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**Childhood Obesity in California: The Impact of School Lunch Options and
Physical Education Standards in Public Elementary Schools**

A Thesis Presented

by

Audrey Connell

To the Keck Science Department

Of Claremont McKenna, Pitzer, and Scripps Colleges

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Senior Thesis in Human Biology

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Abstract

Obesity is a biosocial phenomenon in that it is shaped by both biological and social processes. On the biological level, excess body fat increases one's risk of placing the body in a non-homeostatic state that can weaken the immune response. On the social level, social inequalities are linked to obesity in the United States where racial and ethnic minority communities with low education and high poverty rates bear the largest burden of obesity. In various institutions, multiple actors such as food marketers, public health officials, policy makers, and school administrators dictate the opportunities available to children for them to reach peak health during their formidable growth. School is one environment that can directly help curb childhood obesity because it instills healthy habits at an early age, and it represents a key source of nutritious food and exercise for those who might not have access to otherwise. Children that engage in physical activity and consume a balanced diet can reduce their chance of experiencing obesity in their adult life. Schools are a key site of intervention for two reasons: 1) children spend most of their day at school for at least 180 days of the year 2) policy wise, it is easier to mandate schools what to provide in terms of food service than to expect the nation's thirty-five million households with school age children to be able to provide for themselves. However, schools face numerous challenges that inhibit their ability to provide resources for students and families to engage in healthy behaviors. Social inequalities exist between schools, in ways that influence the learning experience students receive as well as the quality of nutritious meals and physical education; as such, a reliance on outside partnerships to fill gaps in order to obtain access to better nutrition and exercise programs. These partnerships vary from state and school district, but its success depends on the school's ability to fundraise and/or apply for federal funding and grants. Based on my field research, I propose three recommendations to lessen the burden placed on teachers, families, and individuals and improve the access to resources that promote a child's good health and wellbeing. First, institutions should find alternative ways to educate students on healthy eating without adding another strain to the teacher's role. Second, advocate for administrators and local government to critically assess budgets and increase funding for public education across the board so that they can appropriately support their students. Third, urge our government to create and enforce an effective guideline for school districts to adopt healthy eating behaviors and provide adequate physical activities to positively impact children's wellbeing.

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Table of Contents

Introduction	6
Theoretical framework.....	8
Research methods and positionality	9
Summary of chapters	12
Chapter 1: Biology of Obesity	14
Cardiovascular disease.....	15
Type 2 diabetes.....	16
Cancer	17
Gut microbiota	18
Physical activity and the gut	20
The relationship between physical fitness and academic achievement	22
Conclusion.....	24
Chapter 2: Theory of Obesity	26
Framework of obesity and who is to blame.....	26
The effects of lack of access to nutritious foods.....	29
Structural lack of physical access and the stress response.....	32
The role of schools	33
Conclusion.....	34
Chapter 3: Programs and Policies of School Lunches and Physical Education	36
History of the National School Lunch Program	37
Challenges to the implementation of nutrition policies	41
History of physical education programs	42
Challenges to the implementation of physical education policies	44
Observed school’s reliance on partnerships to meet students’ needs.....	46
Bay Elementary	46
Pine Elementary	50
Mountain Elementary	51
Conclusion.....	52
Chapter 4: Burdens on Individuals	54
Bay Elementary	54
Pine Elementary	56
Mountain Elementary	59

Conclusion.....	61
Conclusion	64
Limitations and future research.....	67
Recommendations	67
References	71

Introduction

Obesity is a worldwide health problem affecting millions of people. In the U.S., childhood obesity is a growing concern and public health issue. The current literature suggests that there has been an increase in obesity in children 6-19 years old. The Center for Disease and Prevention reported that between 1971-1974 and 1999-2000 the number of overweight children in these two age groups increased by 400% and 250%, respectively (Moreno et al., 2004). In 2011-2014, the prevalence of obesity among U.S. children and adolescents aged 2 to 19 years was 17.0%; the CDC reports in 2015-2016 the prevalence increased to 18.5% (Ogden et al., 2016; Hales, 2017). It was previously believed that high-income countries are more affected by obesity which can be attributed to more disposable income and access to fast food, but obesity is steadily increasing in low- and middle-income countries, especially in urban settings (Smolin and Grosvenor, 2016). The prevalence of obesity is high among all age and racial groups, but it is most prevalent in low-income populations and minority racial/ethnic groups. Public health officials have declared the dramatic increase in an epidemic, yet there is still some debate as to what needs to change and whose responsibility it is. This epidemic clearly demonstrates that obesity and being overweight is detrimental to human health. Especially in children, obesity is linked to neurologic, cardiovascular, gastrointestinal problems as well as self-esteem and anxiety disorders, depression, and other mental illnesses which not only affect a child's academic performance but also their long-term health (Wiley and Cory, 2013). Additionally, adult and childhood obesity rates burden the country financially due to medical care costs which can rack up to as much as \$147 billion to \$190 billion annually (Smolin and Grosvenor, 2016).

Only in the last 25 years has obesity been viewed as a medical condition. In 2004, the National Institutes of Health (NIH) released a statement that "there is no doubt that obesity is an epidemic that must be stopped" (NIH 2004, cited in Moffat, 2010: 4). The NIH used a science-based approach to tackle the health problem. Their first step was to legitimize the issue by increasing funding for obesity research from \$50 million in 1993 to \$400 million in 2005 (Moffat, 2010: 4). However, the NIH is not the only institution initiating change in policies towards obesity. Researchers, scientists, and policymakers are

promoting healthier lifestyles. In the U.S., scientists have pinpointed increased access to food supply and the move to a more sedentary lifestyle as the reasons for the increase in overweight and obesity rates. Fast food restaurants, convenience stores, and affordable food make it easy for Americans to constantly eat processed food. In general, fat tastes good; a fact that is hard to argue. In addition, they consume more calories in a day because portion sizes have increased. Along with the rise in energy intake, there has been a decline in the amount of energy Americans expend. Americans, especially, are less active during their leisure time because they are having long busy days at work and commute, and thus have limited time for active recreation (Smolin and Grosvenor, 2016).

One change, the NIH is encouraging, requires improving school lunch options. Many public schools in the United States provide meals supplied by the US Department of Agriculture (USDA) National School Lunch Program (NSLP), Extended Day Snack Program, School Breakfast Program. These programs often provide a significant proportion of these children's daily nutrition requirements; thus, it is necessary to make them as nutritious as possible (Wiley and Corey, 2013). Schools are a crucial platform to instilling good eating habits, because school-aged children consume between one-third to half, or 35-47% of their meals and daily calories at school, thus making it the perfect setting for interventions (Micha et al., 2018; Behrens et al., 2018). The other aspect local government officials should focus on is physical education programs and level of engagement in extracurricular activity opportunities for students at their schools. A complementary program to improve child health and wellbeing is physical education (PE) in school because it is directly linked to increased mental and physical development. PE has been associated with improved mood, concentration, academic achievement, and muscle strength.

American politics and policy influence the wellbeing of children either indirectly or directly. It is in the best interest of American society to focus on the dietary and physical activity guidelines implemented at elementary schools, because childhood obesity can also lead to illness, such as cardiovascular and neurological diseases. Today, schools are adapting and changing their school lunch programs and physical education curriculum to meet the needs of their student's wellbeing. However, it has been well documented that resources of nutritious foods and health education are unevenly distributed

among school districts, perpetuating social inequalities and structural violence. My research findings show that, due to the unequal distribution of resources, schools rely on outside partnerships to meet the demands of their student's health. Inequalities also exist within schools because of the variable burden it places on individual families and teachers to provide for nutritious food and exercise for students.

My study on three public elementary schools in California improves our understanding of the policies that determine how much nutritious foods and exercise students get at school and how these affect a child's wellbeing. A worldwide standard on how to appropriately determine whether a child is healthy does not exist. Everyone has different ideas about how much carbohydrates, fats, protein, iron, and other nutrients are needed to stay healthy. My project can illuminate some ongoing challenges and complexities of providing food and exercise programs in elementary schools. Moreover, it provides an understanding of how school administrators, big food companies and distributors, and policymakers perpetuate the social inequalities and the effect it has on young children. Parents should be informed how much time their children play outside and what specific foods are provided at school.

Theoretical Framework

Obesity is a biosocial phenomenon, in that it is shaped by both biological and social processes. It is essential to preface why eating healthy and staying active is critical to reducing the risk of developing health problems later in life. As a biological process, excess body fat increases one's risk of placing the body in a non-homeostatic state that can weaken the immune response. Children that engage in physical activity and eat a balanced diet can reduce their chance of experiencing obesity in their adult life. Food consumption impacts the gut microbiota which in turn affects the body's immune function thus leading to increased risk of developing obesity. Physical activity contributes to the development of fundamental and advanced motor skills, high academic achievement, and a healthy heart.

However, social aspects are equally important. In various institutions such as food companies, public health officials, policy makers, and school administrators, multiple actors dictate the opportunities available to every child for them to reach peak health. As previously noted, schools face many challenges

that inhibit their ability to provide resources for students and families to engage in healthy behaviors. For example, there may be a shortage of PE teachers in the school district, making it difficult for schools to provide quality PE classes. Another challenge is the availability of fresh produce for school offered meals. The institutions located in more convenient areas or that have a large budget are going to have more ease obtaining fresh produce. When the resources are not available to families within the school, they have to look elsewhere to find the support they need. However, families might not always find the means to access sufficient resources due to their race, class, gender, or living environment. One key concept that permeates throughout this study is structural violence, “the avoidable impairment of fundamental human needs embedded in longstanding ubiquitous social structures, normalized by stable institutions and regular experience” (Farmer et al., 2006: 378). The structures that perpetuate inequities are ingrained in many aspects of society and make it more difficult for socially and/or economically marginalized groups to obtain nutritious foods and access to exercise. Additionally, key players like food companies have control over what foods are offered at schools, sometimes making it more challenging for institutions to provide healthy nutritious meals.

Research Methods and Positionality

I have always been intrigued by the differences in the dietary and physical activity standards among the various elementary schools. The private institution that I attended growing up had considerable amount of time for recess and physical education, whereas many of my friends and acquaintances who attended other schools did not have the same experience. Observing disparate experiences led me to want to study and analyze dissimilarities between schools. I think that getting exposed to healthy behaviors early on in life is important and necessary to ingrain good behaviors that can help us as we reach adulthood. It is fascinating to me that different states have varying standards and deal with exercise and nutrition. California is special in that PE time is legally mandated, but other states do not have the same laws in place. I think all children should have the same opportunities for a healthy successful life.

Throughout the interview and research process, I acknowledged my position as a female young adult who

had the privilege of growing up in a financially stable family. I was raised in a safe neighborhood in an urban city and attended a private elementary school. Keeping that in mind allowed me to be open-minded to all the challenges that individuals and school districts face. While it is easy to blame shortcomings on schools themselves, it is more important to look at the structural systems in place that create obstacles for school administrators to provide the best opportunities for their students.

The research questions that guided me throughout this project included: How are national and state-level guidelines for exercise and nutrition being implemented in California public elementary schools? What are some potential limitations in their implementation? Once I narrowed down the direction I wanted to go into, I contacted three schools in California. I chose to focus on California public schools because they would be the easiest to access. After all, I was stationed in California and have contacts within the school system already. I chose the institutions based on my personal connections and the chances of getting more in-depth discussions and interviews.

To get a better insight into parents' and the school staff's perspective on the quality of school lunches and PE, I interviewed adults at three different public elementary schools in California. During the process of obtaining approval from the school districts to interview teachers and other staff, I came to the realization that in order to protect my participants and the schools that were kind enough to help me with my senior thesis, I would need to use pseudonyms.

The first school, which I call Bay Elementary, resides in Nevada County, Northern California. The school serves a little over 200 students in grades kindergarten through eighth grade. This school is relatively new as it was started in 2010. Unfortunately, there was no available public data about enrollment by racial and ethnic designation. The school district is a Basic Aid district, meaning they are funded by property tax and their budget is approximately \$69 million. In 2018-2019, the California Department of Education reported that 29.1% of their student body was eligible for free or reduced-price meals. Of that total, 25.8% were eligible for free meals. I visited the town where Bay Elementary is located over three days in January 2020. My second cousin has two children in the local elementary school and put me in contact with two PE teachers, one dietician, one school psychologist, and one

reading specialist. They were all in-person interviews except for one that was over the phone. The dietician did not work for the school, but she is a close friend of my second cousin, so she agreed to meet with me. She was employed by the local health center, which I thought her knowledge would provide insight to some of the health issues faced by the community in general and by children within that community. All of the staff members I talked to were women with elementary school aged children. They all had about 12-17 years of experience in their profession.

The second institution, which I refer to as Pine Elementary, is located in Los Angeles County, Southern California. Pine serves about 650 students in grade Kindergarten through the sixth grade. The breakdown of race and ethnicity within the school district is 43% Hispanic, 32% White, 10% Asian, 5% African American, and 10% other. The school district reported that about \$2.5 million of the budget goes to child development funds which include physical education curriculum and extracurricular activities. Another \$2.7 million is allocated for cafeteria funds, the school lunch program would fall under this category. The California Department of Education reported that in 2018-2019, 22.2% of their students were eligible for free or reduced-priced meals, of that total 20.3% qualified for free meals. Beyond the website analysis, I had the opportunity to visit the campus and interview teachers in person after I received approval from the Board of Education to interview the staff. The principal sent me a list of all staff who agreed to meet with me, and I followed up with emails to all of them. I spoke with one 4-6th grade special education teacher, one nurse, two 1st grade, one 3rd grade, and one 2nd grade teacher. Their teaching experience ranged from two to 15 to 32 years at Pine Elementary. All of the interviews occurred in their classroom over the course of one week in February 2020.

The third school, which I refer to as Mountain Elementary, is located in Orange County, Southern California. Mountain Elementary is made up of about 500 students and prekindergarten through 5th grade. I chose this school for my research because my cousin is currently attending as a second grader. In my fact-finding, I found that the school district where Mountain Elementary is a part of, reports that the makeup of their student population is 47% Hispanic, 27% White, 20% Asian, and 6% Multiple. About 40% of their students are low-income, 19% are English learners, and 0.3% are in the foster system. In FY

2018-2019, the school district had \$23 million in grant funds for services to support English learners and socioeconomically disadvantaged students. Data provided by the California Department of Education reports that a total of 26.5% of their students are eligible for free or reduced-priced meals, of that total 24.0% are eligible for free meals. I did not have the opportunity to visit Mountain Elementary and observe a class. To get a sense of the parent perspective, I interviewed my uncle over the phone; it will be his daughter's third year attending the institution. He previously had been very involved in his daughter's classroom and had great insight into the strengths and weaknesses of the school.

In addition to the semi-structured interviews described above, my research methods included website analysis of school district demographics and funding, and historical research on school nutrition and exercise programs. I also used document analysis to compare policies, images, and the language used around exercise and nutrition policies. Documents were found through the Claremont College Library databases and government websites. I used databases including the California Department of Education, each school district's website, and Center for Disease Control (CDC).

Summary of Chapters

Chapter 1 examines the biological processes that are negatively affected by excess body fat. Children that are overweight or obese have an increased risk of developing serious health consequences such as heart disease, stroke, type 2 diabetes, musculoskeletal disorders, and cancer. Studies have shown an association between the foods we consume and immune response. Individuals who do not consume a healthy variety of nutritious foods will have a weaker immune system. Engaging in daily moderate to vigorous physical activity can protect against cardiovascular diseases and cognitive function which includes the acquisition of knowledge.

Chapter 2 argues that obesity is a complex and multi-faceted health problem that affects the American population. Often, obesity is framed in a way that places blame on individual choices and habits rather than focusing on the structural systems that perpetuate social inequalities, shape access to resources, and inhibit individuals from engaging in healthy behaviors. Social factors including food

production, household income, geography, and living environment all have major effects on body weight. Social inequalities are linked to obesity in the United States, and racial and ethnic minority communities with low education rates and high poverty rates bear the largest burden of obesity.

Chapter 3 investigates how the National School Lunch Program and the physical education curriculum has changed over time and impacted the opportunities available at institutions for students to access good nutrition and exercise. Currently, many schools rely on partnerships with outside private companies to fill the gaps in public funding. As a result, inequities between institutions form because of variability in reliance on and strength of partnerships with outside actors. Schools with stronger relationships, greater federal funding, and community support can provide more resources for their students to be able to obtain nutrition and exercise opportunities.

Chapter 4 explores how, within schools, the burden to provide opportunities for students to engage in physical activity and consume nutritious foods are often placed on individual families and teachers. Institutions are not only relying on outside partnerships to fulfill the need to support their students, but also on the individuals within the school. I use examples from Bay Elementary, Pine Elementary, and Mountain Elementary schools to highlight how shifting the burden for obtaining good nutrition and exercise onto individuals can also create inequalities within a school. For example, extracurricular activities currently offered at schools can be very expensive and inaccessible to low-income families. As a result, some students can engage in these after school programs, while others cannot afford them or have caretaking responsibilities at home that prohibit them from participating.

Chapter 1: Biology of Obesity

One in three Americans is obese. The increase in obesity rates across the United States is alarming. Healthy People 2020 reported that in 2013-2016 the rate of obesity was 38.6% among adults aged 20 years and older and 17.8% among children and adolescents aged 2-19 years. The World Health Organization defines obesity as a person with a body mass index (BMI) of 30 or more. Although BMI is criticized as a crude measure of obesity, it is widely used for routine weight status in epidemiology, clinical nutrition, and research because it is simple to measure and regularly documented in health records. BMI is calculated by body weight in kilograms divided by height in square meters (Moffat, 2010; Sowers 2003). Some body fat is essential for homeostasis but consistently above a certain range can increase an individual's risk of developing obesity-related health problems such as cardiovascular disease (CVD), stroke, type 2 diabetes, and cancer. Some data suggests that 75% of obese adults have at least one obesity-related health problem (Shah, 2014). Fat is essential to protect organs and muscles, serve as insulation, lubricate joints, and provide energy. Lipids, the chemical term we call fats, are important because they help absorb fat-soluble vitamins and are a source of essential fatty acids (EFA). Our body cannot produce its own EFAs so they must come from our diets. In our bodies, lipids form structural and regulatory molecules that are stored as energy and later broken down via cellular respiration to provide energy in the form of adenosine triphosphate (ATP) (Smolin and Grosvenor, 2016). Obesity greatly increases the risk of chronic disease morbidity and mortality. Childhood obesity results in the similar conditions as adults—namely high blood cholesterol levels, high blood pressure, type 2 diabetes and certain cancers—but with premature onset.

Nutrition and exercise play a crucial role in maintaining a healthy weight to curb childhood obesity. Current research examines how the aspects of diet and regular physical activity impact physical health and cognitive function. Low density, high nutrient diet has been associated with higher educational performance, attendance rates, and overall improved test scores in school-aged children (Behrens et al., 2018). In addition to the impact that nutrition has on a child's cognitive development, physical education

(PE) also plays an important role in a child's biological and intellectual growth. PE has been shown to contribute to more than one-third of a student's recommended daily 60 minutes of moderate to vigorous physical activity (MVPA). PE can also impact and support the acquisition of skills, knowledge, and behaviors that facilitate a healthy lifestyle (Thompson et al., 2018). Frequent MVPA has a strong correlation with reduced incidence of overweight, obesity, and type 2 diabetes in children and adolescents. It can also help protect against hypertension, atherosclerosis, coronary heart disease, and cardiovascular disease in adulthood by helping reduce blood cholesterol levels (Lafleur et al., 2013). PE with proper instruction is recognized as the most effective tool to promote physical activity among children. This chapter focuses on the biology of obesity, its complications, and how nutrition and physical activity play an important role in reducing the risk of developing childhood obesity. I will discuss the various health consequences of obesity including CVD, type 2 diabetes, cancer, and the role of gut microbiota and physical activity in relation to academic achievement to highlight the repercussions of childhood obesity.

Cardiovascular disease

Cardiovascular disease is the leading cause of global mortality accounting for 17.5 million deaths in 2005 and the number of deaths is projected to hit 23.6 million by 2030 (Umer, 2017). Obesity contributes to heart disease; in fact, it is a strong independent predictor of CVD. It increases the likelihood of developing CVD because excessive fat changes our cholesterol levels, increases our blood pressure and leads to diabetes; ultimately, it puts pressure on the heart to work harder. The mechanisms through which obesity increases CVD risk involve changes in body composition that can affect blood circulation and alters heart structure. The ability of the adipose tissue to expand and produce pro-inflammatory cytokines that can directly impair cardiac function as well as the formation of atherosclerotic plaques plays a major role (Carbone et al., 2019). The buildup of cholesterol in the artery walls can cause obstruction of blood flow which can lead to heart attack or stroke.

Visceral obesity, excess weight that develops over time around the center of the body, is associated with insulin resistance which is a predisposing factor for the development of type 2 diabetes, hypertension, and CVD (Sowers, 2003). Insulin plays a crucial role in maintaining homeostasis and other bodily processes. After eating, your blood glucose levels increase, and insulin secreting cells of the pancreas are activated and release insulin into the blood. Glucose is either stored in the liver as glycogen or blood uptake is enhanced in body cells. Since glucose is taken up by cells, there is less glucose in the blood and falls into homeostatic set point thus the stimulus for insulin diminishes. It is common for the body to not produce enough insulin or become insulin resistant, in which the cells stop responding to insulin. When insulin resistance builds up, the body is no longer able to regulate blood sugar levels thus resulting in type 2 diabetes. Weight loss can decrease visceral obesity thus reducing high blood pressure, insulin resistance, and CVD risk (Sowers, 2003).

Type 2 Diabetes

More than 34 million Americans have diabetes; that is about 1 in 10 people. Approximately 90-95% of those millions of people have type 2 diabetes (CDC, 2019). Excess weight contributes to increased risk of type 2 diabetes because it leads to insulin resistance, which then increases the amount of insulin needed to keep a normal range of blood glucose levels. Having diabetes or prediabetes increases an individual's risk of heart disease and stroke. By reducing excess body weight and fat is beneficial in lowering blood pressure, blood glucose levels, and CVD. Overweight individuals who have prediabetes or diabetes would benefit from losing weight because it can help bring their blood glucose to a normal range (*Centers for Disease Control and Prevention*).

In children, it is well established that higher BMI values are associated with an increased risk of type 2 diabetes. Researchers are interested in whether weight loss in children who are obese can reduce their risk of type 2 diabetes later in life. Bjerregaard et al. (2018) conducted a study involving 62,565

Danish male and they measured their weights and heights at 7 and 13 years old and in early adulthood. Results found that at the age of 7 to 19, the risk of type 2 diabetes had a direct correlation to increased BMI even among men whose weight had been within healthy range at 7 years old (Bjerregaard et al., 2018). They concluded that childhood overweight at 7 years old was associated with an increased risk of developing type 2 diabetes in adulthood, only if the child continued to be overweight until puberty. Their findings suggest that if properly intervened before the overweight 7-year-old child hits puberty then it is possible to reduce their risk of type 2 diabetes. Bjerregaard et al. (2018) also mention that an increased risk of type 2 diabetes is unrelated to intelligence or education. Biologically, it is plausible that the accumulation of excess weight in childhood could lead to type 2 diabetes because of the buildup of insulin resistance.

Cancer

The link between obesity and cancer risk is explicit but what is more interesting is the notion that excessive fat increases that risk. The types of cancers associated with obesity include esophagus, breast, colon, kidney, pancreas, and many more. Several mechanisms have been proposed to explain the association between cancer and obesity. One explanation points to the fat surrounding vital organs which in turn inhibits the function of the organ which sends a signal to the body and inflammation ensues, affecting the body's processes. In general, your body has fat cells that produce protein hormones called adipokines, which may contribute to the development of any type of cancer because they promote cell proliferation. For example, the risk of postmenopausal breast cancer in obese women may be due to elevated estrogen levels caused by excess body fat (Key et al., 2011). Hormonal insulin and insulin-like growth factors are more common in obese individuals and promote tumor development. Other proposed mechanisms involved in the increased risk of cancer with obesity are inflammation and altered immune response (*National Cancer Institute*).

Gut microbiota

Diet is considered one of the main drivers in shaping the gut microbiota across one's life. Current studies are examining the mechanisms and interactions of gut bacterial compositions that influence excess body fat buildup. The gut microbiome is an important feature of our bodies that can help scientists pinpoint which proteins and the ways in which cells function that can be advantageous for maintaining a healthy weight. Over 20% of the host microbiota variability is shaped by environmental factors such as diet, drugs, and qualitative measurements to assess the composition of the body (Rothschild, 2018). Dysbiosis, a non-balanced system and altered immune function, when occurs in the gut microbiota has been shown to be associated with susceptibility to obesity (Bai et al., 2019). Through a meta-analysis, Rinninella et al. (2019) found that previous animal studies observed the changes in microbial composition to obesity in mice, which have similar microbiota to humans at the division level. These studies highlight that obesity is associated with changes in gut microbiota composition including lower species diversity and shifts in abundance of genes involved in metabolism. The lack of microbiota diversity in the gut can be considered a contributing factor to obesity-related disorders because the gut bacteria interact with signaling pathways that lead to a modulation of the endocrine system, immune response, nervous system activity, hence the predisposition to metabolic diseases. Based on the analysis of several studies, Rinninella et al. (2019) concluded that the richer and more diverse one's microbiota is the better their bodies are at withstanding external threats. Disturbances to the host-microbe relationship may disrupt the development of the immune system. One should achieve a healthy balance of host-microorganisms so that the body can optimally perform metabolic and immune functions as well as prevent disease.

Now, we understand that food consumption impacts the gut microbiota which in turn affects the body's immune function. Alterations of gut microbiota starting during childhood contribute to inflammation. Magrone and Jirillo (2015) suggest that the consequences of obesity and obesity itself can be prevented not only through caloric restriction but as well as dietary intake of natural products with antioxidant and anti-inflammatory properties. Table 1 includes major features of immune alterations in

obese adults. One of the key points I want to highlight from the table are the roles of M1 macrophages and Interleukin-6 (IL-6). Obesity associated macrophages in VAT are M1 or classically activated macrophages that secrete IL-6, proteins that have been found to be associated with an increased risk of developing type 2 diabetes. On the other hand, in lean individuals, VAT are M2 meaning macrophages are alternatively active and secrete IL-10 which exert anti-inflammatory activities. IL-10 are important because they inhibit the production of pro-inflammatory cytokine, cytotoxicity, and proliferation of T cells. The other key point I want to highlight are the levels of T regulatory cells and T helper cells (Th) in the body. In obese mice, VAT contains higher number of T helper cells (Th). Th1 cells produce interferon (IFN)- γ in vitro which in turn polarizes M1 macrophages. Obese mice that lack IFN- γ expression or T-cell receptor beta-deficient mice are more protected against inflammatory cell infiltration of VAT. T regulatory cells are decreased in both obese mice and humans, which can lead to increased insulin levels and reduced insulin receptor signaling. Data suggests that the anti-inflammatory role of T regulatory cells via release of IL-10 suppresses obesity induced inflammation. In other words, we need T regulatory cells to help maintain healthy levels of obesity-associated macrophages and lean ones.

Table 1. Alterations of innate and adaptive immunity in human obesity (Magrone and Jirillo, 2015).

VAT tissue produces pro-inflammatory cytokines, which are responsible for insulin resistance (16, 19)

The association between C-reactive protein, IL-6, and the risk of developing type 2 diabetes has been documented (21)

M1 macrophages with an inflammatory phenotype have been found in obese people VAT (22, 23)

T regulatory cells are decreased in human obesity (31, 32)

Th17 cells are increased in obese humans (34–36)

CD8+ cells express high levels of the integrin CD11a, which promotes their infiltration of CD8+ into VAT (43)

B cells into VAT provoke insulin resistance, modulating T cells and producing immunoglobulin gG, which account for insulin resistance (44)

Magrone and Jirillo (2015) also found an association between diet and low-grade inflammation which are determined by the ratio between IL-17 and IL-10. As discussed above, IL-10 is a helpful cytokine to have because it can prevent cell proliferation. IL-17, on the other hand, has been associated with pathogenesis of multiple autoimmune diseases such as rheumatoid arthritis and multiple sclerosis. The study found that normal weight children who followed diet and physical activity recommendations exhibited a reduction of BMI, increase in IL-10 salivary levels, and decrease in IL-17 salivary levels. Normal weight children that did not attend to the dietary recommendations and did not practice physical activity noticed an increase in BMI and IL-17 salivary levels while IL-10 salivary levels decreased. Interleukins are a group of cytokines which are a type of proteins that are important in cell signaling. An obese individual will have less helpful interleukins, like IL-10, and more of the negative ones, such as IL-17, that are harmful to the body. The imbalance of helpful and harmful interleukins can put an individual more at risk to various health problems.

Physical activity and the gut

Daily exercise can positively affect a child's gut microbiota composition. The meta-analysis conducted by Rinninella et al. (2019) discovered that exercise frequency is associated with an increased gut microbial diversity in young children and adolescents. The impact physical activity can have on the gut was further supported by Pederson and Febbraio (2012) who focused on the regulatory role of the skeletal muscle. Recently, the role of gut bacteria in bone health and disease has received more significant attention especially how the gut microbiome impacts the skeletal system. The contracting skeletal muscle mediates metabolic and physiologic responses in other organs that are not mediated via the nervous system. Therefore, the skeletal muscle must be able to communicate with other organs via humoral factors, which are released during physical activity into the circulation. Since the skeletal muscle plays such a crucial role in our body's processes, it is considered a secretory organ. Muscles produce and release myokines which work in a hormone-like fashion to exert specific endocrine effects on other

organs in the body. Proteins that are produced by the skeletal muscle but are not released into circulation could work via paracrine and autocrine mechanism, by influencing the signaling pathways within muscles; therefore, myokines can be involved in mediating the health benefits of exercise (Pederson and Febbrario, 2012). Myokines are cytokines that are synthesized and released by myocytes in muscle tissue during muscular contractions (Lee and Jun, 2019). Myokines are believed to act directly on the skeletal muscle to improve its energy metabolism during contraction thus after a bout of exercise there is a higher circulation of various myokines such as IL-6 (Garneau et al., 2020). Myokines are thought to be involved in mediating the multiple health benefits of exercise because they are not only involved in regulating skeletal muscle growth but are also involved in the maintenance of metabolic homeostasis and in the modulation of adipose tissue function and mass. Several pieces of evidence demonstrate that obesity is linked to myokine expression. Physical inactivity or muscle disuse potentially leads to an altered or impaired myokine response and/or resistance to the effects of myokines which explains how lack of physical activity can increase one's risk of cardiovascular diseases, type 2 diabetes, cancer, and osteoporosis (Pederson and Febbrario, 2012).

Magrone and Jirillo (2015) previously stated that obesity associated macrophages secrete IL-6, which are proteins linked to obesity. Pederson and Febbraio (2012) further highlighted these findings by reporting a negative association between physical activity and resting plasma IL-6 levels. The more physical activity the lower the basal plasma IL-6 level and high basal plasma levels of IL-6 are associated with physical inactivity and metabolic syndrome. Pederson and Febbraio (2012) also stressed that physical inactivity and muscle disuse lead to loss of muscle mass and accumulation of VAT and consequently to the activation of a network of inflammatory pathways that promote the development of insulin resistance. They concluded that because proteins produced by the skeletal muscle are dependent upon contraction, therefore physical inactivity most likely leads to an altered myokine response. The mechanism behind the distorted response could provide information about the association between sedentary behavior and chronic diseases.

The relationship between physical fitness and academic achievement

Physical activity, one of the cornerstones of obesity management, is not only beneficial for gut diversity but it has also been linked to aspects of mental developments. Several studies have investigated the relationship between academic performance and physical activity. The state of California recognizes that physical education (PE) contributes significantly to the well-being of students and PE is an integral part of their educational experience. High quality physical education instruction contributes to good health, develops fundamental and advanced motor skills, improves student's self-confidence, and provides opportunities for increased level of physical fitness that are associated with high academic achievement (California Department of Education, 2006: v). Physical fitness is defined as the state and wellbeing in which an individual has the ability to perform aspects of sports and daily activities. Figure 1 shows the value PE and its effects on long-term health based on interviews conducted in 2010. Children who had PE in school were 2.5 times more likely to continue an active lifestyle into adulthood (California Department of Education, 2006).

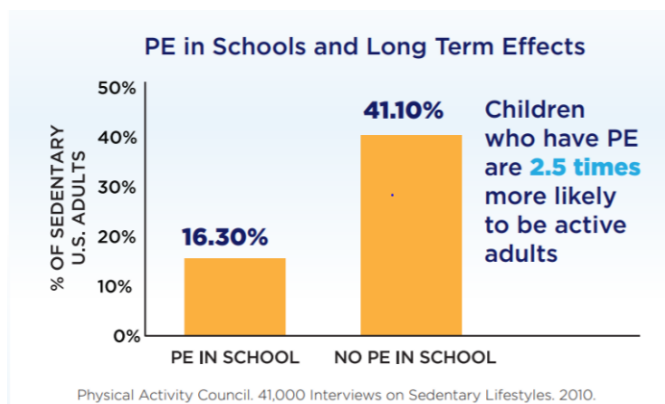


Figure 1. PE in school and its long-term effects (California Department of Education, 2006).

The American National Resource Center and studies conducted by Castelli et al. (2007) and Chomitz et al.(2009) have concluded that there is a positive relationship between test scores and fitness level (Figure 2). When considering various variables including age, sex, school characteristics (school effectiveness) and poverty index, children who had higher levels of physical fitness were still more likely

to have higher scores in reading and math, regardless of the variables. Castelli et al. (2007) found that specifically aerobic fitness was positively associated with total academic, reading, and mathematics achievement while BMI was negatively associated. However, muscle strength and flexibility fitness were observed to be unrelated to test performance. Greater aerobic fitness has also been associated with neurocognitive functions. Studies have found that higher fit children exhibit a more effective neuroelectric profile than lower fit children on a stimulus discrimination task. The high fit children also performed better in behavioral measures of reaction time and response accuracy, a definitive sign that fitness can positively influence working memory and cognitive function.

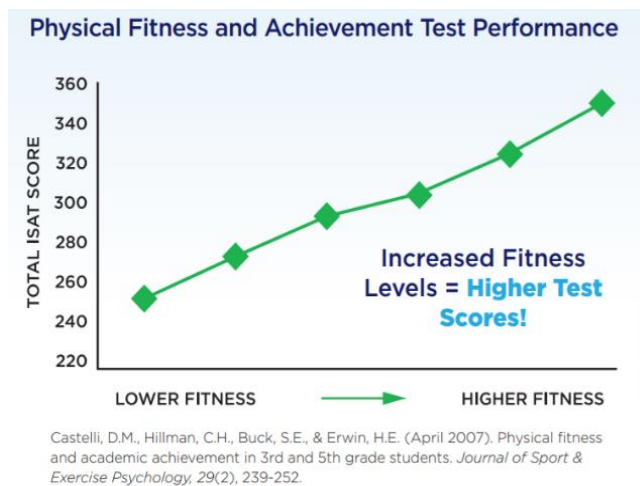


Figure 2. Physical fitness and academic achievement (Castelli, 2007).

One other important aspect to consider is the amount of classroom-based physical activity, which involves any type of physical activity in the classroom that lasts from one to five minutes as a method to recharge the brain and increase focus. Using a meta-analysis and systematic review, Watson et al. (2017) found that classroom-based physical activity had a positive effect on improving on-task and reducing off-task behavior (standardized mean difference = 0.60). Improved on-task behavior led to increased academic achievement (standardized mean difference = 1.03), however, there was no effect found for cognitive function (standardized mean difference = 0.33). Breaks as short as ten minutes significantly improved on-task classroom behavior. In class activity time can be a crucial tool especially if the school is not meeting

the mandated minutes of PE instruction or they do not have enough time in the day to let their students get away from their desks. This study supports the idea that PE is not only about improving cognitive function and physical health, but it also enhances behaviors exemplified in the classroom. They can learn better and feel more engaged with lesson material if there is allotted time to stand up and move around. Figure 3 demonstrates how important it is for children to walk around before engaging in academic material. The brain activity is much higher after a twenty-minute walk in comparison to a brain after sitting quietly for the same amount of time (Hillman, 2009).

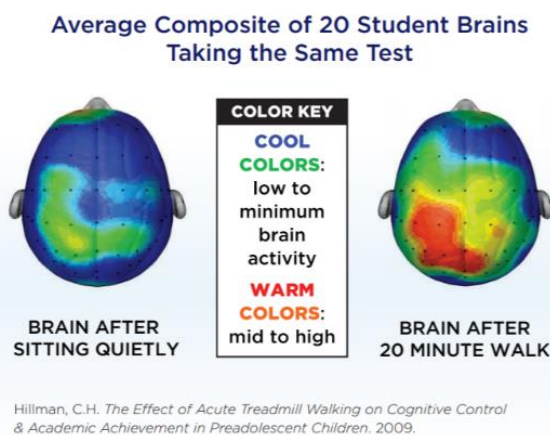


Figure 3. Brain activity in students (Hillman, 2009).

Conclusion

Since there are many factors that contribute to the development of obesity, it is important to understand the fundamental mechanisms and biological basis of this chronic disease. The human body is an intricate structure that contains millions of human and microbial cells and made up of various tissues and organs. There is still ongoing research to investigate how cells, proteins, and tissues interact and the roles they play in bodily processes. However, it is widely acknowledged in the scientific and clinical community that excess fat increases the risk of developing cardiovascular disease, cancer, sleep apnea, and other illnesses. Experts believe that VAT causes inflammation which in turn wraps around our vital

organs and affects certain processes in our body. This includes how our body manages hormones, like insulin and estrogen. The composition of the gut microbiota is also very telling of the risk for developing any health problems. Many of the studies mentioned above looked at different aspects of the gut microbiome and concluded that obesity or excess fat affects the diversity of bacteria in one's stomach. Encouraging children to engage in physical activity can have a long-term impact on their overall health. Studies have shown that high quality physical education instruction contributes to good health and helps build fundamental and advanced motor skills. By being active, children have better brain activity thus greater academic performance. Overall, focusing on the role physical activity and nutrition play in decreasing risk of developing obesity can help the public maintain a healthy lifestyle.

Chapter 2: Theory of Obesity

The obesity epidemic is one of the most difficult public health issues our society has faced due to its complexity, which involves both biological and social factors. The health problems mentioned in Chapter 1 are alarming and an even bigger reason as to why health policies and interventions should address this issue. The way obesity is framed in the United States often places the blame on individual's choices and habits and as a result diverts attention from other contributing factors, including food production and distribution and access to exercise spaces. Given the complexity of causes of obesity, policies should focus on how food production, food consumption, physiology, social psychology, individual psychology, individual physical activity, and physical environment interact with one another. One key site of intervention are schools because they have a huge impact on a child's wellbeing and the behaviors they adopt. In particular, acknowledging and understanding the social inequities that persist in school environments can open doors to addressing the childhood obesity epidemic and reducing risk for future generations.

Framework of obesity and who is to blame

The United States' current approach to educating the public about childhood obesity and its causes involves alluding to the fact that it is the individual's fault. For children, the blame usually falls onto the parent(s) because they are responsible for what food is served at the table and what eating behaviors they encourage and teach. In the United States, obesity is associated with the "stigma of gluttony, immorality, and loss of control, resulting in social discrimination for many obese people, particularly in the workplace and health care settings" (Moffat, 2010: 8). Rather than focusing on the individual-blaming model, it is more productive to acknowledge the issues from a holistic viewpoint. In 2007, obesity researchers from the Foresight Program developed the obesity system map to outline and understand the wide range of behavioral and societal factors that combine to contribute to the causes of obesity (Figure 4). The researchers used an approach that focused on energy-in and energy-out to identify and describe the

drivers of obesity. The resulting map contains 108 variables that drive obesity and are connected by 300 links. Each variable is categorized into seven thematic clusters including food production, food consumption, physiology, social psychology, individual psychology, individual physical activity, and physical activity environment (McGlashan et al., 2018). Finegood et al. (2010) collapsed the Foresight map into the seven clusters as an attempt to reduce the visual burden of the diagram while maintaining the utility of it. The seven categories represent the frequency of relationships both within and between clusters. One interesting aspect to note about the Foresight diagram is the fact that the school environment was not included. This is surprising because school environments tend to be an important source of food and exercise and support healthy lifestyle behaviors that are effective in preventing childhood obesity (McGlashan et al., 2018).

Foresight

Obesity System Map

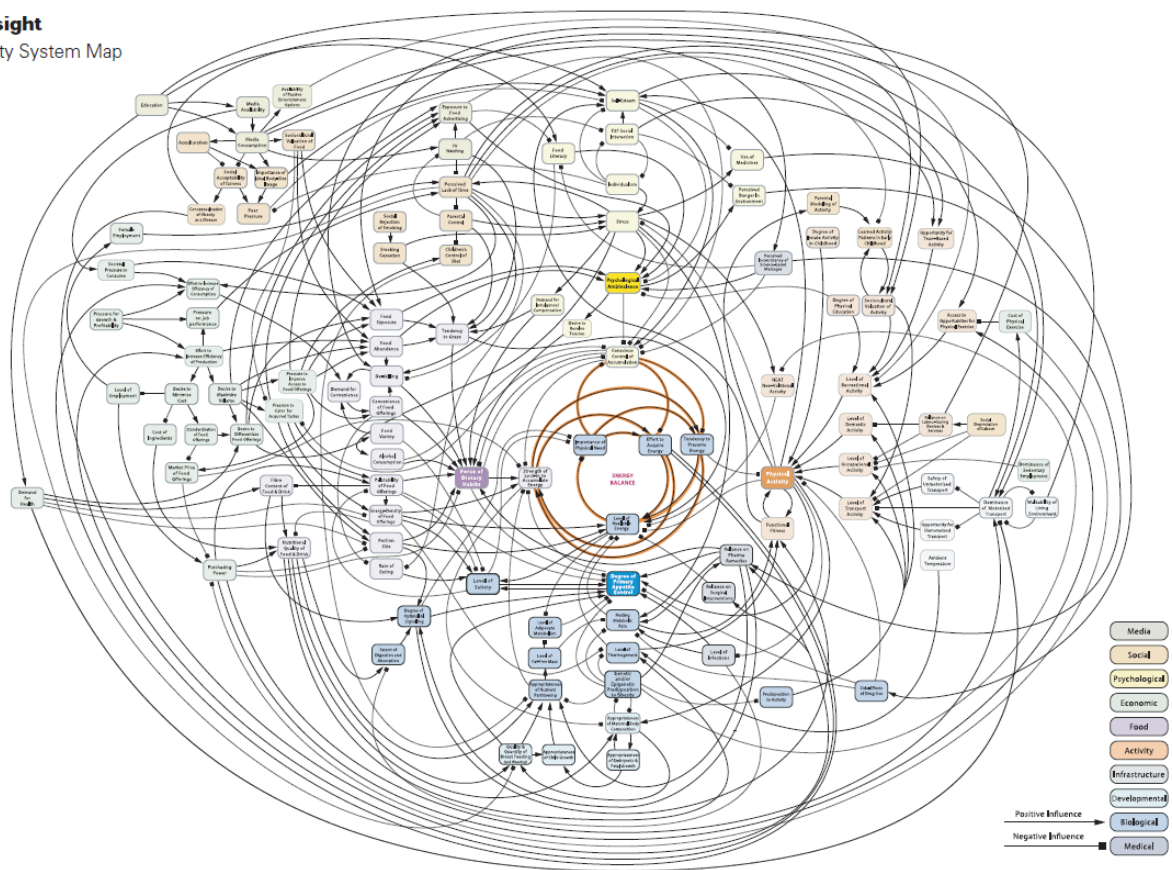


Figure 4. The Foresight Obesity Systems Map - the Expansive Version (Foresight Program, U.K. Government Offices of Science).

While there are many complex factors contributing to obesity, one of the main elements is structural inequality. It is more informative to focus on the more overlooked structural aspect of social inequality which is a key factor that schools can potentially address. Socioeconomic status (SES), the social standing of an individual measured by income, education, and occupation, is a contributing factor to the obesity rates in the U.S. Hedwig Lee argues that social inequality is linked to obesity in the United States. Obesity has become a national public health concern because it is related to a number of negative health, social, psychological, and economic outcomes. Racial and ethnic minorities and populations with the least education and highest poverty rates bear the largest burden of obesity. In addition, disparities in obesity rates tend to be gendered, with women experiencing the largest disparities in obesity by income, education, and race and ethnicity (Lee, 2011: 215). It is important to understand that the prevalence of obesity depends on age, race, and class. As Lee (2011) writes, “For example, the prevalence obesity is higher among females (35.5%) versus males (32.2%) in adulthood (ages 20 and older); but the prevalence of obesity is lower among females (15.9%) versus males (17.8%) in childhood/adolescence (ages 2–19)” (Lee, 2011: 216). Among children and adolescents (ages 2–19), 20.0% of non-Hispanic Blacks are obese compared to 20.8% of Mexican Americans and 15.3% of non-Hispanic Whites. These statistics highlight that vulnerable populations, such as women, people of color, and low-income individuals are often the ones experiencing high rates of obesity because of the lack of support of access to resources to improve their health.

Low SES populations suffer the most because they live in environments that make them vulnerable – for example, because they live in a food desert or they cannot engage in physical activities due to limited green spaces. Their lack of access to affordable nutritious foods, which may lead to obesity, is a consequence of structural violence. Structural violence, a term coined by Johan Galtung and by liberation theologians in the 1960s, describes social structures – economic, political, legal, religious, and cultural – that indirectly impose harm on individuals, groups, and societies and prevent them from reaching their full potential (Farmer, 2006; Kent, 2006). Paul Farmer further argues that structural

violence is a major determinant of the distribution and outcome of disease. In developing countries, victims of structural violence are often individuals living in poverty and are most vulnerable to disease (Farmer 2006). Schewebel and Christie's (2001) study on children in developing and developed countries, found that the cruelties of structural violence, such as lack of food and education, are often subtle, unspoken, and unrecognized which can lead to these cruelties to be normalized. Millions of children die from malnutrition every year not because of a shortage of food but due to its unequal distribution. Structural violence has long-lasting consequences on their intellectual, social and emotional development (Schewebel and Christie 2001:1). The role of social inequalities, as they manifest in the form of structural violence will become clearer later on in this chapter. Specifically, I describe how it impacts and increases the risk of obesity in various communities, such as those living in food deserts. Race, class, and gender are factors to take into account when examining how social inequalities inhibit vulnerable populations.

The effects of lack of access to nutritious foods

Moffat uses the term "toxic environment" to describe areas in which affordable food is processed inexpensively with high density and low in nutrients and the mode of transportation is most commonly automobiles as a result of poor urban planning (Moffat, 2010: 6). The concept of toxic environments shows the geography and socio-economic inequality as more than individual choice and as contributing to a high risk of obesity. It also highlights that people's choices are limited and constrained. Food deserts, a terminology denoting low-income areas with limited food access, is an aspect of toxic environments because children being raised in these areas often end up eating inexpensive, convenient, high-density, and low nutrient food because it is what they can afford and access given their situation and location. Access to food is a major factor in whether someone is at a high risk for developing obesity. Alviola et al. (2012) used panel data set from 2007 to 2009 on the state of Arkansas to identify and determine the effects of food deserts on school district obesity rates. They describe how individuals living in food deserts have a high risk of developing chronic diseases such as diabetes, cancer and heart disease because

“they face high cost, low quality, and limited food choices” (Alviola et al., 2012: 107). In addition, food deserts pose major barriers for individuals with chronic health conditions to find nourishments that meet the required dietary restrictions. Even when controlling for education, residents of non-food deserts consume more nutritious foods than those living in food desert areas. Their findings therefore suggest that food deserts diminish the otherwise positive correlation between education and healthy behaviors.

While less focused on food deserts, Yates-Doerr’s study of nutrition in Guatemala also highlights the correlation between socio-economic status and obesity. She disproves dominant development narratives that explain the rise in overeating and unhealthy habits as a result of industrialization. Rather, in environments where there is a lack of affordable nutritious foods, people will consume high quantities of macronutrients (lipids, proteins, and carbohydrates) while still “consuming insufficient amounts of micronutrients (vitamins and minerals), resulting in the simultaneous prevalence of over- and undernutrition” (Yates-Doerr, 2015:44). Yates-Doerr uses the double-burden theory to argue that obesity is associated with malnourishment. The double-burden theory explains that the body ingests enough food for energetic needs, but it is often lacking the various nutrients needed for adequate bodily function, resulting in negative health outcomes.

Lee echoes Yates-Doerr’s argument by demonstrating how food insecurity and poverty are related: “not all poor individuals are food insecure and not all food insecure individuals are poor, but both groups face unique, and sometimes related, hardships” (Lee, 2011: 221). Lee came to this conclusion based on the findings of a study conducted by Ribar and Hamrick (2003). Ribar and Hamrick drew data for empirical analyses from the 1993 panel of Survey of Income and Program Participation (SIPP) and the follow-on Survey of Program Dynamics to examine the persistence in food insufficiency and poverty in the U.S. SIPP was conducted by the Census Bureau in which they collected data every four months between 1993 and 1995. They found that poverty and/or food insufficiency were indicators of economic hardship. Based on this study, one can conclude that individuals living in food deserts are not necessarily impoverished but rather malnourished due to lack of access to produce. When money is running low,

individuals will often restrict their food consumption and binge on energy-dense food to satiate their hunger. This type of eating is stress-induced, and this cycle of food restriction and overconsumption may lead to weight gain, consequently, increasing their risk of obesity (Lee, 2011: 221).

Low-income families may also have less time to cook nutritious meals, especially if they work multiple minimum-wage jobs; these conditions may also be exacerbated by changing family support structures. For example, Yates-Doerr study demonstrates changing social conditions, including the architectural changes in Guatemalan homes. She provides the example of how in the past, multiple generations would get together and share cooking chores in one kitchen for all their family members. Today, everyone has their own kitchen, so women have to independently cook for their own family. One woman confessed that it is much harder to prepare food and cook by herself for a smaller family. Now as the sole provider, it is much simpler to rely on pre-prepared ingredients rather than going through the burden of going to the store, purchasing all the ingredients, and preparing the meal from scratch. (Yates-Doerr, 2015: 33). The change in social condition driven by an architectural shift that causes people to adjust to their new life set up is another driver of obesity. One can no longer rely on the collective efforts of the extended family under one roof to provide well-balanced, nourishing meals. As a result, the reliance on easy, convenient, inexpensive ingredients and/or processed food become the new staple of the low socioeconomic families.

Food production, distribution, and marketing also play a central role in the social structures that contribute to obesity. Currently, companies are deploying marketing tools and promotional efforts to sell calorie loaded products to public health experts to rectify the harmful effects of the massive increase in consumption of these foods. In doing so, the food industry plays a central role in making the problem worse. The government's budget set aside for health promotion cannot nearly match the massive amount of money the food industry has dedicated for their marketing tools. As Emilia Sanabria writes, “the battle may not just be lost but in fact unwinnable” (Sanabria, 2016: 141). In fact, unhealthy commodities actively promoted by private entities are major drivers of global noncommunicable disease epidemics.

Moodie and colleagues (2013) introduce the term “industrial epidemic” to refer to the spread of diseases

caused by corporate disease vectors. Public-private partnerships directly influence and control the development of public health policies. These partnerships drive the market of unhealthy commodities which in return drive global noncommunicable disease epidemics intentionally and unintentionally. Today, public health officials have put more effort into analyzing the effects of corporate behavior on health (Sanabria, 2016: 149). Given the current situation, one of the options to reduce the burden of this epidemic is not so much about addressing obesity directly but rather addressing the ability to successfully implement an effective intervention that forces the food industry to alter their behavior.

Structural lack of physical access and the stress response

As previously discussed, toxic environments expose people to psychosocial, environmental, and biomedical risk factors such as the low availability of resources, poor working and living conditions, as well as lack of access to proper nutrition and medical services (Lee, 2011:217). The toxic exposure impacts SES which in turn structures one's life in ways that impact one's health. In addition to access to nutritious foods, another major aspect of toxic environments is urban planning, which constrains access to exercise spaces. Lee argues that housing policies and real estate practices commonly cause poor/ethnic minority individuals to live in economically and racially segregated neighborhoods. Unsafe or poorly structured neighborhoods with no streetlights prevent people from walking, biking, or doing any meaningful exercises. Low-income neighborhoods have high levels of physical and social disorder, such as traffic, noise, high crime rates which can influence an individual's desire or ability to exercise outside (Lee, 2011:223). Moreover, several studies have indicated that less safe neighborhoods have a higher prevalence of maternal and childhood obesity, and children living in low-income neighborhoods in the United States have reduced access to facilities that they can engage in physical activities (Moffat, 2010:6).

We have seen that individuals in low income and under-resourced neighborhoods have limitations as to the type of health behaviors they can participate in. Moreover, individuals experiencing environmental

and economic constraints may influence their perception of their social rank and relative position according to their income, race, and gender. Someone's relative position within society can foster negative emotions such as social anxiety, shame, envy, frustration, worthlessness, and distrust. These emotions are internalized and can cause stress-inducing coping mechanisms such as smoking and overeating that can lead to poor health. Psychosocial interpretations indicate that high SES individuals who experience relative inequality can still experience poor health outcomes. Although everyone experiences chronic stress caused by family problems, job strain, or financial pressure, people with limited economic resources and social disadvantages face more stress over their lifetime. The biological effects of chronic stress accumulate more in low-income individuals. Lantz et al. (2005) found that income status, race, and education were big predictors of health status over time when controlling for stress and life event factors. For instance, low SES individuals may have to work multiple jobs to make ends meet including enough money to put food on the table. When the stress response is constant and inflammatory pathways are activated, fat accumulation increases which leads to VAT then in turn causes serious health problems (Isasi et al., 2015). Another example is that African American women have a significantly higher likelihood of experiencing premature labor as a result of the accumulation of stress induced by racial discrimination. It is commonly known that when the body is stressed it begins to pump excess hormones. At a certain level the hormones may trigger labor (Smith, *Unnatural Causes*). In summary, the toxic environment displayed in the form of stress and financial pressure is frequently an underestimated aspect that plays a crucial role in determining someone's risk of developing obesity.

The role of schools

As I have shown, children, as well as adults, are vulnerable to social and structural factors that contribute to the risk of obesity. School is one environment that can directly help curb childhood obesity, not only because it instills healthy habits at an early age, but also because it is a key source of nutritious food and exercise for those who might not have access to it otherwise. As of 2010, only 2% of school-

aged children were meeting the Food Guide Pyramid's recommendations for the five major food groups, fruits, vegetables, proteins, grains, and dairy (Poppendieck, 2010:11). That means one child in six consumes a diet that meets none of the recommendations. Schools are a great starting point for health interventions for two reasons. First, children spend at least 180 days of the year and most of their day at school. Second, policy-wise, it is easier to mandate schools what to do in terms of food service than to expect the nation's thirty-five million households with children to be able to provide this themselves (Poppendieck, 2010: 12). Young children are very impressionable, and the habits taught in school will impact their long-term behaviors. As Poppendieck said "teaching healthy eating and serving healthy food must go hand in hand" (12). In other words, it does not make sense to teach healthy eating if everything offered during lunch, breakfast, and the vending machines are all high in fat, sugar, and salt and lack all important nutrients such as fiber (Poppendieck, 2010). The same goes for exercise. If the curriculum is teaching children to be physically active, yet they are not given enough PE during the week, how will they achieve adequate energy expenditure? They will adopt poor physical activity habits thus affecting their long-term health. Many challenges remain. Not unlike individual's social structures, schools in low-income neighborhoods, food deserts, or toxic environments can negatively impact a child's wellbeing because they may not be able to access or afford nutritious foods, or because it is not safe for them to play in their neighborhood playground. Schools in these areas may lack the support or resources to provide opportunities to sustain the eating and physical activity patterns that researchers believe are needed in order to maintain a healthy body. In the next chapters, I will be discussing further how inequalities take shape within and between schools and the ways school officials and policymakers might address the structural issues.

Conclusion

Obesity is a biosocial phenomenon.

There is a general tendency in the United States to put blame on individuals who are considered obese or overweight as if it is in their control; it is often viewed as lack of self-control or self-esteem. Yet in reality, obesity is much more complicated, as displayed by the obesity world map (Figure 4); the host of factors to keep into consideration as the contributing culprits of the childhood obesity epidemic are food production, food consumption, physiology, social psychology, individual psychology, individual physical activity, and physical activity environment. All of these variables can be connected to structural violence or social inequalities, which in turn produce a harmful effect on an individual's living environment and standards. These factors also negatively impact their individual psychology as well as make them more prone to disease and illness due to marginalization. Social inequality is a broader term that can be used as the explanation for obesity rates in the United States. However, narrowing it to more specific origins such as food production and distribution and urban planning will help us better analyze and unravel the complex problems of obesity as these players add significantly to the current "epidemic" in the US and perpetuate the inequalities that make populations vulnerable.

Chapter 3: Programs and Policies of School Lunches and Physical Education

The federally-assisted National School Lunch Program's (NSLP) goal is to promote the health and wellbeing of children and to ensure they have access to nutritious meals that support healthy growth and development. Schools that participate in the program are expected to make adequate meals that are available to all students and provide free or reduced-price meals to children in low-income families. During the 2012-13 school year, the California public schools that participated in NSLP served more than 4.5 million meals each day or a total of 559 million lunches for the school year (Photos, 2014). California began making strides in improving nutritional quality of foods and beverages sold in schools before national standards were put into place. One of the notable measures that was passed by California state legislature in 2007 was the prohibition of serving trans-fat in school lunches. In 2011, the USDA proposed updated national standards that would require schools to serve more fruits, vegetables, and whole grains to limit the caloric and sodium levels and eliminate trans fats (Photos, 2014). While State laws may show progression towards higher quality school lunches, the mandate does not guarantee that schools are following through and executing plans to meet the standards. Today, lack of federal funding often drives schools to search for outside partnerships to meet the recommended dietary and physical activity guidelines for Americans. This was apparent through my own research at the three schools I observed, where there was a growing emphasis on the use of local and regional partnerships to fill in the nutritional and exercise gaps. In California, lack of certified PE teachers often forces school districts to use other means in making sure students are receiving the mandated 200 minutes of PE every 10 days of school. Schools across the state partner with private companies to bring extracurricular opportunities to their students. The partnerships schools make will vary based on support from the state and school district. The schools I observed in Northern and Southern California used tools and resources such as GoNoodle, a software application, and Harvest of the Month, a toolkit sponsored by the California Department of Public Health, to encourage healthy eating and physical activity. However, while these alliances were mostly successful, schools have varying budgets based on community fundraising, federal

funding, and grants, therefore impacting the types of partnerships they can foster to support their student body. Social inequalities exist between schools, in ways that influence the learning experience students receive as well as the quality of nutritious meals and physical education; as such, a reliance on outside partnerships to fill gaps means that some students will be able to obtain access to better nutrition and exercise programs than others.

History of the National School Lunch Program

Across California, schools vary in their approach of how to provide the resources for their students to engage in healthy behaviors. In the early twentieth century, nutrition science defined the concepts of what Americans needed to eat to maintain good health. As early as the 1920s, these principles of good nutrition, eating a balanced diet, were taught in a very practical location - the lunchrooms (Levine, 2008:11). In 1945, an amended school lunch bill was submitted to the Senate. The bill had two sections: Title I allocated \$100 million to the USDA annually to distribute surplus foods and match food purchase grants. Title II designated \$15 million to the U.S. Bureau of Education annually to distribute to state education authorities in order for them to establish, maintain, and operate school lunch programs as well as provide nutrition education (Ruis, 2017: 146). This bill proved to be a contentious issue between consumers and producers. In the end, Title II was removed from the bill including any reference to nutrition education and instead added language about forbidding federal involvement in education (Ruis, 2017: 154). To gain support for the school lunch bill, politicians and the media framed the bill as a measure of health insurance because it would furnish underprivileged and undernourished American children and help them develop into physically and mentally strong adults. The bill was also framed as a measure of national security, as interpreted in a political and military context, since the bill would help growing boys into productive men who in turn would join the army (Ruis, 2017:154). In 1946, President Harry Truman signed the National School Lunch Act into law, which officially founded the National School Lunch Program (NSLP). The NSLP was not able to reach a larger percentage of American

children and offer widely free lunches until the 1970s due to significant racial disparities. When the program first began, the government questioned whether the “program should target people who are economically needy,” meaning those who did not have enough to eat, or the nutritionally needy, people that had economic access to food but did not have a balanced diet (Levine, 2008: 11). To some degree, school lunch programs ended up addressing both concerns. It remains one of the most popular social welfare programs in the nation and currently operates in nearly all public schools and 94% of public and private schools combined (Photos, 2014). The NSLP “is the single most important source of nutrition for children from low-income families” (Levine, 2008: 2). That is why it is essential that funding for the NSLP stay intact to continually reassess the quality of lunches. In the 1960s and 70s, there were concerns of over funding. Government officials worried that they would not be able to provide a free lunch for every poor child. In order to fund the program, the government gave into commercializing children’s meals and allowing privatization. The U.S. government was concerned about being able to serve free and low-cost meals due to inconsistency of funding so they hoped that food corporations and businesses would bring down the costs. The government would allow privatization as long as that meant all children were fed without ensuring that meals would have a nutritionally positive impact on a child’s health (Levine, 2008: 3). Levine argues that school lunch politics demonstrate that fixing the nutritious qualities of lunches is more complicated than trying to convince children to eat extra fruits and vegetables. America cannot afford to lose the NSLP because millions of children rely on it for their daily food energy intake (Levine, 2008). Without school lunches, many American children would go hungry and many more would be undernourished (Levine, 2008:2). Ruis adds to Levine’s argument by stating that originally the NSLP was to safeguard the health and wellbeing of the nation’s children and encourage consumption of local agriculture and to focus on nutrition education rather than an agriculture protection measure (Ruis, 2017).

The most recent piece of food legislation is the Child Nutrition and WIC Reauthorization Act of 2004, in which Congress included a Wellness Policy Mandate in order to speed the process of enacting it

into law. The legislation requires school districts that receive federal funding for school lunches and breakfasts to form a committee and establish policies that will reform physical activity and the food served on campus. The committees should include administrators, parents, students, school food service personnel, the school board, and representatives of the public (Poppendieck, 2010: 6). Overall, the policy is supposed to bring new voices into the conversation about nutrition and wellness in public schools. In 2010, President Barack Obama signed into law the Healthy, Hunger-free Kids Act, which increased federal reimbursement rates for school meals by six cents per meal and authorized schools to provide free meals to all students based on community eligibility which means if at least 40% of the attending students qualify for free meals individually then the school is certified to provide free meals. The Act also indicates that institutions are required to periodically audit the nutritional content of meals served. Most importantly, it requires all food served on school grounds, including snacks dispensed in vending machines, to conform to the U.S. Department of Agriculture's nutrition standards (Ruis, 2017: 2-3).

In California, the NSLP is administered by the California Department of Education (CDE), Nutrition Services Division. The program operates on a reimbursement basis, with schools getting paid based on the number of meals served. Schools submit a monthly reimbursement claim in which the Department reviews and approves the claim, it is processed, and a check is issued which is usually received within four to six weeks after submitting the claim. Figure 5 explains the meal pattern requirements for the NSLP grades K-12 published on the California Department of Education's website. The table outlines the portions of each type of food that should be incorporated into school offered lunches. Figure 6 depicts the nutritional content of meals and how many calories students should be consuming during lunch.

Meal Pattern	Grades K-5	Grades K-8	Grades 6-8	Grades 9-12
Fruits (cups) ^b	2½ (½)	2½ (½)	2½ (½)	5 (1)
Vegetables (cups) ^b	3¾ (¾)	3¾ (¾)	3¾ (¾)	5 (1)
Dark Green ^c	½	½	½	½
Red/Orange ^c	¾	¾	¾	1¼
Beans and Peas (legumes) ^c	½	½	½	½
Starchy ^c	½	½	½	½
Other ^{c,d}	½	½	½	¾
Additional Vegetables to Reach Total ^e	1 ^e	1 ^e	1 ^e	1½ ^e
Grain Minimums (oz eq) ^f	8-9 (1)*	8-9 (1)*	8-10 (1)*	10-12 (2)*
Meats/Meat Alternate Minimums (oz eq)	8-10 (1)*	9-10 (1)*	9-10 (1)*	10-12 (2)*
Fluid Milk (Cups) ^g	5 (1)	5 (1)	5 (1)	5 (1)

Figure 5. Lunch Meal Patterns (Grades K-12): Amount of Food Per Week (Minimum Per Day)

(California Department of Education, 2019).

Meal Pattern	Grades K–5	Grades K–8	Grades 6–8	Grades 9–12
Min-max calories (kcal) ^h	550–650	600–650	600–700	750–850
Saturated Fat (% of calories) ^h	< 10	< 10	< 10	< 10
Sodium Target 1 (mg) ^{h,i}	≤ 1,230	≤ 1,230	≤ 1,360	≤ 1,420
Sodium Target 2 (mg) ^{h,i} (Effective SY 2024–25)	≤ 935	≤ 935	≤ 1,035	≤ 1,080
Trans Fat ^h	Nutrition label of manufacturer specifications must indicate zero grams of trans fat per serving	Nutrition label of manufacturer specifications must indicate zero grams of trans fat per serving	Nutrition label of manufacturer specifications must indicate zero grams of trans fat per serving	Nutrition label of manufacturer specifications must indicate zero grams of trans fat per serving

Figure 6. Lunch Meal Patterns for Grades K-12. Daily amount based on the average for a 5-day week (California Department of Education, 2019).

Challenges to the implementation of nutrition policies

A key aspect of the success and implementation of NSLP and other school lunch programs are the eating behaviors of children and the involvement of parents. In the three California schools where I conducted observations and interviews, there is a half and half split between children who purchase the school lunch and those that pack a lunch. All of the parents I spoke to choose to pack a lunch for their child because they want to feed them certain foods that may not be available through the meal program and/or because the children may be picky or allergic. My participants hypothesized that the other half of parents do not pack lunch because they work full-time or have multiple jobs which inhibits their ability to go to a grocery store and prepare a meal. Other reasons for packing a lunch are that some families do not qualify for free or reduced-priced meals thus purchasing lunch for their child every day would be

unaffordable. The NSLP and all public schools offer free or reduced-priced meals for those families that cannot afford to purchase a full priced meal or pack a lunch. Levine argues that the goal of the NSLP was to feed all American children nutritious foods; but today the focus is largely on feeding the hungry, and there is no guarantee it will be nutritious. Sadly, many low-income students rely on school lunches for their only daily proper meal. Due to privatization of school lunches, most of the food products served are high-density, low nutrient items such as chicken nuggets and fries, as they are cheap to make and distribute. Schools have the potential to be sites where children receive their daily nutrients, but schools often fail to reach that goal because of underfunding. The schools that receive additional funding from donations, grants, or parent fundraising can afford higher quality foods or a dietician to help improve the meals served.

History of physical education programs

Unlike the NSLP, a national exercise program or legislation does not exist. However, California is unique in that they mandate all schools to provide students in grades 1 through 6 a total of 200 minutes of PE by a qualified teacher per 10 school days and 400 minutes every 10 school days for students grades 7 through 10 (Lafleur et al., 2013). These minutes do not include the time spent for recess and before and after school breaks. To understand the current policies in place, it is important to understand how physical education came to be. Between WWI and WWII, sports, fitness, dance, and PE became an integral part of the educational program in the United States because the government wanted to make sure they had fit men to serve in the army. Dr. Hans Kraus, a specialist in physical medicine and has been called the “Father of Sport Medicine”, was concerned about the sedentary behavior of children and conducted a study in 1954 showing that American school children were less physically fit than a group of Italian and Austrian children. The study measured muscle strength and flexibility (*New York Times*, 1996). Dr. Kraus published the data and caught the attention of President Dwight D. Eisenhower. Dr. Kraus suggested, based on his findings, that schools have more time, equipment, and personnel for PE in order to ensure

American children have the opportunity to be physically fit. President Eisenhower saw the need for fit youth and signed Executive Order 10673 establishing the President's Council on Youth Fitness, consequently, declaring PE a valued core curriculum (Neese, 2012). When the Soviet Union launched Sputnik into space in 1957, the U.S. educational agenda shifted its focus on math and science and less time was devoted to PE. The trend continued in 1965; the curriculum placed more emphasis on academics. The Elementary and Secondary Education Act (ESEA) of 1965 was enacted by President Lyndon B. Johnson put more emphasis on academic achievement such as English, language arts, and math and excluded PE, art, and music (Neese, 2012). However, at the same time, researchers began looking into human and exercise physiology. When the Harvard Fatigue laboratory was established, becoming the foundation of all physiology laboratories in the U.S., fitness gained acceptance as a scientific research field. As a result, America institutionalized and integrated sports into the school system (Films Media Group, "History"). Sport medicine specialists and PE teachers advocated that they could teach kids important life skills such as work ethics, resilience, and character-building through physical activities and sports. In 2008, the HHS published the *Physical Activity Guidelines for Americans* (PAGA) which outlines methods to achieve the recommended 60 minutes of daily physical activity in schools, community, family home, and primary care. The overall goal was to use science-based research to promote a culture that supported activity for all people no matter age or ability. The PAGA encourages a culture of sports, dance, and other physical activities in schools and overall daily life. Schools echo the promotion of physical activity by providing opportunities for extracurricular programs on top of the allotted PE class time. Figure 7 depicts the five overarching standards that elementary and middle school students should reach. PE teachers follow these standards when preparing their curriculum. Based on my conversations with teachers at each school, the integration and goal of PE in the curriculum is mainly to teach their students motor skills rather than being able to play particular sports.

- Standard 1:** Students demonstrate the motor skills and movement patterns needed to perform a variety of physical activities.
- Standard 2:** Students demonstrate knowledge of movement concepts, principles, and strategies that apply to the learning and performance of physical activities.
- Standard 3:** Students assess and maintain a level of physical fitness to improve health and performance.
- Standard 4:** Students demonstrate knowledge of physical fitness concepts, principles, and strategies to improve health and performance.
- Standard 5:** Students demonstrate and utilize knowledge of psychological and sociological concepts, principles, and strategies that apply to the learning and performance of physical activity.

Figure 7. The five overarching model content standards for elementary and middle school students (California Department of Education, 2006).

Challenges to the implementation of physical education policies

Physical education (PE) and general education teachers use the PAGAs to guide the PE classes and ensure that students are meeting the fitness standards. PE can engrain many life skills - teamwork, sportsmanship, and leadership skills - while encouraging regular physical activity. However, some schools do not have the budget or resources to comply with the mandated minutes of PE. For example, Thompson et al. (2019) conducted a study to examine if PE teachers are equally available across California school districts and if the availability was associated with higher student cardiorespiratory fitness. Overall, they found 0.6 PE teachers per 500 students which is equivalent to 1 PE teacher for every 865 students in California school districts for students in grades K-5. Figure 8 depicts the geographic

distribution of PE teachers to students, and for the most part there is a better ratio along the coast, in Northern California, and in the Bay Area. California does not have a law mandating a certain PE teacher to student ratio, although Thompson et al. state that the 1 per 500 students is reasonable and valid. However, the present ratio suggests a PE teacher deficiency. Nationally, 8% of districts do not have a PE teacher whereas in California, half of districts do not have PE teachers on staff in elementary schools. As a solution, school districts may require that a general education teacher teach PE in addition to their academic classes. The study found that larger school districts with a higher percentage of African American and Latino students had fewer PE teachers per student.

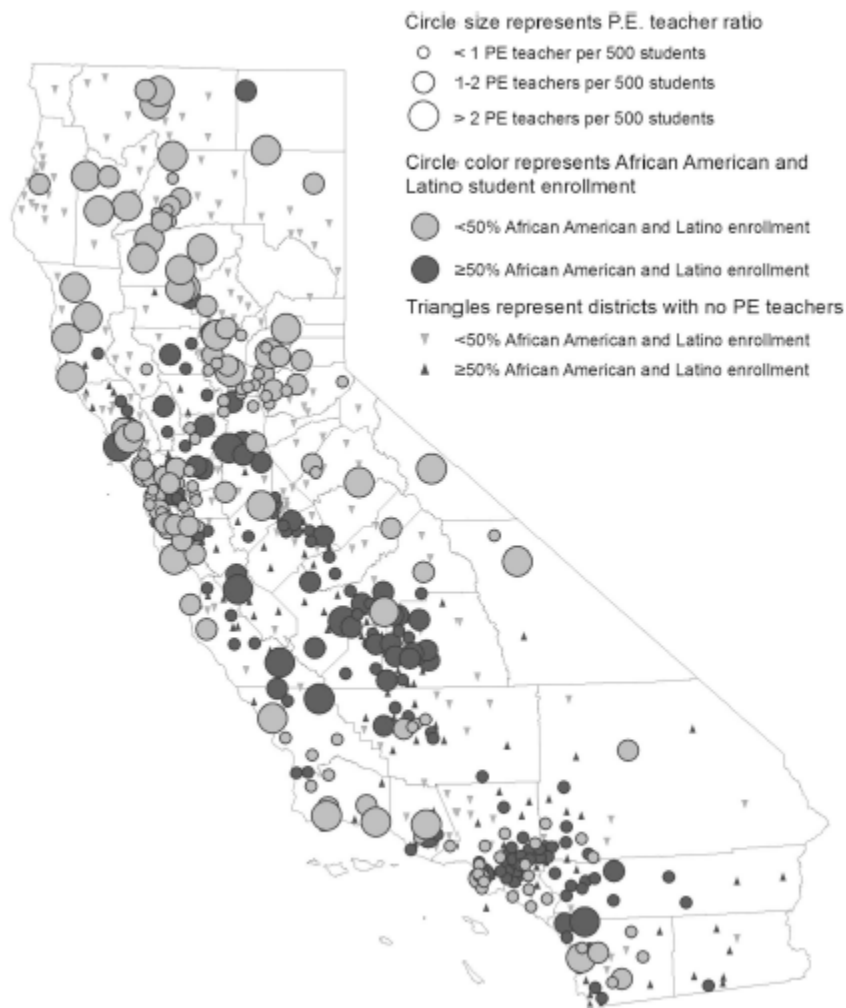


Figure 8. Geographic Distribution of PE teachers across California (Thompson et al. 2019).

Observed school's reliance on partnerships to meet students' needs

California public elementary schools rely on outside companies and partnerships to meet the educational and healthy needs of their students. At the three schools I observed, Pine, Bay, and Mountain Elementary use programs such as GoNoodle and Harvest of the Month to help their students excel in academic and physical achievements. The scheme of contracting companies to fill the gaps are not limited to nutrition and exercise programs. Other resources used by the institutions that echoed the same type of partnership include Expeditionary Learning (EL), a field based learning academic resource, iReady, a program to help teach math and reading, and STEAM, that take a new approach to how classrooms are run. These programs provide tools for children to excel in school that can have long-term effects on their overall wellbeing. Below I describe the various partnerships each school uses to fill the gaps.

Bay Elementary

As demonstrated by the study conducted by Thompson et al. (2019), there is a limited number of PE teachers in school districts across California. The PE teachers I spoke to at Bay said they get each class twice a week for 45 minutes at a time. They both have children at the school, and one works part-time while the other works full-time. Bay's specific case demonstrates that in small communities they rely on parent involvement, community members, as well as partnership programs like EL to meet the needs of the schools.

While visiting Bay Elementary I interviewed Mapes, a PE teacher who has a Masters in Recreation and has spent 20 years in outdoor leadership, running ropes, and leading backpacking trips. Mapes explains that she hopes to “instill in the kids this idea that it does not have to be soccer, we are going to play soccer in PE, so they know the basics. But soccer may not be your thing. Baseball may not be your thing. But the important part is trying out a bunch of different ways of moving your body until you find your thing”. I believe Mapes is echoing the standards from Figure 7 in that physical activity can

take whatever form the individual imagines it to take. It does not matter if the child is performing poorly in a sport that their peers may be excelling in, what matters is they are learning how fun and important being active is to their health and wellbeing. She also hopes to instill in her students that “moving your body is not only the physically healthy thing to do, you know, to keep your body strong, but it is also so good for your mental health”. She mentions the intangible impact PE can have on the students, such as teaching them about teamwork, sportsmanship, leadership skills, communication, and other non-sports related skills. Mapes’ beliefs are reflected in the education style of Bay Elementary because it is an Expeditionary Learning (EL) school is a concept of learning whereby students go out into the field and do field work and trips to explore. EL are school models based on the educational ideas of German educator Kurt Hahn, the founder of Outward Bound. EL, an independent organization that contracts with school districts, is based on outdoor adventure education and comes out of the principles of Outward Bound, an experiential and outdoor education program for youths and adults (*EL Learning*). The program takes their students’ learning and learning targets further through visiting special places and meeting experts in different fields. Mapes described it as putting a student in an environment so that the kids can “put their hands in there” and experience it for themselves. EL does not take away from recess or PE time, but involves doing one to two overnight trips in the fall and in the spring. Since Bay Elementary is in a rural environment it makes it easier to participate in EL and because they have the funding to do so. Other schools across California may not have the time and money to hire a certified staff to lead the trips and provide logistical resources to partake in an EL program.

Some schools capitalize on various opportunities for children to engage in physical activity that can build life-long healthy behaviors. GoNoodle is a software company that helps teachers and parents get their kids moving through interactive activities via videos. This company claims to provide a solution to the problems of the digital age, as younger and younger children are participating in more sedentary behavior. One quote from a parent on the company’s website speaks to the positive effects of exercising: “My little girl used to sit and play video games. Now she can exercise at the same time! This is just

amazing – you turned my child's life around” (*GoNoodle*, 2019). The application is free but there is an option to purchase a GoNoodle Plus account which includes unlimited access to more activities for \$10 a month. The activities are only playable on a desktop or laptop; thus, classrooms without either devices would be unable to experience the benefits of GoNoodle. The feedback on GoNoodle was positive because the teachers viewed the application as a useful tool for getting their students to refocus during lessons. They did not seem to mind using GoNoodle, but they refrained from using it too much, because studies have associated negative health problems with screen time usage. Since Bay Elementary is an EL school, their students are participating in fieldwork that keeps them active and outside of the classroom, so they do not need to resort as much to resources like GoNoodle.

Partnerships with nutritional programs are equally as popular those focused on physical exercise. First, we need to examine the programs that are available to school districts in California. Quality of nutrition programs is dependent on allocation of resources and school location. Bay Elementary and Pine Elementary are in very different parts of California, therefore the types of fresh produce available to each will vary due to climate differences. The California Department of Public Health (DPH) has a statewide program called Harvest of the Month, which aims to “increase access to fruits and vegetables (FV) through school meal program, farm-to-school programs, classroom, school gardens, and farmers’ markets.” The goal is to also increase consumer’s preference for FV, consumption of locally grown produce and connect them to their community, and participation in daily physical activity as well as understand why it is important for overall wellbeing (*Harvest*). Every month, the program helps bring in locally sourced produce, and the school has a tasting with all the students. For example, March’s Harvest of the Month featured fruit is dried fruit. Harvest of the Month signals a change in approach to making sure children are reaching the recommended nutritional and physical activity guidelines. Nutrition education can provide a foundation of knowledge for students to adopt healthy behaviors that can continue into adulthood. Harvest of the Month also places value on locally sourced produce rather than encouraging big processing food companies to influence the meals served at lunch.

I had the pleasure of speaking to Lisa Fligor, a Registered Dietician at Tahoe Forest Center for Health, who holds a Master's in Nutrition. She works alongside the Bay Elementary school district, which participates in Harvest of the Month. They “have parent volunteers that help, and I coordinate with getting the food and dropping it off. We give the schools all the materials as far as lesson plans, ideas, and recipes, but they go and take the produce and have kids taste it and teach them either a nutrition fact or science backed, something that's really cute and educational about [the produce]. I have parents emailing me or texting me the next day, ‘How did you get my kid to eat kale?’ It is because I am not their parent, they were with their peers, and I make good food”. Teaching children how to identify a nutritive food and strategies to incorporate it into a meal is just as important as making sure they are eating healthy. The behaviors they develop as children will more than likely continue into adulthood. Fligor makes an excellent point that the best way to teach children is in a classroom setting because they are with their peers, and thus, feel more inclined to engage with the activities especially ones that have long-term health benefits.

Fligor discussed the strategies she uses to engage with the surrounding community at Bay Elementary to teach them about nutrition. She teaches *Cooking Matters* courses, which is a program that targets parents and caregivers who have a limited food budget to help them provide healthy meals for their families. The campaign's goal is to help “end childhood hunger by inspiring families to make healthy, affordable food choices” (*Cooking Matters*). Fligor mostly teaches the classes at a high school in town and places more attention on teen parents. Her time and the materials are funded by a grant. The courses Fligor teaches are an example of the initiative of organizations nationwide, such as *Cooking Matters* which promotes and supports the population to make informed decisions about healthy options especially in communities that lack education about food skills and resources. Schools that allow space for Fligor to teach her classes will evidently provide opportunities for their students to further succeed. However, not all schools have the luxury to access *Cooking Matters*. The accessibility of these courses and resources further establishes inequalities within schools specifically among children. If all students were given the

same opportunity to take *Cooking Matters*, then the burden would not be placed on the families to independently meet the nutrition standards. But unfortunately, inequalities exist.

Pine Elementary

Pine Elementary partners with companies such as local volleyball or basketball leagues that are sponsored by local businesses to bring extracurricular activities opportunities to their students. It is unclear what the partnership costs for the school and families or whether the programs offer reduced prices for low-income students. Based on my conversations with teachers and parents, it varies on who participates in school-offered extracurriculars, non-school affiliated programs, and who do not participate at all. Across California and the nation, a student's income status and school location will impact their ability to participate in extracurricular programs, thereby perpetuating health inequalities that carry into adulthood.

Schools primarily rely on outside companies to sponsor extracurricular activities offered after school. However, at Pine Elementary they rely on teachers to fill the gaps which I will further discuss in chapter 4. There were a couple more programs that Pine used to positively impact their student's wellbeing. Like Bay Elementary, Pine participated in the Harvest of the Month toolkit, but it was not as widely established and implemented as in Bay Elementary. Teachers were asked to use the Harvest of the Month toolkits in their classroom on top of their already busy classroom schedule. There appeared to be no support from the school district in guiding schools with implementing the toolkit thus the job fell on general education teachers. The teachers I spoke to stated that it was a great idea but thought it had been poorly executed by the administration. Another application used by Pine Elementary was GoNoodle. Every single teacher I spoke to had brought it up in a positive context. They said they were happy to use the application as long as the students were happy, and it encouraged happy and positive vibes within the classroom. Hollers, a third-grade teacher, described GoNoodle as a mindful activity that gets the students

to slow down and refocus. She mostly uses it on rainy days when her students cannot go outside for recess or PE. Hollers explained that GoNoodle is very inclusive because even if her students cannot follow along with the video perfectly, they are still moving along and having fun. Hollers will watch and follow along in the back of the classroom to encourage everyone to do it, her hope is to send a message to her students that if she can do it, they should be able to, too. I understood from Hollers' account that being inclusive towards all abilities is really important to her and especially for those students that do not get to practice the GoNoodle dances outside of the school setting. She explained how it was obvious to her which students had been practicing or not at home. However, the differences in household income status further defines the disparities in homes that can and cannot afford to let their children participate in movement dance videos outside of school. Nonetheless, when Hollers moves alongside her students, she makes a point to include every child no matter their income status. Being inclusive, she suggests, is the best way to encourage all children to participate.

Mountain Elementary

Bui, a parent at Mountain Elementary mentioned that outside company's partner with his daughter's school and offer extracurricular programs such as kickball or biology camp. He said that only about one-fourth of the students participate in these programs due to cost barriers, or because they prefer different programs that they found for themselves which makes the partnership less effective. Similar to the situations at Pine and Bay Elementary, the reliance on private organizations to fill the exercise gaps is problematic because it perpetuates inequalities between schools and students. At Mountain Elementary it is a bigger issue that not all of the students get to participate in after school activities because the children have limited PE class time. Bui recalls that his daughter has PE perhaps once a week and when she first started at this school, they did not even have a PE teacher. They only recently hired a PE teacher who is in charge of all grades. Bui did not mention the reasoning behind Mountain's recent hire and why it took them so long after the school's establishment to do so but it may be due to funding or the availability of

nearby PE teachers. The opportunities for students to be active are not limited to PE or extracurricular programs; they also exist in the classroom. The teachers at Mountain Elementary also use GoNoodle as a brain break activity. Bui had sat in one his daughter's class and noticed how much the kids loved the dance breaks and the teacher would even join in. He cautioned that "it depends on the teacher. My daughter's kindergarten teacher would always play the GoNoodle or Kidz Bop song and she would dance along to the video. Having the teacher move along with them made the kids more comfortable to do it. In prekindergarten, the teacher was not really into the dancing that much, and she did not participate. So, the kids were not as comfortable." Bui brings up an excellent point about teacher engagement and how they participate in activities with their students. Children adopt the behaviors they observe in adults, teachers, and parents. Thus, it is very important that teachers are encouraging and participating in the physical activities with their students and be a role model even though it is an extra burden placed on the teachers to figure out how to incorporate exercise in their classrooms.

Conclusion

While it is necessary and inevitable in our current system that public elementary schools depend on funding to maintain their programs, the variety of sources of funding, both public and private, creates an inadvertent inequality among schools, as each competes to fill their dire and immediate needs to support students socially, physically, and academically. The NSLP as a welfare program is providing its share of a child's daily dietary intake but, due to various circumstances, it does not always fulfill its goals of administering healthy meal plans. Privatization has become a seemingly reliable source of food contribution to the school system but in reality, most of the meals served by these private entities do not meet the *Dietary Guidelines for Americans*. Low-income families rely on school provided meals as the child's only proper meal; it is crucial to hold the NSLP accountable to provide healthy and nutritious foods. Today, that support is still minimal, therefore many schools still have to rely on partnerships with private companies to meet the standards. In my opinion and through my research, it is possible to meet the

nutritional and physical activity guidelines through accountable support from the federal government and school district if the guidelines and legislations are robust and comprehensive.

Chapter 4: Burdens on Individuals

In the previous chapter, I highlighted the reliance institutions build on outside organizations to provide the materials and opportunities for their students to achieve great academic and athletic accomplishments. However, with those partnerships also comes inequalities between institutions, as some are more well positioned than others to garner sponsorships and resources. Additionally, schools that have more support and engagement from the parent community tend to have a stronger relationship with these external organizations, allowing their students more opportunities to engage in activities to enhance their physical and mental development. In essence, these partnerships create disparities, not only among institutions, but also within them, as the burdens are placed on families, individuals, and teachers to meet the academic and health standards of students. Below I highlight examples from Bay Elementary, Pine Elementary, and Mountain Elementary schools. Each elementary school had its own set of challenges due to location or district funding yet the theme of inequalities within institutions was consistent.

Bay Elementary

Baines, a parent at Bay Elementary, says she chooses to pack lunches for her children because “all the students who get hot lunch at my school are all free or reduced lunch. They need that lunch. So, if I sign my kids up for hot lunch it would feel like [my kids] are taking away someone else’s [lunch]”. Feeling that she has the means to pack her own child’s lunch, Baines unselfishly chooses to not tap into the school’s finite lunch budget in hope of saving that portion for those who are truly in need. Baines highlights the fact that a majority of parents recognizes inequalities exist and some parents, unfortunately, do not have the capability to do something as mundane as making lunch for their children. This is the aspect where *Cooking Matters* and other similar campaigns can contribute to reduce the barriers to access healthy food and bridge the gap by helping financially strapped families. These campaigns do not solve the issue of parents' lack of time to prepare a school lunch the night before, but they can introduce healthy

eating habits and subsequently the families can take what they have learned and apply it to meals at home. Although this program addresses nutrition education, it still places the burden on the individual because it reinforces the idea that it is the family's responsibility to eat "healthy". All of the parents I spoke to at Bay Elementary were pleased by the nutritious meals offered by their child's school. The school's commitment to providing healthy lunches alleviates the parents' anxieties about how and what to feed their children while at school. Regrettably, one limitation to my findings is that I did not get a chance to speak to any families that rely on free or reduced priced meals for their children. Low income families may have different thoughts as to the quality of the breakfast and lunch being served, especially if they rely on it to provide a proper daily meal for their kids. The school district's website states that "all meals, foods, and beverages sold or served at schools meet or exceed state and federal requirements which are based on the USDA Dietary Guidelines. We provide all students with access to a variety of affordable and appealing foods that meet their health and nutrition needs." The website explains that food is locally sourced, and "organic ingredients [are used] whenever possible and we avoid highly processed foods." They use local providers such as Produce Plus, a delivery service that transports produce and perishables, to supply the food for the salad bars. Fresh bagels, offered at breakfast, are provided by a local sourdough company, and the milk is provided by a local foodservice distribution cooperative. Based on the school district's food and nutritive services information, they are committed to using fresh and locally sourced foods, but I was unable to confirm via observations to determine if they deliver on their pledge.

In the community at Bay Elementary, there is a recreational center that offers after-school programs that are available to all children. Classes range from ten dollars per class or, for example, swimming classes are \$40 for 6 weeks. The school district added a bus stop which allows students to go straight from school to the recreational center on their own. Adding a bus stop removes the burden for parents to pick up their children from school and drive and drop them off at the rec center. The school district does charge three dollars extra for this service. Hansen explained that since the school district has added the bus stop, her children can participate in more extracurricular activities. She highlighted that "the school

makes [participating in rec center classes] a possibility because as a working parent, I could not have. My daughter would not be doing dancing right now or swimming. It is just so easy, and it makes me feel great that they are doing something and not just in some after school program.” She also loved the fact that her children could make more friends from different schools by participating in classes at the recreational center. Hansen highlights how school districts do their best to support families to allow their children to engage in after school activities even if they are not the school offered programs. This example shows the school district is active in exploring various options to remove the burden on families to fill their children’s time with productive activities. Adding the extra bus stop alleviates at least one form of inequality which is the ability to physically drop their children off at an after-school activity location. This is a counterexample to some of the trends I found to demonstrate the steps schools can take to ease the burden on families.

Pine Elementary

At Pine Elementary, the kindergarten through 1st-grade teachers are required to teach PE while the 4th through 6th graders have certified PE teachers. It was never explained to me by the administration as to why only the older grades receive the expert training. It could be due to a variety of factors, for example, limited access to certified PE teachers in the school district, school funding, class size, or limited physical ability. Hollers, a 3rd-grade teacher who has been working at Pine for 32 years, remarked that because the upper grades have ten more students than the lower ones, that could be the reason for the difference in instruction. The lower grades receive PE three times a week for 35 minutes each, while the upper grades get 50 minutes twice a week. Currently, kindergarten through 3rd grades have about 24 students per class and 4th through 6th grade have about 35 students. One can see that the upper grades do have more students, but at the same time they are afforded an expert resource, while the lower grades teachers have to deal with teaching younger kids while designing their own PE curriculum and executing

the plan themselves without any guidance or assistance. Clearly the burden is shifted onto classroom teachers in this circumstance due to logistical and financial reasons.

Barnett, a 1st-grade teacher who has been teaching for two years, explained that right now she and other teachers are teaching kickball. She and the other three 1st-grade teachers got together and planned the PE class. All four classes separately watched a video on how to play kickball. The students practiced as a class first, then all 96 students were divided into teams and played against each other. The physical activity guidelines do not say that a child must be able to play a specific sport by a certain age, rather it describes the type of motor skill they need to be able to perform, such as being able to balance on one foot or throw and catch a ball. Barnett mentions so long as they meet those standards, the teachers are allowed to plan PE however they choose. She says one of her colleagues has a book from a previous training conference that has ideas on how to organize PE lessons. Barnett says she would rather use games she learned in her teaching program as well as the games she grew up playing in the elementary school she attended as a kid. It appears that the Pine Elementary school teachers have full autonomy as to how they plan their PE lessons so long as they meet the PAGA standards and they can use whatever resources are available to them. The 1st-graders get PE Tuesday, Wednesday, and Thursday for 35 minutes each day. On Tuesdays and Thursdays, they play a game and are learning a certain skill, and Wednesday they jog. Hollers says she likes to break up PE by first having 20 minutes of exercise and 30 minutes of a game. Each of the approaches and formats of PE class is different, but they succeed in teaching their students important motor skills.

Besides being tasked to plan PE classes, lower grade teachers also experience other types of burdens. Barnett explained to me that the nutrition specialist at Pine Elementary placed newsletters in the teachers' boxes twice or three times last year about a food of the month or fruit of the month. Having a nutrition specialist on campus suggests that the administration is focused on providing quality meals. The specialist's job is not only to make sure the lunches meet the dietary standards but also to get the students excited about eating fruit and vegetables. Barnett remembers one letter about apples outlined an example lesson and recipe. She was excited about teaching her students about apples, but then another newsletter

came with a different fruit and “I was like, oh, gosh, I don’t have time”. She thought the idea was “cool”, but it could have been better organized and implemented by the school administration. Having a school-wide focus on dissemination and education about nutritional value of fruits, for example, would not only emphasize the school’s commitment to healthy eating but also free up individual teachers’ time to concentrate on other aspects of teaching.

Pine Elementary does offer free and reduced-price lunches. On the morning of each school day, the teachers take lunch call, which means they tell the kitchen how many students in their class are purchasing the school-provided meal. All six teachers I spoke to at Pine said that on average four to five students in each class purchase lunch. However, they all had difficulty coming up with an average number because it fluctuates depending on the food being served that day. Since the lunch menus are available monthly, the parents know what days they prefer to pack or purchase lunch. On the pizza or chicken nugget days, all teachers remarked they would get as many as ten students purchasing lunch. Interestingly enough, families opt to purchase processed food because it is simple, and they know their children will eat it. Requiring schools to completely change their lunch program to exclude processed foods is more complicated than one might initially think, because one has to take into account what students are used to eating at home and what they enjoy eating at school. Processed foods are simple and cheap; therefore, families may opt to make that type of meal at home subsequently children who are picky eaters will prefer a processed food lunch.

Many students today are very involved in after-school activities. In Howard’s classroom, she has one student who does cheer every single day. Over a recent weekend, the student was in Las Vegas for a competition, and another weekend she will be in Texas for an additional competition and will miss three days of class. Hollers has another student who is very involved in soccer who also has participated in competitions on the weekends. Both of these students are involved in outside leagues, but Pine elementary also offers programs such as a chef’s academy, basketball, tennis, choir, and chess. “As the years have gone on, the after school [programs] have become huge. I have cut back on my homework because of it.” She supported her decision to cut back on the amount of homework she gives her students

with studies that claim that homework is not as effective as one thinks. Homework has been found “to not reinforce what they are learning, and it cuts into family time,” says Hollers. She gives them an activity that should take about 15 minutes and 20 minutes of reading per night. Although the cutback in homework is not a big deal to Hollers, her actions showcase how teachers are forced to change their teaching methods because the school cannot find another way to meet the needs of their students. The activities her students are involved with are through private organizations that are not partnered with the school. The after-school activities offered by the school may not meet the needs of the students thus families search for other programs.

Mountain Elementary

Understanding that not all public schools have the resources to afford a physical education teacher, the equipment to have a PE class, or the space to let children play thus producing the social inequalities highlighted by Lee (2011). Only recently did Mountain Elementary hire a PE teacher and schedule a PE class. Bui is concerned by the amount of PE classes the school schedules. “PE is only once a week. Either on a Wednesday or Friday, I forgot. I think they are more focused on academics than physical education or health. I wouldn’t mind them having more PE days and hiring more PE teachers that are more diverse in terms of different sports.” He mentioned that his daughter gets about 15 to 20 minutes of recess twice a day. Recess does not count towards the 200 minutes of required physical activity per 10 days of school. I learned that outside companies come into the school and offer extracurricular programs such as kickball or biology camp. Bui said that only about one-fourth of the students participate in these programs because it is \$200 for 8 weeks and it is only once a week. Bui highlights the difficulties some families may have providing opportunities for their children to participate in extracurriculars or after-school activities if they cannot afford the programs offered by the school or outside companies. The burden is placed on the family to meet the activity needs of the child rather than the school or school district to provide resources for families that may not be able to afford the program

costs. Some children are left to figure out how to spend their after-school time on their own such as going to the park with friends and having a pick-up soccer game or other kids may have to go home because there are no parks available in the vicinity of their home.

Mountain elementary offers breakfast and lunch; parents have the option to use the school website to choose meal options. The website seems very easy to navigate but from the parent's point of view, the options are limited. Children are picky, and every child has a different taste palate. For that reason, about 70% of parents at Heritage pack lunches rather than buy the school offered lunches. Bui falls into the 70%. "We pack her a lunch because we are more concerned about what she eats. And we know what her diets are and what she likes, compared to the lunches provided." When I inquired as to why he believes other parents also pack lunches for their kids, he explained that "parents are more concerned about what their kids eat. So, they have more confidence that their judgment is better than the school's judgment of what's better for their kids." It goes back to the Institute of Medicine's standards; they interpreted the scientific evidence one way, but these parents will see it differently because they know their kids better than anyone and feel confident about food to best feed their children. When I asked whether the school should be changing their menu, Bui reasoned that they should not because they cannot please everybody. There are so many kids and so many different cultures. There is no way they can cater to every parent's wishes. I think they do try to serve healthy food, based on the description that I read from their menu. They probably try but because there are so many people it's hard to find the right menu. If we did not have the ability to buy food and have time to pack food, then we would pay for her to have that lunch." He brings up the idea that some families have the resources to afford to spend the money and time on packed lunches. Many inequalities exist and persist in the school environment because not everyone can send a lunch with their child and they have to rely on school-provided meals. Parents working full time jobs are busy and thus may not have time to drive to the grocery store, purchase food, prepare lunch, and still have time to go home and spend time with their family. The parents may also struggle with allotting time to prepare dinner, due to these constraints it is easier to purchase the school offered lunches. Some

families are low-income and rely on the free or reduced-priced meals to make sure their children have a proper meal.

Conclusion

Institutions face challenges to meet academic and physical activity needs of students hence they turn to outside companies to provide what they cannot. The differences in opportunities offered to students by schools create inequalities not just between schools but within them. Instead of schools and school districts implementing programs that are equally available to all students, families and sometimes teachers are required to pick up the slack. At Bay Elementary, *Cooking Matters* was available but not accessible to all because some families may not have the time to take the class or they may have to drive to another school to attend it. Programs like *Cooking Matters* that exist in other school districts have the potential to bridge the gap in health education, but there is an issue of making sure all families have access to the lessons. The same goes for extracurricular activities which run through the school via private company or families independently seek activities for their children. The parents I interviewed were able to afford after school programs, such as lacrosse, soccer, and dance, but not all families have the same capability. In a household, a child may have responsibilities that restrict their engagement in extracurricular activities or because of financial reasons. At Bay Elementary, they provide logistical support by adding a bus stop at the recreational center, but the singular effort does not comprehensively resolve the inequalities that exist. I think it is a great first step in facilitating and encouraging families to get their children to stay active and promote a healthy lifestyle.

Institutions are also fostering positive health behaviors through the quality of school-provided meals. Based on access to resources, I think Bay and Pine Elementary are doing the best they can with the resources they have to supply a nutritious meal. Both schools also encourage their students to learn and get them excited about fruits and vegetables. At all three institutions I observed, the majority of parents packed lunch for their children because, according to the parents, the kids were picky eaters, and it was

less hassle for them to pack lunch. Interestingly, on days when the school serves chicken nuggets, then the parents will purchase the meal because they know their kids will eat it as if the kids' palate has been subjected to enjoy the taste of fast processed food. The option to buy or not buy lunch allows these parents full autonomy of what types of food their children are fed. On the other hand, the program allows some families to take advantage of the free or reduced-price meals to feed their kids due to financial reasons and/or time constraints. In these cases, these individuals do not have control over what their kids eat because the school lunch may be the only proper daily meal. For that reason, schools need to offer nutritious food options, because that is the only way for some children to reach their recommended daily vitamin, protein, or carbohydrate intake.

Other forms of inequalities are the role teachers have in a student's life. General education teachers have the responsibility to teach math, science, and language arts, which is a time-consuming job. At Pine Elementary school, I observed an administration that burdened its general education educators with more than only teaching the core subjects. The instructors must lecture their class about a food of the month. But what about the schools that do not have teachers that are as receptive to the idea of giving them an additional task on top of their already-packed lessons? The students who do have teachers willing or able to carve time in their class to teach them about the fruit of the month will have an advantage over their peers that did not have the same instructor. At Pine, the teachers had to prepare PE lessons, which seemed like a time-consuming undertaking, because, on top of planning their classroom lesson, they had to meet with their colleagues and design a PE class.

There are unequal burdens placed on teachers and families due to various factors which could be attributed by social inequities. The inequities create daunting challenges for public school administrators to provide an academically stimulating environment while balancing its offerings of ancillary resources and food options for the families. My research and interviews have been exceptionally informative and interesting; we learn much about the specific needs directly from teachers and parents that can be used as productive feedback for administrators and key decision makers to use as they propose tangible guidance for a more comprehensive nutritional and fitness plan of action, recognizing that there we cannot address

all of the issues but rather improve the current situation. In the next chapter, I propose three recommendations to address some of the issues.

Conclusion

Obesity is a complex issue and a biosocial phenomenon. From the physiological perspective, it is the result of an imbalance between food and beverage consumption (energy intake) and physical activity (energy expenditure). Weight gain occurs when energy intake is greater than energy expenditure (Lee, 2011). In 2003, the CDC reported that 60% of young people have too much fat in their diets, while less than 20% eat the recommended number of daily servings of fruits and vegetables (Moreno et al., 2003). The reason childhood obesity is a critical health problem to examine is because of the implications it can have on adulthood health. Obesity is associated with multiple morbidities including “type 2 diabetes, metabolic syndrome, hypertension, cardiovascular disease (CVD), high cholesterol, sleep apnea, asthma, osteoarthritis, certain types of cancer, and even death” (Lee, 2011: 215). Through research studies, scientists have demonstrated the ways in which food consumption and physical activity can impact an individual’s immune response and how the imbalance between the two can increase one’s risk of developing diseases later in life. The types of phytochemicals, vitamins and minerals, and fat intake can alter the gut microbiome which impacts bodily processes and weakens one’s natural defense capabilities. Other health effects include insulin resistance, which is a common occurrence that can lead to the inability to regulate blood sugar levels (Smolin and Grosvenor, 2016). Studies have also found that physical activity impacts myokine response which is important in regulating skeletal muscle growth and maintaining metabolic homeostasis (Pederson and Febrario, 2012). With regard to school performance, studies have demonstrated a correlation between the level of fitness and academic achievement. Students that engaged in more aerobic and anaerobic activities had high scores on tests, improved on-task behaviors, and overall cognitive function (California Department of Education, 2006: v; Castelli et al., 2007; Watson et al., 2017). The biological interplay of eating too much and exercising too little creates a chronic multifactorial disorder that requires more in-depth examination in order to curb this obesity epidemic. While obesity can be viewed as a biological issue there are other social aspects to keep in mind. Social structures, which include political, economic, and cultural, can directly or indirectly influence food

distribution and production or urban planning and subsequently perpetuate social inequalities that prevent individuals from reaching their peak health.

The bodily processes that are impacted by obesity or overweight provide a fundamental reason to examine the ways in which children learn and adopt healthy behaviors that can serve them well into adulthood. By having access to adequate nutrition and exercise at an early age, preferably before children reach puberty, then they have a reduced risk of developing morbidities (Bjerregaard et al., 2018). Various studies have pointed at schools as a key site of intervention because children spend most of their days at school. One point to keep in mind is that it is not enough to simply teach a child how to engage in healthy behaviors, because they may not have the resources at home or outside of school to fully practice what they have been taught. For example, explaining to a young child that they must eat a lot of vegetables, fruit, meat and avoid processed foods in order to maintain a healthy weight is a good first step. But at home, they may only have access to processed foods due to affordability or limited access and availability of local fresh produce (Lee, 2011; Sanabria, 2016; Yates-Doerr, 2015). Engaging in sports and staying active after school is not an option for every student. In some cases, a child may not have the money to take a bus to the local recreational center, the town does not have reliable public transportation, or the neighborhood is not safe or does not have green space to play in. The obstacles listed above are only some of the existing barriers that children across the nation face that inhibit their ability to practice the healthy behaviors taught in schools. Lee (2011) argues that obesity rates are much higher in communities that live in food deserts or areas with limited green space (Alviola IV et al., 2012; Lee, 2011). In other words, communities with limited access to nutritious foods and spaces to be physically active have higher rates of obesity and overweight. The vulnerable populations such as low-income, women of color, and minority communities often face the burden and experience higher rates of obesity and overweight. In these communities, structural barriers, more than individual habits, are the major contributing factors to the rise of obesity in the U.S.

A focus on these structural factors brings our attention to the role schools can play in reducing the prevalence of childhood obesity. For example, children who cannot get a proper meal at home will

depend on the meal offered at their institution; hence the importance of making sure the quality of food is the best it can be. A child's wellbeing is an even more important reason for school districts to avoid cutting corners when it comes to food services. California mandates that all public elementary schools allot 200 minutes of PE for every ten days of classes. Children who do not have access to green spaces or cannot afford the \$200 8-week soccer program will rely on PE class to get their recommended dose of exercise. School districts need to be stricter in mandating that the PE law is obeyed. However, we must recognize that it can cause additional strain on the school to ask them to provide so much for their students, especially if they do not have the means to do so. In the three elementary schools that were the basis of my study, I observed their reliance on outside partnerships with companies that brought extracurricular programs and staff to teach cooking lessons in order to encourage healthy eating. For example, Fligor, the dietician, was funded by grants to teach the *Cooking Matters* classes. If other schools had access to similar health professionals, it might help students to learn about good nutrition and ingredients, adopt healthy behaviors, and reduce their risk of developing health problems; these are lessons that would benefit them throughout their life.

Additionally, we must acknowledge that social inequalities exist within schools and among them, too. Placing the burden of obtaining adequate nutrition and exercise on individuals, families, and schools to fill the gaps perpetuates the inequalities even more by entitling those who have more economic resources at their disposal. Framing the blame away from these actors can steer us towards finding solutions and strengthening relationships between outside players. If outside programs such as Harvest of the Month begin working with the schools on their terms, then there will be more equal distribution of opportunities within the school for its students to reduce their risk of developing obesity. While this tactic can be beneficial within schools, it may not solve the inequalities among schools because every institution would have to garner the same partnership and funding to be equivalent. The reliance on private companies will create unequal services and it will give reason for the government to defund health, education, and food programs. Strengthening outside partnerships is only a short-term solution; on a

broader scale, federal and state governments should be increasing funding for nutrition and exercise programs to create equitable access to these programs regardless of income status.

Limitations and Future Research

Some limitations should be noted. I did not have the opportunity to speak to families that rely on free or reduced-priced meals. Their opinion may have differed from the parents that I spoke to who could pack lunch for their children. Talking to parents that are dependent on the National School Lunch Program would have brought a different perspective as to whether the food served is believed to be nutritious enough to meet a child's needs. Due to time restraints and questions of legality, I did not observe any classes and conducted interviews either after school or on the participant's day off. Since I did not get to interact with students in their school environment, I am restricted in the claims I can make about how the school lunch program and physical education curriculum impacts its students. I had to rely on the parent perspective to determine the effectiveness of the programs. Another limitation is that I did not interview any parents at Pine Elementary, and thus I depended on what the teachers have observed in their classroom to make conclusions. All three public elementary schools I researched were in similar income-levels thus the comparisons were easily comparable. Future research should focus on comparing low-income, middle-income, and high-income public schools in relatively similar environments. By comparing institutions with vastly different income levels will further highlight the differences and specific constraints they face regarding the opportunities they can provide for their students. An additional area of future research would be how school administrators choose which food distributor and program to use, as well as the challenges of availability and affordability that limit their options.

Recommendations

My first recommendation is finding creative ways to educate students on healthy eating that do not generate additional burdens for teachers. It is worth noting that teachers at Pine Elementary were receptive to teaching their students about the fruit or vegetable (FV) of the month, but that this program

could get pushed aside by the amount of general education material they have to cover in one school year. The goal of the Harvest of the Month is to get students excited about FVs and ways they can eat it at home. I would recommend institutions to find an alternative to educate students on healthy eating without adding another strain to the teacher's role. However, the solution is not to have more all-school events, as some teachers expressed that it is difficult to rearrange their curriculum due to the lost time of the gatherings. Rather, nutrition lessons might be organically worked into the wider curriculum. As out of the box as it sounds, one could incorporate a cooking class, like the *Cooking Matters* course, into math class. As students measure out ingredients, they can learn about dividing, adding, and subtracting. Another idea could be, during PE class, to have the students pretend to grocery shop for the healthy recipes. The children would be getting exercise running around while learning about what food products to buy when they go to the grocery store with their parents. Rather than institutions completely disregarding Harvest of the Month or *Cooking Matters* because of the difficulties in implementation, school administrators could brainstorm ideas as to how to incorporate it into the current curriculum and bring it to teachers as a model, rather than ask them to come up with their own ideas on their own time. Not only would this relieve the educators of extra burdens, but it would provide consistency across grades and schools.

My second recommendation is to advocate for administrators and local government to increase funding for schools across the board. The school district and local governments should assess what funding and support schools need to care for their students. Having such coordinated efforts with a feedback loop can only enhance the programs and maximize the funding. I observed that in all three schools, much of the school funding for extra iPads or other amenities were paid via money raised by the Parent Association. At Pine Elementary, all the teachers made a point to remark to me how involved their Parent Faculty Association (PFA) was in financing their classrooms. Mrs. Smith, a Pine Elementary teacher for 15 years, revealed that the PFA usually raises up to \$50k, and everything goes back into the school fund. This fact highlights how burdens are placed on individuals, in this case parents, to fill gaps and makeup for the lack of school funding. What happens to the institutions that do not have involved or wealthy parent communities to help them raise money? The schools that cannot rely on parent fundraising

should be encouraged to request for supplemental budget allocation. Additional funding can create greater equity between schools, but due to political resistance to an increased school budget, it will be difficult to implement. But not all support for students requires extra funding. At Bay Elementary, they added an extra bus stop at the recreational center to make it easier for students to participate in extracurricular activities. A simple yet specific act like this could make a huge impact on a student's life. That is why I recommend to school districts that when implementing change, it does not have to be big to make a powerful difference in a child's wellbeing.

The final recommendation is linked to my previous proposal of increased funding. With such resources in place, the federal and state governments can require school districts to comply with nutritional and physical activity standards in order to improve their programs. In turn, as an incentive, the schools that consistently reach this goal will receive assistance in the form of support for certified PE and dietitians. My findings resonate with studies conducted by Behrens et al. (2018) and Cummings et al. (2014) who found that with proper support and adequate resources, school districts would have the capacity to meet the nutrition standards, thus making a positive impact on their students. Behrens et al. (2018) performed a longitudinal study examining what the most impactful preparation method would be to make the students eat more fruits and vegetables. Their goal was to examine the impact of food practices and preparation in elementary school lunches. They found that because best practices policies were enacted, fresh fruit was offered nearly five times more than canned fruit; steamed vegetables were offered nine times more than canned vegetables. Their findings suggest that if policies are more strongly enforced and adequate material resources provided, the quality of school lunches can improve. However, in addition to states requiring school districts to comply with their standards, they should also provide the resources for them to fully cooperate with these regulations. Cummings et al. (2014) echoed the same findings when conducting a study to evaluate the sodium consumption in the Los Angeles School District. There they found that children were consuming over the Dietary Guidelines recommended amount of daily sodium intake. In the end, the LAUSD was able to successfully integrate sodium reduction into meals and into the broader comprehensive agenda on health which was adopted into future menu

planning. These two studies support my third recommendation to urge our government to reinforce school districts to adopt healthy eating behaviors and provide adequate physical activities to positively impact children's wellbeing.

In conclusion, I truly believe that we can achieve a healthier school environment if we enact these three recommendations: creative ways to educate healthy eating, increased funding, and reinforce nutritional and physical activity standards.

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