1996). This complicates self-perceptions of overweight (Hofferth & Curtin, 2005). Even among American born respondents, there were discrepancies between racial groups about what is considered the "ideal" body size. African American women thought that a larger body size was optimal compared to White women (Caprio, et al, 2008, & Hammond, 2010). Different ethnic groups were also more influenced by their perception of others' body weight. This differentially impacted weight loss and maintenance (Hammond, 2010). Hispanic families had less knowledge regarding

cardiovascular disease risk factors, the deleterious effects of fried food and participated in less physical activity than White families (Gruber & Haldeman, 2009). However, they were described as having a more "family centric" culture (Dilworth-Anderson & Marshall, 1996). This may mean that the family was a source of strength when trying to achieve a better health status, or create barriers to achieving health related goals (Gruber & Haldeman, 2009). Food itself can be seen as a tool for expressing cultural identity, and a way of maintaining one's cultural traditions (Caprio, et al, 2008), and ethnic roots (Gruber & Haldeman, 2009).

Parents will influence their children, especially younger children (Koehly & Loscalzo, 2009). Still, family is far from the only relationship or environmental impact on childhood behavior. Friends, teachers, community leaders and others will affect children's habits and health behaviors. In addition, there will be cultural or group norms and attitudes embedded within routine intrafamily daily interactions that silently influence health (Koehly & Loscalzo, 2009).

It is essential to recognize that, "… the obesity epidemic is a particularly challenging problem because it results from a system containing a diverse set of actors, at many different levels of scale, with differing individual motivations and priorities. This system has many moving parts and operative pathways, which interact to produce rich variation in outcomes that cannot be reduced to a single mechanism" (Hammond, 2009, p. A98). Social network theory also supports the notion that there is a social aspect to obesity. Overweight adolescents were more than two times as likely to have overweight friends (Hammond, 2010). In one of the most often cited studies, researchers analyzing data from the Framingham Heart Study found that social distance played a larger role in person-to-person spread of obesity than actual geographic distance (Christakis & Fowler, 2007). In addition, the type of friendship mattered. If both friends identified each other, there was a 171% likelihood that the "alter" would be obese if the

ego was also obese. Same sex friendships had a 71% increased risk of obesity. The authors concluded that, "…obesity may spread in social networks in quantifiable and discernible pattern that depends on the nature of social ties" (Christakis & Fowler, 2007, p. 377).

Kjellstorm (2008) contended that without a certain level of social cohesion within a country, equity-enhancing policies will be blocked from being created. And this will, in turn, impact what types and quality of interventions can be effectively created. Evidence points to incorporating social capital as an integral aspect of the larger social welfare and health policy approach. By doing so, the most disadvantaged groups will enhance their well-being. These policies should attempt to increase the social capital of the communities through health, peer and social education. Knowledge and skill sharing will be of utmost importance throughout the various sectors involved (Kjellstorm, 2008). The evidence seems to indicate that without work to enhance and create social, familial and community support, and cohesion, anti-obesity policies will be ineffective. A number of environments, including parental and family influences, help formulate what a child's preferences, habits and eating behaviors are. In concert with other variables, these impact a child's weight and health status.

2.6 **Global Impact**

As explained earlier, global obesity trends have also been rising. During the 1970s and 1980s, the same time that rates began to increase in the U.S., other higher income countries followed suit (Gortmaker, Swinburn, Levy, Carter, Mabry, Finegood, Huang, Marsh & Moodie, 2011). Since that time, obesity rates in middle and low-income countries have also grown. Evidence showed that in 200 countries between 1998 and 2008, obesity prevalence increased. Higher-income countries had the sharpest climbs, but socioeconomic and racial disparities were noted everywhere (Gortmaker, et al, 2011).

Much of the global obesity upsurge is blamed on the change from agricultural economies to import/export economies (Philipson & Posner, 2008). Trade-based economies are at the fickle will of the global food system (Ghosh, 2010). Over the past forty years, international diets shifted to resemble westernized diets. These diets included increased quantities of meat, dairy and less complex carbohydrates (Dixon, Omwega, Friel, Burns, Donati & Carlisle, 2007 and Popkin, 2006). Changed consumption patterns coupled with a reduction of food price, increased food availability (Dixon, et al, 2007) and decreased time spent in physical activity (Popkin, 2006) became the new norm. In the global postindustrial country context there is not equitable access to healthful food (Ghosh, 2010). Higher income people have access to and eat foods farmed and produced outside of conventional agriculture and industry (Dixon, et al, 2007). However, the rest of the populace must obtain food from agribusiness, and much of this is processed versus fresh. When eating out of the home, low-income people eat at fast food outlets rather than at "farm-to-table" restaurants. This constructs a "fast versus slow food dichotomy", with the rich benefitting (Dixon, et al, 2007). Even in this context of increased availability and lower prices, not everyone has equal access to nutritious foods. More nutritious foods are more expensive than factory-prepared meals, further widening the divide between rich and poor.

Data from England indicated that location matters (Procter, Clarke, Ransley, & Cade, 2008). Children in higher income areas had lower rates of obesity. Locally, variables that impacted obesity were different from global factors. Global variables of influence were access to supermarkets and gyms/recreation centers, quality of public transit and urbanization. Local variables were fruit and vegetable consumption, sedentary behavior, and household income. Deprivation and living in urban areas were positively correlated with obesity. Interestingly,

areas with less available public transit had lower rates of obesity. The authors believed that these areas were also higher income (Procter, et al, 2008).

Generally, as populations in developing nations show an increase in longevity, the disease burden moves from communicable to NCD (Kjellstorm, 2008 & Popkin, 2006). Larger drivers, such as a "toxic combination of bad policies, economics, and politics," within countries have been heightened by globalization (Committees on the Social Determinants of Health, 2008, p. 26). These forces are directly at fault for the poor health of the global population (Committees on the Social Determinants of Health, 2008, & Popkin, 2006). There is a general consensus that globalization, including "the traditional social fabric of cities," is deeply affected by trade, trade restrictions, economic sanctions, agricultural and land-use policies (Kjellstorm, 2008, Philison & Posner, 2008 & Popkin, 2006). This disruption can worsen both obesity prevalence rates and enhance disparities in rates.

International prevalence data is limited. It does show that, "by 2008, an estimated 1.46 billion adults globally were overweight … 502 million adults were obese … Estimated 170 million children … overweight or obese" (Swiburn, Sacks, Hall, McPherson, Finegood, Moodie & Gortmaker, 2011, p. 805). These approximations are also weakened by inconsistencies in data collection. Many countries simply don't have a population-based data set to monitor physical activity, sedentary activity, nutrition and BMI (Gortmaker, et al, 2011). The international community also doesn't have standard definitions of childhood overweight and obesity (Cole, Bellizzi, Flegal & Dietz, 2000). Policy changes that have been implemented, have, for the most part, not been properly and critically evaluated (Gortmaker, et al, 2011).

Global obesity demographics and prevalence rates present a worrisome picture of the international community's future health prospects. These rates have been increasing and have

been modeled despite the fact that some countries' raw data has not been collected or adequately analyzed. Additionally, baseline measurement methodologies may differ from country to country, complicating assessments of international prevalence rates. With rates rising internationally, it is also evident that the American environment, while certainly entrenched with unique variables enhancing obesity among subpopulations is not solely at fault. Obesity is on the rise everywhere. The global environment and variables discussed above also hold significant sway.

2.7 **Potential Causes:**

There is little doubt that certain genetic predispositions can affect obesity prevalence among those at higher risk. The rapid proliferation in childhood overweight and obesity across racial, ethnic and geographic boundaries negates the genetic argument as the sole cause (Anderson & Butcher, 2006, Barlow and Executive Committee, 2007, Caprio, et al, 2008, & Krebs, et al, 2007). Certain things that can intensify obesity seem to be hereditable, "eating disinhibition, susceptibility to hunger, and eating in the absence of hunger… Thus, a child's family health history, along with shared behaviors and familial environments, must be considered …" (Koehly, & Loscalzo, 2009, p. A99). Yet, most obesity predictors are behavioral versus genetic (Crothers, et al, 2009). The search for purported elusive genes that are shared by obese people has thus far been disappointing (Swinburn, et al, 2011). Over the past thirty years, obesity rates among every group in the US have increased. While obesity has always increased with age, it now escalates more rapidly with age (Anderson & Butcher, 2006). It is therefore necessary to understand the degrees of complexity and levels of interaction which together make up the alarming rise in childhood overweight and obesity. Social determinants of health may be a substantive area for further research data gathering and knowledge acquisition.

A number of variables have been cited as causing or adding to childhood overweight and obesity. Contributing factors to increased sedentary activity include:

- Increased TV watching (Anderson & Butcher, 2006, Gable, Chang & Krull, 2007, & Sturm, 2005a); more time spent in front of the computer (Sturm, 2005a); increased sessions playing video games (Sturm, 2005a)
- greater time spent on homework (Sturm, 2005a)
- maternal participation in the labor force (Anderson & Butcher, 2006); dual earner families with less time to cook at home and play with children (Paxson, et al, 2006)
- living in unsafe neighborhoods (Gable, et al, 2007)
- dangerous play areas in certain neighborhoods (Crothers, et al, 2009 and Paxson, et al, 2006)
    - perilous walk and bike routes to school (Anderson & Butcher, 2006)
- greater reliance on auto transport and suburban sprawl (Anderson & Butcher, 2006, Crothers, et al, 2009 & Paxson, et al, 2006)

Additional variables include:

- rise in percentage of meals eaten out of the home (Anderson & Butcher, 2006 & Crothers, et al, 2009)
- household instability (Chambers, Duarte & Yang, 2009)
- rapid growth in the number of fast food restaurants (Harris, Schwartz, Brownell, Sarda, Ustjanauskas, Javadizadeh, Weinberg, Munsell, Speers, Bukofzer, Cheyne, Gonzalez, Reshetnyak, Agnew & Ohri-Vachaspati, 2010 & Paxson, et al, 2006)
- enhanced marketing to children (Calvert, 2008, Crothers, et al, 2009, Dorfman & Abramson, 2009, Harris, et al, 2010 & Paxson, et al, 2006)

- couples high profile stars with products (Calvert, 2008 & Paxson, et al, 2006)
- links cartoon characters with products (Calvert, 2008 & Paxson, et al, 2006)
- encourages children to request less healthy food and drink (Crothers, et al, 2009)
- pairs unhealthy fat and sugar laden food with catchy materials (Dorfman & Abramson, 2009 & Paxson, et al, 2006)
- placing non nutritious foods at eye level for children in supermarkets and stores (Paxson, et al, 2006)

- schools decreasing physical activity, recess time and nutrition education (Anderson & Butcher, 2006, & Paxson, et al, 2006)
  - schools hosting vending machines on campus (Anderson & Butcher, 2006 & Paxson, et al, 2006)
  - lower quality federally subsidized school meal programs (Crothers, et al, 2009)
  - exclusive pouring contracts with beverage companies on school grounds (Paxson, et al, 2006)
  - permitting other "competitive" foods on campus which replace school lunch in children's diets (Paxson, et al, 2006)
  - Concentration on academics/passing standardized tests, (Anderson & Butcher, 2006)
  - reduced time for lunch periods (Anderson & Butcher, 2006)
- reduction in quality of child care that doesn't emphasize active play and physical activity (Anderson & Butcher, 2006)
  - increased hours spent in care, or unsupervised, while parents work (Anderson & Butcher, 2006)

    - unhealthy foods being served during hours spent in care (Crothers, et al, 2009)
- less access to fresh fruits and vegetables (Paxson, et al, 2006)
    - food pricing and perception of pricing (Anderson & Butcher, 2006)
- supermarket redlining from the inner cities (Paxson, et al, 2006)
- High intakes of sugar sweetened beverages (Anderson & Butcher, 2006, Crothers, et al, 2009 & Krebs, et al, 2007)
- Larger portion sizes (Anderson & Butcher, 2006, & Krebs, et al, 2007)
- Increased rates of snacking (Krebs, et al, 2007)
- skipping breakfast (Merten, Williams & Shriver, 2009)
- Community disadvantage (Merten, Williams & Shriver, 2009)
- Neighborhood collective efficacy levels and social capital (Cohen, et al, 2005 & Kjellstorm, 2008)
- Preference for higher fat and energy foods (Martin, Thomson, LeBlanc, Stewart, Newton, Han, Sample, Champagne, & Williamson, 2010)
- Breastfeeding versus bottle feeding (Anderson & Butcher, 2006)
- Reduction in hours spent sleeping (Crothers, et al, 2009)

> Taken together, research on obesity singles out no one critical cause of the increase in children's obesity. Rather, many complementary developments seem to have upset the crucial energy balance by simultaneously increasing children's energy intake and decreasing their energy expenditure. The challenge in formulating policies to address children's obesity is not necessarily to determine what changed to create the current epidemic; but rather, what is the most effective way to change children's environment and restore their energy balance going forward (Anderson & Butcher, 2006, p. 38).

The evidence suggests that obesity is not caused by individual behaviors. Rather, childhood obesity is a multifaceted problem that can exacerbate and is exacerbated by social

determinants, including poverty. It seems clear that the obesity epidemic and the ill health effects associated with it comprise a typical case of a health disparity. A health disparity means that disadvantaged groups "… systematically experience worse health or more health risks than do more advantaged social groups…" (Braveman, 2009, p. A91). The experience of health disparities by disadvantaged groups means that their health is further endangered, and they are put at greater risk and future hardship. This additive quality of burden makes health disparities especially dangerous and unjust (Braveman, 2009). The solutions to the epidemic require a firm grounding in all of the structural, cultural and political issues involved in families' day-to-day lives (Kaufman & Karpati, 2007). Simply, the skyrocketing rates of obesity worldwide are caused by variables outside of genetics. Consequently, it is important to examine the environmental, social and policy factors, which have influenced overweight and obesity prevalence (Delpeuch, et al, 2009).

2.8 **Data Issues**

The sheer mass of past and ongoing research attempting to ascertain the root of the obesity crisis might make one think that finding a solution is close to reality. However, the research to date still has multiple issues to clarify. These challenges include missing "clear causality" and instead asserting "cross-sectional correlations" (Anderson & Butcher, 2006, p. 29). Of the few longitudinal analyses, many are on limited samples, decreasing applicability to the larger sample or population. Of the longitudinal data present, there is some question as to the "… timing of the exposure matches the timing of childhood obesity" (Anderson & Butcher, 2006, p. 29). The causes of obesity are manifest (Anderson & Butcher, 2006, Paxson, et al, 2006, Prentice, 2006, & Swinburn, et al, 2011). These causes interact with any number of variables, and are difficult to isolate. In addition, they are effected by and effect policies, and are

surrounded by a general air of uncertainty. Some theorists posit that variables should not be studied in isolation (Paxson, et al, 2006). Causal pathways of health risks impacted childhood development in a number of manifestations. These may be completely unrelated. Obesity related health impacts can last over the life course and may even create a "… lifetime of socioeconomic disadvantage" (Panel on Understanding Cross-National Health Differences Among High-Income Countries, et al, 2013, p. 58). People experiencing excessive economic distress and cutbacks, due to austerity programs like the Sequester, can have further negatively impacted health care access and limited opportunities (Panel on Understanding Cross-National Health Differences Among High-Income Countries, et al, 2013). Examining disadvantage over the life-course shows that disadvantage is not singular, nor arbitrary, but instead is additive for those already under duress. It almost singles out those already in crisis and increases negative experiences (Blane, 2006).

Sturm (2005a & 2005b) analyzed data sets to establish the quality of the data and whether it can help explain the childhood obesity epidemic. Unfortunately, he discovered a paucity of good data and his findings emphasized the need for future research. Gaps in current data availability include details on school based physical activity, homework, screen time, portion sizes, city planning such as urban environments which decrease physical activity (Sturm, 2005a), and longitudinal data points (Strum, 2005b). The bulk of the US research comes from analysis of NHANES data. Other research has begun to span disciplines bringing new lenses to childhood obesity investigations (Kaufman & Karpati, 2007). Much of the additional research confirms the cause for concern.

Some of the research is inconsistent with conclusions falling on both sides of the stated research question. That is, if the research asked, do eating patterns influence childhood obesity,

some studies will say yes while others will say no. What is required are, "more well-designed, longitudinal studies and randomized, controlled trials … before any definitive statements can be made" (Krebs, et al, 2007, p. S206). This need stretches to the array of impact areas cited above (Krebs, et al, 2007).

A group of theorists, minority stakeholders in the literature, strongly believe that the obsession with obesity is just another constructed social problem (National Association to Advance Fat Acceptance, 2009). In their view, the obesity epidemic does not really exist. These thinkers contend that it is possible for people to be healthy at any weight. They are backed by a national movement to advance and accept fat people at any size. In addition they strive to put an end to weight discrimination (National Association to Advance Fat Acceptance, 2009). Many of these theorists also frame their research with Feminist and Queer constructs (Rothblum & Solovay, 2009). A main part of their argument is that tens of millions of Americans attempt to lose weight annually. Those that are successful at losing some weight rarely maintain it for any significant amount of time. According to their view, it is time to accept the fact that people are fat, and understand that they will not all become diseased and disabled during their lifetime. In other words, stop fixating on losing weight as the answer to better health (Rothblum & Solovay, 2009).

Many of the nationally representative datasets and research published from this data, used parent or child self-report of height and weight (Bass, 2013, Bethell, et al, 2010, Chaloupka & Powell, 2009, Chambers, et al, 2009, Centers for Disease Control and Prevention, 2013b, Gibson, 2004, Hofferth & Curtin, 2005, Hinrichs, 2010, Levi, et al, 2012, Li & Hooker, 2010, Metallinos-Katsaras, 2012, Merten, et al, 2009, Moag-Stahlberg, 2011, National Center for Children's Health, 2012, Pan, et al, 2009, Panel Study of Income Dynamics, 2014, Puhl, et al,

2011, Singh, et al, 2000, Singh, et al, 2010, and Tournegau, et al, 2006), nutrition recall surveys of children or parents rather than direct observation (The Academy of Dietetics and Nutrition Foundation, 2012, ConAgra foods, 2012, Cunningham & Zavodny, 2011, Datar & Nicosia, 2009a, Datar & Nicosia, 2009b, Devault, et al, 2009, Gleason & Suitor, 2003, Hair, et al, 2009, Howard & Parkash, 2009, Kay Fox, et al, 2009, Nanny et al, 2008, & Singh, et al, 2008), and surveys of school food service directors or principals instead of direct inspection (Condon, et al, 2009, Probart, et al, 2010, Turner & Chaloupka, 2012, & Van Hook & Altman, 2012). Another subset of research was cross-sectional (Story, 2009, Sturm, et al, 2010, Voss, et al, 2008, & Wethington, et al, 2013).

The school based analysis used in this dissertation will test the variables the National School Lunch Program (NSLP), the School Breakfast Program (SBP), the school food environment (using vending machine availability of sugar sweetened beverages, salty snacks and sweet snacks), Socioeconomic Status (SES) (as a composite variable as well as by proxy in NSLP and SBP receipt), and race/ethnicity (Black, White and Hispanic). Much of the previous research has only assessed limited variables and their relationships to obesity:

- poverty (Bharvaga, et al, 2008, Centers for Disease Control and Prevention, 2013a, Chambers, et al, 2009, ConAgra Foods, 2012, Datar, et al, 2004c, Gibson, 2004, Levine, 2011, Merten, et al, 2009, Ogden, et al, 2010, Pickett, et al, 2005, Singh, et al, 2000, & Wallach and Rey, 2009),
- SES and school food receipt (Datar & Nicosia, 2009a, Hofferth & Curtin, 2005, & Howard & Parkash, 2009)
- SES and race (Kaufman & Karpati, 2007, Miech, et al, 2006, Singh, et al, 2008, Sturm, et al, 2010, & Wang & Zhang, 2006),

- racial disparities (Fernandes & Sturm, 2010, Moag-Stahlberg, 2011, & Pan, et al, 2009),
- race, gender and SES (Balisteri & Van Hook, 2011, Crosnoe, 2006, Datar & Sturm, 2006, Gable, et al, 2007, Herbst & Tekin, 2009, Judge & Jahns, 2007, Ogden, et al, 2002, Ogden, et al, 2012, Singh, et al, 2010, Van Hook & Altman, 2012, & Von Hippel, et al, 2007),
- gender and race (Anderson, et al, 2011, Datar & Sturm, 2004b, Flegal, et al, 2010, Gable, et al, 2008, Kumanyika, et al, 2007, Ogden, et al, 2012, Puhl, et al, 2011, Rose & Bodor, 2006, & Taber , et al, 2012)
- competitive food availability (Chriqui, et al, 2013, Datar and Nicosia, 2009c, Hair, et al, 2009, Larson & Story, 2009, & Turner & Chaloupka, 2012),
- competitive food availability and race (Cunningham & Zavodny, 2011),
- NSLP receipt (Hernandez, et al, 2011),
- NSLP and gender, race and SES (Dunifon & Kowaleski Jones, 2004, & Hinrichs, 2010)
- SBP receipt (Barfield & Kim, 2010),
- NSLP and SBP, SES, gender and race (Datar & Nicosia, 2009b, & Li and Hooker, 2010)
- or gender (Jyoti, et al, 2005).

Of the studies that used similar variables (Millimet, et al, 2008 & Shazenbach, 2009), they were limited to previous waves of the ECLS-K data set or used slightly different competitive food variables. A number also used logistic regression (Anderson, et al, 2011, Barfield & Kim, 2010, Gable, et al, 2007, Hinrichs, 2010, Metallinos-Katsaras, et al, 2012, Singh, et al, 2008, & Singh, et al, 2010). The logistic regression included in this analysis will advance the analysis of the school food environment by analyzing federally subsidized meal receipt, competitive food availability, and potential differences in SES, gender or race/ethnicity

in the 8th grade wave of the ECLS-K data set. This specific combination of variables and data wave has not previously been researched.

2.9 State of current interventions/treatment and research:

At birth, most infants are not obese. Some toddlers who were obese were able to reverse this trend. Therefore, sustainable interventions may be successful when initiated on young children (Gortmaker, et al, 2011). There was a great deal of confusion among the general public about how to attain a healthy weight status. Studies show that, "… 55% of respondents state that they are frustrated, even to the point of inaction, by conflicting information about health and nutrition" (Seiders & Petty, 2004, p. 156). This ambivalence becomes intensified because people do not recognize the possible future adverse health consequences related to obesity (Seiders & Petty, 2004).

Nationally, a multitude of obesity interventions have been run in a number of environments. The majority of them have been small-scale, and targeted at limited audiences. A few encouraged people to get active, versus concentrating on dietary changes. By default, caloric restriction will lead to the best weight loss results (Gortmaker, et al, 2011 & Powell, Calvin III, & Calvin Jr., 2007). Effective caloric restriction balances the equation of calories in/calories out. It is much easier to create a deficit by decreasing food consumption (Rigby, et al, 2004). While there have been some successful randomized controlled trials, there is not enough evidence on community based solutions (Gortmaker, et al, 2011). Most interventions ignore taste modification, which is considered integral for success (Moag-Stahlberg, 2011). Few programs exist that have been evaluated on children aged 0-6 years (Ma & Frick, 2011). Preventive efforts have been attempted at various stages of the life cycle. It is still unclear which is the optimal

subgroup or age group at which interventions should be targeted to defray the future costs of obesity (Ma & Frick, 2011).

For example, school based programs abound, including an intervention in Tulsa, Oklahoma's 4th grade classrooms. This experiment included nutrition education and experiential learning and excluded physical activity and parental involvement. Self-reported consumption improved considerably, compared to children in the control groups (DeVault, Kennedy, Hermann, Mwavita, Rask & Jaworsky, 2009). In Osceola, Florida, a program based in 6 schools aimed at helping the school community effectively implement the new school based wellness policies and childhood obesity prevention efforts. The study incorporated control schools, nutritional changes in National School Lunch Program (NSLP), nutrition education, physical activity and growing school gardens. Significantly more children in the intervention versus control groups stayed in the healthy BMI range for the 2 years of the study. The authors believed that their results were especially promising for low-income students that were at higher risk for obesity and lower academic achievement. They also argued that prevention efforts should be school-based for these higher risk groups (Hollar, Messiah, Lopez-Mitnik, Almon & Agtatson, 2010). For the most part, however, these school-based interventions have been created with a wide variation in methodology. Not surprisingly, results differed considerably (Cook-Cottone, Casey, Hugh Feeley, & Baran, 2009). Research on school based interventions showed positive gains in program participation, dietary and physical activity patterns. Unfortunately, there weren't associated decreases in BMI (Cook- Cottone, et al, & Davis, et al, 2007). Despite the years of implementation and variability in school based obesity programming, there is no scientifically based model. Interventions that had the most impact were those that incorporated

community involvement (Cook-Cottone, et al, 2009). In short, many programs exist, but few are making a legitimate difference.

A number of organizations have researched the field of pediatric obesity treatment and issued recommendations for care and intervention. Hassink (2010), found that treatment could be successful, but it needed to be comprehensive. Effective solutions included counseling for weight loss or a healthy diet, enrollment onto or counseling on physical activity, and instruction and support of behavior management techniques to create nutrition and activity changes. The levels of intensity of intervention, or contact hours, matter. The most promising interventions met twice a week for hour-long sessions for the first 6 months followed by once per week meetings for the next 6 months. These meetings were a mix of individual or group sessions, at times incorporating a multidisciplinary team (Hassink, 2010). Primary care based solutions like this, versus community-based interventions, are very costly and not easily adapted at scale (Gortmaker, et al, 2011). Other researchers advocated for a partnership with parents, promoting authoritative parenting techniques (Davis, Gance-Cleveland, Hassink, Johnson, Paradis & Resnicow, 2007). Tailored programs which meet individual family needs, and collaborations with schools should be pursued (Davis, et al, 2007). Possible school based interventions should incorporate healthy food promotion, health curriculum, increased physical activity, consumption restriction and discouragement of unhealthy foods (Davis, et al, 2007).

When modeling potential intervention effects, the Trust for America's Health (2009), found that, "… an investment of $10 per person per year in proven community-based disease prevention programs could yield net savings of more than $2.8 billion annually in health care costs in one to 2 years, more than $16 billion annually within 5 years, and nearly $18 billion annually in 10 to 20 years (in 2004 dollars), (p. 3)." The organization speculated that this was a

conservative estimate. Their models did not integrate increased worker productivity, and disease reduction following decreased obesity prevalence (Trust for America's Health, 2009).

Even if these interventions can achieve a modicum of short-term success, they concentrated on individuals. Government's role in permissive marketing of non-nutritious foods, allowing agribusiness and fast food conglomerates free reign "…at the expense of the public's health" (Weiss & Smith, 2004, p. 386) was largely ignored. To put it simply, it is easier to concentrate on individual choice as the cause of obesity. This leads to the possibility of applying cheaper solutions. These cheaper solutions do not incorporate the complexity of obesity's causes. This creates a push-pull tension between causes and solutions, "that is ever present in debates about obesity" (Swinburn, et al, 2011, p. 809).

Most interventions don't make the necessary connections to the environmental constructs that influence individual and interpersonal contexts of health (Gruber & Haldeman, 2009). Individualized programs are not sustainable, cost effective, or hit at a population level. Most importantly, they don't challenge the underlying causes of the epidemic (Swinburn, et al, 2011). For the most part, interventions assumed that the parent-child dyad and the family system were the major influences on childhood obesity. The belief is that the family is the primary arbiter of children's nutritional intake and physical activity patterns. This can morph into the expression of developmental and weight control problems in both children and adults (Gruber & Haldeman, 2009).

Following this logic, interventions are generally based on the micro level rather than the macro level. Advice and changes concentrate on meal planning and prep, food shopping, eating, snacking, family recreation, sedentary behaviors and physical activity. Instead, to create population level differences, interventions should encourage "communal coping" (Keohly &

Loscalzo, 2009). "Communal coping" veers away from the individualized responses cited above. This approach encourages individuals to examine themselves in larger contexts including family, friends, and their community. When a health issue arises, incorporating these additional contexts can enhance and create more effective solutions (Keohly & Loscalzo, 2009).

From a research perspective, no single mechanism can explain the entirety of the obesity epidemic. This makes the study of obesity problematic (Koehly & Loscalzo, 2009 and Panel on Understanding Cross-National Health Differences Among High-Income Countries, et al, 2013). In order to create studies that effectively analyze the epidemic, there must be cross-disciplinary investigations. These collaborative efforts need to diverge from the traditional research dichotomies and embrace multi-level and nuanced analysis (Koehly, & Loscalzo, 2009). These deviating investigations are in direct contrast to the bulk of the past research on obesity. Historically, obesity research concentrated on singular or a small subset of variables, and did not examine longitudinal changes (Richard, Guavin & Raine, 2011, & Singh, et al & Kogan, 2010). The literature, at this juncture, points out that, "…some behaviors related to weight gain and weight loss appear to be socially transmissible (Smith & Christakis, 2008, p. 411)." Until the frame is broadened there will not be ample advancement on preventing obesity. In fact, obesity and comorbidities will maintain themselves and perhaps get worse (Friel, Chopra & Satcher, 2007). Thankfully, the research has begun to expand and incorporate more complicated determinants and interventions. These include multilevel models and "distal targets such as the community, or in the case of physical activity, the political environment" (Richard, Guavin & Raine, 2011, p. 321).

2.10 National Organizational Response

Over the past decade, a number of national and international organizations have performed obesity related research. This research has led to the release of policy and position statements. These organizations also made a much more concerted effort to take an active role in decreasing childhood obesity. Groups include the Academy of Nutrition and Dietetics Foundation, the American Dietetic Association (ADA), the African American Collaborative Obesity Research Network, the US Surgeon General, The United Health Foundation, the American Public Health Association, the National Heart Lung and Blood Institute and the World Health Organization. These contained critiques and summaries of the current research base (Kumanyika, Whitt-Clover, Gary, Prewitt, Odoms-Young, Banks-Wallace, Beech, Highes Halbert, Karanja, Lancaster & Samuel-Hodge, 2007, Moag-Stahlberg, 2011, and The National Heart Lung and Blood Insitute, 2009), recommendations for treatment (Davis, et al, 2007, Gortmaker, et al, 2011, Hassink, 2010, Lumeng, Castle & Lumen, 2010, & Spear, Barlow, Ludwig, Saelens, Schetzina, & Taveras, 2007), position statements (Ehrens and Weber, 2009, & Stang, Taft Bayerl & Flatt, 2006), formation of research initiatives (African American Collaborative Obesity Research Network, 2007), calls to action (America's Health Rankings, 2011 & U.S. Department of Health and Human Services, 2001), and strategies for intervention (Robertson, Brunner & Sheiham, 2006).

For the most part, these organizations are operating independently, and concentrating on only a few of the potential causes of the epidemic. Many of them don't address the underlying societal structures and policies which impact daily life (Richard, et al, 2011). In reality, health issues are consequences of, "…reciprocal causation unfolding at multiple individual and environmental levels of influence" (Richard, et al, 2011, p. 309).

To summarize – childhood obesity simply cannot be ignored. Prevalence rates and projections indicate that a large percentage of the US population, in the very near future, will be overweight or obese. In addition, traditionally marginalized groups will bear the burden of this excess weight and the associated comorbidities. While the past few years have seen increased interest in the subject, including from nationally recognized organizations, the response is not adequate. Even more troubling: large drivers that enhance differences among subsets of the population are likely at fault. In most of the research and interventions espoused, these markers of difference are largely ignored. A revised and more inclusive agenda is necessary.

The next section will analyze specific policy levers that impact the obesity epidemic. These policy forces will set the stage for the theoretical analysis. The theory utilized will be the social determinants of health framework. This perspective will question the underlying assumption of micro level research and interventions. It will also query the overall frame used to, by and large, "solve" the childhood obesity epidemic.

Chapter 3: Policy Impacts

Chapter 3 will discuss the numerous national and international policies, which have enhanced obesogenic environments. The evolved agricultural environment and subsidy network, urban planning and environmental policies, tax and fiscal policies, television, advertising and marketing, USDA and federal food policies, school wellness policies, NSLP, SBP, competitive food availability in schools, calorie labeling and reformulation, Head Start and childcare subsidies, and other policies will be described. This lengthy analysis will serve to further explicate the necessity of using more complicated theoretical analyses to understand the obesity epidemic.

3.1 Agricultural Policies and Subsidies

The policies that impact childhood obesity are numerous and do not operate in isolation. They work cohesively to influence families, and enhance rather than fix disparities. These policies span the fields of school-based nutrition, health and wellness, the social safety-net, pediatric care policies, urban planning, etc. Global food policy has spawned a huge change in the way that American products are farmed, manufactured, butchered, and distributed (Phillips, 2006). American farm policy has been co-opted to create a marketplace friendlier to mass producers of corn and soy (Pollan, 2006 & Young & Westcott, 2000). Subsidies are granted to enable agribusiness, or large-scale producers, to rapidly produce and distribute huge quantities of corn and soy (Sautter, Furrey & Gresham, 2006). These commodity crops have become the backbone of the American food system (Fields, 2004). Many family-owned farms have gone out of business (Berry, 1977). Food production is now a monopoly of a few well-guarded and highly scientific corporations who create our food (Pollan, 2006). Pollan (2006) points out that a small

number of strategically placed companies control the path of virtually all the corn produced in America,

> Cargill and ADM … They provide the pesticide and fertilizer to the farmers; operate most of America's grain elevators … broker and ship most of the exports; perform the wet and dry milling; feed the livestock and then slaughter the corn-fattened animals; distill the ethanol; and manufacture the high-fructose corn syrup … Oh yes- and help write many of the rules that govern this whole game, for Cargill and ADM exert considerable influence over U.S. agricultural policies … these companies are the true beneficiaries of the "farm" subsidies that keep the river of cheap corn flowing. Cargill is the biggest privately held corporation in the world (Pollan, 2006, p. 63).

Further, the cheapening of corn production and scientific breakthroughs have made it far easier to add corn to many food products as non-nutritious components (Nestle 2002, & Pollan, 2006). Because food production costs have decreased, supply has increased. This flooding of the market has lowered food prices on items that are cheaper to produce (Morrill & Chinn, 2004, & Schafer Elinder, 2005). This has been called a "hyper aggressive marketing and competitive food scenario" (Weiss & Smith, 2004, p. 380). Even though food has become more available over time, the poor have not obtained increased access to fruits and vegetables. Poor consumers also choose the energy dense option based on cost differential (Morrill & Chinn, 2004).

Both corn and soy products are viewed by some as major culprits in the obesity epidemic (Nestle, 2002). The proliferation of these products in America is a direct result of policies initiated in the 1970's by Earl Butz (Crister, 2003 & Pollan, 2006). Butz, at the behest of President Nixon, embarked on a wholesale shift of the American farm economy in an effort to change attitudes towards production and pricing (Crister, 2003). Butz managed to move food shortages from deficits to surpluses, and this resulted in decreased prices for most commodity foods, which seemed to be positive contributions to the American economy (Crister, 2003 and Pollan, 2006). These processes and policy implications are explained further below.

Earl Butz is "credited" by many with establishing the legislative arena to enhance corn production and deregulate farm policy (Crister, 2003, Kessler, 2009, Levine, 2008, Nestle, 2002, and Pollan, 2006,). In essence, Butz championed large-scale and increased production, excess grain storage, and pricing flexibility (Crister, 2003). Previously, incorporation of sugar into many products expensive (Weiss & Smith, 2004). This permitted the global trade for sugar to enhance developing nations' production of sugar crops. Sugar based foods were cheaper to import rather than manufacture in the U.S. Now, Congress openly aids food conglomerates through direct subsidies, price fixing and price supports (Beghin, El Osta, Cherlow & Mohanty, 2008). Corn subsidies cost Congress $10 billion per year. These supports even jeopardized our trade agreements with Mexico. In order to protect their own sugar cane industry, Mexico was forced to institute a tax on soft drinks (Weiss & Smith, 2004).

Most of the sugarcane produced in the US is concentrated in Florida and Louisiana. Price-supports and subsidies disproportionately reach these states. Nearly all of this "financial aid" goes to 1% of sugar producers (Nestle, 2002). Without these subsidies, sugar producers would lose hundreds of millions of dollars (Beghin, et al, 2008).

Agricultural subsidies and trade also affect the global environment (Schafer Elinder, 2005 and Young and Westcott, 2000). Energy dense foods now easily enter markets in a variety of countries, and are heavily promoted. Uniquely, the world population is at a place where agricultural production is highest. Food is abundant, and cheaper than ever before. While there is still hunger, it is not because there is a lack of food. Rather, it is because of a lack of access to food and an absence of political will to fix the distribution systems (Schafer Elinder, 2005).

The global food system has become standardized (Dixon, et al, 2007). The production, distribution and ownership are concentrated among a few transnational corporations (Goodman

& Watts, 1997). In 2002, the ten largest companies controlled upwards of 24% of the global processed food sales (Dixon, et al, 2007). The transnational companies have offices in many countries. These offices have the flexibility to negotiate with farmers and lobby governments for more favorable trading regulations. On the global level, international conventions and agreements, rather than individual governments and trade organizations oversee trade (Dixon, et al, 2007 & Lynch, 2010). These conventions coupled with "… the national bifurcation of urban food systems are having significant impacts on health inequities … children are especially vulnerable" (Dixon, et al, 2007, p. il121). National and international food justice movements have sprung up in recent years in response to the shift in the global food environment (Wekerle, 2004). Many are seeking to create socially and environmentally conscious food systems (Dixon, et al, 2007 & Wekerle, 2004). These responsive social movements are a direct result of the globalization of the food trade promoting consumption of less healthy foods (Kjellstorm, 2008). Food, itself, has become a political issue (Robertson, et al, 2006).

Butz's new policy direction coupled with the discovery by Japanese scientists in 1971 of a cheaper sweetener, high fructose corn syrup (HFCS), led to the production of sugar at significantly reduced prices (Crister, 2003 & White, 2008). This decreased the overall production cost of any high-sugar product. HFCS, has many "chemical attributes" which enhance processed foods (Crister, 2003, pg. 10) and made it a good replacement for sucrose as a sweetener (White, 2008). HFCS defrays freezer burn, prolongs shelf life, maintains fresh taste, and can help make food more visually appealing (Crister, 2003).

Unlike sucrose or dextrose, the body digests fructose differently. Instead of being broken down into its constituent parts before it gets to the liver, it bypasses this process and remains almost whole when it arrives. This process is known as "metabolic shunting" and is amplified

because of the high concentrations of fructose in HFCS. HFCS breakdown was not adequately studied before it was permitted onto the market (Crister, 2003). Our bodies rapidly absorb fructose, which some researchers argue may have a large hand in the rising obesity trends (Nestle, 2006). In addition, other extra sweeteners are added to corn syrups, which are in turn packed into processed foods (Crister, 2003 & Nestle, 2006). Within a decade after Butz's far-reaching policy changes, the landscape of the American food supply had drastically altered. HFCS products could easily be made in much larger quantities. Bluntly, "… Butz had delivered everything the modern American consumer had wanted. A new plentitude of cheap, abundant and tasty calories had arrived. It was time to eat" (Crister, 2003, p. 19).

In addition, corn has morphed into the best way to farm vegetables. Soy has turned into the most efficient way to raise protein, aka livestock, for consumption. Biology, science and big business have forced a turn from agriculture's natural processes to make farming a scientific endeavor, which yields the highest profits and largest crops (Crister, 2003, Nestle, 2006, & Pollan 2002). Cattle are no longer ruminants, but rather are fed a blend of corn and soy products, which fattens them up more quickly, bringing them to slaughter faster (Crister, 2003 & Pollan, 2006). The refined diets of farmed animals coupled with a lack of exercise, has also vastly increased the saturated fat content in meat (Robertson, et al, 2006).

Food companies can also now create foods and insert additives into food that directly trigger cravings for more food in humans. Food scientists even target the same pathways known to impact addictive behaviors in their design of different food products (Engelhard, et al, 2009).

It has been shown that a diversified diet is the most beneficial to maintaining a healthy weight (Kennedy, 2004). Achieving this dietary standard is becoming increasingly difficult. The past century saw the eradication of over 75% of the crop genetic diversity. Historically, over

10,000 plant species made up the human diet. Now, 90% of the human diet uses just 120 species of all food products (Robertson, et al, 2006). This reduction in crop genetic diversity coupled with limited access to increased varieties of food means diets are restricted before consumer choice and taste enters into the consumption equation.

3.2 **Urban Planning and Environmental Policies**

In many low-income, inner city and rural areas there are limited numbers of supermarkets and stores. When these stores exist, they stock sub-standard produce at high prices. This describes a "Food Desert," or a neighborhood or community that is cut off from purchasing affordable and nutritious foods (Beaulac, Krisjansson & Cummins, 2009, Chaloupka & Powell, 2009, & Tarnapol Whitacre, Tsai, & Mulligan, 2009). The bulk of the food stock in stores in food deserts is energy dense and low nutrient, but cheaper than healthier options (Tarnapol, et al, 2009). Marginalized poor and minority communities have less opportunity to purchase healthy food (Beaulac, et al, 2009). Poor food access is caused by, "structural inequalities in the food retail environment" (Beaulac, et al, 2009, pp. A105). These larger structural issues mean that the poor face increased nutritional disadvantages in food deserts (Beaulac, et al, 2009).

Food pricing even impacts children (Andreyeva, Long & Brownell, 2010 & Datar & Sturm, 2005). When available, lower fruit and vegetable prices predicated significantly lower gain in BMI between Kindergarten and 3rd grade (Datar & Sturm, 2005) and increased consumption (Chaloupka & Powell, 2009, & French, 2003). Fifty percent of this relationship was found in the Kindergarten to first grade year. Although smaller in magnitude, lower meat prices predicted significantly higher gains in BMI. These effects were larger for children living in poverty, those who were already overweight or obese by Kindergarten, and also in Asian and Hispanic children. Researchers concluded that, "the geographic variation in fruit and vegetable

prices is large enough to explain a meaningful amount of the differential gain in BMI among elementary school children across metropolitan areas" (Datar & Sturm, 2005, p. 1059). Lowering fast food prices decreased consumption of fruit and vegetables (Chaloupka & Powell, 2009, & French, 2003). Children at the higher end of the BMI spectrum were most affected by price changes. This raises the possibility that these increases/decreases in pricing had the largest impact on their BMI (Chaloupka & Powell, 2009.)

Food deserts have been shown, through mapping, to also be inhabited by people with higher obesity rates and comorbidities. However, food access is only one part of the larger food environment (Tarnapol Whitacre, et al, 2009). A much higher number of fast food outlets and convenience stores were located in low-income and African American communities. Other restaurant options were limited or nonexistent. These communities also lacked physical activity options: shortages of free activity options, public sites and affordable commercial gyms (Chaloupka & Powell, 2009.) The mulitfactoral nature of food deserts can be thought of as "deprivation amplification," in low-income neighborhoods (Beaulac, et al, 2009). Theoretically, food deserts could be changed to encourage eating increased amounts of nutritious foods at lower prices, and create access to free and affordable physical activity outlets. However, there is no guarantee that this would translate into changed eating and physical activity behaviors (Tarnapol Whitacre, et al, 2009).

Urban planning and environmental policy impacts community members in many ways. For adults with physical and other types of disabilities, access to supermarkets and grocery stores can be difficult. Some store entrances do not meet the code of the Americans with Disabilities Act. This is especially disconcerting, given that obesity tends to have a higher incidence amongst the physically disabled (Mojtahedi, et al, 2008).

Transportation, transport options, and road planning can also worsen food deserts. Transportation planning can change air quality, physical activity levels, and land use patterns (Bell & Cohen, 2009). It can form isolated neighborhoods with low-income communities bearing the brunt of this negative impact. Transportation policy's reach includes the arenas of health, environment, food and employment. Each of these spaces both separately and in concert influence health (Bell & Cohen, 2009). Many have called for a move away from automobile-reliant transport (Bell & Cohen, 2009, Kjellstrom & Hinde, 2007 & Vandergrift & Yoked, 2003). This transition would integrate policies that increased public transit options, and self-mobility choices while also including solutions to address food production, distribution and access to grocery stores. These efforts would be concentrated in currently underserved and isolated low income communities and communities of color. These families are already spending 37% of their income on transport versus the national average of 18% (Bell & Cohen, 2009). Optimistically, there is a slow shift happening in planning practice. Planners are now looking at creating "active communities." These communities promote physical activity as part of everyday life (Hayne & Moran, 2004).

The overall environment that currently seems to aggravate obesity has been dubbed the "obesogenic environment." Researchers generally recognize the presence, but not the length of exposure, to the "obesogenic environment" (Braveman, 2009).

3.3 **Tax and Fiscal Policy**

Americans currently spend approximately twelve percent of their income on food (Powell, & Chriqui in Cawley, 2011). A number of advocates call for implementing an aggressive tax policy on energy dense, low nutrient food (Gortmaker, et al, 2011, Mytton, Gray, Rayner, & Rutter, 2007). The tax mirrors the "sin tax" on alcohol and cigarettes in most states.

The tobacco taxes were seen as an integral tool in decreasing consumption. The hope is that similar taxes on unhealthy food will also impact consumption patterns (Gortmaker, et al, 2011, and National Conference of State Legislators, 2013). Other tax policy ideas include providing tax credits for participating in health and wellness activities, grocery store improvements or locating chains in food deserts, and bonuses to stores that have just recently offered fruit and vegetables (National Conference of State Legislators, 2013). However, obesity is much more complex than tobacco control. Taxes will need to be levied at multiple levels and environments (Gortmaker, et al, 2011).

Support for these taxes has been exceedingly low. In some areas, outright bans have been sought on very large sized sodas, as in New York City (Bittman, 2012), or blocking SNAP recipients from using food stamps to purchase sodas (Pear, 2011). The beverage industry has fought both of these proposals with attack ads and promotions. In the case of the soda ban, the beverage industry brought a successful lawsuit that blocked implementation of the ban. Their messaging advocated for consumer choice and individualism (Bittman, 2012, and Pear, 2011).

Despite the nationwide call for food and beverage "sin taxes" to fight against obesity, research on their effectiveness in decreasing consumption has been mixed. Some researchers have found that taxes did not decrease consumption (Fletcher, Frisvold, and Tefft, 2010, and Powell and Chaloupka, 2009), while others have found that it has decreased consumption (Brownell, Farley, Willett, Popkin, Chaloupka, Thompson and Ludwig, 2009). The assumption is that soft drink prices are fairly elastic. Therefore, a price increase should decrease consumption. This could, in turn, create a tax surplus on purchases. The average tax on soda in a grocery store was 4.2%. This tax rate was 3.5 percentage points higher than taxes on other foods (Sturm, Powell, Chriqui and Chaloupka, 2010). Increasing the current soda tax by one percentage point

"…reduces the amount of calories consumed by soda by nearly 6 calories" (Fletcher, et al, 2010, p. 972). Strum, et al (2010), found that the higher the soft drink tax rate, the greater the BMI reduction among the heaviest children. When taxes were levied on sodas, consumption decreased, but this seemed to be traded off with whole milk. Replacement with milk negated the caloric reduction from decreased soft drink intake. There was, however, a 3-milligram reduction in caffeine intake. The investigators remarked that a much higher tax rate (Sturm, et al, 2010) of approximately 16% is needed to effectively reduce consumption (Fletcher, et al, 2010). Researchers also recommend an excise tax versus a sales tax, which could be levied per ounce or sugar content (Brownell, et al, 2009 and Sturm, et al, 2010). This type of tax would be more effectively rolled into the price of the product and "plainer" for the consumer upon purchase (Sturm, et al, 2010).

Certain theorists view obesity as an externality, or a burden paid for by the entire community (Brownell, et al, 2009, Hayne, et al, 2004, and Mytton, et al, 2007). The externality translates into lost human capital. In order to correct the burden, effective obesity prevention and concurrent cost reduction needs to be regulated. In fact, the very overconsumption of food defies "rational consumption," as defined by mainstream economic theory (Hayne, et al, 2004).

3.4 **Television and Advertising Policy**

Advertising has flooded the marketplace with promotions of unhealthy food products to children. This includes advertisements that impacted consumption of food at school (Molnar, 1996), especially for low-income children (Calvert, 2008). Children are seen as a huge force of consumers with tremendous buying power, warranting their own streams of paid advertising (Calvert, 2008 and Molnar, 1996). Advocates of a regulation free environment argued that it is parents' jobs to educate their children to choose food responsibly (Seiders and Petty, 2004). The

minimal regulation on television advertising were monitored by the Federal Communications Commission (FCC) under the Children's Television Act (CTA). These laws stated that only 10.5 minutes per hour of advertising during weekends and 12 minutes per hour on weekdays were permitted on cable television children's stations (Calvert, 2008). American children spent 22 hours per week in front of the television. The number of commercials they saw was overwhelming. In 1994 it was estimated that on the major networks 977 commercials aired on Saturday mornings, alone (Nestle, 2002). In 1987 these same networks only aired 225 commercials during that time slot (Nestle, 2002). To remain within the commercial time limits mentioned earlier, companies have shortened the length of commercials on television (Weber, Story and Harnack, 2006). Advertisements targeted at children and for foods contributing to the obesity epidemic have also grown exponentially in recent years: in 1995, $541 million was spent on soft drink advertising (Anderson and Butcher, 2006). By 1999, this had ballooned to $799 million (47%). Concurrently, other food related advertising grew only 20%. Commercials aired during children's television programs are "regulated." Ads aired during adult television programs are not. Since children also watch adult shows, they are exposed to further food and product advertising (Anderson and Butcher, 2006). Compared to other countries, the United States policies on marketing to children were extremely lax. Sweden and Norway completely banned advertising to children, Greece limited toy advertisements to after 10 P.M., and Denmark and Belgium have severe restrictions (Committees on the Social Determinants of Health Communications, 2006).

These marketing images have expanded well beyond television and have also infiltrated schools (Molnar, 1996). In addition to the pouring contracts and lunches described later, companies also used a variety of school based product promotion. These included textbooks,

which used products of low nutritional values as central teaching tools (Morrill and Chinn, 2004, and Nestle, 2002). Examples of teaching aids included the "Domino's Pizza Encounter Mat" or the "Oreo Cookie Counting Book" (Calvert, 2008). Companies also strategically placed vending machines to optimize prime advertisement space and billboards. They sponsored kids' clubs, and paid for Channel One, an in-school television station (Morrill and Chinn, 2004, and Nestle, 2002). Included in the Channel One "package" for schools were expensive televisions and equipment. Channel One generally aired for 12 minutes each morning in 12,000 schools. Approximately 8.3 million students viewed the programs. Two out of the 12 minutes of airtime was dedicated to marketing (Nestle, 2002). Most of the advertisers were food companies, and the products were of minimal nutritional value. This channel was a well-recognized marketing tool for companies (Morrill and Chinn, 2004, and Nestle, 2002). The infiltration of food marketing within educational institutions is especially troubling because schools should actually be a prime arena to enact policies limiting exposure of children to advertising. Educational campuses don't face the same 1st amendment battles as general television airtime (Weiss and Smith, 2004).

Disturbingly, there is virtually nothing regulating advertising on the Internet. Laws have simply not caught up to the increasingly digital world. In this new domain, children can click on a link and be brought straight to a product's website from a television or device (Committees on the Social Determinants of Health Communications, 2006). Online advertising is not subjected to any time limits. In 1999, 73% of children had a personal computer in their home. By 2004 this number increased to 86% of 8-18 year olds. In 1999, this age group spent 24 minutes participating in online activities. By 2004, online activity jumped to 62 minutes (Weber, et al, 2006). Fast food companies have tailored their websites to entice young children. This includes "advergaming" which handily disguises marketing and advertising as games for children (Harris,

et al, 2010, and Weber, et al, 2006). "Advergaming" has led to hundreds of thousands of unique child and teen users of websites per month (Harris, et al, 2010). Company Facebook pages have millions of fans. Marketing was supported by smartphone apps that children easily downloaded. While the volume of TV advertising minimally decreased, it has been easily outpaced by the above online developments (Harris, et al, 2010). In a study of 40 food brands, 37 had their own web sites (Weber, et al, 2006). Almost all of these websites, "contained interactive components such as sound, animation and movement. Roughly 60% of the Web sites contained links for games, family-fun sections, or a designated area for children. Advergaming was present on almost two thirds (63%) of web sites" (Weber, et al, 2006, p. 1464). There was minimal nutrition information provided. Research needs to address the gap in knowledge to understand how web based advertisement strategies effect children (Weber, et al, 2006).

Many of these advertisements were designed to target younger children who may not have the cognitive ability to differentiate between advertising and program content (Calvert, 2008, Committees on the Social Determinants of Health Communications, 2006, Linn, 2004, and Nestle, 2002). Thirty-two percent of 2-7 year olds had a TV in their bedroom (Linn, 2004). In fact, in 1995 the American Academy of Pediatrics issued a statement that marketing directed at young children, "… is inherently deceptive and exploits children under eight years of age" (Schlosser, 2001, p. 262). Because children spend a lot of time watching television by themselves, there is no one to explain advertisement versus program content to them (Linn, 2004).

Current advertisements pay celebrities as endorsers, incorporate popular characters to push products, and use repetition, premiums, and catchy slogans (Calvert, 2008, Molnar, 1996, and Weber, et al, 2006). By doing so, companies hope to create brand-conscious youngsters who

develop brand loyalty (Calvert, 2008, and Weber, et al, 2006). Once a food company successfully associates themselves with a TV program, in the viewer's eye, the program itself becomes a food advertisement. The best example is Kraft's appropriation of "SpongeBob" to create "SpongeBob shapes" pasta (Elliott, 2008 and Linn, 2004). The pasta swiftly became a best seller. Food stores had, "… shelves filled with examples of these links between media programs and food manufacturers" (Linn, 2004, p. 371). Small investments on the part of food companies yielded enormous profits. Profits of tens of millions of dollars are realized on television investments of $50,000 (Calvert, 2008). This low risk and monetary input and high reward/profit equation leads to an ever increasing spiral of this type of business activity.

Despite Americans proclivity for litigation, as of the mid 2000s there had been no court case that questioned advertising of low nutrient food to children (Weiss and Smith, 2004). It seems important to ask, "…whether advertising junk food to children could be considered 'misleading' if it confuses and unfairly manipulates children into influencing parents' purchases" (Weiss and Smith, 2004, p. 383). Parenting experts often times tell parents to "pick their battles." Despite this advice, it is exceedingly difficult for parents to fight against commercially driven arguments with their children (Linn, 2004). Parents, correctly, try and set limits for their children. At the very same time, corporations are creating advertising that tells children to continuously ask their parents for their products and negate parent-set limits (Linn, 2004). This marketing mechanism has even been dubbed "the nag factor" (Cardello, 2009).

Many busy families without time to cook used fast food to feed their children. Inevitably, fast food companies jumped into the advertisement game. The bulk of these ads were directed at children and companies increased their market share by locating restaurants adjacent to schools (Cohen, 2013 and Molnar, 1996). Approximately one third of children and adolescents

consumed fast food. Fast food makes up about 16-17% of youngsters' total caloric intake. Fast food companies have advertised so aggressively to children, that the White House called upon companies to change tactics in support of the Let's Move initiative (Cohen, 2013). In 2009, fast food companies spent $4.2 billion on advertising. Two to five year olds saw 2.8 ads, 6-11 year olds 3.5 ads, and 12-17 year olds viewed 4.7 ads per day (Harris, et al, 2010). Thus far, only McDonald's and Burger King joined the voluntary "Children's Food and Beverage Advertising Initiative (CFBAI)." Even after their participation, between 2007 and 2009, preschoolers saw 21% more ads for McDonald's and 9% more for Burger King (Harris, et al, 2010). Older children saw 26% more ads for McDonald's and 10% more for Burger King. Both companies' child targeted marketing promotes toys instead of healthier meal choices. CFBAI has not attracted any other companies and has multiple loopholes. These gaps permit ongoing advertising and the use of the organizational pledge as an "in name only" mechanism. Over time, children's exposure to advertising increased rather than decreased (Harris, et al, 2010).

Fast food companies led the charge in "supersizing" items (Young and Nestle, 2007). For consumers, this purchasing option made economic sense. Snack products now crowded shelves. Generally, their portion sizing per package was more than a single serving size and not clearly labeled (Nestle, 2002). Consumers were easily tricked into eating larger snacks at lower prices (Nestle, 2002 and Seiders and Petty, 2004). In the face of rising criticism, industry has battled back saying that parental and consumer choice are responsible for navigating their own health and diets. Therefore, companies are not at fault for America's increasing obesity status. Additionally, industry contends that blame is not singular. Rather, "no one food contributes to obesity more than any other, that is, that no foods are inherently good or bad" (Seiders and Petty, 2004, p. 155). Essentially, it's not our fault America is fat, it's American's fault.

Marketing is also specifically aimed at racial and ethnic subgroups, "Hispanic preschoolers saw 290 Spanish-language fast food TV ads in 2009 and McDonald's was responsible for one-quarter of young people's exposure to Spanish language food advertising" (Harris, et al, 2010, p. x). African American children were exposed to 50% more ads than White children. Both McDonald's and Kentucky Fried Chicken targeted ads explicitly to African Americans. The companies aired 75% more ads in these markets versus White markets (Harris, et al, 2010).

Harris, et al (2010) found that 84% of parents had weekly family trips to fast food outlets. The vast majority went to McDonald's at the request of their children. In recent years, most fast food restaurants started offering healthier options. Yet, healthful alternatives were never the default options offered. For children, there were approximately 3,039 meal combinations. Only 15 of these met nutrition criteria. Just 17% of regular menu items were considered healthy. Most of these were beverages (coffee or diet soda). Only 12% of lunch/dinner sides and 5% of lunch/dinner/breakfast main dishes were nourishing. Snack and dessert items contained up to 1500 calories (Harris, et al, 2010).

Harris, et al (2010) also found that the interior of restaurants themselves served as marketing arenas. Within restaurants, there were at least 15 signs promoting food items. Only 4% of signs advertised healthy items. When ordering food, french fries or other unhealthy sides were automatically added to orders 84% of the time. A healthy beverage option was offered with under 50% of orders. Subway was the only chain that suggested healthy items in children's meals 60% of the time. Once parents were at McDonald's, Burger King or Wendy's, they ordered fries with a kid's meal two-thirds of the time, and one-third bought a soft drink. In contrast, while at Subway, two-thirds purchased fruit, yogurt, or juice or milk. As children aged,

parents also adjusted the size, or volume of the order. Parents of elementary school children typically ordered a combo or value/dollar meal rather than a children's meal. Teenagers not only ordered the most unhealthy items, but also bought at least 800-1100 calories during an average visit (Harris, et al, 2010). Although the Subway business model seems to be both profitable and nutritionally sound, the vast majority of fast food outlets have shown no inclination to offer menu items along the lines of Subway's, in addition to their standard fare. Or, to have stores dedicated to more healthful fast food as a business experiment.

Advertising and marketing surrounds us. We have become so numb to it that we don't even notice it at a conscious level anymore, and the techniques companies use to infiltrate our world are becoming very clever (Nestle, 2002). After all, there are entire TV shows dedicated to "World's Funniest Commercials" and reports of how much ads cost during the Super Bowl are astronomical. Think for a minute about products associated with ingenious advertising, such as the Budweiser frogs, the Marlboro Man, the Double Mint Twins, etc. For many of us who grew up during the 1980's, these are images that will forever remain in our memories. And none of them are products that enhance healthy lifestyles.

3.5 **USDA and other Federal Policies**

Also oddly intertwined into the ongoing federal food policy debacle is the United States Department of Agriculture (USDA) regulations on food contents. Historically, Congress sidestepped regulation on food itself. Avoidance was partially a capitulation to industry interests. This state of affairs remains, despite the overwhelming evidence that industry self-regulation efforts have been almost non-existent. Self-regulation has done nothing to alter the content of the food we eat (Linn, 2004) or made it safer (Mead, Slutsker, Dietz, McCraig, Bresee, Shapiro, Griffin and Tauxe, 1999).

In order to understand how policy has been formulated and regulated, an analysis of USDA involvement in nutrition and translation of nutrition information to the general public is included in this discussion. At this point, most people are familiar with the USDA pyramid, or the new "MyPlate" highlighting food intake and Recommended Daily Allowances (RDAs) of nutrient intake. Every five years the USDA goes through a long and arduous process to update these guidelines. Nestle (2002) points out that despite minimal changes in nutrition and dietary advice over the past 60 years, a majority of the US population remains confused by nutrition recommendations (Dixon and Banwell, 2004 and Nestle, 2002). Business interests and food companies trying to sell more of their products have coopted the messaging. While the USDA aspires to be a science-based institution that only espouses advice backed by rigorous scientific evidence, this effort normally gets brushed aside in the face of politics (Hilgartner, 2000) and money (Nestle, 2002). In essence, the USDA is forced to bow to outside pressure, which commands an enormous amount of wealth and influence (Dixon and Banwell, 2004 and Hilgartner, 2000), and is responsible for 13% of the U.S. gross national product (Nestle, 2002). Seventeen percent of the U.S. work force is employed by the food industry. These companies have world-wide influence and investments (Nestle, 2002).

During the 1950s and 1960s, the USDA tried to combat malnutrition. Nutritional messaging included advice to eat more of some products that contained a great deal of vitamins and minerals, especially meat and dairy. By the early 1970s, population health had shifted and nutritionists were becoming much more concerned about overconsumption and related ill-health effects (Nestle, 2002). This concern was likely exacerbated by the switch in farm policy from supply to demand created by Butz and President Nixon (Allen and Wilson, 2008). They were also worried that previous food guides were not straight forward regarding caloric consumption

and portion/serving size (Welsh, Davis, and Shaw, 1992). Nestle (2002) has pointed out that as a result, the USDA tried to switch messaging from "eat more" to "eat less." Food companies, who were trying to earn larger profits, balked at this messaging. The USDA and related committees attempted to publish reports during the late 1970s that recommended eating less of items such as red meat, but they faced huge backlash. There has essentially been no federal food policy which recommends that people "eat less" since then. Included in the analysis of the backlash, one reporter was quoted, "the political *raison d'etre* for the Department of Agriculture is to make it easier for farmers to make money. And that purpose is not well served by permitting the people in Bethesda, Md., to run loose on such politically sensitive matters as red meat, butter, and eggs" (Greenberg in Nestle, 2002, p. 47). During these proceedings, something else emerged about the USDA. There was a large conflict caused by the USDA's, "dual mandates" of ensuring the agricultural sector's viability and protecting the public's health. All too often, the agricultural sector had powerful lobbyists and were able to appeal to federal decision makers more often than public health advocates (Nestle, 2002).

These tensions remained through the years. As the 2000 Dietary Guidelines were being prepared and debated, it became clear, once again, that business interests would infringe and influence policy formation (Nestle, 2002). A summit was held in May of 2000 between the USDA and the Department of Health and Human Services (DHHS). The goal was to discuss the national nutritional guidance that largely concentrated on obesity. However, when the conference was over, neither agency's leadership recommended decreased consumption of any foods. By the time the guidelines were published, the standards for the RDAs had had fallen so low that wine was permitted to be marketed as beneficial to health. Among health advocates, it

was well known that the Wine Institute selectively used certain research findings to misleadingly paint wine as a health benefit (Nestle, 2002).

Much of this scenario is the result of the complicated system of lobbying in the US. Food and beverage companies have enormous budgets dedicated to lobbyists (Guither, 1980, and Ndayisenga and Kinsey, 1999). Lobbyists operate in a gray area of "legal" contributions to campaigns (Nestle, 2002) and wield considerable influence (Akard, 1992). This system has also created a "revolving door" of employment: lobbyists get hired as government officials, such as USDA representatives, and vice versa (Apollonio, Cain and Drutman, 2009 and Vidal, Draca and Fons-Rosen, 2012). This extends the influence of business in government (Gilbert and Oladi, 2012) and means that monetary influences have a receptive audience for their ideas (Apollonio, et al, 2009). Government workers tend to end up employed by the industries they are familiar with, and have a bias towards that industry. Not surprisingly, Republican lawmakers (Nestle, 2002) and those in farm states (Bellemare and Carnes, 2013), benefitted more from agricultural lobbyists (Nestle, 2002). The more money donated by agribusiness Political Action Committee's to a particular candidate swayed votes in support of industry (Bellemare and Carnes, 2013 and Nestle, 2002).

In 2010, the Supreme Court ruled in "Citizens United" to essentially reject limits on campaign contributions by individuals, unions and corporations. This led to the creation of Super PACs which cannot "coordinate" directly with candidates, but can give to their campaigns (Hasen, 2012, and Toobin, 2013). Since a corporation is legally defined as an "individual," they can give unlimited amounts to the Super PACs, but are still limited in direct contributions to candidates (Hasen, 2012). In the past, very large contributions were donated illegally. Now, the wealthy legally and more easily dictate who will run the strongest campaign and what actions

political actors will take if they are elected. In addition, these extreme financial contributions allow them unfettered access to the candidate, who must listen to and, in some measure, please her/his contributors (Toobin, 2013).

Industry has also infiltrated academia and research (Behrens and Gray, 2001 and Nestle, 2002). In their ever-present quest for research grants and funding, university departments have permitted themselves to be solely funded by corporations. The University of California, Berkeley, Department of Plant and Microbial Biology partnered with Novartis. Under this partnership, Novartis was allowed to choose who participated in research, monitor unpublished research, access all research, work with faculty to choose which projects moved forward, include one of their own scientists on faculty, and "…negotiate for licensing rights to technologies produced by the research…" (Nestle, 2002, p. 121). This is especially astonishing given the paradigm of research universities. Research is supposed to be unbiased, scholarly, and in the spirit of advancing human knowledge (Behrens and Gray, 2001 and Nestle, 2002).

There have been a number of policy recommendations and changes based on past research. Some have been implemented with a degree of success, while others have no regulatory teeth and therefore are not making much of a difference (Fitzgibbon, Hayman, Haire-Joshu, 2008). Recent changes included incorporation of healthier foods for purchase with the Supplemental Nutrition Assistance Program (SNAP) and through WIC (Women, Infant, and Children) services. In fact, the new name for the Food Stamp program, SNAP, hopes to, "reflect our focus on nutrition and putting healthy food within reach for low income households" (United States Department of Agriculture, 2009). Some view the SNAP program as the platform that could potentially have the most impact in reducing obesity (Townsend, 2006). In addition to moving departmental responsibility from the USDA, changing the formulation of food permitted

for purchase would force food companies to reformulate products. This would also increase demand for healthier products, like fruits and vegetables, and perhaps cause price to decrease. Embedded within the SNAP budget is 1% for a nutrition education component. A much higher budget for education activities should be incorporated to make a meaningful impact (Townsend, 2006). In 2009, WIC state offices transitioned to new "food packages". The intent of the change in the WIC program was to more effectively reach the nutritional needs of participants including mothers and children. (United States Department of Agriculture, 2009).

Most notably, First Lady Michelle Obama, identified childhood obesity as her issue of interest. She created the "Let's Move!" campaign and organization, "to solve the epidemic of childhood obesity within a generation" (The White House, 2012). Let's Move promoted inter and intra organizational support to enhance health through strategies and information provided through their website. A large amount of press has been focused on the initiative and it has helped to sharpen focus onto the issue of childhood obesity in the past few years.

3.6 **School Wellness Policy:**

Research indicated that obesity also impacted academic achievement (Chirqui, Schneider, Chaloupka and Pugpach, 2009, Datar and Sturm, 2004c, and Gable, et al, 2008). Using the ECLS-K data base, Gable, et al (2008) found that overweight children scored lower on both reading and math measurements than their non-overweight classmates. These same students had lower teacher ratings of student abilities and emotional wellbeing. They also had worse self-reports on psychosocial measures. Even more disturbing, children that were never overweight maintained higher academic standing than overweight children. Overweight children's performance trended downward over time. These negative effects started before children, especially girls, were defined as clinically overweight (Gable, et al, 2008). Overweight boys had

more absences than non-overweight boys. Obese children had, "significant decreases in physical and social functioning (Datar and Sturm, 2006, p. 1454)." On academic indicators, children that became overweight seemed to mimic children that were consistently overweight. However, the directionality of the relationship was not clear. Did overweight cause poor school performance, or did poor school performance cause overweight (Datar and Sturm, 2006)? Girls who were overweight were significantly more likely to have behavior problems compared to girls who were not. Boys did not have this relationship. Over time, there was no evidence that overweight was a risk factor for manifesting future behavior problems. The authors contended that, "… overweight girls start school with significant parent- and teacher-reported behavior problems (Datar and Sturm, 2004b, p. 809)." In another study, overweight girls exhibited a statistically significant lower result on academic performance compared to non-overweight girls. Again, boys did not have a statistically significant difference in scores (Judge and Jahns, 2007).

In school, the majority of children in the United States were not participating in the recommended amount of physical activity per day. Schools with limited physical education and facilities had more Black than White students, a higher percentage of minority children attending, families with low incomes (Fernandes and Sturm, 2008), and more mothers with a high school diploma or less (Datar and Sturm, 2004a). Having a gym led to children participating in 8.3 minutes of physical activity per week. In hot or humid climates, having a gym lead to an increase in physical activity that was three times higher. Although having a gym led to increased time spent in physical activity, it did not do so in a way that significantly affected obesity prevalence (Fernandes and Sturm, 2010). When in school, children are recommended to participate in 150 minutes per week of physical activity. Schools provide a national average of 30 minutes per week (Datar and Sturm, 2004a, and National Conference of State Legislatures,

2013). Girls who were overweight and obese and had a one-hour increase in physical education per week between Kindergarten and first grade had a significant negative BMI correlation. Datar and Sturm (2004a) estimated that if schools increased physical activity up to the recommended weekly amount, the overweight prevalence could be decreased between 43% and 60%. Among girls in the Kindergarten class of 1998-1999, there was a slight benefit of exposure to "high levels of physical activity (70-300 minutes per week)" and academic performance. There was no negative effect of exposure to physical activity in any of the groups examined (Carlson, Fulton, Lee, Maynard, Brown, Kohl, and Dietz, 2008).

School attendance might have provided a protective effect for some children. Research showed that Kindergarteners gained more weight over the summer months than during the school year (Von Hippel, Powell, Downey and Rowland, 2007). In fact, the BMI gain during summer months for higher BMI children was almost twice the rate of gain during the school year. The deceleration in BMI gain during the school year of this same subset of children was more pronounced than that of children with lower BMIs (Von Hippel, et al, 2007). Other researchers assessing the transition from daycare to school found that, "… on average, the transition to school does not herald a large change in a child's opportunities to consume and expand energy" (Anderson, Butcher, Cascio and Schanzebach, 2011, p. 985). However, children that were not in non-parental day care prior to starting full-day Kindergarten had significantly lower BMI with an additional year of schooling. The biggest change in daily structure generally happens when children enter elementary school, and for these children, school had a protective effect on BMI (Anderson, et al, 2011). Even the type of school children attended impacted obesity levels. Children enrolled in public school had a .150 higher BMI than the BMI of children in private schools (Lid and Hooker, 2010). Overall, children that qualified for NSLP or

SBP had higher BMIs than those that did not qualify. Coupling public school attendance with NSLP or SBP qualification yielded a .725 higher BMI than children attending private school or qualifying for NSLP or SBP. In low SES children, school type did not impact the probability of being overweight (Li and Hooker, 2010). In the 2011-12 school year there were 5.3 million children attending private schools (National Center for Education Statistics, 2014a), and 49.5 million in elementary and secondary schools. A majority of children, 34.6 million, were in prekindergarten through 8th grade and 14.9 million were in grades 9 through 12 (National Center for Education Statistics, 2014b). This means that the combination of NSLP and SBP receipt and school type can increase the level of obesity in tens of millions of children each year.

Throughout its history, the US school system, "…has typically fallen short in considering health a priority for academic emphasis or outcomes" (Esposito, et al, 2009, p. A97). Prior to federal advancements on school wellness, a number of school districts (Esposito, et al, 2009), and states (Health Affairs, 2010), took it upon themselves to start monitoring children's BMI, and restricted access to vending machines on campus (Samuels, Lawrence, Woodward-Lopez, Clark, Kao, Craypo, Barry and Crawford, 2009). Some of these school districts, or schools, were able to effectively incorporate BMI tracking into an overall health-based policy. The health-based policy integrated all aspects of the school environment (Esposito, et al, 2009), or helped to create more rigorous statewide policies than the minimums required by federal policies (Samuels, et al, 2009).

In recent years there has been a large push for schools to more effectively address the issue of childhood obesity, including federally mandated wellness policies. Enacting school laws at the federal level is exceedingly complicated since each independent school district retains overarching policy implementation authority. Under "local control," school districts have the

prerogative to follow State education policy, or to not implement a policy (Levi, et al, 2012). In 2004, the "Child Nutrition and WIC Reauthorization Act of 2004," included a section addressing schools that served free or reduced price lunches subsidized by the federal government. This section mandated schools to embrace the School Wellness Initiative and develop a wellness policy. The policy would go into effect by the start of the 2006-2007 school year. The law set minimum requirements to promote nutrition education, physical and school-based activities to enhance wellness, and incorporate federal nutrition guidelines into federally subsidized school meals (Public Law 108-2981). Unfortunately**,** this mandate had no funding (Chriqui, et al, 2009, and Nanney, et al, 2008) or regulatory power attached. This absence left many school lunches still serving non-nutritious and potentially fattening, calorie and energy dense food (Esposito, et al, 2009). Additionally, the law did not include any restrictions on competitive foods sold on school campuses (Ehrens and Weber, 2009, Story, 2009, and Weber, 2007).

Although ninety-four percent of school districts had wellness policies by the start of the 2006-2007 school year (Chriqui, et al, 2009), a number of criticisms about the policy emerged. Detractors of the legislation claimed that it was far too minimal. The policy left out a toolkit that laid out effective approaches to decreasing childhood obesity, only concerned consumption during school hours, and most importantly, had no regulatory teeth. Schools were free to ignore the policy, as there was no punishment for doing so (Smith, 2006). The ADA recognized that the policy was a fairly impressive first step in attempting to improve the school food environment. The organization still found that school environments varied greatly in their healthfulness. Without national standards governing competitive food sales, food environments are far too variable to be effective in improving childhood nutrition (Ehrens and Weber, 2009).

The language used in the law's narrative allowed school districts a great deal of discretion in deciding which parts of the law to implement, and which points to leave out. Nationwide, this created an enormous amount of variability in the policies (Chriqui, et al, 2009, Committees on the Social Determinants of Health Nutrition Standards for Foods in Schools, Stallings and Yaktine, 2007 and Fitzgibbon, Hayman and Haire-Joshu, 2008). The policy also did not address food marketing (Chriqui, et al, 2009). For cash strapped schools that chose to abide by the law, the policy change might have increased financial challenges. Implementation of the new standards may have cost these schools profits, since the law was unfunded and encouraged restrictions on competitive food availability (Fitzgibbon, et al, 2008). However, researchers did not find a reduction in vending machine revenue after the implementation of the policies (Wharton, Long and Schwartz, 2008). This analysis was done very soon after the policy took effect, limiting the scope of its findings.

School wellness policy was certainly a step in the right direction. Yet, it seemed like goal setting without any measurement of these goals, no support, and no punishment for failure (Smith, 2006). In essence, the policy was the epitome of a toothless mandate. Over the 5 years between the time school wellness policies were initially supposed to be created, the 2006-2007 school year, and 2012, only half of the provisions were enacted. And, just a quarter of schools nationwide did so in an adequate manner (Chriqui, Resnick, Schneider, Schembeck, Adcock, Carrion, and Chaloupka, 2013).

In light of these and other criticisms, a new policy, the Healthy Hunger Free Kids Act of 2010, was enacted to phase in during the 2012-2013 school year (P.L. 111-296, Levi, et al, 2012, Chriqui, et al, 2013). This policy updated nutrition standards for federally subsidized school meals. It also included a competitive food rule, encouraged increased participation in physical

activity throughout the school day, incorporated goals for nutrition education, and urged health policy development, evaluation, monitoring and reporting (Chriqui, et al, 2013 and Levi, et al, 2012). Yet again, there was no funding attached to this law (Chriqui, et al, 2013). It was too early to report research on this policy change at the time of this writing.

3.7 The **School Breakfast Program (SBP) and the National School Lunch Policy (NSLP):**

More than 31 million children are fed via the National School Lunch Program every day (The Food and Nutrition Service, 2012). The school environment is arguably one that has an enormous impact on children, including the food that is served on campuses. In fact, NSLP participation reduced the number of children of underweight status (Dunifon and Kowaleski Jones, 2004). SBP participation had positive effects on achievement, tardiness and absences. Researchers conceded that NSLP participation was not associated with measureable academic effects (Dunifon and Kowaleski Jones, 2004). Despite some positive research, both NSLP and SBP have been identified as culprits in the childhood obesity epidemic. Accordingly, researchers examined the nutritional content of school lunches to understand how unhealthy they might be (Story, Snyder, Anliker, Weber, Cunningham-Sabo, Stone, Chamberlain, Ethelbah, Suchindran, and Ring, 2003, and Thompson, Bachman, Baranowski, and Weber Cullen, 2007). The results, were by and large, disappointing. School meals have a difficult job of providing nutrients to children from needy families as well as helping to prevent overweight (Story, 2009).

In 2012, the lunch program was present in over 100,000 public and non-profit private schools and childcare institutions. The program is federally housed in the Food and Nutrition Service of the USDA, which then administers the program to the States (Food and Nutrition Service, USDA, 2012). The program is thought to stimulate the economy by bringing in

donations of food stuffs and dollars via meals purchased to both schools, and the federal budget through schools food purchases of commodities (Harris, 2002, and Peterson, 2009).

Once the NSLP hits the state level, the state's educational authority is responsible for operating the program through local school food programs. While these lunches must meet federal nutritional guidelines, such as the 2010 Dietary Guidelines for Americans, the on-the-ground decisions about what foods to serve are left to local school food authorities. Previously, research has found that 78% of school lunches did not meet adequate dietary guidelines (Cooper and Holmes, 2006). Since that time, additional requirements, discussed above, have been instituted. Studies have not yet been released on schools compliance with the new law.

Children from families who have incomes at or below 130 percent of the poverty line can obtain free school meals. For the 2012-2013 school year, this cutoff was $29,965 for a family of four; and the reduced price cutoff of 185 percent of the poverty line was $42,643. All other children can also purchase a full price lunch through their local school. The cost to pupils of these full-price lunches is minimal. The federal government subsidizes these full-price lunches, as they must be operated as a non-profit endeavor by the school (National Food Service, USDA, 2012).

Since 1998, schools have also been providing after-school snacks for free or reduced costs under the same federal program. After school snacks have identical income guidelines as expressed above. In addition, any school that provides at least 50% of their lunches for free gets 100% of their snacks distributed to children for free (National Food Service, USDA, 2009).

The mandated provision of school lunch to indigent children is, from an historical perspective, quite new in the United States. Around the turn of the twentieth century, the United States haphazardly provided lunch through a number of charity organizations. The aim of

feeding children at school was to provide traditionally malnourished children with a large percentage of their daily caloric intake (Cooper and Holmes, 2006 and Gunderson, 2009). Further, hunger was associated with poor school performance by a number of theorists (Hunter, Spargo, Richards in Gunderson, 2009). Much of this research was not verbalized effectively until the Superintendent of the New York City Board of Education asked, "again I appeal to you, in the name of suffering childhood, to establish in each school facilities whereby the pupils may obtain simple wholesome food at cost price" (Maxwell in Gunderson, 2009, p. 8). From inception, the question was whether to target only those children needing nutritional assistance or the whole school aged population (Levine, 2008). Perhaps the decision to fund school lunches for all children has inadvertently added to the childhood obesity epidemic, despite the program's best intentions.

Before the schools would take over the charity funded school lunch program administration, the funding groups had to prove program need. Interestingly, in New York City, program receipt was decided by taking height and weight measurements (Gunderson, 2009). School lunch was envisioned as an opportunity to teach children to, "choose wisely the food they buy … train them in sane habits of eating" (Boughton in Gunderson, 2009, p. 9). In Chicago and Los Angeles, school boards and schools themselves instituted the programs. School boards recognized the need to provide children who lived far from school a place for a nutritious mid-day meal (Gunderson, 2009). Nutritionists convinced themselves that school lunch would lead to a simple solution to the malnutrition problems of the immigrant and poor populations in the US (Levine, 2008). Unfortunately, reality has proven to be quite a different story.

Layered into the provision of school lunch were also wartime realities. Many young men attempting to enlist were denied entrance to the armed forces because of diseases directly related

to malnutrition. School lunch was seen as a straightforward way to supply the country with a healthy, fit fighting force during World War II (Cooper and Holmes, 2006).

It quickly became evident that states could not finance the school lunch program without federal aid. Federal aid came through a variety of policies, such as the Reconstruction Finance Corporation in 1932-1933, the Civil Works Administration, 1934 and the Federal Emergency Relief Administration. As the economic situation in the country worsened during the Depression, millions of children were left without any way to pay for a school lunch. In 1936, Public Law 320 passed through Congress which permitted a set aside for the Secretary of Agriculture of 30% of customs duties. This money could be used to increase domestic consumption of certain agricultural commodities. In turn, these commodities were passed onto schools for lunches. The system was set up to interfere as little as possible with the market structure. By 1937, there were 3,839 schools getting commodities and 342,031 children were fed. In 1939, the number of schools serviced jumped to 14,075 and the corresponding number of children rose to 892,259. In an expansion effort through the Federal Surplus Commodities Corporation, the number of schools participating jumped to 78,841 in 1942 with 5,272,540 children participating (Gunderson, 2009).

Initially, these programs dispensed food based on the number of undernourished children. This formula was changed to finance the total number of children participating in the program. However, distribution was capped by the USDA to ensure that food dispersal did not exceed a per month quota. This is still the formula used today, except that certain identified food items have unlimited distribution, as long as supply remains (Gunderson, 2009).

In July 1943, Congress passed Public Law 129, which permitted the spending of $60 million in maintenance of school lunch and milk programs for the 1943-1944 school year. The

following year Congress passed Public Law 367 which granted a set aside of $50 million for the subsequent school year. This law also included federal guidelines for obtaining funds, the first time this was done. The same set aside was passed the following year with an additional $7.5 million granted for December of 1945 to carry the program over until 1946 (Gunderson, 2009).

While this was a step in the right direction, it was not sufficient to feed all children and to maintain employees and equipment. By 1946, Congress realized that there was a need for permanent legislation and a consistent yearly budget for school lunch. This resulted in the sponsoring of the National School Lunch Act, Public Law 396. This Act defined the nutrition of school children, who were maintained by the consumption of domestic commodities, a concern of national security (Cooper and Holmes, 2006 and Gunderson, 2009). Strict fund allotment and distribution formulas were created for appropriation. Per state allocation was calculated by the number of school-aged children in the state and the number of needy children in that state. This formula was created to provide states with a lower per capita income a larger share of the funds. The bill also designated the provision of matched state funds (Gunderson, 2009).

The National School Lunch Act that passed in 1946 was a far cry from the dreams of nutrition scientists and home economists, some of the most ardent advocates and supporters of the program. Advocates were discouraged because the Act did not support the nutritional needs of children, rather it was merely monetary support for agriculture. The final language acquiesced to the Department of Agriculture and southern Democrats and was more concerned with bolstering farm needs than children's diets (Levine, 2008). During the first few years of the program, the Department of Agriculture claimed it as a jewel in the Department's crown stating, "no other method of surplus disposal brings farmers so large an increase in income per dollar of government subsidy as does the school lunch program" (Levine, 2008, p. 48). For schools, the

story was entirely different. Generally speaking, schools might have been thrilled to receive free food, but they had no idea what foodstuffs to expect from week to week. Therefore, the nutritional quality of lunches was unknown and variable. Nutrition reformers had also hoped that the program would act as a suitable platform for nutrition education to children, but this did not come to fruition (Levine, 2008).

By the 1950's, advocates managed to install the National School Lunch Program as a permanent fixture in the annual federal budget. Legislators hoped that this would lead to increased access and distribution of lunches. Instead, many of the neediest children were not getting access to free lunch. The program was still based on surplus commodities, leaving schools in a peculiar situation. The only way that schools got food was if the Secretary of Agriculture declared the specific item a surplus. School lunch became a dumping ground for excess supplies of meat, cheese, eggs, and milk. Schools were contracted to accept whatever food was donated by the federal government- leaving them a lack of choice in food distribution. Politics continued to infuse itself into school lunch policy. Southern legislators won the battle for decreased federal regulation and oversight of school lunch provision. Meanwhile, more liberal politicians did not challenge any regional and racial inequities apparent in the policy (Levine, 2008).

The school lunch policy path of the 1960s tried to fix the problems of access that many children had in obtaining free school lunch. At the same time, a small minority of nutritionists started noticing a trend of overeating in American culture. Doctors were advising more patients against the damages that overweight could wreak on the body. Diets and other fads were beginning to be advertised (Levine, 2008).

After a number of studies revealed that many of the neediest students were not getting school lunch, advocates attempted to solve this dilemma (Cooper and Holmes, 2006). Many older urban schools were built without cafeterias and kitchens. They could not cook on premises and provide food to large student populations. As a social welfare program with redistribution of income as one of its central tenets, the NSLP was questioned due to its uneven distribution to poor children. Increased pressure from advocacy groups led to the creation of a "New School Lunch Bill of Rights." The predicament became part of the solution to American social inequality, and Congress passed the Child Nutrition Act of 1966. This Act included the Special Milk Program, which allowed schools flexibility to create nutrition programs and provided some money for equipment purchases (Cooper and Holmes, 2006). Additionally, a provision to provide school breakfast for needy children was enacted (Kennedy and Davis, 1998). While this act set aside federal money to funnel directly into school lunch, it did not change the overall distribution and financing structure. Eventually, the structure led to administrative and financial inequality (Levine, 2008). This policy process also combined all school food programs under one federal department in an effort to foster similar programming nationwide (Cooper and Holmes, 2006).

Research also emerged which showed that children functioned better academically if they were provided with breakfast (Cooper and Holmes, 2006). These studies also showed that if a healthy breakfast was served at schools, both absenteeism and tardiness levels dropped (Cooper and Holmes, 2006).

It became clear over time that the original appropriation levels created by Congress were not adequate to feed the nation's children. In 1965, $146 million was budgeted for the entire country. This sum was inadequate, so, in 1968, Congress granted an extra $32 million to expand

the program to needy areas, and in 1969, Congress increased this to $50 million. By 1973, the dollar allotment rose to $226 million. The school breakfast program, meanwhile, grew from $3.5 million in 1969 to $18 million in 1973 (Levine, 2008). In 1973, Congress passed the Child Nutrition Act, which made the SBP permanent. To ensure that more children could access the SBP, Congress passed the 1989 Child Nutrition Act. This required a separate set aside by the secretary of Agriculture to fund SBP in states where schools were trying to feed indigent children. Between 1990 and 1995 Congress increased the per district allotment for schools that wanted to serve SBP as a start-up program. The SBP has the same income qualifications and price reduction structure as NSLP (Kennedy and Davis, 1998).

While a higher federal allotment might seem like a reasonable policy solution, the impact of the mandate to supply more lunches had a detrimental effect on many schools. In order to comply and gain access to funds, schools had to distribute many more lunches than ever before. The funds set aside by Congress did not finance any central infrastructure improvements. This meant that schools without cafeterias and kitchens had no way to complete expensive alterations to their buildings (Levine, 2008).

Between 1968 and 1972, the number of children who qualified to pay for a full priced school lunch declined steeply. This led to a remarkable increase in the number of children getting a free school lunch and the growth and expansion of the program nationwide. Essentially, free school lunches had become the nation's premiere social welfare program for children. The vacuum left by being forced to pay for more children's meals created a huge budget shortfall for schools. During Nixon and Regan's presidencies, the school lunch program transitioned from one that fed nutritionally needy children to serving economically disadvantaged children. In order to cope with the budget crisis, school food administrators

started inviting food service companies into schools. These companies provided the food, and sometimes served the food as well. The result was that, "by the end of the 1970s school cafeterias came more and more to resemble fast-food restaurants … many free lunch advocates lauded the move. Liberals who generally eschewed big business and criticized corporate values were willing to go along with at least limited privatization if it meant that poor children could eat for free" (Levine, 2008, p. 152). Eventually, business interests assumed the major role in school lunch, and consumer choice, profitability and efficiency mantras reigned supreme. Nutrition and student well-being was no longer paramount. Instead, most lunch rooms were forced to turn to big business to keep their doors open (Levine, 2008). Competitive foods, by nature, were of minimal nutritional value and rapidly replaced more nutritious options in children's diets (Fleischhacker, 2007). In essence, the acceptance of liberals of the conservative economic ethos fundamentally and perhaps irrevocably changed the landscape of school lunch purchasing, provision and policy. What was once a well-intentioned food policy aimed at providing aid to poor children turned into a money making endeavor. Because of the inability of Congress to politically act and fund wholesome school lunches, liberal policy makers acquiesced to conservative ideas about school financing. This loosened the grasp school lunch advocates had on the policy, in an effort to keep the lunch program alive. In a direct reflection of much of the policy and government devolution of the 1980s, school lunch policy followed suit and also became an economic venture for schools (Levine, 2008).

Next, the federal government actually recommended that public/private partnerships be formed to provide school lunches. School lunch provisions were likened to other institutional activities that the government maintained such as the military and hospitals. On the other side of the spectrum, advocates rightly worried that including restaurants and other commercial entities

in lunch provision would turn the program's attention away from children's diets and towards profits (Levine, 2008). School lunch advocates were still trying to push school lunch as an avenue for health education, promote health and growth, and permit children to choose healthy foods that they liked (Levine, 2008). States continued to refuse to provide matching funds. Many schools were left in a conundrum of how to supply free lunches with a limited budget. The solution was pouring rights, which were sold off to beverage companies (Levine, 2008, Kramer-Atwood, et al, 2002, Van Hook and Altman, 2012). The companies lobbied for competitive foods to be permitted into school lunchrooms. Because children would be spending money on competitive foods, companies saw it as an avenue for increased revenue streams (Levine, 2008). Researchers point out that in addition to expensive pouring rights (Kramer-Atwood, et al, 2002), contracts also featured "incentive items" like cups, T-shirts, posters, drink bottles, scholarships, and scoreboards in exchange for exclusive rights to sell their products in schools (Van Hook and Altman, 2012). In essence, junk food was now being permitted to compete with a more nutritious, and cheaper, meal.

To make matters worse, the Reagan administration cut about $400 million from the budget, which directly affected school lunch programs. Throughout the early 1980s, the budget was cut yet again. Of all the nutrition programs that were hit, the school lunch programs suffered the worst cuts in the program's history (Levine, 2008). During Reagan's presidency the standards for inclusion of food into the school lunch program were also changed. No one can forget when his administration allowed ketchup to be counted as a vegetable (Cooper and Holmes, 2006).

By the time we entered the 21st century, childhood obesity was on the rise and finally on people's radars. Interestingly, a number of analysts (Fox, Dodd, Wilson, and Gleason, 2009, and

Gleason and Suitor, 2003) directly pointed the finger at school meals, stating that they "contributed to children's 'overconsumption of calories, fat, cholesterol, salt and sugar" (Levine, 2008, p. 184). Federal government reports were conducted on the issue including one, which analyzed the school-based sale of competitive foods. This report, by the House Appropriations Committee, showed that school lunch programs were inextricably linked to private food-service companies and competitive foods for the financial viability of their programs (Levine, 2008). Over the past decade, communities and schools have started to push back against competitive foods. They have refused to sign pouring rights contracts, removed vending machines completely, and forcefully endorsed the school wellness policy. Some schools have formed zones around the campus where food companies are not permitted to enter (Wharton, et al, 2008).

Schools also faced another interesting dilemma: how to provide qualifying students with nutritionally adequate meals, without exposing them to any associated stigma with NSLP receipt (Stein, 2008). Due to NSLP policy, competitive foods served a la carte needed to be kept separate from NSLP food during lunch periods. Simultaneously, schools are supposed to protect the identity of participating students to thwart humiliation. Essentially, this created a dual system of lunch service and made the privacy provision harder to maintain. Over a 20-year time span, there was a reduction in NSLP participation rates of 1.2%, largely blamed on the stigma associated with receipt (Stein, 2008). Indeed, there are students that would rather go hungry than face the disgrace of obtaining NSLP. Out of the school day periods, lunch is seen as a primary conduit for students to socialize. Children's sensitivities may be raised during this time, and they may try to eschew NSLP in an effort to disassociate from "poor" status among their peers. This

realization has helped move some schools to start using a debit card-like system for school meal purchases (Stein, 2008).

3.8 Research on NSLP

The School Nutrition Dietary Assessments (SNDA) began in 1995 to assess if the school meals programs were hitting USDA nutrition targets. They also analyzed nutrient quality, and intake patterns of the SBP and NSLP. Over the years, these studies showed the nutritional inadequacies in the school meals, and the growth potential for these meals. Many of the recent changes in the formulation recipes of NSLP and SBP foods followed the results of this analysis. (Story, 2009). A meta-analysis conducted to assess the impact that the recent school wellness policy changes had on school revenues showed that in the short-term, finances weren't affected. Wellness policies did not translate into a loss of revenue for schools (Wharton, et al, 2008). These studies were completed prior to the most recent school wellness policy changes.

The No Child Left Behind Legislation passed under President Bush introduced an interesting twist to school funding scenarios. Schools are fined substantially if enough students don't pass standardized exams. In an effort to help more children pass the exams, food service administrators increased the caloric and glucose content of school meals and snacks in the weeks before the tests. Theoretically, glucose will act much like brain food and help the students focus more. Increased focus should raise the percentages of children who pass the tests and keep school funding streams intact (Figlio and Winicki, 2004).

Detrimentally, some school districts and states passed laws that mimic governmental procurement laws. These regulations dictated that schools must purchase foods from the lowest bidder. This translated easily into forcing poorer districts to buy food which was less healthy for students (Cooper and Holmes, 2006).

Schanzebach (2009), performed a similar analysis to the following analysis, using the ECLS-K data. She examined the caloric intake of children who ate a reduced price or free lunch compared with those who brown bagged, or brought their lunch to school between Kindergarten and 5th grade. This study will seek to assess the 8th grade data wave, and see if Shanzebach's findings on the impact of the school food environment on obesity are supported in this data wave. This analysis includes NSLP, SBP and competitive foods. Schanzebach opted to use a regression discontinuity because, "a naive regression of school lunch on overweight may overstate the causal impact of lunch if not all other related factors are perfectly controlled…" (Shanzenbach, 2009, p. 689).

When children entered kindergarten, there was not a discernible difference between the groups of children who brought lunch versus those that ate the school lunch. At the end of first grade, however, the children who ate school lunch were 2.4% more likely to be overweight. There was no difference in activity rates between the two groups of children. Full and half day kindergarten attendees had the same obesity rates. Children who ate school lunch were more likely to move from the non-obese to obese category over the two years. The same trend that developed between kindergarten and first grade continued between first and third grade. Children that ate school lunch were 2.3 percent more likely to be obese and 6 times more likely to be overweight. By fifth grade, this trend had worsened to 4.5 percent more likely to be obese and 6.7 percent more likely to be overweight (Schanzebach, 2009). A school based analysis assessing overweight and obesity rates during 8th grade follows.

Overall, the findings showed that children who ate a school lunch were much more likely to be obese than children who brought their lunch to school. They also ate close to 40 more calories per day than "brown baggers." If sustained over a long period of time, Schanzebach

estimated that these children could gain 1.7% in their BMI. If the amount eaten increased to 120 calories per day, this group of children could leap up to seven percentage points on their BMI percentile range. Schools in lower income districts served children lunches with about 80 more calories than those in higher income areas (Schanzebach, 2009). Supporting her findings, other researchers found that children who obtained school lunch were more likely to remain persistently overweight. On the other hand, children that ate SBP did not have a significant effect on their obesity rates (Gable, et al, 2008).

Hernandez, Francis and Doyle (2011), also used the ECLS-K data and analyzed the effect that NSLP participation had on sex difference trajectories in BMI from children in Kindergarten to 5th grade. Using sex as a moderating variable they focused on lunch within elementary school because of the qualitative difference that lunch offerings have between elementary, middle and high school. In contrast to Schazebach's findings, there was not a statistically significant difference in BMI change between those that did and did not participate in NSLP. No statistical difference emerged between low- and higher income children. They did find that low-income Black children were 39% more likely than low-income White children to consistently receive NSLP. Low-income Hispanic children were 79% more likely to maintain NSLP receipt than low-income White children (Hernandez, et al, 2011). Consistent with Schazebach's findings, researchers contended that selection bias was not an issue when analyzing NSLP associations. In another study using the ECLS-K data waves between Kindergarten and 3rd grade, researchers found that, "…SBP is not a contributing factor to the current obesity epidemic, and may actually constitute a valuable tool, but the NSLP is contributing to the obesity epidemic" (Millimet, Chermis and Husain, 2008, p. 19). These seemingly disparate outcomes should be reevaluated, as the data set and the sample was the same. While all three studies used a form of regression, they

were all different. Schazenbach (2009) used regression discontinuity, Millimet, et al (2008) used OLS and Hernandez, et al (2011) used poisson regression. The conceptual models were also slightly different, perhaps impacting the confounding relationships and variables controlled for within the models.

SBP participation has been shown to be associated with greater child weight in 3rd grade and a larger change in weight between Kindergarten and 3rd grade. On the other hand, there was no relationship between NSLP receipt and child weight. Children who participated in both programs were likely to be non-white, live in the South, have a less educated or teen mother, and be low income (Millimet, et al, 2008). Datar and Nicosia (2009a) found that minority, low-income children with single-parent households and mothers with lower education levels, were more likely to participate in school meals. Additionally, children whose mothers worked were more likely to participate in both programs. While working more hours had a positive relationship with NSLP, this was not the case with SBP. In fact, children with mothers that worked were less likely to participate in SBP. The authors assert that, "from a policy perspective, … our results also suggest that policies that promote maternal labor supply (e.g. TANF, FMLA) may indirectly affect children's outcomes by influencing decisions regarding participation in school meal programs" (Datar and Nicosia, 2009a, p. 27).

School lunch formulation has gone through a number of changes over the years. The intent for some of these alternations was to provide children with healthful meals. But, the foods children chose to eat may not have been the healthiest option (Condon, Kay Crepinske, and Kay Fox, 2009). A part of the school meal policy is the "Offer versus Serve" option, which allows children to replace 1-2 items included in the NSLP or SBP tray (Condon, et al, 2009, Gordon, Crepinsek, Nogales, and Condon, 2007, and Pilant, 2006). The policy was implemented to

decrease food waste (Gordon, et al, 2007). Most schools used this policy: 78% of elementary schools, 93% of middle schools and all high schools (Kay Crepinsek, Gordon, McKinney, Condon and Wilson, 2009). Schools were more apt to serve "Offer and Serve" SBP options that met nutrition criteria, perhaps because SBP had less nutritional restrictions than NSLP (Gordon, et al, 2007). "Offer versus serve" was found to decrease consumption of healthful food (Pilant, 2006).

Researchers found that children's food choices may ultimately be based on hedonic ratings of taste (Caporale, Policastro, Tuorila, and Monteleone, 2009) and peer influence (Caporale, et al, 2009, and Rawlins, 2009). Even when children selected foods based on hedonic ratings, there was still food waste. The waste indicated that other factors also impacted children's food choices. This was especially true when contrasting school lunch choices with home meal patterns. Children were more apt to pick foods similar to what their parents provided (Caporale, et al, 2009). In addition to offering healthier options for lunch and breakfast, clearly nutritional education needs to help children select healthier items (Condon, et al, 2009).

Children's school day food purchases have also changed. Between 2003 and 2010, a higher percentage of children bought food from grocery stores rather than school vending machines and snack bars. It is unclear if these purchases were healthier options. The increase was not uniform across races. African American children from low-income homes were more likely to purchase food from vending machines at schools compared to White or Hispanic children (Moag, Stahlberg, 2011).

While a number of researchers actively pursued research on NSLP and SBP, there is growing concern that children's multiple need-based program receipt confounds these analyses. Many programs have similar cut offs for receipt (NSLP, SBP, SNAP and WIC), it can be

difficult to find variables that are not collinear (Hinrichs, 2010). Examining historical data on 5-17 year olds between 1937-1973, Hinrichs (2010), did not find an effect on BMI from NSLP. There was, however, a significant and positive relationship between NSLP and educational attainment. This effect was larger in Whites than Blacks (Hinrichs, 2010).

School lunch has been denigrated in the popular press (Komisar, 2011, Mozes, 2008, and Neighmond, 2008), and in the research literature (Anderson, et al, 2011, Cooper and Holmes, 2006, Datar and Nicosia 2009a, Datar and Nicosia, 2009b, Devault, et al, 2009, Dunifon and Kowaleski Jones, 2004, Ehrens and Weber, 2009, Fleischhacker, 2007, fox, et al, 2007, Gleason and Suitor, 2003, Hair, et al, 2008, Hernandez, et al, 2011, Kay Crepinsek, et al, 2009, Levine, 2008, Martin, et al, 2010, Milliment, et al, 2008, Pilant, 2006, Schanzebach, 2009, Stein, 2008, and Story, et al, 2003).. Despite these criticisms, "… school lunch often gets a 'bad rap,' it offers the most nutritious foods available at school" (Moag-Stahlberg, 2011, p. 14). In addition, many local programs still have to rely on foods donated by the USDA, usually various meat products that contain a high percentage of fat (Caprio, et al, 2008).

School lunch was extended to more groups, in part, to help alleviate family budgets. Economists assume that the receipt of the subsidy will shift resources within the household (Howard and Prakash, 2009). However, resource allocation will ultimately depend upon preferences. In actuality, the subsidy may not impact household spending. Researchers found that children who received NSLP increased consumption of fruits, green salad, and 100% fruit juice while they decreased consumption of milk. Children that were partially subsidized also lowered their milk consumption. In addition to NSLP, food availability near a child's home accounted for part of the variation in children's consumption patterns (Howard and Prakash, 2009).

When children don't eat school lunch, or bring it with them, their alternates are a la carte options, or sometimes, vending machine purchases. Twenty seven percent of African American children that did not buy lunch at school bought it from the vending machine (Moag- Stahlberg, 2011). Twenty nine percent purchased lunch from the school store or restaurants close to the school. Thirty four percent skipped lunch completely (Moag- Stahlberg, 2011). Those who participated in SBP were more likely to experience household food insecurity, compared to those who did not access the program. While the SBP is seen as beneficial for families, it might have the added benefit of alleviating consistent food insecurity once families have entered the food insecure divide (Bartfeld and Kim, 2010). On the negative side, children that attended public school and were also qualified to receive NSLP or SBP they had a .725 higher BMI than children attending private school (Bartfeld and Kim, 2010).

3.9 Competitive Food Availability in Schools

For years, the only regulation governing competitive foods in schools was that foods, "… of minimal nutritional value, defined as foods and beverages that have <5% of the Recommended Dietary Allowances per serving for eight key nutrients, cannot be sold in school foodservice areas during meal times" (Kay Fox, Gordon, Nogales and Wilson, 2009, p. S58). Of the items integrated into school wellness policies following the 2004 mandate, competitive foods were the items least addressed on school campuses (Chriqui, et al, 2013). The American School Food Service Association supported the assertion that some limits should have been placed on foods served to children during the school day (Probart, MccDonnell, Jomass and Fekete, 2010). Schools may be teaching students about proper nutrition in the classroom, and then negating these lessons by allowing easy access to competitive, and non-nutritious food throughout school grounds (Pilant, 2006). Hair, Ling and Wander (2008), found that nine out of ten schools sold

competitive foods. Schools with lower percentages of minority students had more competitive foods available for purchase. Suburban and rural schools also had more options of unhealthy foods compared to urban schools. Sweet snacks made up the highest proportion of unhealthy foods, followed by salty snacks and sodas, and sugar sweetened beverages. Schools that provided NSLP and SBP served healthier options (Hair, et al, 2008). The sale of competitive foods reduced participation in NSLP. This reduction cut into budgets through a loss in revenue stream (Fleischacker, 2007).

Competitive food choices come in all varieties, from healthy foods that are also federally reimbursable to extremely unhealthy sides and desserts (Kramer-Atwood, Dwyer, Hoelscher, Nicklas, Johnson, and Schulz, 2002). Additionally, unhealthy choices can cause decreased consumption of more healthful items (Kramer-Atwood, et al, 2002). Using Kindergarten through 8th grade waves of the ECLS-K, investigators did not find that availability of competitive foods directly predicted obesity (Van Hook and Altman, 2012). Regardless of race/ethnicity and SES, there were no notable effects produced by competitive foods (Van Hook and Altman, 2012). The researchers suggested that competitive food availability and the general school food environment did not directly cause childhood overweight. Rather, the best predictor was actually weight status at younger ages. Further, "… schools may not be good at addressing the root causes of childhood obesity that originate in children's homes and communities" (Van Hook and Altman, 2012, pg. 36). The analysis in this dissertation also explored the relationship between competitive food, available in vending machines, and overweight and obesity status in the 8th grade.

Datar and Nicosia (2009b) used the Kindergarten through 5th grade ECLS-K data waves to assess competitive food availability's effect on BMI. They did not find "substantive or

significant" effects on BMI. Competitive food availability in school was correlated with purchases. These in-school purchases were shown to merely replace out of school junk food purchases. Availability of competitive food had no impact on academic and social- behavioral outcomes. Datar and Nicosia (2009b) reason that, "…certain policy measures, such as outright bans on competitive food sales, might appear premature and even detrimental to schools because they remove a key source of discretionary funds" (p. 28). Expanding the analysis to include the 5th and 8th grade data waves, also confirmed that availability led to increased purchases. Thirty one percent of 5th graders and 42% of 8th graders had access to these beverages during school hours (Cunningham and Zavodny, 2011). Results of this study confirmed that purchasing did not increase consumption. There was no positive effect on weight gain (Cunningham and Zavodny, 2011). Concentrating on the 5th grade wave of the ECLS-K, Jones, Gonzalez and Frongilla (2009) also supported the finding that sugar sweetened beverages impacted overall purchasing behavior. Yet, this did not translate into increased consumption. If fruit juice or water was made available, children were three times more likely to opt for the sweeter option (Jones, et al, 2009).

A meta-analysis of competitive food availability (Larson and Story, 2010) and data from the Los Angeles Unified School District (Sanchez-Vaznaugh, Sanchez, Baek, and Crawford, 2010), found that in the absence of competitive foods in schools, children's diets were healthier. This is encouraging, as the Los Angeles Unified School District (LAUSD) was widely considered to have some of the strongest policies governing competitive foods in the nation. LAUSD was one of the first to adopt standards governing competitive food content (Agron, 2010), and can be looked at as a model system.

Coupling the 5th and 8th grade waves of ECLS-K and school food laws, researchers assessed weight status among adolescents in states that previously restricted competitive foods

(Taber, et al, 2012). In 2003, states that did not have laws governing competitive food nutritional content, also did not have large numbers of Hispanic students or low SES students. On the other hand, states with weak laws did have larger numbers of Hispanics and more low income students. Supporting the findings above from LAUSD, students in states with strong competitive food laws had a decreased likelihood of remaining overweight or obese between fifth and 8th grade. Students in states with weak laws were more likely to remain overweight or obese between the two grades. Law strength and consistency were the most important impact factors on increasing or decreasing BMI. Children in states with strong laws that had consistent messaging and required nutritional standards gained the least BMI between fifth and eighth grade (Taber, et al, 2012).

The Healthy, Hunger-Free Kids Act of 2010 initiated a change in school food law needed to place restrictions on competitive foods (Chriqui, et al, 2013 and Taber, Chriqui, Perna, Powell and Chaloupka, 2012). By 2011, there were many national school-based restrictions governing in-school access to sugar sweetened beverages (Cunningham and Zavodny, 2011). Children's purchases and consumption of sugar sweetened beverages are rarely limited to in school time. Regardless, this is an area that has been studied numerous times and many school-based policy solutions have been created. Reduction of sugar sweetened beverage access is one of the simplest policy mechanisms for advocates and public health workers to leverage. Despite the ease of creating these policies, it is necessary to understand whether this restriction on in-school purchases will curtail overall consumption. Or, will children buy more sugar sweetened beverages during out-of-school time?

3.10 Calorie Labeling and reformulation

A number of municipalities have passed laws requiring restaurant chains with a certain number of food outlets per square mileage to post nutrition information within their stores (Elbel, Kersh, Brescoll and Dixon, 2009). The foods eaten at these outlets are considered less nutritious, energy dense, with high sugar and fat contents (Guthrie, Lin, and Frazao, 2002). Girls, not boys, and obese, not healthy weight children, were more likely to use nutrition information during purchases (Wethington, Maynard and Blanck, 2013). However, children that ate at these fast food outlets two times or more per week were less likely to consult nutrition content postings before purchase. There was no significant association based on age, race/ethnicity, parents' marital status or region. The authors suggested that future nutritional information should be displayed in a "consumer friendly" manner. The material should be made palatable for children to make healthful purchasing choices (Wethington, Maynard and Blanck, 2013), and to attract the attention of children most likely to purchase unhealthy food.

Voluntary efforts to embolden food companies to post nutrition information in stores and/or reformulate their products have failed (Farley, Caffarelli, Bassett, Silver and Frieden, 2009). As profit is king, companies feared that nutrition displays would make them less competitive. And in turn, they would lose money. It was generally necessary to "encourage" company involvement by formulating government guidelines and laws (Huang and Yaroch, 2009).

3.11 Head Start and Childcare Subsidies

Most research on childhood obesity concentrated on school-aged children. Nonetheless, in 2008, there were 13 million preschool age children in the United States (Herbst and Telkin, 2009). Forty one percent of preschool aged children were in center based childcare for at least

35 hours per week. Clearly, research on this cohort of children is important. The nationwide variance in quality of care was quite wide (Blau, 2001). Childcare subsidies theoretically allowed parents to have more disposable income. The subsidies may have permitted parents to switch care from informal to formal arrangements (Blau, 2001). Subsidy users were more likely to be Black and use center based care. It was unclear if subsidies influenced mothers to use disposable income to purchase healthier food. Children of mothers who worked were more likely to be overweight or obese, regardless of subsidy receipt status. When comparing children in parental care and those using subsidies, subsidy users had significantly and consistently higher weight status (Herbst and Tekin, 2009). Unfortunately, this analysis did not include a discussion of race or gender.

It seems that the subsidies themselves placed children in environments where they were more likely to be overweight or obese (Herbst and Tekin, 2009). Alternatively, mothers who placed their children in center-based care were somehow different from those that didn't. In the lower BMI cohorts, there was no subsidy effect. Children with a BMI over the median who received subsidies had larger BMI gains than those below the median. The authors concluded that the subsidy effect, which increased children's BMI, operated through their participation in center-based care. Considering the knowledge that lower-income children were in center based care, had diminished physical activity opportunities, and the subsidy effect was larger for children of higher BMI's, there was cause for concern (Herbst and Tekin, 2009).

Head Start is the government sponsored child-care for low-income families. The Department of Health and Human Services oversees the program and gives grants to local and state agencies. Since 1965, over 31 million children have been served by Head Start (United States Department of Health and Human Services, 2011). If a large number of children are

already obese by the time they are enrolled in Head Start, attacking the problem when they are school aged may be too little, too late. As of 2010, Head Start meals and snacks were not yet adequately regulated, much like broader school environments. Staff should be trained in health and wellness, and wellness programs should be established and enforced. In order to guide this process, federal legislation should be enacted. This legislation should also reduce access and presence of vending machines serving unhealthy options throughout the day (Health Affairs, 2010).

3.12 Other:

In the past decade legislation protecting companies from litigation have been introduced or enacted in both state and federal legislatures. Sometimes dubbed the "cheeseburger bill," these laws insulated food companies from having to pay out civil liabilities (Burnett, 2006). These protections included safety from litigation if a person ate specific foods, gained weight and then developed an illness as a result of this weight gain (Weiss and Smith, 2004). These laws enforced the pro-business and individual responsibility ethos of the American policy environment.

International recommendations, including those introduced by the World Health Organization (WHO), suggesting that foods should have no more than 10% added sugar, have received a fair amount of industry-based backlash. Countries that produced sugar for export also responded negatively to this suggestion (Rigby, et al, 2004). A clear understanding of the complex nature of the international food system is fundamental to understanding obesity related consumption. Supply, demand, access, and marketing of foods is dictated by the companies that own the market share of the global food chain (Huang and Yaroch, 2009). That essentially leaves public health at industry's mercy "…because the same companies that produce unhealthy foods also produce healthy ones. Therefore, the question for public health is not to treat the food

industry as the enemy but to capitalize on the industry's need for a positive image and long-term business viability" (Huang and Yaroch, 2009, p. A110).

In response to local obesity prevalence rates, some municipalities have tried to motivate their citizens to be healthier. City government and workplaces hosted "the Biggest Loser" challenges for city employees and residents (Nassau County Department of Health, 2009). While these activities are not without merit, their intent may be muted because they are not evidence based. Uneducated ventures are particularly detrimental and a common error made by policy formulators, enactors, and politicians. Even more encouraging is that physicians themselves recognize that facing this epidemic will take many more agents of change than just themselves (Krebs, et al, 2007). Hopefully, the medical community can work in tandem with local legislators to create meaningful programmatic and policy changes.

In summary, a large number of local, regional, national and international policies enhance obesogenic environments. These policies are not coordinated, and can impact people at various stages in their life cycle. In addition, policies can interact and create wholly unintended negative consequences. A proper theoretical frame needs to be applied to fully analyze these differential impacts. Children spend the bulk of their waking hours within school campuses (Larson and Story, 2010). School environments are seen as the first and easiest place to intervene in the childhood obesity epidemic (Committees on the Social Determinants of Health Nutrition Standards for Foods in Schools, et al, 2007, Goldberg, Collins, Folta, McLarney, Kozower, Kuder, Clark and Economos, 2009, and Pilant, 2006). Educational environments can help shape healthier diets and lifestyle related behaviors. There is simply no other institution or environment where children spend time as consistently (Kay Fox, Gordon, Nogales and Wilson, 2009). As such, the analysis used in this dissertation will investigate the school food environment's impact

on childhood obesity. The theoretical approach will be a social determinants of health framework.

The next section of the paper will introduce the SDH theory and model. The evidence presented in the previous sections supports the notion that a wider view needs to be applied to both investigate and to solve the epidemic. SDH should provide this pathway.

Chapter 4: Theory: Social Determinants of Health

The Social Determinants of Health (SDH) theory is built on perspectives of equity. It's definition, history, use in research, and impact on obesity research will be described below. While SDH is not necessarily a new concept, it has never been fully embraced. The current research examining the school food environment's impact on childhood obesity should support the use of SDH to frame future social policy and problem analysis.

In an influential piece, Dr. Paul Farmer delineated his "pathologies of power" theory. He used this concept to explain that public health was no longer treated as a human right. However, medical care is, "… every bit as crucial as civil rights" (Farmer, 1999, p. 1487). People generally cherish their health status over their wealth. Health is a value, but it also enhances access to life's opportunities. Without health, people's dreams are sidelined, and life's goals become secondary (Vagero, 1995). Pervasive inequalities exist between those without access to power and resources. This has created a reality in which medical advances and prosperity are denied those who are worse off (Panel on Understanding Cross-National Health Differences Among High-Income Countries, et al, 2013). While laws have biases and ideology embedded within them, by its nature public health should rise above these prejudices. Public health should, "… not ask whether an event or process violates an existing rule: they ask whether that event or process can be shown to have ill effects on a patient or on a population. They ask whether such events can be prevented or remediated" (Farmer, 1999, p. 1491). Farmer (1999) believes that using this approach will help in the fight for human rights.

The health status of the United States' populace demonstrates a typical example of Farmer's theory. Health status is not attributable to "mere" disadvantage, rather it is evidenced by much higher morbidity and mortality rates for children and adults in disadvantaged

populations. These significant negative trends have been dubbed "the American health-wealth paradox" (Panel on Understanding Cross-National Health Differences Among High-Income Countries, et al, 2013, p. x). This paradox impacts the population as a whole. American life expectancy is shorter than other developed nations. Comparably, the US has a more diverse population, admits larger numbers of immigrants, and excludes large parts of the population from health insurance (Panel on Understanding Cross-National Health Differences Among High-Income Countries, et al, 2013). The United States' traditional reluctance to acknowledge a role in curbing destructive behavior under the guise of protecting individual rights may play a large role in America's poor health status compared to that of other nations. Countries that have a more liberal political and governmental philosophy and social welfare paradigm have much better population health by most measures, compared to countries that are more conservative in these areas (Solar and Irwin, 2010).

The reasons cited above cannot be the only explanations for the American health disadvantage. Even Americans of higher incomes with health insurance have poorer health outcomes than their peers in the United Kingdom (Panel on Understanding Cross-National Health Differences Among High-Income Countries, et al, 2013). Overall, those in the United States who are the most disadvantaged have the worst health outcomes. Despite this fact, "…the health of the entire population may be affected by the conditions that more severely compromise the health of disadvantaged groups" (Panel on Understanding Cross-National Health Differences Among High-Income Countries, et al, 2013). This health disadvantage is already present by childhood and adolescence. Disadvantage impacts adult health status (Shaw, Dorling, and Davey Smith, 2006), making early childhood an important time to disrupt causal pathways (Braveman, Egerter, and Williams, 2011, and Panel on Understanding Cross-National Health

Differences Among High-Income Countries, et al, 2013). Compared to other countries, children aged 5-19 in the US had higher mortality rates from all causes. This manifests pervasively for obesity in the population (Panel on Understanding Cross-National Health Differences Among High-Income Countries, et al, 2013). It is clear that the ill-health of the American populace is now a social justice issue (Committees on the Social Determinants of Health, 2008), since the determinants of poor health status are associated with social disadvantage and marginalization (Kelly, Morgan, Bonnefoy, Butt, Bergman, Mackeback, Exworthy, Popay, Tugwell, Robinson, Simpson, Narayan, Myer, Ouweling, Jadue, Florenzano, and Measurement and Evidence Knowledge Network, 2007).

Much of the past research on health has evaluated disease trends and simple variables such as race and ethnicity (Koh, 2011), or has used a narrow analysis of SES and its influences on health (Braveman, et al, 2011). This avenue was certainly useful to assess disease status. It is not the same frame from which ongoing causes and solutions should be investigated. Future research needs to accurately track and measure social determinants. This refined vision will ultimately expose important influences on health (Koh, 2011). A Social Determinants of Health (SDH) approach borrows from ecological and socioenvironmental theories. These concepts assume that people and environments are inextricably linked. Daily lives are continuously impacted by any number of public policies, contexts and environments (Sihto, Ollila and Koivusalo, 2006).

4.1 History of the social determinants of health theory proliferation

The World Health Organization (WHO) was created in 1948. The organization's central tenet incorporated a "holistic health model," and, "… hope for action on global health equity and attention to the social causes of health" (Frield and Marmot, 2011, p. 226). Historically, the

social approach to health had been present for centuries (Irwin, Scali, Vega and Solar, 2005) but had a varied reference vocabulary, definitions and policy response (Vagero, 1995). Some credit the social approach to health with improving food supplies, sanitation and living conditions. These advances led to the regional and global eradication of outbreaks of some communicable diseases (Irwin, et al, 2005).

After the WHO's creation, the next few decades brought rapid advancement in biotechnology. This progression shifted public health's focus away from achieving equity (Frield and Marmot, 2011, Solar and Irwin, 2010, Woolf, Johnson, Philips and Philipson, 2007, and Woolf, Johnson, Fryer, Rust and Satcher, 2004). These technological advances did not benefit everyone equally (Frield and Marmot, 2011, and Woolf, et al, 2007). Post WW II, international public health made larger commitments to technological answers to health problems rather than population based approaches. Over time, both the UN and the WHO fell under heavier US influence. Characteristically, the US was not interested in espousing a social model of health. This messaging was perceived to be too close to a Communist mantra, during the Cold War Era (Irwin, et al, 2005). As a result, an enormous amount of time, energy, and money went into enhancing medical and technological improvements. Modeling parity in mortality rates between African Americans and Whites between 1991 and 2000 showed that the concentration on medical advances rather than on determinants of health caused an increase in mortality (Woolf, et al, 2007).

In 1978, at the WHO meeting in Alma Ata, the organization produced the first "Health for All" declaration. The declaration launched the primary health care movement. It also drew renewed focus to a more organic view of health (Frield and Marmot, 2011, and Irwin, et al, 2005). During the 1970s the term "determinants of health," first came into use (Sihto, et al,

2006). Because of the financial crisis and the more conservative political and philosophical bent of the 1970s and 1980s, only a partial movement came to pass (Frield and Marmot, 2011). The Neoliberal agenda pushed medicine to strive for efficiency and limited spending. This increased the private sector presence in the health zone and further decentralized prevention and treatment. This devolution moved the WHO further away from equity-based public health (Irwin, et al, 2005, and Solar and Irwin, 2010).

During the 1980s and 1990s, countries began to more seriously investigate their own health inequities. The United Kingdom's Black Report on health inequalities sparked these inquiries. This report was the first time that researchers advocated an aggressive approach to decreasing social and economic inequality with the goal of achieving health parity in the UK. Soon other nations such as the Netherlands, Spain and Sweden started their own research into healthy inequity (Solar and Irwin, 2010).

In 1986, Canada created the Ottawa Charter on Health Promotion during the first ever international conference on health promotion (Frield and Marmot, 2011, and Irwin, et al, 2005). The conference and charter reinvigorated interest in the "Health for All (HFA)" approach. Though, much of the concentration at this time was on NCDs in middle and high-income countries. The ensuing time period, "… revealed the vulnerability to external shocks and domestic political vicissitudes of some of the policies that had enabled these countries to become models for improving population health and health equity" (Irwin, et al, 2005, p. 15).

During the 1990s, the theoretical discussion regarding equality took a step forward. Public Health advocates realized that social theories needed to be more adeptly applied. These theories elucidated the global impact of socioeconomic inequality from an epidemiological perspective (Szreter and Woolcock, 2004). Theorists postulated that if a reduction in income

inequality was not made a paramount social goal, the disadvantaged would be further persecuted and discriminated against. This increased victimization would create additional negative reactions among these populations, reinforcing their health inequalities (Szreter and Woolcock, 2004).

In 1998, the WHO saw a leadership change. The new management instituted a renewed push to address SDH. During the mid-1990s, the vocabulary of SDH began to come back into use. In the early 2000s, high-income countries like the UK, Australia, Canada and New Zealand also became more open to the approach (Irwin, et al, 2005). The Millennium Development Goals (MDG) helped refocus energy and interest in the topic (Frield and Marmot, 2011). The MDG necessitate a positive movement to reduce poverty, enhance food security, increase educational access and women's empowerment, and create better living conditions in slums. Without progress on health initiatives, the MDG are completely out of reach (Irwin, et al, 2005).

Over the past 15-20 years, a more refined discourse has emerged presenting social factors and health as the mainstays of future progress (Braveman, et al, 2011). The CDC has taken steps to embrace the WHO's SDH ethos by incorporating SDH in their 2020 Health People objectives. Inclusion is important because any changes may impact behaviors and help to advance public health agendas beyond the health sectors (Koh, 2011).

The WHO established the Committees on the Social Determinants of Health (CSDH) in 2005. The goal of the committee was to investigate worldwide health inequities. Prior to the creation of the CSDH, there was no coordinated approach to understanding SDH. The commission formed networks, "… of research, policy, and practice around specific thematic areas: globalization, employment and working conditions, early child development, health

systems, urban settings, social exclusion, women and gender equity, and priority health conditions" (Friel and Marmot, 2011, p. 228).

In May of 2009, at the World Health Assembly, the attendees unanimously voted to accept a resolution on health and health equity approaches. This spurred actions within the WHO to pursue population parity in health, research and analyze health equity, create policies and ensure consistency between these policies and programs (Friel and Marmot, 2011). This philosophy has also been incorporated at certain levels of the United Nations.

In the United States, the Robert Wood Johnson Foundation has had a focus on and recognition of racial and socioeconomic disparities in health. Together with the Commission to Build a Healthier America, they issued a set of 10 recommendations on SDH. This group's conclusions did not embrace those of the WHO, and instead concentrated on individual behaviors (Friel and Marmot, 2011). The impact of this difference of opinion is still unknown and may influence future generations. The world may be at a unique juncture to move forward to tackle SDH. For perhaps the first time, the realization that substantial, overarching structures, policies and shocks to the global infrastructure impact health and wellbeing has become evident. Since the 2008 crisis, "the nature of the relationship between economic downturns and health inequities is clear. The health of people who lose jobs, who have poor employment prospects, and who are in precarious employment is affected disproportionately compared with other people" (Friel and Marmot, 2011, p. 232). Economically, for efficiency reasons, it behooves the international community to act to promote equity in health (Friel and Marmot, 2011). The right to good health is in direct contrast to the economic idea that externalities, such as poor health, are a general consequence of the market. In fact, the attainment of equitable health status might clash with utility principles (Kelly, et al, 2007). Despite the theory's presence on the

world stage, there has been very little progress made, since there has been no movement to address the precipitating issues that caused the initial formation of the SDH theory (Berkeley and Springett, 2006a).

4.2 Health Gradient

Marmot (2007) argued that three circumstances caused the social gradient to positively or negatively affect those within it: money/material conditions, status/relative position and power. Societies, by default, had ranking systems, but health gradients differed (Marmot, 2007). In essence, the inequality endemic in one's ranking in the system, which oneself and others recognized, causes a "status syndrome." This precipitated an inability to participate fully in society due to a lack of autonomy over life's circumstances. While social determinants exist, they are relevant to health status and impacted everyone on the gradient. These determinants, themselves, don't explain the gradient; the "… social forces at work that lead to social groups lower in the hierarchy having worse health than higher groups," did (Marmot, 2007, p. 241).

Understanding that obesity prevalence rates, co-morbidities, and lower SES are all part of the social gradient in health necessitates analyzing these problems in the context of the effects of disparities/social determinants on these problems (Cohen, et al, 2005 and Committees on the Social Determinants of Health, 2008). The concept of the gradient can be confusing to some, as it is not simply a breakdown of the worst off versus the better off, but is a continuum that is not necessarily linear. In the gradient, even those at middle-income levels are not as well off as those above (Braveman, et al, 2011, and Brunner and Marmot, 2006). Therefore, relative position within the hierarchy matters. In turn, biological and psychological processes creating health status mediate this social organization. Ill health, itself, can change and worsen the positioning and exposure to stress in the gradient (Brunner and Marmot, 2006). For the most part, with other

socially related issues, as SES differences improve, health status also tends to improve. However, this does not seem to be the case with obesity. In the current structure, there is a clear divide between the highest and lowest income groups. Those in the middle-income levels defy the usual "stepwise pattern" of health and have similar obesity rates as low income groups (Braveman, 2009) leading to a nonlinear portion of the gradient.

A health gradient means that the poorest, the most marginalized, the traditionally and historically most excluded groups will experience the worst health (Committees on the Social Determinants of Health, 2008), and have a higher degree of stress that will further negatively impact their health status (Brunner and Marmot, 2006). Those that are excluded also experience "multidimensional disadvantage" (Shaw, et al, 2006). It is highly unlikely that social factors do not exacerbate the disparity in prevalence levels (Cohen, et al, 2005). Other causal theories tend to base themselves at the micro or mezzo level. A social determinants perspective incorporates social network theory, ecological models, social capital, systems theory, health disparities and other larger, holistic and macro level frames. Micro and mezzo level perspectives ignore "the complex social environment that might surround children and their families … Similarly, a school-based intervention that does not consider the familial social environment or interpersonal influences within the neighborhood or community settings would also be limited" (Koehly and Loscalzo, 2009, p. A100). Social determinants solutions assume that an individual intervention will overlook the larger discrepancies in systems. It is these discrepancies that handicap groups of people who experience more health disparities and social disadvantage. This makes individual interventions almost fruitless (Koehly and Loscalzo, 2009 and Panel on Understanding Cross-National Health Differences Among High-Income Countries, et al, 2013). The gradient requires

population based policy and systemic changes that can encourage sustainable change for individualized and micro level interventions (Baum, 2007).

4.3 Social Determinant of Health:

Social determinants of health (SDH), "… refers to the complex, integrated, and overlapping social structures and economic systems that include social and physical environments and health services. These determinants are shaped by the level of income, power and resources at global, national, and local levels. They are also often influenced not only through personal choices, but through policy choices as well" (U.S. Department of Health and Human Services, 2010, p. 1). There are two major determinants of health status. First, those that are structural and create divisions among people like socioeconomic status, sex, age, race and sexual orientation. The second are determinants that underpin the above and, place people in "health-compromising conditions" such as access to services, employment, and housing (Kjellstorm, 2008, p. 1). These determinants are linked to lack of opportunity and resources that block people from improving, protecting or maintaining their own health status.

The literature points to five determinants of population health: biology and genetics, individual behavior, social environment, physical environment and health services (Marmot, 2007, Solar and Irwin, 2005, and the U.S Department of Health and Human Services, 2010). The Social Determinants of Health theory concentrates on tackling the final three, as they are not controllable by the individual, but do affect individual environments. This method relies on the World Health Organization's (WHO) conceptual framework of SDH that focuses on the drivers of the health gradient. The framework aims to distill the interaction between determinants, show how this interaction creates inequality, and determine what issues to attack first and the appropriate injection points for intervention (U.S. Department of Health and Human Services,

2010). By addressing SDH, the health of the population can be improved, and this should also have a positive effect on other socioeconomic factors (U.S. Department of Health and Human Services, 2010).

At its core an SDH approach is not anchored by evidence, but rather germinates from the assertion that the entire population deserves the same rights to good health as the well off. Science proposes to be "objective" in its approach to research. Nonetheless, the reality is that all science is "socially constructed" and therefore, bias is inevitable. Bias can stem from the writer's political affiliations, to the methodology used for analysis. This bias will pervade every step of the research and writing process, and it is essential for the investigator to acknowledge this from the outset (Kelly, et al, 2007). Effective SDH research acknowledges and incorporates the assumption of equity.

A health disparities methodology, "…highlights health or health-related differences closely linked with differences in social advantage on both socioeconomic and racial/ethnic lines" (Braveman, 2009, p. A92). Social disadvantage, itself, is a layered and complicated concept including material conditions, access to resources and services, psychological effects, and stress. These "layers" coexist and interact with one another and intervening layers and unfold over time (Braveman, 2009, and Braveman, et al, 2011), and can even change independently (Kelly, et al, 2007). From an epistemological standpoint, context is also very important – social justice issues will change over time and can be culturally unique (Kelly, et al, 2007).

In the United States, racial and ethnic group membership is closely related to social disadvantage and advantage (Braveman, 2009 and Shaw, et al, 2006). For example, just the fear of racism detrimentally affects health status (Nazroo and Williams, 2006). Racism severely

impacts health (Krieger, 2002), especially institutional racism that reinforces segregation in housing and access to services (Braveman, 2009). Segregation robs Blacks and Hispanics of the chance to reside in communities that promote health and keeps them cut off from economic opportunities (Williams and Collins, 2001). Negative experiences caused by racism, segregation, and the awareness of these in one's life, impact health outcomes through "… psychosocial pathways involving stress and physiological responses to stress…" (Braveman, 2009, p. A92). Racism forcefully determines disadvantage, access, and opportunity faced by multiple subpopulations (Nazroo and Williams, 2006). Obesity itself can lead to exclusion and social disadvantage (Braveman, 2009). Coupled with race-based disadvantage, the cumulative health disadvantage experienced by certain groups is a crushing negative force.

The analysis of issues from a SDH perspective permits researchers to ask different questions. These questions should more cogently address the root and aggravators of obesity and inequality, as well as the impacts that improve difference within a lifetime. Where are the most logical points for interventions to disrupt obesity pathways? Will population based changes in obesity prevalence produce subgroup reductions for those most at risk? What are the disparate impacts on all levels of obesity for varying groups (Braveman, 2009)? How can we get to a place of equity, and what equity precisely should we be striving for? Are we more concerned with health disparities themselves, or larger questions of "underlying social advantage or privilege, i.e., different levels of power, wealth, or prestige" (Braveman, 2009, p. 10)? The ultimate goal should be comparable health status among all groups. In fact, not just comparable, but health status of the highest quality, in all its facets: physical, psychological and social wellbeing. Equity in health care means that rationing is according to need rather than income, and implies a commitment to a higher standard of care (Braveman, 2009).

Using a Social Determinants of Health and Environmental Health Promotion model, researchers analyzed both the physical and social aspects of neighborhood environments on children's obesity status (Franzini, Elliot, Cuccaro, Schuster, Gilliland, Grunbaum, Franklin and Tortolero, 2009). They found that the social or neighborhood environment was more important in predicting obesity and physical activity participation than the physical environment. Neighborhoods with higher collective efficacy, measures of social cohesion, and perceived safety, had a positive relationship with physical activity. These neighborhoods also had a negative relationship with obesity (Franzini, et al, 2009). Merely altering the physical environment of the neighborhood will not be enough to make a lasting impact. These surface changes will not address underlying social processes. The social processes are likely ingrained in "neighborhood structural characteristics, such as social and economic inequalities, poverty, and residential segregation" (Franzini, et al, 2009, p. 276). In a study analyzing atherosclerosis risk and the neighborhood effect on this risk, results showed that both the physical and social features of neighborhoods impacted health (Diez Roux, Stein Merkin, Arnett, Chambless, Massing, Nieto, and Sorlie, 2001). Residents of disadvantaged neighborhoods, both White and Black, had a higher risk of developing disease than those in advantaged neighborhoods (Diez Roux, et al, 2001). With that in mind, policies that reduce economic disparities would be required to facilitate a decrease in the social and economic disparities faced by families (Franzini, et al, 2009).

4.4 US Context

The American concentration on individual failure and responsibility has placed the concentration of obesity research, interventions and policy making at the person level. It is the contention of the SDH approach that research, interventions and policy should be at the macro level, where true change can take place (Baum, 2007, and Shaw, et al, 2006). In fact, detrimental

individual behaviors are felt to be a by-product of policies, both economic and social. Politics influence behavior and the combination of these magnifies deprivation and cuts people out of "the American dream." Additionally, this "toxic combination" helps create the health gradient and extends overall deprivation to those above the poverty line and are still considered "the working poor" (Committees on the Social Determinants of Health, 2008 p. 36). These groups are cut off from the same material goods, social access and opportunity that the middle and upper echelons possess (Committees on the Social Determinants of Health, 2008). While some individualized interventions have had success on specific people, these are generally only realized in the short –term. These micro-level interventions also impacted those at the higher levels of the social gradient more effectively, thereby reinforcing the status quo (Friel, et al, 2007). This individual culture ignores the damage that material deprivation can have and clouds the impact that income has on a parent's ability to effectively care for their child. As well as protect their children's and their own health (Shaw, et al, 2006). Further, "… that the experience of poverty is rarely static and unchanging and that it has a cumulative effect" (Shaw, et al, 2006, p. 201).

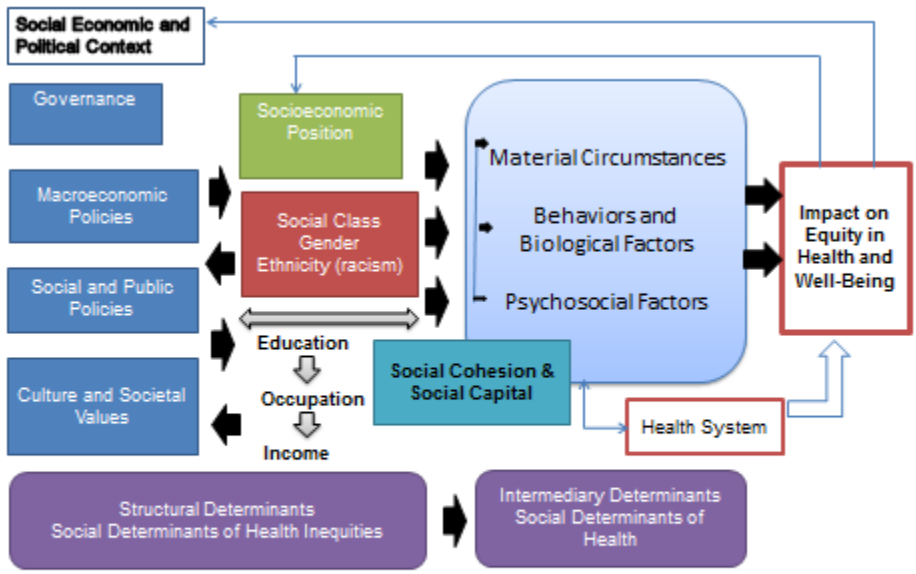
America's individualism may preclude it from adapting an approach that treats equity as a right (Vagero, 1995). Given the current divisiveness regarding the Affordable Care Act, and the inability to pass a public or single payer option, it seems unlikely that advocating for a "right to health" will come to fruition at this time.

A social determinants approach steers away from the "moral failure" mantra. Instead, it points towards a larger paradigmatic analysis. At the core of this is the unequal distribution of everyday life and larger structural factors that distance sub populations from the goal of attaining a healthy weight status (Friel, et al, 2007).

4.5 Conceptual Model

The SDH conceptual model, in Figure 1, paints a picture of the many spheres which impact obesity. These include food systems and behaviors, built environment and behavior, social conditions and behavior, societal inequity and unhealthy weight (Richard, et al, 2011). Also built in to the model are social contexts, including societal structure and stratification of social positions (Solar and Irwin, 2010). The model integrates social stratification's influence on exposure to negative health effects and variation in vulnerability to these pressures. And finally, it acknowledges the differential consequences that result from the above – including social, economic and health impacts (Solar and Irwin, 2010).

Figure 1: Social Determinants of Health conceptual model (adapted from Solar and Irwin, 2010)



The incorporation of these many "spheres of influence," attempts to personify, how social, economic and political mechanisms give rise to a set of socioeconomic positions, whereby populations are stratified according to income, education, occupation, gender, race/ethnicity and other factors; these socioeconomic

> positions in turn shape specific determinants of health status (intermediary determinants) reflective of people's place within social hierarches; based on their respective social status, individuals experience differences in exposure and vulnerability to health-compromising conditions. Illness can 'feed back' on a given individual's social position, e.g. by compromising employment opportunities and reducing income; certain epidemic diseases can similarly 'feed back' to affect the functioning of social, economic and political institutions (Solar and Irwin, 2010, p. 5).

Differential health impacts are set within contexts. These contexts, in coordination with larger structural mechanisms and the relative hierarchical position of a person, result in a "structural determinant" and the associated social determinants (Solar and Irwin, 2010). In this model, the health system itself is also an SDH. Other SDH models do not incorporate access to and the effects of the health system. However, the health system has an enormous impact on people's lives (Solar and Irwin, 2010). Also occupying a space in this model are the concepts of social cohesion and social capital, although there is disagreement on its overall place within the model (Solar and Irwin, 2010). It is generally recognized that social capital is embedded within and cuts across the larger structural processes as well as the intermediary subsets, touching on all parts of the theory. However, theorists worry that concentrating on social capital may move people away from dealing with the politics embedded in the theory. Understanding and attacking the "political nature" of SDH is essential for effective change (Solar and Irwin, 2010).

Adopting the WHO stance to combat health disparities necessitates government intervention. Americans cannot reach their full potential and their "right to happiness" because of economic, social and environmental forces beyond their control that limit their healthful choices and opportunities in life (Koh, 2011, p. 14). It is the government's place to enhance people's health status, by enforcing "human rights norms, principles, and agreements" (Koh, 2011, p. 14).

When the path is blocked for people to access rights, it is government that should be eliminating hurdles, especially for the disenfranchised (Braveman, 2009).

This conceptual model is vastly different from the majority of the mainstream models used to research childhood obesity. The above literature review included studies that investigated either a single, or small subset of variables – and ignored the larger contextual spheres contained in the SDH model. Below, a logistic regression will be used to assess the school food environment – a mezzo level set of variables. It is the hypothesis of the investigator that testing the model at this level will show that the current interventions have, at best, an inconclusive track record in modifying the school age obesity epidemic. Further, this can lead researchers and advocates to push for new policy changes which may not have any discernible impact because they do not change the larger structural inequities that create SDH.

In summation, the SDH analytical frame is appropriate to scrutinize childhood obesity. It is the proper theory to use with complicated social and public health issues. SDH acknowledges and investigates the multiple layers and multitude of variables that impact people to create "an intractable problem" like obesity or poverty.

In the next chapter, the SDH perspective will be used to test the school food environment's impact on childhood obesity. The model will try and understand if poor and minority children, are more obese and ascertain if the school food environment is to blame. While it may be useful to complete this limited analysis, the larger SDH are what creates the obesogenic environment. The outside of school factors/policies/environments that exist within the SDH model will more thoroughly explain the epidemic. SDH will absolutely impact the school food environment. But, narrowing the analysis to this solitary mezzo level context leaves

out other necessary explanatory variables. The larger contextualized SDH analysis is beyond the scope of this dissertation.

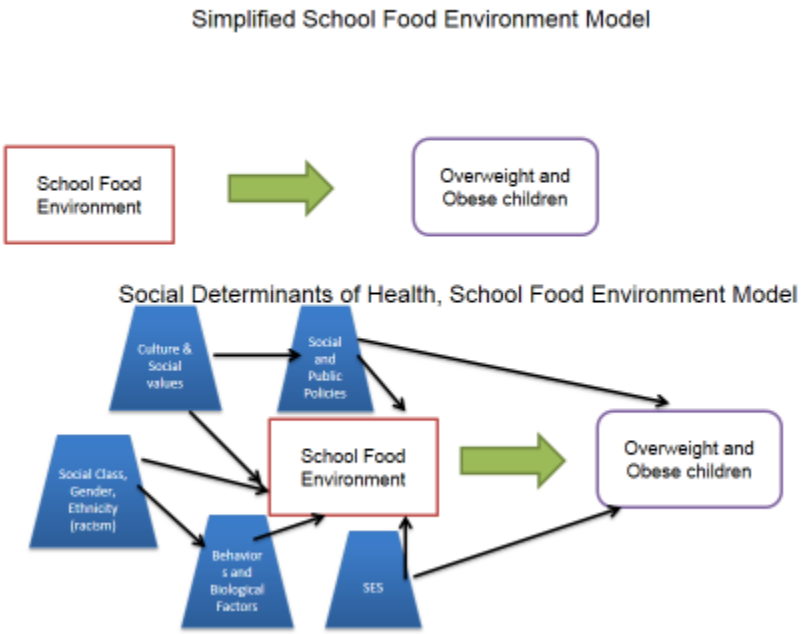
Chapter 5: Methodology

The below study tests the school food environment's impact on childhood obesity. The analysis is guided by the Social Determinants of Health (SDH) framework. Logistic regression, a widely applied analytical technique for understanding dichotomous dependent variables, will be used to understand the relationship between the school food environment and childhood obesity. In the final section of the chapter, these results will be linked to an SDH frame of childhood obesity.

Research Question: What does the school food environment tell us about childhood obesity?

Underlying questions: Does the school food environment increase or decrease the BMI of children? Does the National School Lunch Program (NSLP) increase or decrease BMI? Does the School Breakfast Program (SBP) increase or decrease BMI? Is there a difference in school children's BMI of different socioeconomic statuses? Does access to vending machines with sugary snacks, savory snacks and sugar sweetened beverages increase or decrease children's BMI? Does the school food environment increase or decrease the BMI of Black or Hispanic children differently than White children?

Figure 2: School food environment conceptual model



The following analysis will test the simplified school food environment model. The literature review lead to the hypothesis that the school food environment should have some effect on children's BMI. In addition, the sub hypotheses analyzed are directly supported by the above literature review. A great deal of previous research assumes that the relationship of interest is contained in the simplified model. This assumption is unwarranted and effects the results of these studies. The present analysis will support the usage of the social determinants of health model for future research.

5.1 Hypotheses

Hypothesis 1 (National School Lunch Program and obesity):

H_1: Children who eat the National School Lunch Program (NSLP) have a higher probability of becoming obese when compared to children that do not receive the National School Lunch Program.

Sub hypothesis: Black and Hispanic children who consume the National School Lunch Program have a higher probability of becoming obese when compared to White children that receive the NSLP.

Hypothesis 2 (School Breakfast Program and obesity):

H_2: Children who obtain the School Breakfast Program (SBP) have a higher probability of becoming obese when compared to children that do not receive the School Breakfast Program.

Sub hypothesis: Black and Hispanic children that obtain the School Breakfast program have a higher probability of becoming obese when compared to White children that receive the SBP.

Hypothesis 3 (vending machine availability):

H_3: Children who have access to vending machines at school which contain sweet and savory snacks and sugar sweetened beverages have a higher probability of becoming obese when compared to children that do not have access to vending machines at school.

Sub hypothesis: Black and Hispanic children who have access to vending machines at school have a higher probability of becoming obese when compared to White children that have access to vending machines at school.

Sub hypothesis: Poor children who have access to vending machines at school have a higher probability of becoming obese when compared to non-poor children that have access to vending machines at school.

5.2 Definitions:

Overweight/Obese-

Generally, obesity is defined, "as abnormal or excessive fat accumulation that may impair health, and studies suggest that, without intervention, reversal of obesity is uncommon" (Colquitt, Picot, Loveman, and Clegg, 2009, p. 2). In order to standardize this research with other accepted notions of childhood overweight and obesity, the Body Mass Index [BMI= weight (kg)/ height^2 (m)], was calculated for all respondents.

Most health practitioners and researchers use the CDC BMI cutoffs developed in 2000 to categorize children as overweight or obese (CDC, 2000). These charts indicate that "at risk of overweight" is to be considered between the 85th percentile and 94.99%. "Overweight" is considered above 95%. In 2007, an Expert Committee made up of representatives from the American Medical Association, the Department of Health Resources and Service Administration and the CDC came together to provide recommendations and standards for more nuanced definitions of the spectrum of childhood obesity. Based on the recommendations of this committee**,** this study will classify children with a BMI between the 85th and the 95th percentiles as overweight and those with a BMI over the 95th percentile as obese. The Committee also recommended adopting a BMI percentile $\geq$ 99th % classification for severe obesity, which would warrant more extreme interventions. However, the literature and subsequent adaptation recommendation lack definitive research on this point (Barlow, S. and the Expert Committee, 2007).

There are acknowledged issues and drawbacks with using BMI, as it is not a direct predictor of disease initiation (Barlow and Expert Committee, 2007). Additionally, the CDC growth charts were published in 2000, yet, they use data from 1963-1995, "which makes them

statistically nonrepresentative of the US population in 2000" (Krebs, et al, 2007, S194). The Expert Committee declined to label children as obese in 1994, but by 2005 the Institute of Medicine had delineated the definitions used by the Expert Committee in 2007, which included a categorization of children as obese (Krebs, et al, 2007). On the other hand, BMI is correlated well with body fat and associated health risks. BMI is considered a decent indicator of elevated cardiovascular risk factors. Elevated childhood BMI is generally deemed a good predictor of sustained high body fatness through adulthood and increased morbidity and mortality. BMI is also a much easier test to administer by non-clinicians and can be completed with relatively little training on standardized equipment. BMI is easily used for research purposes across disciplines. According to the Expert Committee, the medical community can rely on BMI as an initial screening tool, and the "…the starting point for classification of health risks" (Barlow and Expert Committee, 2007, S169).

Poverty-

While the data set has a number of available SES indicator variables, the SES composite and school breakfast and lunch receipt will be utilized as proxies for low SES. This was necessary due to multicollinearity between variables. The creation of the SES composite will be described in further detail below.

5.3 Data Set*:*

The Early Childhood Longitudinal Study- Kindergarten (ECLS-K) cohort was created in order to build a cohesive and nationally representative data set of children who were followed from their entrance into kindergarten, during the school year 1998-1999, through eighth grade. The data collection was a joint venture of the U.S. Department of Education and the National Center for Education Statistics. The National Center for Education Statistics (NCES) is the

federal body responsible for collecting, analyzing and reporting data that concerns education in the United States. The NCES was charged by Congress to highlight and investigate high-priority education data needs, and accurately, consistently, and completely define indicators of education status and trends. The Institute for Education Sciences worked with NCES to create the data set. Finally, it was also mandated to report and disseminate relevant education research in the most useful manner. Because NCES is a federal entity the data is considered public property and is readily available (Princiotta, Denton Flanagan, and Hausken, 2006). Of paramount importance to the present study is the fact that height and weight of the children were collected at each data wave. Unlike other data sets, actual anthropometric measurements of children were taken rather than using parent self-report of children's height and weight. Self-report of height and weight has been shown to erroneously report height and weight leading to lower BMI estimations (Kuczumarski, Kuczmarski and Najjar, 2001, Palta, Prineas, Berman and Hannan, 1982, Stunkard, and Albaun, 1981). Data was collected on income, a number of other socioeconomic indicators, and school food environment variables.

The data collection included eight waves with the final wave made publicly available for analysis in 2009. These contained collection points during the fall and spring of 1998-1999, the Kindergarten year, the fall and spring of 1999-2000, First Grade, the spring of 3rd grade (2002), the spring of 5th grade (2004), and the spring of 8th grade (2007). Every effort was made to keep the public use data files confidential precluding individual analysis and tracking of cases.

The guiding impetus for the creation of the data set was to look at school readiness, child development and early school experiences. There was no control group in the original study design, and it was observational, possibly leading to questions of internal validity of measurements and design (Data and Sturm, 2004a). In addition to multiple data points at various

times throughout children's schooling through eighth grade, information was collected regarding child care arrangements, school performance, early education and learning, family, and community variables (Department of Education, 2009). It was impossible to control for some confounding variables because of the design of the original surveys and the temporality of the data set. Also, random error will be a factor in every study regardless of how rigorous the design is. Yet, the sheer number, representativeness and random nature of this data set still maintains it as an excellent data source for investigations (Carlson, et al, 2008, Von Hippel, 2007, Datar and Sturm, 2006).

5.4 Sampling Procedure:

The data, as described in the codebook and user guide, was taken of a sample of 22,782 children in the 1998-1999-kindergarten class. The data was representative of the 3.8 million students in kindergarten during 1998-1999 (Tourangeau, Nord, Le, Pollack, and Atkins-Burnett, 2009). The data was meant to be nationally representative of the kindergarten class of 1998-1999, not of the first grade class of 1999-2000, or of the third grade class, etc. The children were enrolled in 944 kindergarten programs in both public and private schools during the 1998-1999 school year. The researchers used a dual-frame, multistage design to create the original sample. One hundred primary sampling units (PSUs) were selected from a national sample of counties and county groups. Within the PSUs, public and private schools were picked and children were included from those schools. Public schools were chosen from the National Center for Education Statistics (NCES) 1995-96 Common Core of Data (CCD) Universe File. A private school sampling frame was created from the 1995-96 Private School Survey (PSS), collected by the NCES. For each school, approximately 23 kindergarten students were selected. Children

attended both full and half day kindergarten and were from a variety of demographic backgrounds (Tourangeau, et al, 2009).

With each data wave, all the students that were still enrolled at the same school were re-contacted. By eighth grade**,** a cohort of students had been excluded from data collection: those that emigrated, were deceased, or transferred to a school that was not included in the sub sampling from an earlier grade year. Eighth grade served as an appropriate cut off for sub sampling because most children did not remain in the same school between fifth and eighth grade. Children naturally moved from elementary to middle school, thus negating the need for sub sampling (Tourangeau, et al, 2009).

The response rates were fairly high in each wave of collection: for the 1998-1999 base year it was 74%. The child completion rate was 92%, and the parent response rate was 89%. The response rate for the eighth grade year was 68% for children and 66% for parents. Impacting response rates, some children may have been held back from advancement onto the next grade. Some children may have been newly included in the sample during sample waves collected after the base year, or left out of the subsequent data wave because they were no longer in the correct grade. The same theory holds for children who skipped an academic year. These children may not have been included in the original base year analysis, but were incorporated later on. Or, they were included in the original base year, but advanced beyond the kindergarten cohort and were therefore excluded from subsequent sampling. By the 8th grade data wave, total respondents across all measures dropped to 9,725 (Tourangeau, et al, 2009).

5.6 Demographics

The sample demographics, displayed in Table 1, included a greater percentage of children that were not poor, n= 7395, 83.9%, not overweight or obese, n=6142, 70.6% and White, n=6291, 72.1%. Blacks, n=929 made up 10.7% of the sample while Hispanics, n=1483

comprised 17%. There were slightly more boys, n-10950, 51.2%, than girls, n=10446, 48.8%. Over 62% of children had access to sweet and savory snacks, n=6252, and sugar sweetened beverages, n=5623, at school. Sixty two percent of children also reported not obtaining NSLP, n=2486, and SBP, n=1981. Of note was the composite variables SES, not poor n=7395, poor= 1414, and gender had many more data points than the rest of the variables, including the food environment variables.

Table 1:

Frequency – percentages

Variable Name		Frequency	Percent	Valid Percentage	Cumulative Percentage
SES	0 - not poor	7395	34.5	83.9	83.9
	1- poor	1414	6.6	16.1	100
	Total	8809	41.1	100	
	Missing	12600	58.9		
	Total	21409	100		
Gender	0- female	10446	48.8	48.8	48.8
	1 - male	10950	51.1	51.2	100
	Total	21396	99.9	100	
	Missing	13	0.1		
	Total	21409	100		
Hispanic	0 - not Hispanic	7240	33.8	83	83
	1 - Hispanic	1483	6.9	17	100
	Total	8723	40.7	100	
	Missing	12686	59.3		
	Total	21409	100		
Black	0 - not Black	7794	36.4	89.3	89.3
	1- Black	929	4.3	10.7	100
	Total	8723	40.7	100	
	Missing	12686	59.3		
	Total	21409	100		
White	0 - not White	2432	11.4	27.9	27.9
	1- White	6291	29.4	72.1	100
	Total	8723	40.7	100	
	Missing	12686	59.3		
	Total	21409	100		

Table 1 continued

Variable Name		Frequency	Percent	Valid Percentage	Cumulative Percentage
Sweet Snacks	0 - unavailable	2816	13.2	31.1	31.1
	1 - available	6252	29.2	68.9	100
	Total	9068	42.4	100	
	Missing	12341	57.6		
	Total	21409	100		
Salty Snacks	0 - unavailable	2440	11.4	27.1	27.1
	1 - available	6560	30.6	72.9	100
	Total	9000	42	100	
	Missing	12409	58		
	Total	21409	100		
Sugar Sweetened Beverages	0 – unavailable	3374	15.8	37.5	37.5
	1- available	5623	26.3	62.5	100
	Total	8997	42	100	
	Missing	12412	58		
	Total	21409	100		
NSLP	0 - no receipt	4064	19	62	62
	1- receipt	2486	11.6	38	100
	Total	6550	30.6	100	
	Missing	14859	69.4		
	Total	21409	100		
SBP	0- no receipt	3947	18.4	66.6	66.6
	1- receipt	1981	9.3	33.4	100
	Total	5928	27.7	100	
	Missing	15481	72.3		
	Total	21409	100		
BMI	0 - not obese	6142	28.7	70.6	70.6
	1 – overweight/obese	2559	12	29.4	100
	Total	8701	40.6	100	
	Missing	12708	59.4		
	Total	21409	100		

Of note, samples with larger N cause a reduction in the standard errors for both skewness and kurtosis, leading to possibly rejecting the null hypothesis (Tabachnick and Fidell, 2007).

5.5 Data Collection Procedures:

Trained evaluators took assessments of teachers, school administrators, parents and children. Children were assessed in person at their schools. Parents were contacted via telephone. The ECLS-K used a number of validated, published and reliable assessments and surveys. The minimum number of assessments completed within a wave was seven, and the maximum collected was eleven (Tourangeau, et al, 2009).

Evaluators were trained to visit the children in their schools and conduct assessments. A direct child assessment was collected in kindergarten, first grade, third, fifth and eighth, but covered different topics depending upon the year. What makes this data relevant for the present analysis is that at each wave**,** height and weight measurements of the children were collected. School food environment variables were also included, such as SBP and NSLP, vending machine and snack availability (Tourangeau, et al, 2009).

Parent interviews were conducted in a 40-50 minute phone interview, again by trained interviewers. If the family did not have a telephone, the interview was done in person. Computer technology was used to assist the recording of answers. Teachers and school administrators completed surveys by hand (Tourangeau, et al, 2009).

In completing data collection, the researchers strove to include all sampled children and families. To this end, materials were adapted for children with special needs and families whose first language was not English. The parent interview was translated into Spanish. Further, if the parents spoke a language other than English or Spanish, a translator was provided. The only children that weren't directly included were those speaking sign language, using Braille, or

whose Individualized Education Plan indicated that they should not be assessed. As the concentration of the present study is on poverty and childhood overweight and obesity, it is not relevant to discuss the specific measures used to assess educational experience and items such as math and science competency (Tourangeau, et al, 2009).

5.6 Analysis Methodology*:*

The descriptive and multivariate analysis presented below is a secondary data analysis of the ECLS-K 98/99 cohort. The analysis was completed on the eighth grade wave of publicly available, anonymized data.

The statistical software package used was IBM SPSS Statistics 21.0 (IBM SPSS Statistics 21.0, Chicago, Illinois). SPSS is a commonly used statistical software package that allows an investigator to input raw data and produce analytic results (SPSS, Inc., 2009).

Variables-

Variables included in the analysis will be described below. First, each child was identified by their identification variable (CHILDID). This variable was a numerical ID that included a school ID, a 3 digit student number and the letter "c" (Tourangeau, et al, 2009).

BMI:

In all eight waves of data collection, the Institute for Education Sciences (IES) put together composite variables to ease analysis. The first composite variable used was the child's BMI. Height and weight were measured at each round of data collection. Height was recorded in inches to the nearest quarter inch using the Shurr Board Vertical Stadiometer. Weight was logged in pounds to the nearest half pound using a Seca digital scale. The measurements themselves were documented using a height and weight recording form. Each measure was conducted twice for each child. Multiplying the composite weight in pounds by

703.0696261393 and dividing by the square of the child's composite height in inches yielded the BMI composite variable (Tourangeau, et al, 2009).

The BMI composite variable was recoded for the logistic regression analysis. Because BMI is a range, and differs across ages and genders, cut offs were made to attempt to be as inclusive as possible for the children in the cohort. It was estimated that most children would be 13 in eighth grade, and the healthy weight range for boys at 13 years of age begins at a BMI of 14.5. Girls, at the same age, begin their healthy BMI range at 15.3. Therefore, all children with BMIs below 14.5 were excluded to mitigate against the possible effects of underweight children on the analysis. An additional 507 cases with no BMI were deleted, bringing the n for children with BMI data to 7733. For the analysis, BMIs were further recoded into not obese (0), which included all BMIs between 14.5-24.19, and overweight/obese (1), which included all BMIs above 24.2. This categorization included both genders.

Socioeconomic Status:

The second composite variable used in the analysis was socioeconomic status. This data point was created to reflect the family's status at the time of data collection, for the eighth grade data, it would be the fall of 2006. This variable included household level data on the male and female guardian/parent occupation, education and the household income. Occupation was scored according to the 1989 General Social Survey Prestige Score, and was taken as an average. Income included a "broad range" variable and a "detailed range" variable. The "broad range" variable defined income as earning $25,000 or less per annum or $25,000 or more per annum. The "detailed range" encompassed a large range with approximately 13 levels. Those falling below the federal poverty level were asked to estimate their income to the nearest $1,000 (Tourangeau, et al, 2009).

While this variable was a composite, respondents did skip some of the answers to questions used to create the SES variable. Detailed income range was often skipped, but not questions on education and occupation. IES used a 2-stage procedure to impute occupation and education, as described for other variables, using previous rounds of data entry. Education was taken from the earlier round. When imputing a value for occupation, researchers ensured that the same parent/caregiver was being interviewed as the earlier round, and participation in the labor force was assessed. Income was imputed using "hot deck" imputation and not taken from preceding rounds of data collection. "Hot deck" imputation finds donors within the data set that are similar to the respondent and randomly selects that donor's value for the cell (Tourangeau, et al, 2009).

Using prior rounds of data entry to sort the variables, donors closest to previous rounds were used. If more than one variable was missing, hot deck was done in sequential order on separate variables, by type of household. Imputed values were never used as donors and no donor was used multiple times. The following order was used to impute the variables: education, occupation and finally, income category. To impute occupation, IES used a 2-step procedure: initial imputation of labor force status of the parent, and only those parent's that were ascertained to be employed had their occupation imputed. Similarly, the detailed income range also followed a 2-step process. The cases with broad income range present were completed first. For families with both parents included in the analysis, the hot deck procedure used the following order: "mother's education, father's education, mother's labor force status, mother's occupation, father's labor force status, father's occupation, detailed income range, where the broad income range was known; and detailed income range, where the broad income range was unknown" (Tourangeau, 2009, pgs. 7-27). Once these steps were completed, everything besides the exact

income value was computed for the SES composite variable. The investigators used the log of the mid-point of the income range for the remaining respondents in the composite calculation.

After all the component pieces of the SES composite variable were imputed, they were each normalized into z scores with a mean of 0 and a standard deviation of 1: "The expression of z-score $z_{hi} = \frac{x_{hi} - \bar{x}_w}{se(\bar{x}_w)}$, x_{hi}= "the value of the h-th SES component for the i-th household; $\bar{x}_w$ = the weighted mean of x_{hi} ; and se($\bar{x}_w$) is the standard error of $\bar{x}_w$" (Tourangeau, 2009, p. 7-29). For income, the logarithm was used: x_i= income for the i-th household, "the logarithm of income is less skewed than the direct income values" (Tourangeau, 2009, p. 7-29). The SES computation for the i-th household is:

$$SES_i = \frac{\sum_{h=l}^{m_i} z_{hi}}{m_i}$$

m_i = number of nonmissing SES component variables for the household. A continuous SES composite variable was created ranging from -2.48 to 2.54. The composite itself is the average of up to five measures. From these, a categorical SES variable (W8SESQ5) was created that was broken down into quintiles. Quintile 1 represented the lowest SES category while quintile 5 was the highest. For households that were missing a parent/caregiver, which would lead to missing components, the SES was computed using the average of whatever components were available. For the present analysis, dichotomous variables were necessary – so quintiles 2 through 5 were collapsed as one category to signify higher SES, or the "not poor" category, while quintile 1 remained to indicate low SES, or "in poverty".

Gender:

A gender composite variable was created for the 8th grade wave and was taken directly from the fifth-grade wave, if it was present. If the fifth grade composite was missing, the third-grade was used instead. These composites were created from a combination of the parent

interview, the child report and the Field Management System (FMS). The FMS helped monitor data collection and triangulated the data (Tourangeau et al, 2009). If the data on this variable was not consistent through the 3rd grade wave, the most often reported gender was used. If it was unclear, data from the previous parent interview was used, followed by the 3rd grade composite and the parent data (Tourangeau et al, 2009). If that was not available, then the gender indicated in the child report was used. Gender was originally coded as (1) = male and (2) = female, but was recoded to 1=male and 0= female for analysis.

School Lunch and School Breakfast:

During the parent based surveys, parents were asked if their child received free or reduced price lunch: "Does {Child} receive free or reduced price lunches at school?" Similarly, for school breakfast parents were asked "Does {CHILD} usually receive a breakfast provided by the school?" Possible answers were yes (1), no (2), not applicable/refused/don't know/not ascertained as described below. Answers were recoded for analysis to yes (1), no (0) (Tourangeau, et al, 2009).

School Food Environment Variables:

Children were asked, during interviews in the 8th grade wave of data collection a number of relevant questions regarding food that was made available to them on school campuses. Three such variables were included in the analysis. The first question asked was "In your school, can kids buy candy, ice cream, cookies, cakes, brownies or other sweets?" The first question will be referred to as "sweet snacks" availability at school. The second question, denoted as "salty snacks," was "In your school, can kids buy potato chips, corn chips (for example, Fritos, Doritos), Cheetos, pretzels, popcorn, crackers or other salty snack foods at school?" The third question regarding the school environment will be discussed as "sugar sweetened beverages" and

was “In your school, can kids buy soda pop (for example Coke, Pepsi, Mountain Dew), sports drinks (for example Gatorade), or fruit drinks that are not 100% fruit juice (for example Kool-Aid, Hi-C, Fruitopia, Fruitworks) in the school?” Respondents to all three questions were able to indicate yes (1), no (2), refused/don’t know/not ascertained as described below. Variables were recoded to a dichotomous yes (1), no (0) for analysis (Tourangeau, et al, 2009).

Race:

To accommodate analysis, a composite race variable (W8RACE) including each race/ethnicity category present in the data set, American Indian, Asian, Pacific Islander, Black, White, Hispanic, and multiracial, was used. However, if this data was collected in previous rounds via the parent interview, the question was not asked in this round of data collection. Parents were permitted to answer in more than one category to indicate the race of their child (Tourangeau, et al, 2009). Using these answers, three dummy race variables were created indicating a child’s inclusion as either Black, White or Hispanic. Inclusion in the category was represented by coding=1. There were 73 cases with no race information and these respondents were deleted from the analysis.

Variable coding – missing:

Variable coding for missing data, in the original data set: -1: not applicable, including skips; -7: refused (nonresponse); -8: don’t know (nonresponse); -9 Not ascertained (non response); blank: system missing (including unit non response). According to the code book, -1 indicated non response (skipping a question because of a previous answer) or other legitimate reasons that led the respondent to not answer a specific question. Additionally, the respondent may have skipped the question for an unknown reason, which would also be included in this category of non response. The code -7 indicated that the respondent told the interviewer that

they wouldn't answer the question, or refused to participate in that question. Persons who replied that they did not know the specific answer to a question were coded as -8. The code -9 was used if a question was left blank that should have been answered. In the 8th grade wave, "system missing" meant that an entire assessment was not included in data input. For variables incorporated in the analysis, these were all recoded as "system missing" to enable SPSS to compute the statistic accurately. The same coding was used for the composite variables (Tourangeau, et al, 2009).

Missing Variable Analysis

Missing variable analysis was conducted on the data before deletion of the missing data points. The output and analysis is included in Appendix 2. The main concern was that the NSLP variable and the SBP variable both had fairly high percentages of missing data, 69.4% and 72.3% respectively. Respondents may have skipped these questions because of the stigma associated with federally subsidized school meal receipt (Stein, 2008). Despite these large numbers of missing data, the missing variable analysis permitted inclusion of the variables because there were ample cases left in the data set for statistical purposes.

Because logistic regression was used, the assumption of linearity is not integral to a proper analysis. Testing for homogeneity of variance can be found in Appendix 1. Levene's test showed that most of the variances were not homogenous, and the null hypotheses were rejected. Those relationships that were not homogenous were NSLP, SBP, SES, salty snacks, White, Hispanic, American Indian, Asian and Black. Gender had a significance level of .051 so was right on the cusp of rejecting the null, as well. Despite the heterogeneity of the variances, Mertler and Vannatta (2005), have found that even if the assumption was violated, inclusion of the variables in the analysis was permissible as it did not harm the model. Therefore, the

variables NSLP, SBP, SES, salty snacks, White, Hispanic and Black were included in the analysis.

Chapter 6: Results

6.1 Descriptive Statistics:

Discussion of the descriptive statics will be limited in the text, and additional analyses and narrative can be found in the various Appendices, Appendix 1- Homogeniety of Variance, Appendix 2 – Missing Variable Analysis, and Appendix 3 – Gender Cross Tabs.

Table 2, found below, indicates that after data cleaning, the final n=4404. Standard deviations were small, emphasizing that the spread of values was not large. For the most part, the skewness of the individual variables was small. However, there were a few variables that had higher positive skews: SES, Hispanic, Black, and Pacific Islander and multi-racial. This skew indicated that the mean was not in the center and that many of the cases thinned out towards the right, longer tail of the distribution. "Salty snacks" had a minor negative skew. Therefore, the mean of this variable was not at the center of the distribution and the left tail of the distribution was long. The standard errors of skewness remained small in all the variables. But, the high values of the skew for Pacific Islander (8.341) and multi-racial (13.661) and their small total n permitted dropping them from the analysis. The kurtosis of certain variables was also large: American Indian (28.248), Asian (14.521), Pacific Islander (67.603), and Multiracial (184.680). As a result of their kurtosis and overall small total n, these were also dropped from the analysis. Of the remaining variables, only Black ethnicity had a slightly positive, but not concerning, kurtosis of 3.119.

Table 2
Descriptive Statistics

	SES	Gender	Hispanic	African American	White	Sweet Snacks	Salty Snacks	Sugar Sweetened Beverages	NSLP	SBP	BMI
N Valid	5875	5875	5875	5875	5875	5723	5671	5671	5875	4404	5875
N Missing	0	0	0	0	0	152	204	204	0	1471	0
Std. Deviation	0.386	0.499	0.385	0.331	0.457	0.461	0.447	0.483	0.482	0.485	0.464
Skewness	1.648	-0.095	1.66	2.262	-0.884	-0.835	-1.004	0.554	0.554	0.503	0.799
Std. Error of Skewness	0.032	0.032	0.032	0.032	0.032	0.032	0.033	0.032	0.032	0.037	0.032
Kurtosis	0.715	-1.992	0.759	3.119	184.68	-1.303	-0.993	-1.694	-1.694	-1.748	-1.362
Std. Error of Kurtosis	0.064	0.064	0.064	0.064	0.064	0.065	0.065	0.065	0.064	0.074	0.064

6.3 Correlations:

In order to further understand the relationship between the variables, correlations were performed and presented in the table below. These measures helped to assess multicollinearity in the model, and guided the insertion and deletion of appropriate variables. The analysis can be found below the table 3.

Table 3
Correlation Matrix

	Hispanic	Black	White	Sweet Snacks	Salty Snacks	Sugar Sweetened Beverages	School lunch	School Breakfast	BMI	SES	Gender
Hispanic											
Pearson R	1	-.142**	-.279**	0.002	-0.004	-0.025	.289**	.161**	.079**	.304**	0.002
Sig (2-tailed)		0	0	0.851	0.766	0.062	0	0	0	0	0.876
N	5875	5875	5875	5723	5671	5671	5875	4404	5875	5875	5875
Black											
Pearson R	-.142**	1	-.537**	.044**	.035**	0.012	.266**	.208**	.070**	.129**	-0.025
Sig (2-tailed)	0		0	0.001	0.008	0.368	0	0	0	0	0.058
N	5875	5875	5875	5723	5671	5671	5875	4404	5875	5875	5875
White											
Pearson R	-0.279	-.537**	1	0.015	.026*	.035**	-.386**	-.305**	-.088**	-.279**	.029*
Sig (2-tailed)	0	0		0.265	0.048	0.008	0	0	0	0	0.028
N	5875	5875	5875	5723	5671	5671	5875	4404	5875	5875	5875
Sweet Snacks											
Pearson R	0.002	.044**	0.015	1	.538**	.245**	-.029*	-.032*	-0.01	-0.03	-.043**
Sig (2-tailed)	0.851	0.001	0.265		0	0	0.03	0.039	0.576	0.064	0.001
N	5723	5723	5723	5723	5668	5668	5723	4269	5723	5723	5723
Salty Snacks											
Pearson R	-0.004	.035**	.026*	.538**	1	.247**	-.037**	-.053**	-0.02	-0.01	-.035**
Sig (2-tailed)	0.766	0.008	0.048	0		0	0.005	0.001	0.08	0.565	0.009
N	5671	5671	5671	5668	5671	5642	5671	4230	5671	5671	5671
Sugar Sweetened Beverages											
Pearson R	-0.025	0.012	.035**	.245**	.247**	1	-0.012	0.001	-0	-0.01	-.043**
Sig (2-tailed)	0.062	0.368	0.008	0	0		0.354	0.928	0.832	0.552	0.001
N	5671	5671	5671	5668	5642	5671	5671	4223	5671	5671	5671
School Lunch											
Pearson R	.289**	.266**	-.386**	-.029*	-.037**	-0.012	1	.456**	.135**	.513**	-.027*
Sig (2-tailed)	0	0	0	0.03	0.005	0.354		0	0	0	0.039
N	5875	5875	5875	5723	5671	5671	5875	4404	5875	5875	5875
School Breakfast											
Pearson R	.161**	.208**	-.305**	-.032*	-.053**	0.001	.456**	1	.092**	.311**	.037*
Sig (2-tailed)	0	0	0	0.039	0.001	0.928	0		0	0	0.015
N	4404	4404	4404	4269	4230	4223	4404	4404	4404	4404	4404
BMI											
Pearson R	.079**	.070**	-.088**	-0.007	-0.023	-0.003	.135**	.092**	1	.106**	-0.015
Sig (2-tailed)	0	0	0	0.576	0.08	0.832	0	0		0	0.24
N	5875	5875	5875	5723	5671	5671	5875	4404	5875	5875	5875
SES											
Pearson R	.304**	.129**	-.279**	-0.025	-0.008	-0.008	.513**	.311**	.106**	1	-0.023
Sig (2-tailed)	0	0	0	0.064	0.565	0.552	0	0	0		0.074
N	5875	5875	5875	5723	5671	5671	5875	4404	5875	5875	5875
Gender											
Pearson R	0.002	-0.03	.029*	-.043**	-.035**	-.043**	-.027*	.037*	-0.02	-0.02	1
Sig (2-tailed)	0.876	0.058	0.028	0.001	0.009	0.001	0.039	0.015	0.24	0.074	
N	5875	5875	5875	5723	5671	5671	5875	4404	5875	5875	5875

** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed); Cannot be computed because at least one of the variables is constant

6.4 Correlation Analysis:

Pearson's R, the most commonly used correlation coefficient, was utilized in this analysis. It is generally recognized that an r of .2 is the minimum for establishing a notable relationship between variables (Ferguson, 2009). Many of the variables had significant relationships with one another, however their correlations remained low.

The Hispanic variable was positively correlated with NSLP, SBP, BMI and SES. Of the positive correlations, NSLP and SES were both over .2. NSLP and Hispanic had a correlation of .289. Hispanic and SES had .304. While exhibiting a relationship, these were both very small.

The Black variable was also positively correlated with NSLP, SBP, BMI and SES. The correlations with SBP and NSLP were over .2. Again, both of these relationships were barely over .2, indicating that the relationships were weak. For both Black and Hispanic, these positive correlations were expected, as evidenced by the literature review.

White was negatively correlated with NSLP, SBP, BMI and SES. Of these correlations, NSLP, SBP and SES were over .2. Again, none of these correlations were particularly large.

Of the school food environment variables, the only relationship of note for the variable Sweet snacks was a positive correlation of .538 with salty snacks and a smaller positive correlation with sugar sweetened beverages. Salty snacks also had a small positive correlation with sugar sweetened beverages. If we assume that schools with an unhealthy food environment will be more than likely to have these items available, the correlation makes sense.

NSLP was negatively correlated with White, and positively correlated with Hispanic, Black, SBP, and SES. The strongest correlations were with SBP .456 and SES .513. The correlations with SBP and SES make sense, because receipt of NSLP was needs based.

SBP was negatively correlated with White, and positively correlated with SES. The correlation with White was .305 and SES was .311. While these are larger than some of the above relationships, they are still not very notable.

Interestingly both the BMI and gender variables' correlations were all under .2.

6.5 **Logistic Regression:**

Logistic regressions were computed to ascertain the relationships that led to higher levels of overweight/obesity. All models used the binary obese variable as the dependent variable (0= not obese, 1 = overweight/obese), with a number of independent variables described below. Because of the dichotomous nature of the variable, it was impossible to transform it to increased fit. However, transformation was not necessary because "… no transformation can ever transform a dichotomous variable, which takes on only two values, into any resemblance of a Normal distribution (Hox, 2010, p. 3)." For each model, a number of model fit tests were computed.

6.6 Logistic Regression Findings:

Three logistic regression models were run, with a Forward Selection (Likelihood Ratio) entry method. This entry method is a stepwise selection method that begins with no predictors in the model, enters one variable at a time by adding the predictors with the largest score statistic whose $p < .05$. At each insertion, SPSS checks to ensure that with each new variable added, the variables already in the model should remain or be removed. The decision to remove variables is based on the Likelihood Ratio test (SPSS, 2009). The advantage of using this entry method is that variable entry is left to mathematical prediction instead of researcher control (Burns and Burns, 2008). Forward entry using the Likelihood Ratio is one of the most commonly used variable entry methods (Mertler and Vannatta, 2005).

To check the validity of the model, the models were also run using Backward Selection (Likelihood Ratio). This entry method initially enters all the variables in the model and removes variables based on their Likelihood Ratio score.

Due to the multicollinearity of SES, lunch and breakfast receipt variables, it was necessary to run separate models for analysis. The first regression, in Table 4, tested hypothesis 3, that children with access to vending machines with unhealthy food were more likely to be obese. Variables tested were SES, gender, Back, Hispanic, White, sugary snacks, savory snacks and sugar sweetened beverages. Variables were entered into the model in 3 steps: first SES, then Black and finally Hispanic. White race was excluded as the comparison group. For each model, a number of model fit tests were computed. The log likelihood tests the effect of each variable in the model. Those variables with a large difference between the reduced and full model are incorporated. Two R square calculations, Cox & Snell and Nagelkerke were computed by SPSS to assess model fit. These R Square estimations were meant to be a replacement for R Squared in linear regression. Pseudo R Square should explain how much of the variation of the dependent variable was attributable to the model. However, Hagle (2004), claimed that while it is widely accepted and used during model fit tests for logistic regression, it is rendered inherently meaningless by nature of the use of dichotomous variables. For this model, the -2 Log Likelihood model fit tests were acceptable, while the R Square estimations were quite small. These tests seem to indicate that the model fit was questionable. The model correctly classified under 69% of the cases. The Wald statistics indicate that the variables Black, Hispanic and SES significantly predicted overweight/obesity status. However, the odds ratios for SES= 1.54, Black = 1.631 and Hispanic= 1.484 revealed little increase in the likelihood of increasing overweight/obesity status when the predictors increase by 1.

None of the school food environment variables: sweet snacks, salty snacks, or sugar sweetened beverages, had high enough likelihood ratio scores to be entered into the model, and were therefore excluded. The only variable that approached appropriate significance was sweet snacks, with a p of .064 at step 3. Finally, gender was also excluded from the model, meaning that it also was not an adequate predictor of the likelihood of being overweight/obese.

Table 4

Logistic Regression: SES and school food environment variables

	Wald	P	OR	95% C.I. for OR	
				Lower	Upper
Step 1					
SES	69.721	0.000	1.824	1.584	2.101
Constant	774.117	0.000	0.406		
Step 2					
Black	18.632	0.000	1.467	1.233	2.746
SES	59.146	0.000	1.750	1.518	2.019
Constant	775.847	0.000	0.392		
Step 3					
Black	28.769	0.000	1.631	1.364	1.949
Hispanic	25.312	0.000	1.484	1.273	1.731
SES	31.267	0.000	1.540	1.324	1.792
Constant		0.000	0.368		

	-2 Log Likelihood	Cox & Snell R Square	Nagelkerke R square
Step 1	6934.034	.012	.017
Step 2	6915.807	.015	.021
Step 3	6890.955	.020	.027

Interestingly, running the model using Backward Entry (Likelihood Ratio), shown in Table 5, yielded a final model with an additional variable: salty snacks. This variable was included despite its p value being .064. The backward entry model confirmed that the vending machine variables were not helpful in predicting obesity. SES, Black and Hispanic remained significant predictors for the model.

Table 5

Logistic Regression: SES and school food environment variables, backward entry

Step 4	Exp (B)	P	S.E.
Black	1.641	0.000	0.091
Hispanic	1.486	0.000	0.079
Salty snacks	0.887	0.064	0.064
SES	1.537	0.000	0.077
Constant	0.401	0.000	0.058

The second model, shown in Table 6, tested hypothesis 1, that children who obtained a school lunch were more likely to be overweight/obese and hypothesis 3, that children who had access to vending machines at school were more likely to be overweight/obese. In this model SES was removed and NSLP receipt was included and considered a proxy for SES. Variables tested were NSLP, sugary snacks, savory snacks, sugar sweetened beverages, Black, Hispanic, White and gender. White was excluded as a dummy variable. The first variable entered into the equation was NSLP, followed by Hispanic and finally, Black. Again, the vending machine variables did not contribute to the model. The Wald statistics indicate that the variables Black, Hispanic and NSLP significantly predicted overweight/obesity status. Again, the model fit log likelihood tests were adequate while the Pseudo R square were quite small. The model correctly classified under 69% of the cases. The odds ratios for NSLP= 1.597, Black = 1.434 and Hispanic= 1.407 revealed little increase in the likelihood of increasing overweight/obesity status when the predictors increase by 1. Finally, gender and the vending machine availability variables did not score high enough to get entered into the model, meaning that they were not adequate predictors of the probability of being overweight/obese.

Table 6

Logistic Regression: NLSP and school food environment, forward entry

	Wald	P	OR	95% C.I. for OR		p
				Lower	Upper	
Step 1						
NLSP	106.053	0.000	1.838	1.637	2.063	0.000
Constant	733.268	0.000	0.361			0.000
Step 2						
Hispanic	11.616	0.001	1.296	1.116	1.504	0.001
NLSP	79.433	0.000	1.732	1.535	1.955	0.000
Constant	736.952	0.000	0.352			0.000
Step 3						
Black	14.44	0.000	1.434	1.191	1.727	0.000
Hispanic	18.667	0.000	1.407	1.205	1.643	0.000
NLSP	51.29	0.000	1.597	1.405	1.815	0.000
Constant	744.426	0.000	0.342			0.000

	-2 Log Likelihood	Cox & Snell R Square	Nagelkerke R square
Step 1	6896.550	.019	.026
Step 2	6885.076	.021	.029
Step 3	6870.867	.023	.032

The backward entry of the variables, in Table 7, also confirmed that NSLP receipt, and Black and Hispanic race variables were adequate predictors of obesity. Gender and the vending machine variables were once again excluding, which means they were not adequate predictors of the likelihood of being overweight/obese.

Table 7

Logistic Regression: NSLP plus school food environment, backward entry

Step 4	Exp (B)	P	S.E.
Black	1.434	0.000	0.095
Hispanic	1.407	0.000	0.079
NSLP	1.597	0.000	0.065
Constant	0.342	0.000	0.039

The final model, shown in Table 8, tested hypothesis 2, that children who obtained a school breakfast were more likely to be overweight/obese, and hypothesis 3, that children with access to vending machines at school were more likely to be overweight/obese. SBP was inserted

in place of NSLP, and served as proxy for SES. Variables included in the analysis were SBP, sugary snacks, sweet snacks, sugar sweetened beverages, Black, Hispanic, White, and gender. White was excluded as a dummy variable. SBP was entered first, followed by Hispanic and finishing with Black. The Wald statistics indicate that the variables Black, Hispanic and SBP significantly predicted overweight/obesity status. The model fit indicated that the Likelihood Ratio tests were acceptable, while the Pseudo R square were small. The model correctly classified under 67% of cases. The odds ratios for SBP= 1.378, Black = 1.404 and Hispanic= 1.419 revealed little increase in the probability of increasing overweight/obesity status when the predictors increase by 1. Again, neither gender nor any of the vending machine variables were entered into the model indicating that they were not significant predictors of the likelihood of being overweight/obese.

Table 8
Logistic Regression: SBP and school food environment, forward entry

	Wald	P	OR	95% C.I for OR	
				Lower	Upper
Step 1					
SBP	38.377	0.000	1.514	1.328	1.726
Constant	385.478	0.000	0.436		
Step 2					
Hispanic	12.013	0.001	1.321	1.129	1.547
SBP	31.117	0.000	1.46	1.278	1.667
Constant	388.125	0.000	0.417		
Step 3					
Black	11.814	0.001	1.404	1.157	1.703
Hispanic	17.71	0.000	1.419	1.205	1.669
SBP	21.053	0.000	1.378	1.202	1.581
Constant	393.148	0.000	0.4		

	-2 Log Likelihood	Cox & Snell R Square	Nagelkerke R square
Step 1	5333.317	.009	.013
Step 2	5321.445	.012	.016
Step 3	5309.804	.015	.020

Confirming the forward entry model, backward entry, shown in Table 9, also only retained Black, Hispanic and SBP as variables in the final model. This upholds the findings of the earlier models that gender, and the vending machine variables were not good predictors of the likelihood of being overweight/obese.

Table 9

Logistic Regression: SBP plus school food environment, backward entry

Step 5	Exp (B)	P	S.E.
Black	1.404	0.001	0.099
Hispanic	1.419	0.000	0.083
SBP	1.378	0.000	0.070
Constant	0.400	0.000	0.046

6.7 Summary of Findings

Of the variables regressed, SBP, NSLP, SES (as a separate variable as well as a proxy in SBP and NSLP) and Black and Hispanic ethnicity were adequate predictors of the likelihood of being overweight/obese for the Kindergarten class of 1998-1999, 8th grade data wave. None of the other school food environment variables, together considered as "vending machine availability," were adequate predictors of the probability of being overweight/obese. Race was a consistent predictor of the likelihood of being overweight/obese. In 2 out of the 3 models, Black was a better predictor than Hispanic, although, overall, the odds ratios were close in size. Both NSLP and SES were adequate predictors of overweight/obesity. SBP had the smallest odds ratio of all the predictors, meaning it had the least impact of the variables in predicting obesity status.

Of the hypotheses tested, a limited number were held by the results. Hypothesis 1, which assumed children who obtained NSLP and Hypothesis 2, which assumed that children who received SBP had a higher probability of being overweight/obese, were supported by the analysis. In addition, the assumptions that Black, Hispanic, and poor children were more likely to be overweight/obese, were upheld. These findings also reinforced the previous research that

Black and Hispanic (Balisteri and Van Hook, 2011, Crothers, et al, 2009, Levi, et al, 2012), and low-income children were more likely to be overweight or obese (Center for Disease Control and Prevention, 2009, Crothers, et al, 2009, Gable, Britt-Rankin, Krull, and Guthrie, 2008). The current study also supported the findings that children who received NSLP are more likely to be obese than those that don't (Gable, et al, 2008, Milliment, et al, 2008 and Shanzebach, 2009). Contrary to Gable, et al (2008)'s findings, but confirming Millimet, et al (2008)'s, the data in the 8th grade showed that children who obtained SBP were more likely to be overweight/obese. The models supported Hernandez, et al (2011)'s finding that there was no gender difference on childhood obesity levels and NSLP receipt. On the other hand, none of the other school food environment hypotheses were upheld. This finding strengthens previous research that did not find that competitive food availability increased obesity rates (Cunningham and Zavodny, 2011, Datar and Nicosia, 2009b, Jones, et al, 2009, and Van Hook and Altman, 2012).

Overall, however, the models do not appear to strongly predict obesity. Many of the relationships of interest had much smaller correlations than the literature suggested. These low correlations indicated a minimal level of association, and may mean that the relationships have a lot of variation, necessitating more research. For example, had the correlations between most of the variables of interest reached the level of .5, or .8, the relationships would have had much more meaning. As they stand, there is still a lot of unexplained variance. In a sample of this size, it is also surprising that the correlations weren't larger.

Additional models were created using the Block variable entry method, where all variables are entered into the model simultaneously. The models, odds ratios, and model fit test did not differ from the forward entry, likelihood ratio entry method.

An added concern about these models were the model fit tests and the classification of cases' results. The model fit tests were very small, perhaps indicating that the models were not well placed to examine the data. In addition, the classification tables showed that many of the cases were not correctly predicted by the model. Both of these results seem to show that there is something else happening which may explain the variation in the relationship between these variables and obesity status.

From a prevention and policy perspective, the findings of these regressions showed that solutions targeted at reducing vending machine availability or making the products available in these vending machines healthier, may be fruitless. If vending machine access is the focus of policy rather than the free and reduced price meal options, then the desired result, reduction in childhood obesity among children, may not come to fruition. The findings also indicate that the models were not strong, and much more research needs to be conducted to understand the full impact of different environments on childhood obesity.

To return to the main issue, what do these regressions really tell us about the overall childhood obesity epidemic? The conclusions do support some of the previous research (Balisteri and Van Hook, 2011, Center for Disease Control and Prevention, 2009, Crothers, et al, 2009, Cunningham and Zavodny, 2011, Datar and Nicosia, 2009b, Gable, et al, 2008, Hernandez, et al 2011, Jones, et al, 2009, Levi, et al, 2012, Milliment, et al, 2008 and Shanzebach, 2009, and Van Hook and Altman, 2012). Nonetheless, the model fit tests were in the acceptable range, but not optimal. This may indicate that the regressions were unstable, or, could suggest mediating and moderating relationships that exist between and among variables that were not handled by the models. These relationships may be due to the countervailing influences embedded in the overall social determinants of health structure. Even from a mezzo

level – "the school food environment" – that data support the new nutrition guidance of the school wellness policies. However, the school food environment is far larger than just the federally subsidized meal programs. If, for example, vending machines were taken out of schools completely, what impact will that have on the overall epidemic? As this is the point of concentration of a good number of the school wellness policies, understanding the policy's potential impact or lack of impact is important. Or, if both SBP and NSLP were made entirely of healthy offerings, vending machines, Channel One, and all associated marketing materials were removed from the school, how would these changes influence children? What about the environment outside of school? And, if, according to the SDH perspective, the way to truly make a population level impact is to decrease inequality through redistributive policies, do any of these small steps matter? The results of this study appear to point to a need to expand the obesity research paradigm to multiple environments of impact which appear to show more promise than the current efforts.

Limitations:

This study was a cross-sectional, secondary data analysis. In addition, at this point, the data is old – from the 2005-2006 school year. Since this data was collected, a significant number of policy changes have been implemented which might impact BMI in children, and in schools. Multilevel modeling may dissect out more of the interrelationships between and among variables.

Chapter 7: Policy Implications and Conclusions

Surprisingly, the theory and literature lead us to expect more robust results from the regression analysis than were obtained. The results do not tell us a lot about the impact of the school food environment on childhood obesity. This analysis can be considered a typical example of how researchers explore childhood obesity mezzo environments. The study was cross sectional, yet, it expanded previous analysis to the 8th grade data wave, adding to longitudinal results on the school food environment's impact on obesity levels. The models indicated that vending machine availability did not impact BMI despite a presupposition that this was a major contributor to childhood obesity. Even for the variables that did predict obesity status, their odds ratios were small, and the model fit and classification results were disappointing. The analysis does not tell us a lot about how obesity has manifested, or even what relationships are significant. The results also don't help pave a clear path to create effective obesity solutions. It is clear that much more research needs to be done. Until models begin to truly incorporate the SDH drivers discussed in the theory chapter, and solutions acknowledge them, children will continue to be obese. And they will age into morbidly obese adults, with a greater likelihood of disease and disability.

Mentioned earlier were a number of guidelines and suggestions created by national organizations, governing bodies and in limited quantities, by government. Governmental action and inaction has been discouraging. Every change that elected leaders attempted to make "have been heavily contested by the food industry, so implementation is politically difficult" (Gortmaker, et al, 2011, p. 843). The United States has come to a point in its history when it is necessary to take a different path. This course should advance the WHO's agenda, incorporate a "health in all policies" approach, and place health as a basic human right (Farmer, 2999). It will

engage more than just public health advocates, and be nontraditional (Koh, 2011). Included in this solution is moving the term "social determinants of health" from the "ivory tower" into the mainstream (Koh, 2011). Critically, addressing mothers and protecting young children (Blane, 2006 and Woo Baidal and Taveras, 2012) will have the most lasting impact, as early childhood is viewed by many as a key intervention point (Wadsworth and Butterworth, 2006). Early exposures impact a person throughout their life-course, and "… become written into the physiology and pathology of their body. The social is, literally, embodied; and the body records the past …" (Blane, 2006, p. 54). Each stage in the life-course can add equally and impact health status through protection or disadvantage (Blane, 2006). After all, a healthy and productive society is everyone's aim: employees, politicians, social scientists, physicians, public health experts, and, most of all, parents and children.

7.1 **Micro Level**

Micro and mezzo level solutions might have some short-term impacts. Bespoke interventions can still be effective at a personal level. These customized tactics should attempt to introduce nutrition education, physical activity and behavior change methodologies. Programs should also include public education to teach parents about the impact that marketing has on their children's health status (Linn, 2004), with governmental funding (Committees on the Social Determinants of Health Communications, 2006).These interventions can take place in the primary care arena, school, after school, community center, etc. and might necessitate a partnership between different groups. While these techniques may lead to reductions in BMI, for the most part, the evidence on their sustainability is lacking (Committees on the Social Determinants of Health Communications, 2006). In the long term, these interventions are weak.

Individual or even local level techniques may stagnate, "… if regional and global levels of policy-making restrict the choices that can be made and policy space that can be taken at local level" (Sihto, et al, 2006, p. 9-10). To achieve long-term benefits, individualized interventions need to be integrated into a multi sector approach (Sieders and Petty, 2004). This unified approach should also attack the larger drivers of the epidemic to make a true, lasting impact (Epping-Jordan, Galea, Tukuianga and Beaglehale, 2005 and Friel, et al, 2007). Integral to success, economic development must be paired with a social justice approach (Engelhard, et al, 2009).

Some researchers believe that trying to create solutions at the physician-patient level is fruitless (Seiders and Petty, 2004). Concentrating at this lower level will take a long time to implement, roll out and make effective. In fact, population based approaches will be the most successful (Seiders and Petty, 2004). Therefore, the bulk of the recommendations that follow will be at the mezzo and macro level.

7.2 Mezzo Level

These mid-level solutions will, again, only hit a limited environment. Using the current study as an example, policies that decrease access to competitive foods within the school environment may be ineffective. Even changing the formulations and offerings for SBP and NLSP may not adequately help reduce low-income Black and Hispanic children's obesity levels. Indeed, enacting an effective school wellness policy will surely impact children during the school day. However, "nonschool environments, such as homes, contribute to children's overweight problems as much as do school environments" (Crothers, et al, 2009, p. 790). A number of solutions have been offered to correct market based misinformation regarding food content, and consumption. Importantly, public and private endeavors will be necessary – public

health can learn from industry, and industry can also learn from public health. These partnerships will take compromise from both sides. Once this relationship is established, it should be transparent, formalized, equally accountable, and include strong overarching governance structures with well-defined leadership (Huang and Yaroch, 2009).

Advocates call for changing food labeling to make it easier for people to understand the foods they are purchasing (Engelhard, et al, 2009, and Seiders and Petty, 2004). One solution is to pass the cost burden of this new labeling schema onto the food companies. Borrowing a risk assessment framework from environmental policy, "junk" food can be identified as "an unhealthy choice" and regulated as such. All other foods can be categorized and labeled as "healthier," "less healthy," and "intermediate." These categories can be used to impact pricing, as in the UK, Australia and New Zealand (Engelhard, et al, 2009).

The Yale Rudd Center recommends that children should be steered away from eating the worst fast food items. Restaurants can do this by embracing and enforcing meaningful standards. These criteria would be merged into all marketing, especially advertising aimed at very young children (Engelhard, et al, 2009 and Harris, et al, 2010). Companies could sign binding agreements to limit promotion (Schafer Elinder, 2005) and exposure to marketing (Linn, 2004) of non-nutritious food to children.

Fast food companies currently spend billions of dollars on advertising to create life-long loyal customers, and increase visits to their establishments. They certainly have the capacity to create healthier products. Food companies could use the same marketing mechanisms to ensure that they create long-term customers for healthy food. In theory, this may also increase profits, as brand-loyal customers would live longer, and spend money for lengthier time periods (Harris, et al, 2010). The most popular and least nutritious items should be reformulated to reduce fats,

sugar, sodium and calories. Children's meal items ought to be age appropriate. Healthy sides and beverages should be created, available, and the default options. Portion sizes should be adjusted and consistent across restaurants, and food at these restaurants would be labeled (Harris, et al, 2010).

Americans spend half their food budget eating out of the home. This means that restaurant based solutions should yield some consumption results. Historically, the US has been reluctant to uniformly regulate restaurant labeling. Given the public health impact, the FDA could adapt such a role. In addition, any legislative action taken by the US has the possibility of being adapted and enacted in other developed nations (Hayne, et al, 2004). These changes would take an industry-wide commitment. Even if government attempted to pass a law with some of these goals, it would not move forward without the food industry and their lobby agreeing with the concept. Industry cannot fight the laws, and government cannot pass laws that contain statutory loop holes.

Other low cost policy alternatives include creating true "food sin taxes," which could be sales/excise taxes on fattening foods (Engelhard, et al, 2009). The taxes, if levied high enough, should decrease consumption. Coordinated with labeling, these taxes would act as another push to decrease purchasing of non-nutritious products. Low-income households are the highest purchasers of these items and there is some danger that the poor would bear the burden of these taxes (Engelhard, et al, 2009). To defray this impact, the taxes should be aimed at the producers. Perhaps, after the threat of this new taxation, manufacturers would be more likely to reformulate products to make them healthier (Engelhard, et al, 2009, and Seiders and Petty, 2004), and tax free. This would, in turn, make healthier foods cheaper for consumers (Beaulac, et al, 2009, Engelhard, et al, 2009, and Seiders and Petty, 2004).

Credits can be offered for participating in healthy activities. These can include individual behaviors like prevention and fitness programs, or for purchasing healthier food options. There could be business incentives for grocery store improvements/development, including offering fresh fruit and vegetables (National Conference of State Legislators, 2013). Part of this approach would also reduce food deserts through policy responses at the local, state and federal levels. Legislation would be both environmental and social (Beaulac, et al, 2009). Companies should no longer be permitted from deducting food advertisement for unhealthy foods from corporate taxes (Seiders and Petty, 2004).

7.3 **Macro Level**

The National Policy & Legal Analysis Network to Prevent Childhood Obesity (2010) advocated for policy changes to reduce childhood obesity levels. In their view, change should start from the local legislature. This can come in the form of an actual law, task force or committee to study an issue and propose next steps, suggest actions for those subject to city directives, or accomplish other short-term tasks (The National Policy & Legal Analysis Network to Prevent Childhood Obesity, 2010). Government should lay the procedural groundwork to advocate and enact policies, and industries should follow suit. If industry mimics the legislative mandates, and embraces them fully, there should be a wider reduction in prevalence levels (The National Policy & Legal Analysis Network to Prevent Childhood Obesity, 2010). Solutions need to avoid paternalistic approaches to consumption restriction, and choose long term health versus short term economics (Smith and Weiss, 2004).

Governmental policy making is essential to make a lasting impact to reduce obesogenic drivers. These will include policies insisting that agriculture incorporates a “health for all” approach, reduction of marketing and distribution/sale of unhealthy food to children, as well as,

"…food industry policies (e.g. moving product formulation towards healthier compositions, self-regulation of marketing to children" (Swinburn, et al, 2011, p. 810). These macro approaches are sustainable, systemic, hit at the correct population groups, and can actually reverse environmental drivers. Admittedly, getting them passed may be rather difficult given the power and money that the food lobby has. The crux of the issue, that these policies are directed at the determinants versus the individual, is the key take-away. In essence, the entire food system paradigm needs to be adjusted to one that makes health and development of the marginalized of paramount importance (Swinburn, et al, 2011).

A natural solution to the problem might be to assess what other countries are doing and try and adapt all, or part of their agendas in the United States. Unfortunately, there is simply no good example that exists. The global community is also "… searching for answers about how to reverse the rising tide of adult and childhood obesity" (Swiburn, Sacks, Hall, McPherson, Finegood, Moodie and Gortmaker, 2011, p. 804).

New Zealand and some Nordic countries can act as preliminary examples (Swinburn, et al, 2011). In 2000, New Zealand created a health approach with an equity focus. In 2002, Sweden managed to pass thus far the most aggressive SDH public health strategy. It took direct aim at the determinants, on a national level (Solar and Irwin, 2010).

The current global political and economic structure is the result of a natural progression in development. Governments merely responded to the sweeping changes in the economic and political environments and unknowingly fostered obesogenic environments. Global food production is a Catch-22. The very advancements that have made food cheaper and more available, that defray malnutrition and starvation, "… will inevitably lead to overconsumption and obesity … yet another detrimental effect of individual and corporate overconsumption"

(Swinburn, at al, 2011, p. 806). With the global push towards capitalism and neo liberal policies, including lackluster regulatory approaches, it becomes hard for countries to veer away from creating obesogenic environments (Levine, 2011). In urban environments within high-income countries, like the United States, health focused development, and social equity concerns are essentially non-existent (Kjellstorm, 2008). During rapid urbanization, the global community should be mindful that infrastructure, social and economic issues will continue to create significant health inequalities. This is especially concerning in areas with steep population increases, as urbanization itself can be thought of as an SDH. Precipitous growth "…can challenge the aspirations of equity due to the tendency for accumulation of wealth and power among the urban elite" (Kjellstorm, 2008, p. 5).

By tackling the global food system, more nutritious foods will become available to those other than the most well off. The first step in this process will be to eradicate the scheme of food overproduction. Part of this route will include fixing the practice of export subsidies, tariffs on imports, and US based federal subsidies (Schafer Elinder, 2005 and Smith and Weiss, 2004). These trade costs deeply impact the progress of agricultural economies in developing nations. Farming may be the key, because subsistence farming in developing nations can help to eradicate poverty and malnutrition. Subsistence farming can increase available food supplies, employment opportunities, and reduce food prices (Schafer Elinder, 2005). The money that is saved from subsidies can be redirected to nutritional education and advocacy efforts (Schafer Elinder, 2005). Ensuring that populations are adequately nourished should not be permitted to be a mere market mechanism. Government and civil society have a role to encourage intersectoral approaches that work with agriculture, urban planning, small businesses, and health sectors. When negotiating plans, parties must actively understand and concede the "complex webs of causation between

global and national policies," that promote capitalism and excessive food production (Dixon, et al, 2007, p. il26).

7.4 Health in all policies examples

The UK tried to establish a "Health For All" agenda to tackle SDH, expecting to have new and excellent results (Berkeley and Springett, 2006b). Part of the overall policy goals were to, "raise living standards; …and developing safe walking and cycling routes" (Sihto, et al, 2006, p. 160). However, the agenda was never allowed to escape the confines of governmental structures. The cultural, social and governmental paradigm never included a "health for all" approach, so it could not easily incorporate this new path. Governmental structures such as departmental silos and past ill-will between and among organizations caused policy fragmentation that separated health policy from other supporting policies. Inevitably, the process stalled and the "health for all" agenda never progressed beyond mere rhetoric (Berkeley and Springett, 2006b).

Constraining the effectiveness of the agenda was, among other things, the competitive structure of requests for proposals for funding. This arrangement created a project-based culture that forced organizations, large and small, to spend resources to adapt to a new funding philosophy.

The social world also inhibited the agenda's success. These barriers included the, "general national environment … economic pressures, regulation/legal issues, political system, influence of multinational companies… state of relevant technology, emerging health needs of the population, cultural beliefs about health and illness" (Berkeley and Springett, 2006b, p. 2880-2881). These limitations were nested within each other and interacted with one another and the

environment. At the time of the article, the only change that had taken place was a language change, while the status quo remained completely intact (Berkeley and Springett, 2006b).

Other countries also tried to create a similar agenda, but they ignored the existing social and political structures that blocked successful implementation (Irwin, et al, 2005). By not adequately addressing these, the agendas stood apart and alone on their theoretical pillars and generally faltered. Policy makers asked for data and evidence to support the new agenda, which was not available. At the time, no successful case examples existed to present to policy makers. An even more profound methodological issue was at hand, however. There was no good way, "… to measure social conditions and processes and accurately evaluate their health effects" (Irwin, et al, 2005, p. 16). Without measurement and data, it is exceedingly hard to build an evidence base to help create sound intervention and policies.

Further impeding progress was the government structure itself: inter departmental authority was threatened, budgets were restricted, health and environment sectors were valued less, and the ethos of political expediency overruled long-term agendas (Irwin, et al, 2005). At the same time, there was a definitive shift away from "health for all" models towards a primary health care based paradigm. Primary care based medicine was touted as more efficient and politically feasible. Initially, this selective approach was supposed to be a stop-gap solution used while a true population based HFA could be crafted. Additionally, advocates overestimated the ability of groups to compromise and the true effect that a bottom-up approach could have. Critics claimed that the very language of HFA protected the position from attack, despite being "technically vague and financially unrealistic" (Irwin, et al, 2005, p. 17). This made it inherently impossible to successfully launch.

Buttressing these critics' claims was the global affinity for the neoliberal policy agenda and the "Washington consensus." The neoliberal agenda espoused less government intervention, and a free market ideology (Pollin, 2005). This free market ideology was in direct conflict with the "Health for All" schema of expansion of government intervention and redistributive policies. At the same time, globalization policies were taking root, with larger international policy influence created by the World Bank rather than the WHO (Irwin, et al, 2005).

These agendas also stagnated because of a lack of education, knowledge, and evidence about the issues. Underlying this failure was the nebulous fact that certain groups of people benefitted from the status quo. By not taking action on SDH, the existing power dynamic maintained itself. Groups with current advantages preserved them. On the other hand, if effective SDH policies were enacted, these groups could lose money, power, and standing (Irwin, et al, 2005).

The future may seem bleak. Yet, there are some U.S. cities and states that have achieved success in slowing down, and decreasing their obesity prevalence rates. In recent years, Philadelphia, New York, Mississippi and California have seen reductions. Philadelphia and New York have emerged as leading examples in finding workable solutions (Robert Wood Johnson Foundation, 2012). Both of these cities implemented a number of policies simultaneously, and made them comprehensive in nature. Mississippi and California only concentrated on the school environment. All four sites made advances, although Philadelphia was the only location able to make any progress on the disparities gap. The city saw significant declines among African American males, Hispanic females, and low-income children. On the other hand, Mississippi only saw a significant drop among White children. In New York City, there were across the board reductions, but these were less remarkable among Black, Hispanic and children in high-

poverty schools. California saw a statewide decline. Still, 38 out of 58 counties in California saw an increase in prevalence rates (Robert Wood Johnson Foundation, 2012). Clearly, the combined efforts of individualized interventions with policy approaches are needed to achieve change (Gortmaker, et al, 2011).

7.5 **Barriers to success**

And still, "the task of equity health promoters would be much easier if there were a simple message or pitch to politicians and senior policy makers. But the reality of the situation makes equity a hard nut to crack" (Baum, 2007, p. 92). For governments without a social equity agenda, establishing health equity will be inherently difficult to accomplish without the "top-down" mechanism of policy making. In order to create health parity, it is essential that the population has faith and trust in their governmental entities. The government should have fair and transparent policy making and governing. The entire community must be willing to pursue true redistribution. This redistribution ought to enable interaction of people from all socioeconomic groups (Baum, 2007).

Other barriers to passage include varying views, definitions, and implications of health and illness. The omnipresent and hegemonic place of the medical model may also mean that change away from the current research and treatment mores will take place at a glacial pace. Adherence to the medical model means that the very debate on a paradigm shift from this model to SDH gets trapped. Instead of focusing on "episteme and ontological issues," discussions stall and remain "within the terms of the reference of the old paradigm" (Berkeley and Springett, 2006a, p. 182).

Some question healthy equity as a viable policy solution for the US. In a review of the literature, Smith (2006), found a dearth of available policy solutions. The complexity of

overweight and obesity mean that heavy monetary and other resources need to be invested to implement strategies and changes which will garner effective reductions. This reality likely scares off elected officials and administrators as too daunting a task (Smith, 2006). Most of the recent action in Congress on childhood obesity has been promoted by individual people versus comprehensive or coordinated efforts. During the 109th Congress, 60 bills and resolutions addressing obesity were introduced, but none went to Committee. Unfortunately, most legislators and Americans value short-term solutions. Any conceivable answer to obesity reduction is inherently long-term and thereby not politically practical (Smith, 2006). In order to maintain political feasibility, interventions are supposed to have clear results within a specific government's time in office (Berkeley and Springett, 2006a). Creating a true, effective, comprehensive obesity solution would be far reaching and might initially detrimentally impact certain groups through redistributive policies (Smith, 2006). In essence, a successful answer would have direct and abrupt costs for Americans to bear.

Even more frustrating, to create comprehensive obesity solutions would mean intense governmental cooperation. At least half the cabinet departments would need to work together. American government structure is not set up for this type of collaboration. Inevitably, any attempt to establish a wide-ranging obesity resolution would lead to more and more people claiming jurisdiction and further power struggles (Smith, 2006). Undoubtedly, an SDH policy approach would be extremely complicated. And the sophistication needed to create these interventions and policies may be out of reach. The very system "may lead policy design to overlook potential synergies, and successful interventions in a single area may be counteracted by responses elsewhere in the system. Policies that do not take into account the full set of actors and their responses can even backfire dramatically" (Hammond, 2009, p. A100).

Culturally speaking, the United States values capitalism above all else (Frank, 2000), and a large percentage of the population has a healthy fear of centralized governmental power (Morone, 1998). These paradigms constraint public sector budgets and involvement. Programs and departments are often forced to vie for the same and very limited resources. Little benefit is seen in a "health in all policies" as a framework, or even the utility of preventive health promotion. Political realities present enormous obstacles to establishing "health for all" initiatives, "… and, more often than not, permeate through all other barriers either as party politics or realpolitik issues" (Berkeley and Springett, 2006a, p. 184).

Obesity doesn't lend itself to easy predictions (Hammond, 2009). And, the heterogeneity of the United States' population means that programs and solutions won't have the same impacts across the board. These factors, coupled with the decentralization of current and future interventions may mean that top-down policies are ineffective. This leaves targeted interventions as "the norm" (Hammond, 2009). The need for population based policies may also make it a difficult selling point for policy makers compared to a policy specifically targeted at a group (Baum, 2007). Much like the many interacting levels of SDH, the political barriers also interact with one another and may exacerbate tensions.

Effective solutions, based on a Social Determinants of Health perspective, will be inordinately difficult to even propose. It is likely that American individualism will insert itself into any political fight (Fleischacker, 2007, Rigby, et al, 2004, and Smith and Weiss, 2004). Unfortunately, this unique brand of individualism is also hurting the nation in the obesity fight. Congress no longer feels beholden to protect the population, "… it instead considers passage of laws that promote a rhetoric of personal responsibility and do little to change the unhealthy food environment" (Smith and Weiss, 2004, p. 387). It is much easier to attack individual

responsibility than to attach blame to corporations or structural drivers (Rigby, et al, 2004). Even singling out the school wellness policies, critics have countered that it should be parents' responsibility to decide what food their children are eating. Their view is that choices within school should be provided. And in fact, not providing choices infringes upon children's, "consumer freedom and personal choice" (Fleischacker, 2007, p. 151).

Yet, "this 'personal responsibility' approach has been tested over many decades and as a public health policy has clearly failed" (Rigby, et al, 2004, pg. 429). Using individual behavior as a target allows policy makers, legislators, companies, and the public to ignore the underlying causes of obesity and disparities in prevalence levels and health effects. The very nature of the US response to the obesity epidemic: individualized interventions and backlash to even city-wide public health initiatives, evokes "victim-blaming" assumptions and the individual liberty ethos that underpins the American subconscious (Baum, 2007, Rigby, et al, 2007, and Smith and Weiss, 2004). Historically, the individualistic philosophy was pushed in the United States to thwart the fear of totalitarian regimes gaining ground here (Baum, 2007). Over time, it has created a climate where it is easier to get interest groups and political parties to buy into plans that promote individualization and responsibility. This pits public health endeavors as part of a "nanny state" (Baum, 2007), and makes overall population based initiatives almost completely irrelevant.

The US environment has also created a "safety net" approach to social inequity. In contrast, the populace needs a "'springboard' approach, which repairs the damage caused by past disadvantage (Blane, 2007, p. 72). Politicians no longer see themselves as leaders of social revolutions. Instead, they assess the tenor of their constituents, those that wield voting power, or like-minded interest groups with voting power, and push to make those interests a reality

(Marmot, 2007). Politicians' careers are short lived. Therefore, creating long term and population level changes are, by default, almost politically impossible. Real change becomes a pipe dream (Gortmaker, et al, 2001 and Richard, et al, 2011). It will become imperative to use research, science, and evidence to push the social and political agenda to create change in the social institutions that control our lives (Marmot, 2007).

Developing an evidence base on SDH has been difficult because there is,

> … lack of precision in specifying causal pathways; merging the causes of health improvement with the causes of health inequities; lack of clarity about health gradients and health gaps; inadequacies in the descriptions of the axes of social differentiation in populations; the impact of context on interpreting evidence and on the concepts used to gather evidence; and the problems of getting knowledge into action (Kelly, et al, 2007, p. 7-8).

In order to move exploration forward, researchers should work on a precise definition of equity, and push the creation of an evidence base that has variability in methodologies (Kelly, et al, 2007). Investigators need to address the above evidence gaps, and find innovative ways of understanding social structures and research bias (Kelly, et al, 2007). Making equity the focus of policy has specific assumptions and consequences. These include having a well-defined picture of the social arrangement so that interventions can be created which can be both universally applied and nuanced for specific sub groups. The determinants of inequalities must be attacked (Kelly, et al, 2007). Because equity is a moral model, there is no agreed upon definition of the term. Generally, it is likened to "social justice and fairness," however, even these concepts have subjective interpretations. In principle, equity should be defined by need and this need should be assessed when confronting inequalities. Additionally, "equity is not the same as equality; inequities are inequalities that are judged to be unfair, i.e., both unacceptable and avoidable" (Braveman, 2009, p. 10).

7.6 **Steps for Action**

Obesity prevention advocates and researchers from various fields exist, yet, there is no broad, national obesity plan that a majority supports, or is aware of. This disjointed reality exists despite the White House's recent involvement with childhood obesity. In fact, many of the recommendations and goals issued by authorities are most likely out of reach for the average person (Peters, 2006). Any approach that is created needs to address the complex and multilevel set of impact factors. It needs to understand the evidence base and use it to intervene throughout the life course. This can be especially difficult since, for children, interventions and impacts need to happen at very different stages of their development (Esposito, et al, 2009). A cohesive and comprehensive plan will need to emerge – rather than advocates from different sectors fighting alone. The many suggested approaches "… can create a 'policy cacophony', which makes the task of obesity prevention appear hopelessly difficult" (Gortmaker, et al, 2001, p. 839).

Farmer (1999) believes that programs implemented need to enhance "pragmatic solidarity (p. 1492)." Research and academia need to fully embrace understanding "the multiple dynamics of health and human rights," and most especially how societal inequality, such as racism and sexism, manifests as possible causes of poor health and entrenches the gap between the better and worse off (Farmer, 1999, p. 1492). Issues of access must therefore be of paramount importance (Farmer, 1999). In order to parse out the differential detrimental impacts of health events, researchers will need to work together across unfamiliar fields to develop "a new sociology of knowledge" (Farmer, 1999, p. 1492). By not placing equity at the center of policies and preventive efforts, even those with the best intentions, might be reinforcing the growing gap between groups instead of decreasing it (Baum, 2007). Careful movement forward is needed, to ensure that inequality isn't magnified.

Any progress on the SDH agenda will require a significant monetary investment (Committees on the Social Determinants of Health, 2008). Allowing unfettered economic growth will not promote equity. A great deal of debate centers on the discussion of poor living conditions creating and worsening poor health. It seems clear that increasing the health status of those at the lowest rung to the median health level is necessary. This transformation "…would have a major impact on overall health and should improve a nation's productivity" (Committees on the Social Determinants of Health, 2008, p. 39). Altering living standards and health status should not be solely focused on individual matters. To enhance the well-being of those on the bottom end of the health gradient, policy will need to attack social stratification. Including the social mores, "isms" and overall values of a society (Committees on the Social Determinants of Health, 2008). As well as examining the different governmental blockages at all levels of government that impede forward progress in these areas (Committees on the Social Determinants of Health, 2008).

Countrywide economic growth is generally touted as the best way out of poverty for a nation. Some theorists contend that this growth benefits the already better off and leaves the bulk of the poor behind. Historically, "the increasing inter- and intra- national economic inequality of recent years indicates that alternative policies to reduce poverty are necessary" (Kjellstorm, 2008, p. 11). If economic growth is going to be permitted, it should be carefully aligned with the MDG, to ensure general parity (Kjellstorm, 2008). In the current social structure, those that move up in social class gain in their health status compared to the class they left behind. But they do not achieve as high a health status as the class they then enter. If a person moves down the social ladder, the converse happens. The current structure may constrain the growth of equality if many people do it at once, and larger structures are not changed (Blane,

2006). Others have found that switching class did bring overall health status closer (Robertson, et al, 2006). This means that there is hope as "health inequalities are modifiable" (Robertson, et al, 2006, p. 181). The research on this topic is inconclusive, and needs to be expanded (Solar and Irwin, 2010).

Despite the barriers and setbacks discussed above, a policy oriented approach to equity is likely the only step forward. This policy approach, working in tandem with explanatory research and monitoring will increase the ability of interventions to tackle SDH. This SDH path will encompass "a commitment to equity" (Braveman, 2009, p. 15). This promise will move beyond "mere" poverty alleviation and service provision. The identification of societal divisions as unfair will be integral to creating real change. When meaningless suffering and death based on health inequities is viewed as unjust and intolerable (Braveman, 2009), true prevention efforts can be created. Everyone should be afforded the opportunity to participate in, "a more just distribution of capabilities," including health and control over one's health status (Marmot, 2007, p. 249).

In order to advance health equity, education needs to become a centralized and embraced policy construct. Currently, those with lower education levels are two times more likely to die earlier (Woolf, et al, 2007). If educational attainment was equalized to college level, "each year, an average of 195610 deaths would have been averted" (Woolf, et al, 2007, p. 680). Between 1996 and 2002, this educational equality would have saved 1369335 people. Compared to lives which were saved by medical advances alone, that is "a ratio of 8:1" (Woolf, et al, 2007, p. 680). Higher educational achievement leads to increased levels of health knowledge, as well as greater incomes and access to better quality jobs and health care. Education cannot be the sole action area of an SDH approach. We do not, as yet, have a clear picture of how, precisely, education

impacts health outcomes (Woolf, et al, 2007). Therefore, as mentioned earlier – a comprehensive, multi-sector approach needs to be advocated and advanced.

Due to the enormity of SDH approaches, a "step wise framework" of incremental policy change is necessary. The hope is that this type of measured change and intervention will be more manageable for implementation. First, policies that are the most impactful and the easiest to initially execute should be completed. During this process, local creativity with measurable incremental objectives to tacking health disparities will be delineated (Epping-Jordan, et al, 2005). In this approach, there are three planning stages and three implementation steps:

> Planning 1 – estimate population and need and advocate for action; Planning 2 – formulate and adopt policy; Planning 3 – identify policy implementation steps; Policy implementation 1 – (core) – interventions that are feasible to implement with existing resources in the short term; Policy implementation 2 (expanded) – interventions that are feasible to implement with a realistically projected increase in or reallocation of resources in the medium term; Policy Implementation 3 (desirable) – evidence-based interventions which are beyond the reach of existing resources (Epping-Jordan, et al, 2005, p. 1669).

Other approaches incorporate multiple policy entry points. The variability of entry points permit interventions to be aimed at diverse audiences (Irwin, et al, 2005). Interventions should aim to decrease social stratification, specific exposure, and lessen the vulnerability of the disadvantaged. Also, they should intercede through the healthcare structure to fix unequal access to care and the consequences of ill health. Localities should base their approaches upon need and specify their audience: targeted or universal. The impact that these approaches have will depend on how well health is integrated into the overall social and governmental structures. Success will also rest on whether or not the populace sees the responsibility of the endeavor as individualized or part of the collective social consciousness (Irwin, et al, 2005).

Another version of the step wise approach for action proposes the following, "1- improve the conditions of daily life – the circumstances in which people are born, grow, live, work, and

age. 2- tackle the inequitable distribution of power, money, and resources – the structural drivers of those conditions of daily life – globally, nationally, and locally. 3 – measure the problem, evaluate action, expand the knowledge base, develop a workforce that is trained in the social determinants of health, and raise public awareness about the social determinants of health (Committees on the Social Determinants of Health, 2008, p. 26)." In all, a revised policy frame is needed that addresses employment and housing in an effort to enhance psychological and physical resources between the haves and the have nots (Friel, et al, 2007).

At the heart of this change, is the empowerment of the community at large. Currently marginalized individuals, communities and countries should be emboldened to actively participate in promoting change, prevention plans and policy formulation. Importantly, this agenda is long-term and will last throughout the life course. The overall aim of achieving parity is to ensure that inequities between and within countries dissipate. The health of those who are worse-off should achieve a level equal to that of the best off. Countries that have made progress on SDH share important political features, including being traditionally concerned with population health as a social good, heavy investment in social welfare, participatory governance and universal insurance or healthcare coverage (Committees on the Social Determinants of Health, 2008). Clearly, the United States political ethos varies dramatically from the above. Getting to a place where the majority of the populace, and elected officials view health and justice as integral to equity will be difficult.

Both of these step-wise approaches assume a "joined-up" policy-making approach. This tactic encourages collaboration and cooperation between sectors (Sihto, et al, 2006, p. 10). "Joined-up" policy creation is a departure from the current fragmented slant. This methodology values, "cross-cutting objectives," and elucidated, "joint working arrangements with other

sectors …" (Sihto, et al, 2006, p. 11). In addition, all parties recognize potential blockages to working together. To combat these impediments, factions create a plan to overcome them, and this is valued as part of the overall policy progression (Sihto, et al, 2006). Encouraging policy-makers that have not previously thought about health as a central tenet of their area of expertise, will also be a challenge. In essence, health needs to be inserted in their policy agenda. They have to convince their stakeholders that health matters, and it has to become vital to their world view in order to move forward (Sihto, et al, 2006).

Instead of seeing the current economic and political climates as negative and intractable, they can be reframed as an opportunity – an opportunity to make a change. Approaches can work at multiple levels. The aggressive line of attack will hit redistribution head-on, directly resolving wealth and health gradients. The less aggressive path will use programs that are concerned primarily with mending disparities that have already manifested, for disadvantaged groups (Irwin, et al, 2005). There is simply no way that health equity will be achieved without access to affordable care and health promotion activities (Kjellstorm, 2008). America is at a unique point in its obesity policy "frame." The media and general public largely recognize that America's health status is on the brink of disaster. It behooves policy makers, advocates and researchers to capitalize on this understanding. It is time to create and promote achievable scenarios, and enter them onto the political stage (Sihto, et al, 2006).

Specific policy goals to enhance the US health status gradient could be 1 – poverty reduction, 2 – enhancing working conditions of low-skilled employees, 3 – ensure that those who experience ill health do not become socially and economically isolated, 4 – increasing health care access for the disadvantaged to ensure proper care, 5 – reduce gender and race based social stratification, 6 – increasing educational attainment, 7 – decrease exposure to factors that

negatively impact health (Solar and Irwin, 2010). Additionally, a paradigmatic shift away from individual liberty towards communal interest will be necessary for any real change in obesity and health to come to fruition.

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Appendix 1: Homogeneity of Variance

An assumption of logistic regression was that variables have a relatively equal variance. Levene's test was used, and if it was significant it indicated that the samples variances were not equal, and the null hypothesis was rejected. However, even if the assumption was violated, inclusion of the variables in the analysis was permissible as it did not harm the model (Mertler and Vannatta, 2005). In the table below, entitled "Independent Samples T Tests" the Levene's test indicated that most of the variances were not homogenous and null hypotheses were rejected. When calculating these t-tests, the independent variable – "obese or not" was used as the grouping variable to compare all the dependent variables to. Those relationships that were not homogenous were NSLP, SBP, SES, salty snacks, White, Hispanic, American Indian, Asian and Black. Gender had a significance level of .051 so was right on the cusp of rejecting the null, as well.

The t-tests comparing the means of the variables showed a number of interesting relationships. For those variables where the null hypothesis was rejected, the "Equal variances not assumed" t-test was used. For those variables that the null hypothesis was accepted, the "equal variances were assumed" t-test was used. Of the variables that did not assume equal variances, SBP, NSLP, SES, White, Hispanic, and Black were all significant at p=.01. American Indian was significant at p=.05. This indicated that the means of these variables were not equal to the mean of the obesity variable (the independent variable). Salty snacks was not significant, therefore the null was accepted. For the variables with equal variances assumed, none of the variables (gender, sweet snacks, sugar sweetened beverages) were significant; therefore the null hypotheses were accepted.

Table 10

Independent Samples T Test

	Levene's Test		t-test for Equality of Means				
	F	Sig	t	DF	sig (2-tail)	Lower CI	Upper CI
SBP							
Equal Variances Assumed	103.710	0.000	-6.114	4402.000	0.000	-0.124	-0.064
Equal Variances not assumed			-6.031	2904.414	0.000	-0.125	-0.063
NSLP							
Equal Variances Assumed	237.593	0.000	-10.440	5873.000	0.000	-0.166	-0.114
Equal Variances not assumed			-10.193	3384.456	0.000	-1.670	-0.113
SES							
Equal Variances Assumed	254.451	0.000	-8.156	5873.000	0.000	-0.109	-0.067
Equal Variances not assumed			-7.660	3097.463	0.000	-0.110	-0.065
Gender							
Equal Variances Assumed	3.797	0.051	1.175	5873.000	0.240	-0.011	0.044
Equal Variances not assumed			1.174	3579.902	0.240	-0.011	0.044
Sweet Snacks							
Equal Variances Assumed	1.234	0.267	0.559	5721.000	0.576	-0.018	0.033
Equal Variances not assumed			0.558	3467.200	0.577	-0.018	0.033
Salty Snacks							
Equal Variances Assumed	11.837	0.001	1.753	5669.000	0.080	-0.003	0.047
Equal Variances not assumed			1.737	3370.295	0.082	-0.003	0.048
Sugar Sweetened Beverages							
Equal Variances Assumed	0.180	0.672	0.213	5669.000	0.832	0.061	0.030
Equal Variances not assumed			0.213	3428.446	0.832	0.061	0.030
White							
Equal Variances Assumed	152.670	0.000	6.754	5873.000	0.000	0.061	0.112
Equal Variances not assumed			6.568	3197.298	0.000	0.061	0.112
Hispanic							
Equal Variances Assumed	139.669	0.000	-6.099	5873.000	0.000	-0.087	-0.045
Equal Variances not assumed			-5.810	3095.015	0.000	-0.088	-0.044
Black							
Equal Variances Assumed	111.426	0.000	-5.371	5873.000	-0.050	-0.068	-0.032
Equal Variances not assumed			-5.066	3127.411	-0.050	-0.069	-0.031
American Indian							
Equal Variances Assumed	22.069	0.000	-2.361	5873.000	0.019	-0.021	-0.002
Equal Variances not assumed			-2.211	30950.015	0.027	-0.021	-0.001
Asian							
Equal Variances Assumed	21.302	0.000	2.290	5873.000	0.022	0.002	0.026
Equal Variances not assumed			2.411	4077.179	0.016	0.003	0.026

Appendix 2: Missing Variable Analysis (MVA)

Table 11
Missing Variable Analysis: Univariate Statistics

		Missing	
Variable	N	Count	Percent
Gender	21396	13	0.1
Hispanic	8723	12686	59.3
Black	8723	12686	59.3
White	8723	12686	59.3
BMI	8701	12708	59.4
Sweet Snacks	9068	12341	57.6
Savory Snacks	9000	12409	58
Sugar Sweetened Beverages	8997	12412	58
NSLP	6550	14859	69.4
SBP	5928	15481	72.3
SES	8809	12600	58.9

Unsurprisingly, a good percentage of respondents were missing data on some of these variables. There was attrition between kindergarten and 8th grade, leading to some missing data.

Table 12

Missing Variable Analysis: Tabulate Patterns

	Missing Patterns											
Number of Cases	Gender	Sweet Snacks	Savory Snacks	Sugar Sweetened Beverages	BMI	SES	Black	White	Hispanic	NSLP	SBP	Completed if…[b]
4147												4147
847										X		4994
1071										X	X	7491
1426											X	5573
244		X	X	X	X							4883
286					X							4433
11680		X	X	X	X	X	X	X	X	X	X	21369
811						X	X	X	X	X	X	8370

Patterns with less than 1% cases (214 or fewer) are not displayed.

[a] Variables are sorted on missing patterns

[b] Number of complete cases if variables missing in that pattern (marked with X) are not used.

According to table 15, the same respondents skipped the Sweet and Savory Snack question as well as the Sugar Sweetened Beverage availability and BMI question. Another noteworthy pattern was skipping the vending machine availability and BMI, as well as race classification and NSLP and SBP. A different set of respondents skipped the racial classification question and the NSLP and SBP. And one final noteworthy pattern, was a group of people that skipped just the NSLP and SBP questions. While this was a large number of people, the "Complete if …" column shows that there were still be ample cases left in the data set for analysis.

Summary: MVA Cross Tab Analysis

There were not demonstrable differences between boys and girls skipping questions. It is therefore likely, that these variables were missing at random. Hispanic children were more likely to answer the sugar sweetened beverage availability at school, if they reported there were no drinks available for purchase. Interestingly, both children that got NSLP or SBP were more likely to answer the beverage question (a difference of approximately 7% for lunch and 14% for breakfast).

Black children, like Hispanic children, were more likely to answer the sugar sweetened beverage availability question if beverages weren't available at their school. Again, Black children were more likely to answer the SBP and NSLP receipt questions if they received these items. White children, on the other hand, were less likely to answer the beverage question if they did get either NSLP of SBP.

Only one category of BMI had a slightly different response rate. Children that were overweight or obese were more likely to answer the SBP question. Repeating the above observation, children that had sweet snack availability at their school were more likely to answer the SBP question. Children that had savory snack availability at school were more likely to answer the SBP question. Again, children that were more likely to have sugar sweetened beverages available at school were more likely to answer the SBP question.

NSLP response also revealed some interesting discrepancies. This isn't completely unexpected given that the answer to this question is likely linked with social stigma and other biases (Stein, 2008). Children that did not have sweet snacks, savory snacks or sugar sweetened beverages available at their schools were more likely to answer the NSLP question. In an interesting juxtaposition to these variables, children that also obtained SBP at school were more

much more likely to answer the NSLP (66% did not get breakfast, while 90.7% that did also answered the NSLP question) questions.

Much like NSLP receipt, differences were expected between those who did and did not answer the questions related to SBP. Children in schools without sweet snacks, savory snacks and sugar sweetened beverages were more likely to answer the SBP question. Children who did receive NSLP were more likely to answer the SBP question.

SES was only used in one model, because both NSLP and SBP were used as proxies for SES. Additionally, SES variable was collinear with a number of the food consumption variables.. Children who were not overweight or obese, who did not have access to sweets, savory snacks and sugar sweetened beverages were more likely to have BMI data. On the other hand, children who got NSLP (71.7% versus 88.4%) and SBP (63.5% versus 87.3%) were much more likely to have BMI data.

Appendix 3 – Summary: Gender Cross tab

A separate gender cross tabulation was completed to ascertain if there were significant differences between boys and girls in the sample. There were more males then females in the data set, and more not obese males than females. The Chi Square p value was not significant, indicating that there was not a significant difference between boys and girls who were obese (X^2 = 1.380, df = 1, p = .240).

There were more "not poor" males versus females, but the Chi Square was not significant. There was not a significant difference between boys and girls who were poor (X^2 = 3.195, df = 1, p = .074). Approximately the same number of males and females received NSLP. The Chi Square p value was significant, indicating that there was a significant difference between boys and girls who obtained NSLP (X^2 = 4.276, df = 1, p = .039). Slightly more males than females get SBP. The Chi Square p value was significant, indicating that there was a significant difference between boys and girls who got SBP (X^2 = 5.968, df = 1, p = .015).

Roughly the same number of males and females were Hispanic in the sample. The Chi Square p value was not significant, indicating that there was not a significant difference between boys and girls who were of Hispanic descent (X^2 = .025, df = 1, p = .876). Approximately the same number of boys and girls were Black in the sample. The Chi Square was not significant, indicating that there was not a significant difference between boys and girls who were Black (X^2 = 3.583, df = 1, p = .058). However, the p value was close to significance, so the relationship was of note. There were more White males than females in the sample. The Chi Square p value was significant, indicating that there was a significant difference between boys and girls who were white (X^2 = 4.850, df = 1, p = .028).

About the same number of males and females had access to sweet snacks at school. The Chi Square p value was significant, indicating that there was a significant difference between boys and girls who had sweet snack availability at school (X^2 = 10.714, df = 1, p = .001).The same numbers of males and females had access to savory snacks at school, and it was much higher than those that had access to sugary snacks. The Chi Square p value was significant, indicating that there was a significant difference between boys and girls who had access to savory snacks at school (X^2 = 6.785, df = 1, p = .009). The same number of boys and girls had access to sugar sweetened beverages at school, and these numbers were closer to the numbers that also had savory snack access at school. The Chi Square p value was significant, indicating that there was a significant difference between boys and girls who had access to sugar sweetened beverages at school (X^2 = 10.310, df = 1, p = .001).