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by


Abel M. Flores

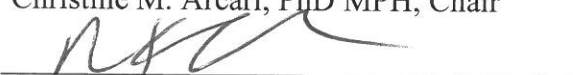
2014

The Capstone Committee for Abel M. Flores Certifies that this is the approved  
version of the following capstone:

**PROPOSING A MODEL SCHOOL-BASED CHILDHOOD OBESITY  
PREVENTION PROGRAM FOR CUERO, TX,  
A RURAL UNDERSERVED CITY**

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PREVENTION PROGRAM FOR CUERO, TX,  
A RURAL UNDERSERVED CITY**

by

**Abel M. Flores, B.S.**

**Capstone**

Presented to the Faculty of the Graduate School of  
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for the Degree of

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## **Dedication**

I would like to dedicate this capstone to my family and to my dear friend and partner John M. Cornwell. Their love and support give me the energy to conquer my fears and endlessly pursue my goals in life.

## **Acknowledgements**

I would like to first acknowledge my parents, Pedro and Bertina Flores, for if not for their constant love and support, I would not be where I am now. I would like to acknowledge my dear friend and partner, John M. Cornwell, for his support in my academic endeavors. Lastly, I would like to acknowledge my capstone committee, Drs. Christine Arcari, Kristen Peek and Bret Howrey.

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PREVENTION PROGRAM FOR CUERO, TX, A RURAL  
UNDERSERVED CITY**

Publication No. \_\_\_\_\_

Abel M. Flores, M.P.H.

The University of Texas Medical Branch, 2014

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Abstract: Childhood obesity has become a national public health crisis in America. While many reports on childhood obesity prevention programs exist, the results are heterogeneous due to the diversity of the interventions, study populations and research settings. School-based programs focusing on healthy lifestyles provide a promising setting for preventing childhood obesity. The purpose of this capstone is to propose a model school-based childhood obesity prevention program set in Cuero, TX, a rural, underserved city. A systematic review of literature pertaining to school-based obesity prevention programs is utilized for retrieval of relevant articles for analysis. I was able to retrieve 319 relevant articles. After inclusion and exclusion criteria were applied, 10 articles remained for data abstraction and analysis. Several of the interventions, including Coleman's Healthy ONES program, Coyle's MFVP program, Prelip's LAUSD program, Sallis' SPARK program, and Pbert's study program failed to show significant changes in BMI and/or behavior modification. Wordell's program showed their intervention group were 1.21 times more likely to eat fruits compared to control group students. Johnston's CATCH program showed a decrease in BMI score in their

intervention study group receiving physical education. Contento's C3 intervention showed a significant change in level of physical activity, an increase in healthy food choices and a decrease in sugary drinks and sweets within the intervention group. Ling's CDC-based intervention study showed a 10% increase in students meeting CDC nutrition recommended goals. Manger's VITAL program showed a 3.9% decrease in BMI in their intervention group. Based on literature review, programs that focus solely on one approach to childhood obesity prevention are not effective in reducing BMI or modifying behavior in children. In contrast, school-based programs that target both diet and physical activity behavior produce more significant results. My model program is called The HEARTY Program (Health Experience And Readiness Targeting our Youth), a 3-year, multi-component approach to educating students about healthy diet and physical activity behaviors. This program will prepare students to act on healthy behaviors in and out of the school environment.

## Table of Contents

List of Tables .....	viii
List of Figures .....	ix
List of Abbreviations .....	x
Chapter 1 Introduction .....	1
Chapter 2 Background .....	3
Epidemiology .....	3
Physiologic Factors .....	7
Physical Activity and Diet .....	7
Environment.....	11
Treatment .....	12
Significance.....	12
Chapter 3 Methodology .....	14
Chapter 4 Results .....	15
Interpreting the Data Abstraction.....	15
Interpreting Intervention Results .....	29
Chapter 5 Discussion .....	39
Chapter 6 Proposed Model School Program.....	42
Bibliography .....	48
Vita.....	52



## LIST OF TABLES

Table 1:	Intervention Study Identifying Information.....	17
Table 2:	Intervention Study Background and Hypothesis.....	20
Table 3:	Study Population Characteristics and Measured Outcome.....	27
Table 4:	Analysis of Intervention Data.....	34

## LIST OF FIGURES

Figure 1:	Trend in Obesity and Overweight Prevalence (%) among U.S. Children Aged 6-17 Years, by Race/Ethnicity, 1999-2008.....	4
Figure 2:	Trends in Obesity & Overweight Prevalence among Children Aged 10-17 Years, by Household Income/Poverty Status (Federal Poverty Level (FPL)), United States, 2003-2007.....	5
Figure 3:	Overweight and Obesity among U.S. Children age 10 – 17, by Location, 2007.....	6
Figure 4:	Obesity Prevalence, Children 10-17 years, 2007.....	6
Figure 5:	Children and Adolescents Ages 6–19 Getting at Least 60 Minutes per Day of Physical Activity, United States, 2003–2004.....	7
Figure 6:	Proportion of children and adolescents watching $\geq 2$ hours per day of TV/video, computers and total screen time by age group, 2001–06 ...	10
Figure 7:	Retrieval of Final Articles for Literature Review.....	15

## **LIST OF ABBREVIATIONS**

UTMB	University of Texas Medical Branch
GSBS	Graduate School of Biomedical Science
TDC	Thesis and Dissertation Coordinator
CDC	Centers for Disease Control and Prevention
HHS	U.S. Department of Health and Human Services
NHANES	National Health and Nutrition Examination Survey
NIH	National Institute of Health
NSCH	National Survey of Children's Health
FPL	Federal Poverty Level
BMI	Body Mass Index

## CHAPTER 1 INTRODUCTION

Childhood obesity has become a serious public health issue in the United States with considerable age, sex, ethnic and geographic disparities.<sup>1</sup> From 1976 to 2008, the National Health and Nutrition Examination Survey (NHANES) has shown a more than three-fold increase in the prevalence of obesity in children and adolescents in the United States<sup>1</sup>. Current data suggest childhood obesity will likely remain on the rise, with several reports estimating that by the year 2030, more than 60% of U.S. children will be overweight or obese.<sup>2</sup> Multiple studies have shed light on the various etiological factors that increase the risk of obesity in children, such as genetic predisposition, level of sedentary behavior and dietary habits.<sup>3</sup> While there are many reports on childhood obesity prevention programs, the results are heterogeneous in large part due to the diversity of the interventions, study populations and research settings. A review of the current literature on childhood obesity prevention programs shows interventions are typically in one of the following settings: community, clinic, school or home. This capstone will focus on childhood obesity programs in the school setting.

The specific aims for this capstone are to:

1. Conduct a systematic review of school-based intervention programs to prevent childhood obesity in the United States
2. Design a school program to prevent childhood obesity in a rural, underserved area

The target school that I will focus on will be Cuero Middle School, grades 6-8, in Cuero, TX. Cuero, TX is located in Southeast Texas and is the largest city in Dewitt County. With a population of 6,841, an ethnic/racial makeup composed of 42% Hispanic

and 17% African American, a median household income under \$25,000 and 27% of the population living under the federal poverty level, Cuero, TX is a rural and an underserved community.<sup>4</sup>

## CHAPTER 2 BACKGROUND

Obesity in childhood is defined by the Centers for Disease Control and Prevention (CDC) as a BMI greater than or equal to the 95<sup>th</sup> percentile in children of the same age and gender.<sup>5</sup> Overweight is defined as a BMI greater than the 85<sup>th</sup> percentile but less than the 95<sup>th</sup> percentile in children of the same age and gender.<sup>5</sup> NHANES data shows the prevalence of obesity among U.S. children has increased from 5.7% in 1976 to 19.7% in 2008.<sup>1</sup> Demographic analysis of prevalence data shows childhood obesity is disproportionately distributed across age, gender, race/ethnicity and geographic location.

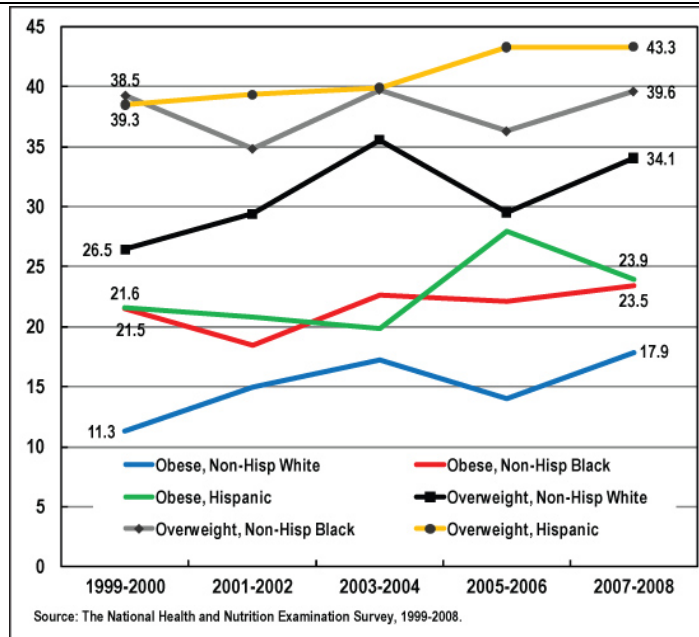
### **Epidemiology**

Age: A 2011-2012 study from the CDC showed the prevalence of childhood obesity in the United States to be 8% among children aged 2-5 years, compared with 18% of 6-11 year-olds and 21% of 12-18 year-olds.<sup>6</sup> The prevalence rate of obesity in the United States increases with increasing age of children.<sup>6</sup> A longitudinal study conducted by CDC shows that from 2003 to 2010, the rate of increase in obesity prevalence was least in 2-5 year-olds and rates had in fact decreased slightly in the last several years among pre-school children.<sup>6</sup>

Gender: 2009-2010 NHANES data shows U.S. boys have a higher prevalence of obesity than girls, with 18.6% prevalence in boys compared to 15% prevalence in girls.<sup>7</sup> Additionally, between 1999 and 2010, obesity rates in boys have significantly increased, while the prevalence in girls of all ages have remained largely stable.<sup>8</sup>

Race/Ethnicity: Minority groups are overwhelmingly at risk of developing obesity. 2008 U.S. NHANES data, shown in Figure 1, illustrates that Hispanic children have an obesity prevalence of 23.9%, followed closely by non-Hispanic Blacks at 23.5%.<sup>1</sup> Non-Hispanic Whites carry the lowest prevalence at 17.9% nationally.<sup>1</sup>

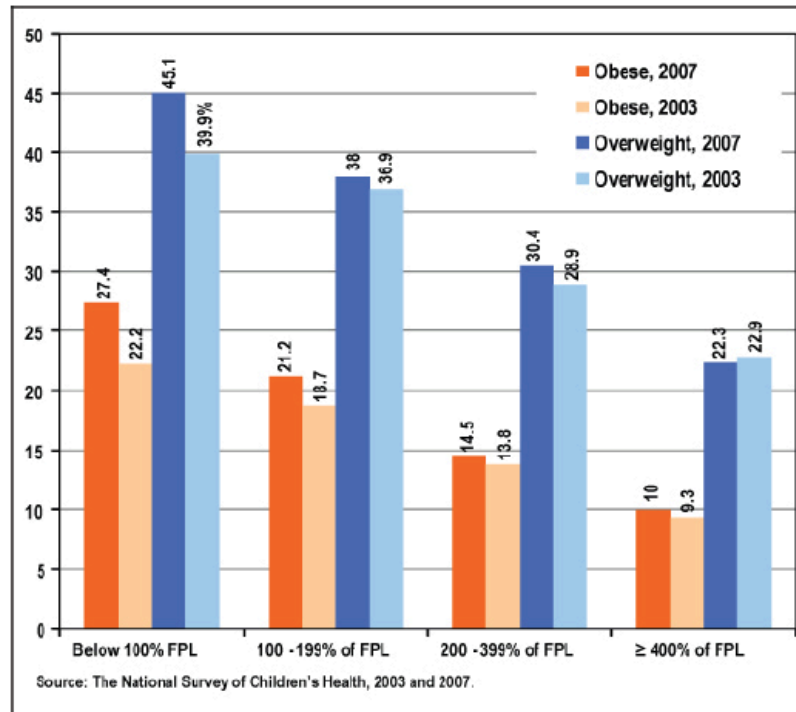
**Figure 1: Trend in Obesity and Overweight Prevalence (%) among U.S. Children Aged 6-17 Years, by Race/Ethnicity, 1999-2008<sup>1</sup>**



Socioeconomic Status: Childhood obesity is also disproportionate by socioeconomic status in the United States. Figure 2 depicts data from The National Survey of Children’s Health (NSCH) regarding trends in childhood obesity/overweight stratified by household Federal Poverty Level (FPL). A significant inverse relationship exists between household income and childhood obesity; homes with lower income have higher prevalence of childhood obesity and overweight.<sup>1</sup> In 2007, children from lowest-income households had obesity prevalence almost three-times higher than children from the highest income bracket households.<sup>1</sup> Furthermore, the data shows this prevalence

within the lowest income households is increasing with time, such that, between 2003 and 2007, obesity has increased by more than 5% nationally in those children living below 100% FPL.<sup>1</sup>

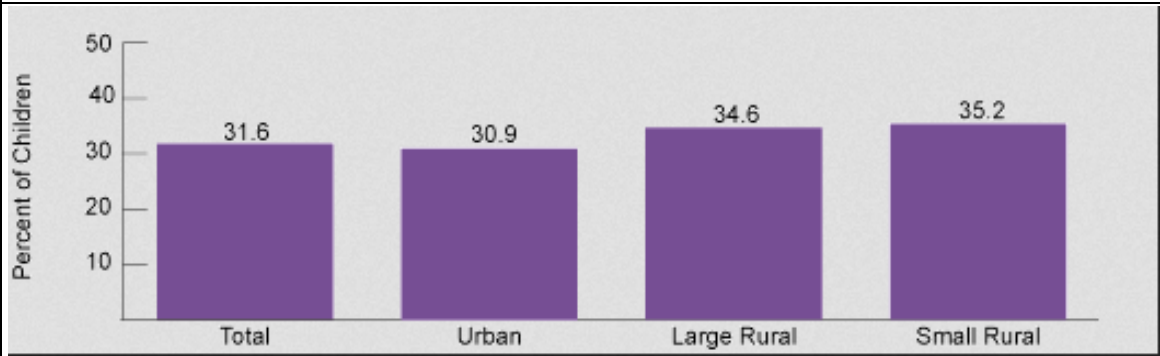
**Figure 2: Trends in Obesity & Overweight Prevalence (%) among Children Aged 10-17 Years, by Household Income/Poverty Status (Federal Poverty Level (FPL)), United States, 2003-2007<sup>1</sup>**



Geographic Location: Childhood obesity is also disproportionately prevalent depending on geographic location. Figure 3 shows that in 2007, approximately 35 percent of U.S. children aged 10–17 years living in small rural areas were overweight or obese, compared to 30.9 percent of children living in urban areas.<sup>9</sup>

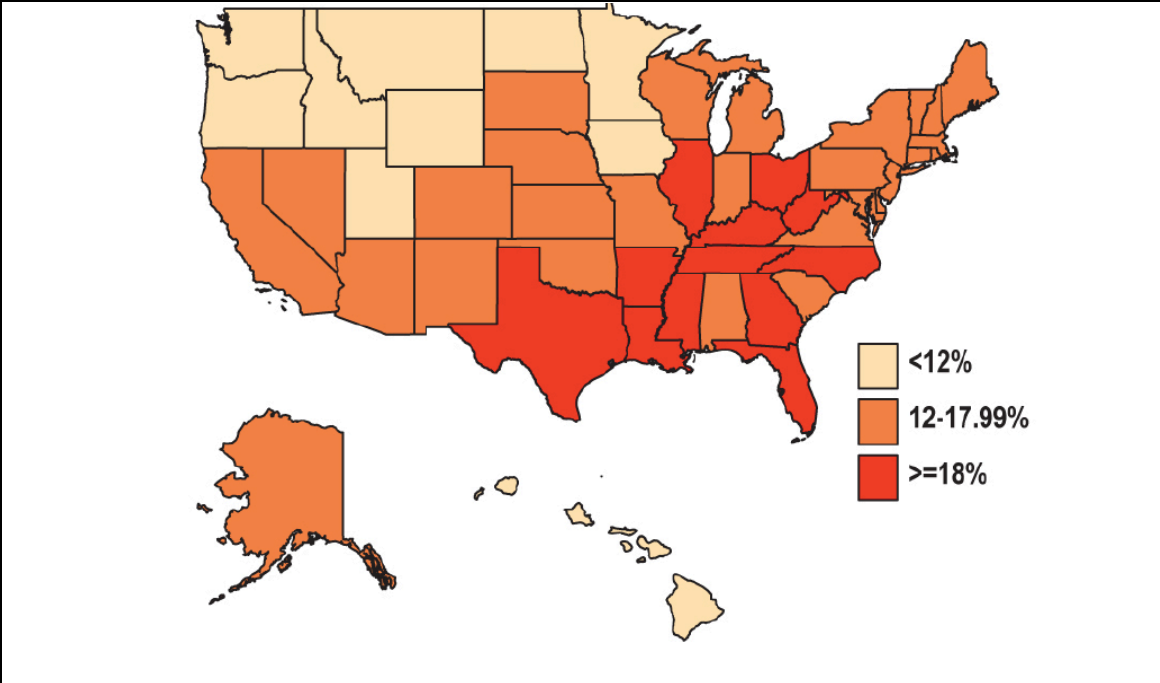


**Figure 3: Overweight and Obesity among U.S. Children age 10 – 17, by Location, 2007<sup>9</sup>**



Source: Health resources and services Administration, Maternal and Child Health Bureau and Centers for Disease Control and Prevention, National Center for Health Statistics, National Survey of Children's Health

**Figure 4: Obesity Prevalence, Children 10-17 years, 2007<sup>1</sup>**



Source: The National Survey of Children's Health

Studies on the national distribution of childhood obesity indicate a variance in the prevalence of obesity among the geographic regions of the United States as well. Figure 4 shows that in 2007, the childhood obesity prevalence in the U.S. was highest in Southern and Southeastern states.<sup>1</sup> Furthermore, this data shows twelve states are reported to have a childhood obesity prevalence greater than 18% (marked in red), double the number of states in that bracket just three years prior from the same study.<sup>1</sup>

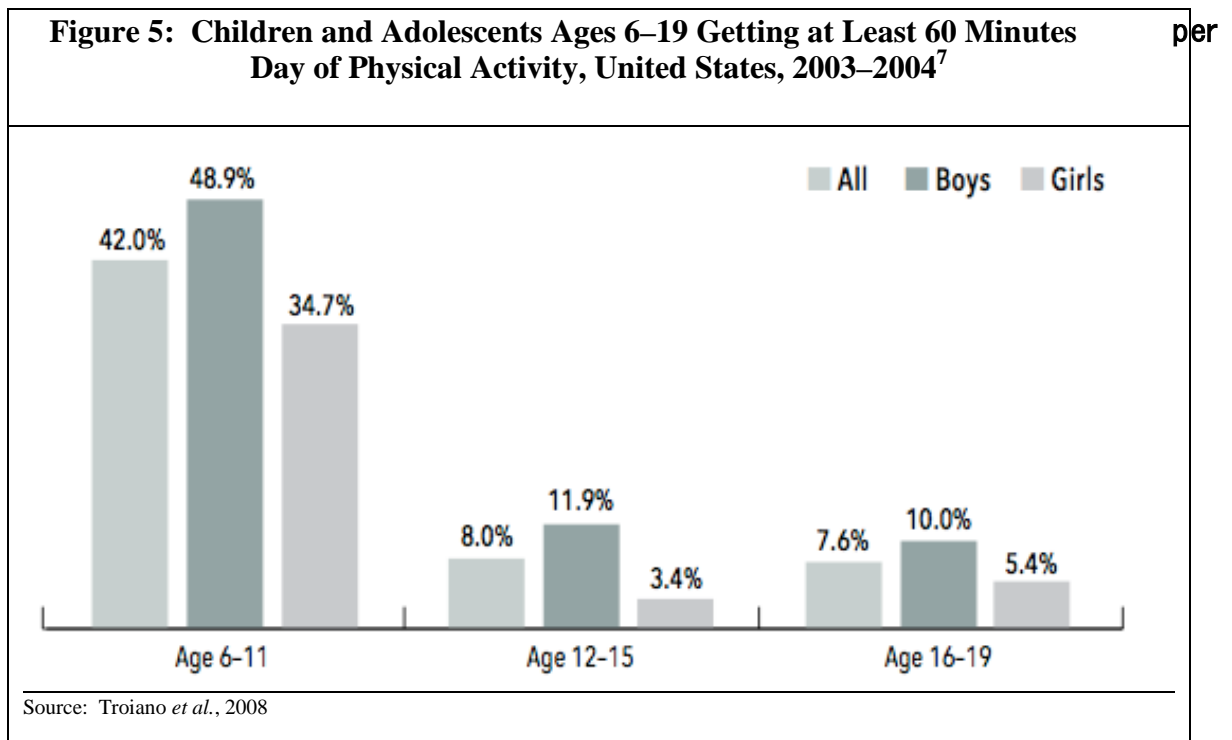
### **Physiologic Factors**

Studies consistently support a genetic component to the development of obesity. Evidence from monozygotic twin and family inheritance studies suggest heredity contributes 5 – 40% of the overall risk for obesity.<sup>10</sup> Additionally, studies on genetic inheritance have shown that children have up to 75% risk for obesity when both biological parents are obese.<sup>10</sup> However, the genetic makeup of the United States alone cannot explain the rapid change in obesity prevalence over the last several decades. Thus, current research is focused in the field of epigenetics and the role of the environment in modifying genetic expression, as behavioral and environmental characteristics of the American population are thought to influence the expression in the genome more than previously believed.<sup>10</sup>

### **Physical Activity and Diet**

Research shows that a disruption in the balance between energy consumption and energy expenditure is a major underlying factor in the development of childhood obesity.<sup>7</sup> Physical inactivity and poor diet have both been studied at length in an effort to better understand how this balance is disrupted. The U.S. Department of Health and

Human Services (HHRS) recommends all young people between 6 and 17 years of age take part in at least 60 minutes of physical activity daily.<sup>11</sup> However, approximately 30% of U.S. children do not exercise three or more times a week.<sup>12</sup> In a 2004 study measuring physical activity in U.S. children (Figure 5), almost half of boys and a third of girls in the 6-11 years age category met daily HHRS physical activity guidelines.<sup>7</sup> However, the percentage meeting requirements in the 12-15 years category drops precipitously to 8%.<sup>7</sup> Thus, not only does physical activity decrease with age, but it drops substantially between the 6-11 years and the 12-15 years age brackets.<sup>7</sup>

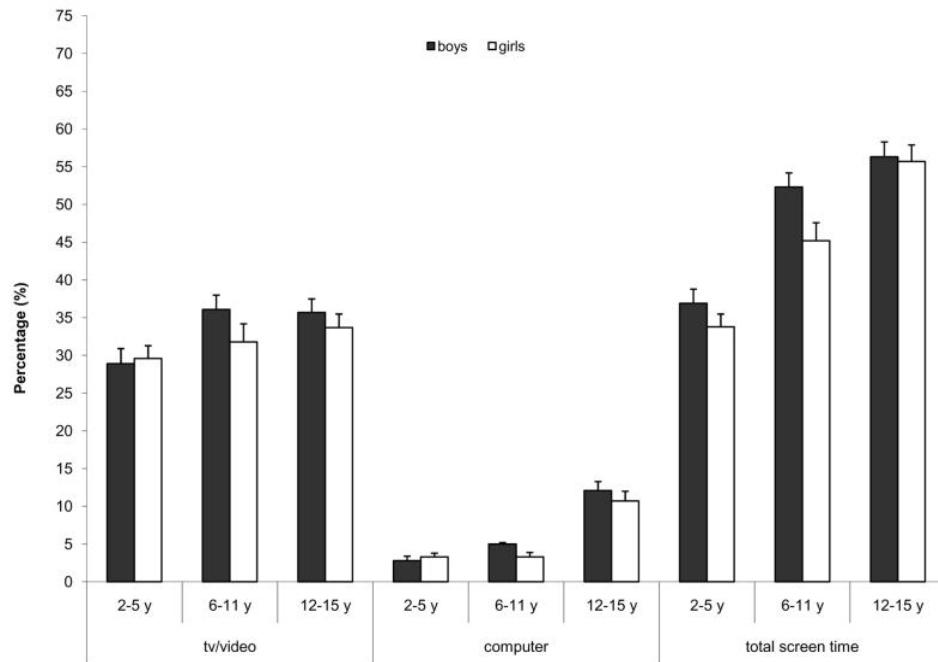


The trend in physical inactivity is correlated with studies showing sharp increases in the amount of entertainment-based screen time in children, which replaces available leisure time that could otherwise be used in engaging in physical activities. The American Academy of Pediatrics (AAP) released a policy statement recommending that all children limit screen time, which includes TV, computer, and most multi-media devices, to less than two hours per day.<sup>13</sup> Findings from the U.S. National Health and Nutrition Examination Survey indicate many children do not follow AAP screen time recommendations.<sup>1</sup> 2001-2006 NHANES data (Figure 6) shows U.S. boys aged 2-15 years exceed the 2-hour minimum daily screen time by a range of 37% to 56%.<sup>14</sup> Girls aged 2-15 years exceed the 2-hour minimum daily screen time by a range of 34% to 55%.<sup>14</sup> U.S. Children aged 12-15 years engage in more hours of screen time per day than children aged 2-5 years, and the prevalence of children exceeding the 2-hour screen time limit increases with increasing age.<sup>14</sup>

Additionally, the same study found that 58.5% obese children aged 12-15 years exceeded 2-hour daily screen time limits compared to 44.6% of normal weight children of the same age.<sup>14</sup> Patterns of excess screen time lead to sedentary lifestyles that contribute to the imbalance in the energy equation through decreased energy expenditure.

Changes in eating patterns also correlate with increasing prevalence rates of childhood obesity. Trends in eating patterns among U.S. children have changed significantly over the last several decades. One study looking into trends in food consumption among U.S. children found that, within the last 20 years, foods high in sugars and saturated fats predominated the top changes in per capita food consumption in children aged 2-6 years.<sup>16</sup> In addition, fast food consumption is now the major source of calories consumed outside the home in U.S. children.<sup>17</sup> Between 1977 and 2008, the percentage of total calories derived from fast food consumption in U.S. children increased from 2% to 14%.<sup>15,17</sup>

**Figure 6: Proportion of children and adolescents watching  $\geq 2$  hours per day of TV/video, computers and total screen time by age group, 2001–06<sup>14</sup>**



Source: U.S. National Health and Nutrition Examination Survey

The increase eating patterns of fast food is significantly correlated with increasing U.S. trends in childhood obesity over the last 30 years.<sup>17</sup> Furthermore, soft drink consumption, which currently constitutes the leading source of daily-added sugar in the diet among U.S. children, has increased by over 500% over the last 50 years.<sup>18</sup> A study by Ludwig et al. looking into the association of sugar-sweetened drinks and childhood obesity found that children who consume one sugar-sweetened drink daily are 1.41 times as likely to become obese compared to children who consume non-sweetened drinks.<sup>18</sup> Increases in food portion sizes over time also play a role in the increase of childhood obesity, as larger portions of food lead to higher daily total caloric intake.<sup>19</sup> While hamburgers have remained one of the most frequently consumed fast food items in U.S. children, their average caloric content has nearly doubled over the last twenty years.<sup>19</sup>

Trends in consumption of high sugar, high fat dense foods are compounded by minimal change in the trend of fruit and vegetable consumption by children over time. In a 2011 HHS survey of U.S. high school students, only 15% of students reported eating the daily recommended three servings of vegetables daily.<sup>20</sup>

## **Environment**

Although limited data currently exists on the relationship between childhood obesity and the environment, recent data is showing that environmental influences play a much larger role on the prevalence of childhood obesity than previously thought. Studies on sleep duration and obesity in teens have shown that the health benefits on each additional hour of sleep is twice as big on obese children than on children of normal weight.<sup>21</sup> An additional study showed that increasing sleep from 7 hours to 10.5 hours among 18 year-olds reduces the obesity prevalence by 4% in that age group.<sup>21</sup> New evidence highlighting the role children's environments on obesity has led several school districts to modify children's environment within the schools. After removing sugary drinks and sweets from vending machines, deep fryers from cafeterias and replacing whole milk products with skim milk, a district in New York was able to show a 5.5% decline in the number of obese schoolchildren over a four-year period.<sup>21</sup> Availability of both resources and access to food in the community have a strong influence on the diet lifestyle children develop.<sup>22</sup> A study in Philadelphia found that students on average purchase more than 350 calories on each visit to corner stores, and 29% of these students shop at corner stores at least twice per day, five days per week.<sup>22</sup> This is compounded in low-income neighborhoods, where lack of full-service grocery stores and farmer's

markets leads to limited exposure to healthier food options for children.<sup>23</sup> Additionally, perceived safety within the community plays a significant role in recreational outdoor activities for children. Neighborhood crime, busy traffic and lack of street lighting have all been shown to decrease the number of opportunities for children to engage in physical outdoor activities.<sup>23</sup> Evidence supports the greater risk of obesity in children living in unsafe neighborhoods, and in communities with limited physical activity resources.<sup>23</sup>

## **Treatment**

The most common strategy to treat childhood obesity is behavioural modification through diet and physical exercise. If behavioural modification is not successful or if body habitus prevents physical activity, pharmacologic treatment is offered. The only medications currently approved by the FDA for the use of weight loss in children are Orlistat and Sibutramine.<sup>3</sup> Both medications have a side effects profile that warrants discussion with a physician before agreeing to pharmacologic approach. A third strategy for management of childhood obesity is gastric bypass surgery. Typically, because of the complications associated with surgery, bariatric surgery is reserved for children who are morbidly obese or suffer significant health problems secondary to their weight. Bariatric Surgery has shown very high success in reducing BMI to near normal or normal weight in children.<sup>3</sup>

## **Significance**

Childhood obesity is a major public health concern. Studies show that over 70% of obese children will continue on to become obese adults.<sup>24</sup> Furthermore, predictions show that at

least two in three children born after 2000 will suffer from obesity-related health problems, including cardiovascular disease, hypertension, diabetes, osteoarthritis, cancer and asthma during their adult life.<sup>25</sup> The cost of childhood obesity on U.S. economy is especially evident when looking at health care expenditures. Between 1979 and 1999, obesity-related annual hospital costs in children increased from \$35 million to \$127 million.<sup>2</sup> Additionally, the yearly direct healthcare costs of childhood obesity-related emergency room, outpatient, and prescription drugs total over \$14 billion.<sup>26</sup> As childhood obesity transitions into adulthood, impacts in the workplace become substantial as productivity is affected. An estimated \$4.3 billion related to job absenteeism per year is attributed to obesity.<sup>27</sup> Furthermore, studies have shown an estimated \$500 of losses related to low work productivity per obese worker per year.<sup>28</sup>

The answer to the obesity epidemic in America is prevention. Recent legislation changes, including the Affordable Care Act, support a gradual shift in U.S. health markets toward a greater focus on preventive health. My intent with this capstone is to create a sustainable school-based obesity prevention program for the Cuero Middle School in Cuero, TX to reduce childhood obesity and overweight to create a healthier future for our children.



## CHAPTER 3 METHODOLOGY

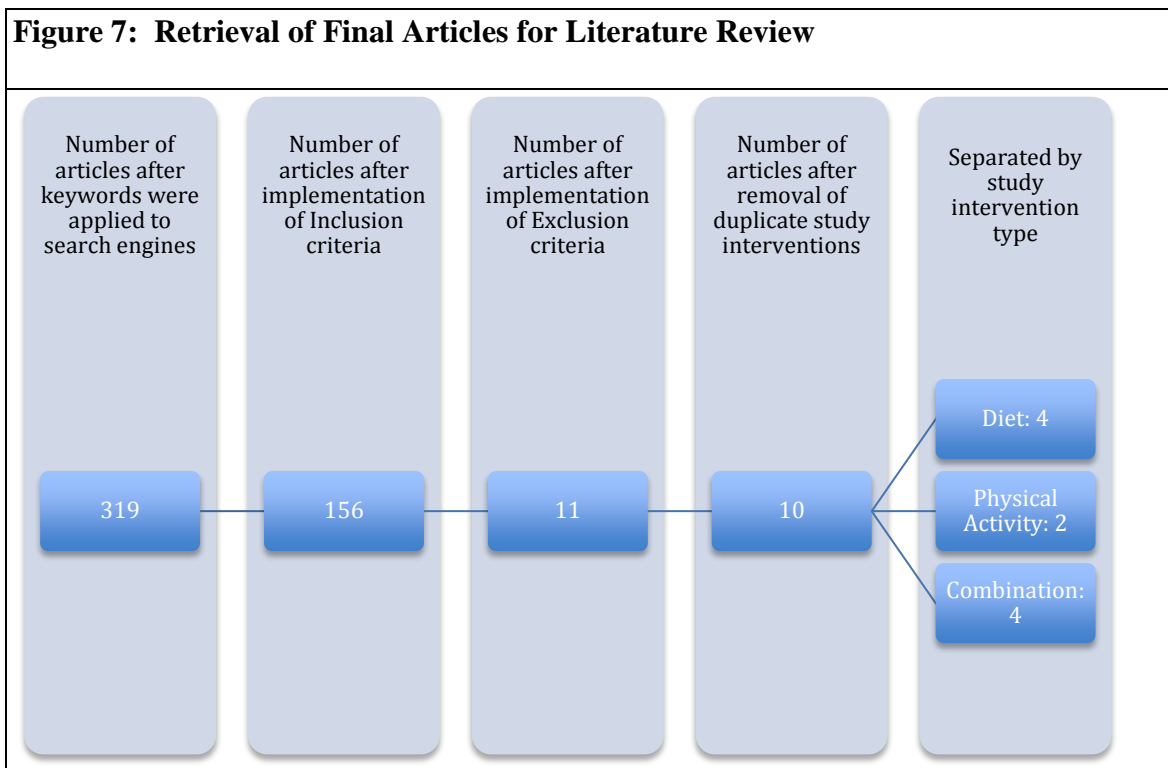
A systematic review of current literature pertaining to school-based obesity prevention programs was utilized for data retrieval. The databases OVIDSP-Medline, EBSCO-HOST and CINAHL were searched to identify research articles for the systematic review. Keywords used in the literature search included: “Childhood obesity”, “Obesity in children OR obesity in adolescence”, “prevention”, “intervention”, “school program”, and “evaluation”. Inclusion criteria used: childhood obesity as the problem addressed by the study, study interventions implemented in the school setting, and measured study outcomes containing an assessment related to diet, physical activity or behavior modification. Exclusion criteria used: age of the study population greater than 18 years or less than 2 years, non-English language, non-U.S. study population, studies that involve surgical or pharmacological interventions, and studies without a health-related outcome component as it pertains to childhood obesity.

Data abstraction included: 1) intervention type (diet, physical activity, both), 2.) intervention components (education, behavioral intervention, policy/regulation change) 3.) primary outcomes measurement, 4.) description of intervention, 5.) study hypothesis 6.) methods of control 7.) description of intervention setting, 8.) method for measuring outcomes, and 9.) duration of study.

## CHAPTER 4 RESULTS

Using the keywords, I was able to retrieve 319 articles. A total of 156 articles met inclusion criteria. After exclusionary criteria were applied, 11 articles met criteria. Two of the articles covered the same program, so the most recent article was selected, leaving a final selection of 10 articles (Figure 7).

**Figure 7: Retrieval of Final Articles for Literature Review**



### Interpreting the Data Abstraction

Analysis of Intervention type yielded four articles whose intervention focused solely on student's diet (Coleman, Coyle, Prelip, and Wordell), while two articles focused on physical activity interventions (Johnston, Sallis). The remaining four articles focused on a combination of diet and physical activity components in their interventions

(Contento, Ling, Manger and Pbert). Eight of the interventions provided an educational component in their studies (Table 1), and in each of these studies, the information was disseminated during school hours (Table 2). Five interventions provided a behavioral modification component in their study and three interventions made policy/regulatory changes as part of their study.. All studies utilized a similar method of outcome measurement, including change in BMI pre- and post-intervention, change in dietary consumption, change in level of physical activity or a combination thereof.

Of the programs that focused on dietary nutrition, the most common approach involved applying policy/regulatory changes to the food options offered in school cafeterias and vending machines (Table 2). One program's intervention (Coyle) involved handing out free fruits and vegetables on school campuses.. Both interventions that measured outcomes on physical activity alone created school fitness programs based on the idea that children were not receiving enough physical activity in the schools (Johnston, Sallis). Six of the ten studies chose to work with students living in rural/underserved regions (Table 3).

<b>Table 1: Intervention Study Identifying Information</b>				
<b>Intervention Program</b>	<b>Program Name</b>	<b>Study Design</b>	<b>Intervention Components</b>	<b>Primary Outcomes Measures</b>
<b>Coleman et al.</b>	Healthy ONES	Nested Cohort group Randomized Trial	Provision of Information  Behavioral Interventions  Legislation/Regulation/Enforcement	1. Eliminate unhealthy foods and beverages on campus  2. Develop Nutrition services as main source for healthful eating  3. School Staff Model Healthful eating
<b>Contento et al.</b>	C3 (Choice, Control, Change) school Curriculum	Pre-post, cluster randomized intervention-control design	Provision of Information	Measurement of energy balance-related behaviors targeted by the intervention
<b>Coyle et al.</b>	Mississippi Fresh Fruit and Vegetable Program (MFVP)	Group pretest/posttest Comparison Analysis	Environmental Intervention	1. Measure childrens' preferences for fruits and vegetables during the school year  2. Measure the change in fruit and vegetable consumption during the school year
<b>Johnston et al.</b>	Coordinated Approach To Child Health (CATCH) Program	Randomized control Trial	Provision of Information	Decrease the rate of weight gain in children through training staff to promote more healthful behaviors

**Table 1 continued: Intervention Study Identifying Information**

<b>Intervention Program</b>	<b>Program Name</b>	<b>Study Design</b>	<b>Intervention Components</b>	<b>Primary Outcomes Measures</b>
<b>Ling et al.</b>	Based on the Coordinated School Health Program recommended by CDC	Quasi-experimental design with repeated measures	Provision of Information Behavioral Interventions Legislation/Regulation/Enforcement	1. Improve physical/health education 2. Increase Health education 3. Improve Family/Community environment 4. Enact School Wellness policies
<b>Manger et al.</b>	Values Initiative Teaching About Lifestyle (VITAL) Study	Non-randomized intervention trial	Provision of Information Behavioral Interventions	To see whether the BMI in children would decrease after 2-year implementation of the VITAL program
<b>Pbert et al.</b>	“Looking Good, Feelin’ Good” Program	Randomized controlled trial	Provision of Information Behavioral Interventions	1. Reduction in BMI 2. Improvement in Diet 3. Improvement in Physical Activity

**Table 1 continued: Intervention Study Identifying Information**

Intervention Program	Program Name	Study Design	Intervention Components	Primary Outcomes Measures
<b>Prelip et al.</b>	Network-LAUSD program	Quasi-experimental pretest/posttest intervention	Provision of Information	<ol style="list-style-type: none"> <li>1. Fruit and Vegetable consumption</li> <li>2. Knowledge of food groups</li> <li>3. Attitudes and beliefs towards fruits and vegetables</li> <li>4. Parent/Teacher influences on student perceptions of fruits and vegetables</li> </ol>
<b>Sallis et al.</b>	Sports, Play, and Active Recreation for Kids <sup>34</sup> Program	Randomized pre-test/posttest control trial	Provision of information Behavioral interventions	Assess standardized BMI scores over time
<b>Wordell et al.</b>	N/A	Randomized control trial	Legislation/Regulation/Enforcement	Determine if an association exists between altered cafeteria food and changes in food choices in children inside and out of school

**Table 2: Intervention Study Background and Hypothesis**

Intervention	Intervention Description	Theory	Hypothesis	Control
<p><b>Coleman et al.</b></p>	<p><i>What:</i> to eliminate unhealthy foods from the schools, begin providing healthy options at school campuses and have teachers model healthy eating behavior</p> <p><i>How:</i> Healthy ONES team created a District Advisory board to oversee schools. Each school in turn created their own advisory team to implement the intervention</p> <p><i>Who:</i> Elementary and middle school children</p> <p><i>Where:</i> economically disadvantaged school district</p>	<p>The model incorporated an Evidence-based public health <sup>30</sup> approach to address school nutrition policy and environmental change</p>	<p>Outside Unhealthy foods/beverages would be significantly reduced in intervention schools as compared to control schools – thus, obesity rates would stay the same in intervention schools, while they would increase in control schools</p>	<p>Schools were matched by location and Size</p>

**Table 2 continued: Intervention Study Background and Hypothesis**

Intervention	Intervention Description	Theory	Hypothesis	Control
<b>Contento et al.</b>	<p><i>What:</i> Goal to improve school nutrition services and promote better nutritional choice-making in children by providing C3 curriculum of 24 lessons lasting 45 minutes each</p> <p><i>How:</i> Focus on addressing specific Energy Balance related Behaviors (EBRBs) that are identified as contributing to obesity risk reduction</p> <p><i>Who:</i> Seventh grade children are the target of this project</p> <p><i>Where:</i> School science classes</p>	<p>Creating a behavior modification intervention around the theory of Social Cognitive Theory (SCT) and Self-determination Theory (SDT)</p>	<p>By integrating a theoretical framework model into a childhood obesity prevention intervention, the program outcomes would be enhanced</p>	<p>The 10 intervention schools were matched on school size, race/ethnicity, free/reduced lunch percentage, and test scores. These matched controls would receive delayed C3 curriculum so as to measure influence of outcome of program through theoretical framework</p>
<b>Coyle et al.</b>	<p><i>What:</i> Increase student access to fresh fruits and vegetables by providing them free at school</p> <p><i>How:</i> Schools receive funding to purchase fruits and vegetables which are then distributed at the schools</p> <p><i>Who:</i> Students attending Mississippi schools that qualified for federal funding</p> <p><i>Where:</i> On school campuses</p>	<p>This intervention was chosen as a solution to address the issue that consumption of fruits and vegetables in school children is below recommendation levels</p>	<p>Increasing access of healthy food options to children will increase the potential for influencing their food preferences</p>	<p>No controls</p>



**Table 2 continued: Intervention Study Background and Hypothesis**

Intervention	Intervention Description	Theory	Hypothesis	Control
<p><b>Johnston et al.</b></p>	<p><i>What:</i> Incorporate health and physical education into the existing school curricula taught by trained health professionals. Motivational Interviewing was used to address resistance to change</p> <p><i>How:</i> health information provided by health professionals during classes</p> <p><i>Who:</i> Elementary school children</p> <p><i>Where:</i> within school classrooms</p>	<p>Integrating health and physical education information into classrooms has been effective, but the inclusion of trained health professionals eases burden for teachers and help promote motivational interviewing</p>	<p>1. Children in PFI groups will show a greater decrease in their standardized BMI scores more than in classrooms where no health professionals are used</p> <p>2. Normal weight Children in PFI groups will maintain their weight status.</p>	<p>Professional-Facilitated interventions<sup>33</sup> were matched with Self-help<sup>33</sup> control groups where teachers alone provided the health-related information</p>
<p><b>Ling et al.</b></p>	<p><i>What:</i> A comprehensive school-based intervention targeting physical activity and nutrition</p> <p><i>How:</i> promotion of physical activity in schools with PE consultants; improved nutrition content in schools through education in classes, family health nights, nutrition workshops</p> <p><i>Who:</i> Children K-5<sup>th</sup> grade from 4 rural elementary schools in central Kentucky</p> <p><i>Where:</i> On school campuses</p>	<p>To successfully address childhood obesity in the schools, it is necessary for a program to include a nutrition, a physical activity, and a policy component</p>	<p>Pedometers – measure physical activity</p> <p>Recall survey – assess nutrition</p>	<p>No controls</p>

**Table 2 continued: Intervention Study Background and Hypothesis**

<b>Intervention</b>	<b>Intervention Description</b>	<b>Theory</b>	<b>Hypothesis</b>	<b>Control</b>
<b>Manger et al.</b>	<p><i>What:</i> 8 weekly lessons lasting 30 minutes taught to 2<sup>nd</sup> grade students</p> <p><i>How:</i> program consisted of the 8 lessons, which contained interactive activities</p> <p><i>Who:</i> 1<sup>st</sup> - 2<sup>nd</sup> grade students from Catholic Diocese in Pittsburg</p> <p><i>Where:</i> Sessions were held in the classrooms</p>	<p>The focus of this program is teaching children to eat healthy and promoting physical activity to young children so as to prevent excess weight gain later in life</p>	<p>Instilling a healthy lifestyle in children will prevent excess weight gain</p>	<p>There were no controls used</p>
<b>Pbert et al.</b>	<p><i>What:</i> School nurse-directed diet and behavior modification intervention with utilization of a cognitive behavior approach</p> <p><i>How:</i> 6 one-on-one counseling sessions over a 2-month period using a social cognitive theory approach. Nurses had one day training session</p> <p><i>Who:</i> overweight and obese high school students</p> <p><i>Where:</i> school nurse office</p>	<p>The focus of this program is to utilize school nurses to provide cognitive behavioral counseling and health promoting information to students already overweight or obese</p>	<p>A nurse-delivered counseling intervention will result in an improvement in diet and physical activity and will decrease BMI in students already overweight or obese</p>	<p>Intervention schools were matched on enrollment, gender, race/ethnicity, and rate of free/reduced lunch</p>

**Table 2 continued: Intervention Study Background and Hypothesis**

Intervention	Intervention Description	Theory	Hypothesis	Control
<p><b>Prelip et al.</b></p>	<p><i>What:</i> A multi-component nutrition education intervention program that incorporated social cognitive behavior to motivate children to change dietary habits</p> <p><i>How:</i> Interactive teaching materials taught by the teachers</p> <p><i>Who:</i> Low-income 3<sup>rd</sup> 4<sup>th</sup> and 5<sup>th</sup> graders in Los Angeles</p> <p><i>Where:</i> education lessons occurred in the classrooms and in the Intervention + program, parents incorporated curriculum into the home</p>	<p>This program focuses on the nutrition component to promoting a healthier lifestyle, but utilizes a multi-component approach, including school and community leaders and pediatricians</p>	<p>A multi-component nutritional education program that utilizes parents and teachers as models of behavior change will result in an increase in fruit and vegetable consumption and a more positive perspective of healthy eating</p>	<p><b>3 groups were created:</b></p> <ol style="list-style-type: none"> <li>1. Comparison group - No intervention</li> <li>2. Intervention group - Teachers received teaching materials from state</li> <li>3. Intervention + Condition – teachers received materials plus 2 training sessions on food group education and motivational empowering. In addition, parents of participating children participated in 5 nutrition education workshops</li> </ol>

<b>Table 2 continued: Intervention Study Background and Hypothesis</b>				
<b>Intervention</b>	<b>Intervention Description</b>	<b>Theory</b>	<b>Hypothesis</b>	<b>Control</b>
<b>Sallis et al.</b>	<p><i>What:</i> Physical activity-based program implemented that focused on increasing amount of physical activity at school and taught behavior-change skills to generalize physical activity outside of school environment</p> <p><i>How:</i> Students were placed into 3 groups: Control group where no intervention took place, teacher-led fitness intervention, and specialist-led intervention. Classes were done 3 times per week lasting 30 minutes.</p> <p><i>Who:</i> students during their 4<sup>th</sup> and 5<sup>th</sup> grade years</p> <p><i>Where:</i> intervention was held within the schools</p>	<p>The focus of this intervention is promotion of physical activity in the schools as studies had shown schools are not providing enough physical activity for students to meet daily recommendations. Furthermore, the study was chosen because of belief that students need to be taught how to incorporate physical activity into their lives outside of school</p>	<p>The SPARK program will result in an increase in physical activity in children leading to healthier outcomes</p>	<p>Control Group was used</p>
<b>Wordell et al.</b>	<p><i>What:</i> Food nutrition program that focused on altering the food environment in schools and reporting the changes in food choices by the students</p> <p><i>How:</i> limiting vending machines to offer only non-flavored bottled water, introducing a fruit and vegetable bar in cafeterias and restricting a la carte items to only milk and fruit items.</p> <p><i>Who:</i> 7<sup>th</sup> and 8<sup>th</sup> grade students attending the two intervention schools</p> <p><i>Where:</i> on school campuses</p>	<p>The purpose of this study was to determine whether there was an association between an altered food environment in school and the food choices middle school students make in and out of school</p>	<p>By altering the food supply in the intervention schools, children attending those schools will make healthier food choices</p>	<p>There were 2 interventions schools and 4 control schools</p>

**Table 3: Study Population Characteristics and Measured Outcomes Measurement**

Intervention Program	Location	Population Density	Setting	Method of Outcomes Measurement	Intervention Time Interval
<b>Coleman et al.</b>	Study occurred within intervention schools, Data gathered within school premises and at school functions	Underserved inner-city population	School District	Observation of child food choices in school  Height and weight measurements were collected every month for the duration of the intervention	3 years (1 baseline year and 2 intervention years)
<b>Contento et al.</b>	The intervention occurred in 10 schools within a low-income school district in New York. The Science classrooms of intervention schools using science teachers to teach the materials	Mixed underserved population	School District	<p><b>Behavioral Outcomes:</b> Nutrition and physical activity target behaviors were measured with the EatWalk Survey Questionnaire</p> <p><b>Theory-Based Psychosocial Mediators:</b> C3-created Survey Questionnaire measured Childrens’ intentionality to change, perceived barriers, and self efficacy</p> <p>To compare the means of intervention and control groups, ANCOVA was performed</p>	Specific Time lapse not provided, but consisted of 24 lessons of 45-minutes each taught in science classes

<b>Table 3 continued: Study Population Characteristics and Measured Outcomes Measurement</b>					
<b>Intervention Program</b>	<b>Location</b>	<b>Population Density</b>	<b>Setting</b>	<b>Method of Outcomes Measurement</b>	<b>Intervention Time Interval</b>
<b>Coyle et al.</b>	25 Mississippi schools who received CDC funding to purchase the fruits and vegetables during the 2004-2005 school year	Mixed underserved student population	Federally-sponsored state program	Paired t-tests to compare pre- and post-questionnaires and interview responses	During the 2004-2005 school year
<b>Johnston et al.</b>	7 Elementary schools from Houston, TX	Mixed Suburban Population	District-wide program	Paired t-tests and chi-square analysis to compare Pre and posttest BMI and Z-score	2 consecutive years
<b>Ling et al.</b>	4 elementary schools in central Kentucky	Rural underserved population	Specified rural counties	Pedometers used to measure physical activity  School Physical Activity and Nutrition Questionnaire (SPAN) survey was used to assess nutrition – given every month for 5 months	5 months (Jan – May 2011)
<b>Manger et al.</b>	29 elementary schools within the Catholic Diocese of Pittsburgh	N/A	N/A	Record height and weight measurements and calculate BMI scores in the students	2 year study

**Table 3 continued: Study Population Characteristics and Measured Outcomes Measurement**

<b>Intervention Program</b>	<b>Location</b>	<b>Population Density</b>	<b>Setting</b>	<b>Method of Outcomes Measurement</b>	<b>Intervention Time Interval</b>
<b>Pbert et al.</b>	Overweight and obese High school students in Massachusetts	Urban, inner-city population	Inner-city school district	BMI was calculated using height and weight measurements  Dietary intake was assessed with 24-hour dietary recall interviews  Physical Activity was assessed using an accelerometer Actigraph GT1M for a 7-day period  Sedentary behavior was measured using a portion of the Youth Risk Behavior Survey	6 month study
<b>Prelip et al.</b>	3 <sup>rd</sup> , 4 <sup>th</sup> and 5 <sup>th</sup> graders attending low-income schools within Los Angeles County	Low income inner-city population	County-wide	The Healthy California questionnaire: A 5-part survey that evaluated students perceptions of fruit/vegetables and the role of parents and teachers in influencing their beliefs	September 2009 – May 2010
<b>Sallis et al.</b>	7 elementary schools from Poway, CA, a suburb of San Diego	Inner city suburb population	District-wide	Student surveys and fitness tests (Mile run, Pull ups, and sit ups) were given at the beginning and at the end of each school year	2- years
<b>Wordell et al.</b>	6 middle schools located in an undisclosed Midwestern city	Inner city underserved population	District-wide program	Beverage and snack questionnaire to assess previous weeks food choices in and out of school	3 years

## **Interpreting Intervention Results**

Analysis of the ten school-based obesity prevention programs attempting to address the issue of childhood obesity largely resulted in mixed results, with no single program providing overwhelming outcomes measures in children's health status.

Nutrition Programs: Coleman's Healthy ONES program hoped to show a decrease in standardized BMI scores in children whose schools eliminated unhealthy snacks in school and provided nutrition education information in classes, but, even though it was able to show an increase in healthy eating behavior through their self-report surveys, they were unable to show any impact in BMI scores between intervention and control groups.<sup>30</sup> In providing free fruits and vegetables to students in intervention schools, Coyle's MFVP program aimed to increase student's willingness to eat more fruits and vegetables. However, findings showed that healthy dietary eating habits and improved perceptions of fruit/vegetables were only seen in 8<sup>th</sup> graders, with no significant changes in behavior noted in the 5<sup>th</sup> and 10<sup>th</sup> grade intervention groups.<sup>25</sup> Prelip's LAUSD program used an interactive nutrition education curriculum taught by teachers and also created a 3<sup>rd</sup> study group that involved parental education on nutrition as well. Although the study found students reported more positive feelings towards fruits and vegetables at the end of the study, they were unable to translate students' perspectives into significant behavioral change.<sup>31</sup> Wordell's program was able to show a positive association between modified food environment at the school and student food choices, including results showing intervention group students were 1.21 times more likely to eat fruit out of school compared to control group students.<sup>32</sup> However, not all foods analyzed



in the study showed significant results, with some negative behaviors actually increasing at the conclusion of the study (intervention group students were 1.4 times more likely to eat pastries outside of school than control group students).<sup>32</sup>

Physical Activity Programs: Johnston's CATCH program wanted to show that having specialized health professionals educate students about physical activity would result in a greater decrease in BMI score than controls. The study showed a small, but significant decrease in BMI score in the intervention study group receiving education from the specialists.<sup>33</sup> The Sallis SPARK study solely focused on physical activity as a solution to fighting childhood obesity. Although SPARK increased physical activity in the intervention schools, it was not able to show a change in students engaging in more physical activity out of school, and was only able to show significant changes in fitness tests in girls, not in boys.<sup>34</sup>

Combination Programs: Contento's C3 intervention sought to incorporate cognitive behavioral theory into a curriculum that addressed both diet and physical activity behaviors in students. The study reported mixed results, but was able to show a significant change in level of physical activity, an increase in healthy food choices and a decrease in sugary drinks and sweets within the intervention group.<sup>34</sup> Ling's CDC-based intervention study used a multi-component approach to change both nutrition and physical activity in children. The study was able to show a 10% increase in students meeting nutrition goals and a significant increase in both genders meeting study-targeted physical activity goals.<sup>35</sup> Manger's VITAL program sought to change 1<sup>st</sup> and 2<sup>nd</sup> grade students' nutritional and fitness behavior through an interactive curriculum taught in the

classrooms and was able to show a decrease in BMI of 3.9% in the intervention study group, compared to 1.1% in the control group.<sup>36</sup> Additionally, Manger was able to show a 20% increase in healthier eating behavior and an increase from 56% to 76% in frequency of physical activity in children of the intervention study group.<sup>36</sup> Pbert's "Looking good, Feelin' Good" program sought to use motivational interviewing in a counselor-taught nutrition and physical education intervention, but was unable to show any significant improvements in nutritional or physical health in the intervention students.<sup>37</sup>

**Table 4: Analysis of Intervention Results Data**

Intervention Program	Population Statistics	Outcome Findings	Measured Outcome Results	Conclusion
<p><b>Coleman et al.</b></p>	<p>Gender: Girls 57%</p> <p>Avg. Age: 8.9 years old</p> <p>Total Obesity Prevalence: 25%</p>	<ol style="list-style-type: none"> <li>1. Total outside food and beverage items per child per week: decreased over time in the intervention schools and increased with time in the control schools</li> <li>2. Outside unhealthy food items found on intervention school campuses decreased over time, whereas they increased with time in the control school campuses</li> <li>3. Rates in Obesity over time were similar between Intervention and control groups. Both saw an increase in BMI Z scores over time</li> </ol>	<p>--</p>	<p>Hypothesis not supported as BMI Z scores increased in both intervention and control schools. Likely due to program focus only on nutritional changes and intervention did not have a physical activity component</p>

**Table 4 Continued: Analysis of Intervention Results Data**

Intervention Program	Population Statistics	Outcome Findings	Measured Outcome Results	Conclusion
<p><b>Contento et al.</b></p>	<p>Gender: Male 51%</p> <p>Mean age: 12</p> <p>Each group had around 25% AA, 70% Latino, 5% Other</p>	<ol style="list-style-type: none"> <li>1. Intervention Students reported a significant decrease in less healthful behaviors, a decrease in consumption of sugary beverages, and a decrease in consumption of less processed snacks.</li> <li>2. The intervention group reported eating smaller portion sizes and engaged in physical activity more frequently</li> <li>3. Intervention group decreased recreational screen time</li> <li>4. No increase in fruit/vegetable intake was seen in the intervention group</li> <li>5. Positive outcome expectations increased across all C3 target behaviors in the intervention group</li> </ol>	<p>Effect sizes on all significant results were 0.21 to 0.30</p>	<p>Intervention resulted in decreases in frequency of consumption and size of unhealthy foods and beverages, amount of screen time and increase in physical activity. Overall, the study had mixed impacts on targeted energy-balance related behaviors</p> <p>Furthermore, the study had significant positive effects on most of the psychosocial mediators measured, particularly outcome expectations and self-efficacy</p> <p>This study supports the idea that an intervention that combines medical science methods and behavioral theory may provide effective strategies for addressing childhood obesity</p>

**Table 4 Continued: Analysis of Intervention Results Data**

Intervention Program	Population Statistics	Outcome Findings	Measured Outcome Results	Conclusion
<p><b>Coyle et al.</b></p>	<p>Self-report Questionnaire: 725 students</p> <p>24-hour Dietary Recall Survey: 207 students</p>	<ol style="list-style-type: none"> <li>Changes in the attitude towards willingness to eat fruit and towards self-efficacy varied by grade level, with Grade 8 being the only group that showed and increase</li> <li>Students' familiarity with fruits and vegetables increased across all grade levels</li> <li>Changes in preference towards fruits and vegetables varied by grade level, with an increase in preference for fruit only was seen in grade 8. Decrease in preference for vegetables was seen in Grade 5 and 8, but was unchanged in Grade 10.</li> </ol>	<p>Student consumption of fruit in school increased significantly, by 0.34 in Grade 5 and 0.61 in Grade 8, but vegetable consumption during school showed a significant decrease in all groups</p>	<p>Providing free fruits and vegetables in schools shows mixed results in attitudes, preferences for, and intentions to eat more</p>
<p><b>Johnston et al.</b></p>	<p>Ages: 7-9</p> <p>White: 28.3%</p> <p>Asian: 25.3%</p> <p>Black: 23.3%</p> <p>Hispanic: 23.1%</p> <p>321 Overweight or obese children</p> <p>477 Normal weight children</p>	<ol style="list-style-type: none"> <li>Overweight and Obese children in the PFI groups significantly reduced their zBMI scores</li> <li>10.8% of normal weight students became overweight or obese during the program, and no differences in risk were found between the intervention and control groups</li> </ol>	<p>1. <math>-0.07^{33}</math> vs. <math>-0.04^{33}</math> reduction in zBMI score</p>	<p>The study showed that integration of health-related curricula into classrooms can improve weight outcomes in children and this impact can be enhanced through use of trained health professionals</p>

**Table 4 Continued: Analysis of Intervention Results Data**

<b>Intervention Program</b>	<b>Population Statistics</b>	<b>Outcome Findings</b>	<b>Measured Outcome Results</b>	<b>Conclusion</b>
<b>Ling et al.</b>	Total: 1508 Average Age: 8.3 years (5-13) Gender: Boys – 54.5% Girls – 45.5% Race/Ethnicity: N/A 14% lived below federal poverty level 68% qualified for free/reduced lunch	<ol style="list-style-type: none"> <li>1. There was a modest, but significant increase in the number of children meeting physical activity guidelines</li> <li>2. The results of physical activity varied by grade and by school</li> <li>3. There was a significant increase in number of children meeting nutritional guidelines for fruits and vegetables</li> </ol>	<p><b>Physical Activity Goals Met:</b></p> Girls: Baseline 1.1% Post-test: 6.9%                     Boys: Baseline 1.6% Post-test 4.1% <p><b>Nutrition Goals Met:</b></p> Total: Baseline 14.8% Post-test 25.9%	Enacting a comprehensive obesity prevention program in school can increase physical activity levels and improve nutrition levels in rural-based children
<b>Manger et al.</b>	Total: 697 students Intervention: 61% male Control groups: 39% male 14% prevalence of obesity in study population	<ol style="list-style-type: none"> <li>1. Increased number of parents who observed their child eating healthier in the intervention group</li> <li>2. Increased physical activity reported from children in the intervention group</li> <li>3. Greater decline in the BMI percentile of children in the intervention group than in the control group</li> </ol>	<ol style="list-style-type: none"> <li>1. An increase in percentage of kids eating healthier from 60% to 80%</li> <li>2. Increase in exercise frequency from 56% to 76%</li> <li>2. BMI percentage decrease in Control was 1.1% and in intervention group was 3.9%</li> </ol>	The VITAL study was associated with small but statistically significant changes in BMI percentage scores. This study shows that targeting children early can help prevent the onset of excessive weight gain and obesity later in life

**Table 4 Continued: Analysis of Intervention Results Data**

<b>Intervention Program</b>	<b>Population Statistics</b>	<b>Outcome Findings</b>	<b>Measured Outcome Results</b>	<b>Conclusion</b>
<p><b>Pbert et al.</b></p>	<p>Mean Age: 15.8 years</p> <p>Gender: 70% female</p> <p>Race/Ethnicity: 77% non-Hispanic White in all study groups</p> <p>Mean Rate of participation in free/reduced lunch: 16.6% (I), 24.4% (C)</p> <p>Mean baseline obesity rate: 69.5% (I), 60% (C)</p> <p>Mean BMI: I: 31.24 C: 32.78</p>	<ol style="list-style-type: none"> <li>1. No statistically significant differences in diet or exercise between the intervention and control groups at the end of the 6-month period</li> <li>2. The intervention had no effect on screen time between the intervention and control group</li> <li>3. 75% of students found the intervention helpful</li> </ol>	<p><b>Adjusted mean difference in BMI between Intervention and Control:</b></p> <p>-Baseline: -0.09 -Posttest: -0.22<sup>25</sup></p>	<p>Although a majority of students felt they benefited from the intervention, there were no statistical improvements in their overall health status. Likely, the cognitive behavioral portion of the intervention was not thorough enough in helping students overcome barriers and effectively strategize</p>

**Table 4 Continued: Analysis of Intervention Results Data**

Intervention Program	Population Statistics	Outcome Findings	Measured Outcome Results	Conclusion
<p><b>Prelip et al.</b></p>	<p>Age range: 8-11</p> <p>Grades: 3, 4, 5</p> <p>Comparison:</p> <ul style="list-style-type: none"> <li>• Gender: female 55%</li> <li>• R/E: 63% Hispanic, 25% Asian, 5% White</li> </ul> <p>Intervention:</p> <ul style="list-style-type: none"> <li>• Gender: female 56%</li> <li>• R/E: 69% Hispanic, 5% Asian, 17% White</li> </ul> <p>Intervention +:</p> <ul style="list-style-type: none"> <li>• Gender: female 43%</li> <li>• R/E: 82% Hispanic, 2% Asian, 10% White</li> </ul>	<ol style="list-style-type: none"> <li>1. There was a significant difference between the groups regarding race/ethnicity</li> <li>2. Neither of the intervention studies saw a significant effect on fruit/vegetable consumption</li> <li>3. Knowledge on fruits and vegetables increased in the intervention + group and decreased in the comparison group</li> <li>4. There was a significant effect on the students' attitudes and beliefs towards fruits and vegetables in the intervention+ group compared to the comparison and intervention groups</li> </ol>	<p>--</p>	<p>Although students reported more positive attitudes towards the knowledge and consumption of fruits and vegetables, these positive changes did not translate into a behavioral change</p>
<p><b>Sallis et al.</b></p>	<p>Mean Group Statistics:</p> <ul style="list-style-type: none"> <li>• Age: 9.49</li> <li>• White: 82%</li> <li>• Asian: 12%</li> <li>• Latino: 4%</li> <li>• AA: 2%</li> </ul>	<ol style="list-style-type: none"> <li>1. There were no significant differences between the 3 groups in recall surveys reporting off-school physical activity</li> <li>2. There was a significant improvement in the mile-run and pull-up fitness tests for girls at post-test, but there were no significant improvements in physical fitness tests in any of the groups for boys</li> </ol>	<p>--</p>	<p>The SPARK program increased health-related physical education in the schools, but did not make an impact on physical activity out of school.</p>



<b>Table 4 Continued: Analysis of Intervention Results Data</b>				
<b>Intervention Program</b>	<b>Population Statistics</b>	<b>Outcome Findings</b>	<b>Measured Outcome Results</b>	<b>Conclusion</b>
<b>Wordell et al.</b>	<p>Because race was &gt;90% White in all schools, race was not considered in the analysis</p> <p>55.6% response rate in surveys<sup>32</sup></p> <p>Boys (51%) Girls (49%)</p>	<ol style="list-style-type: none"> <li>1. Students self-reports low consumption of all 9 food categories on food survey<sup>32</sup>; juice, sweet drinks, chips, candy, pastries, energy drinks</li> <li>2. Only 25% reported at least 2 servings of milk per day outside of school</li> <li>3. Girls reported more frequent consumption of fruits than boys outside of school</li> <li>4. 26% of girls consumed at least two fruits per day compared to 21.3% of boys</li> <li>5. Boys consumed more sweet drinks and pastries at school than girls did</li> <li>6. Intervention students were 56% less likely to eat pastries and 27% less likely to consume juice</li> </ol>	<p><b>Likelihood for consumption in Intervention vs. Control group in schools:</b></p> <ul style="list-style-type: none"> <li>• Fruit: 1.01</li> <li>• Vegetables: 1.08</li> <li>• Sweet drinks: 0.87</li> <li>• Pastries: 0.44</li> <li>• Energy drinks : 1.03</li> </ul> <p><b>Likelihood for consumption in Intervention vs. Control group out of schools:</b></p> <ul style="list-style-type: none"> <li>• Fruit: 1.21</li> <li>• Vegetables: 0.94</li> <li>• Sweet drinks: 0.94</li> <li>• Pastries: 1.40</li> <li>• Energy drinks : 0.84</li> </ul>	<p>The study showed a positive association between modified food environment and reported student food choices. Thus, school food policies can be part of the long-term solution to the youth obesity epidemic. Results in this study are limited due to lack in ethnic/racial diversity in participants and due to self-reported nature of the data retrieved</p>

## CHAPTER 5 DISCUSSION

Almost 60 million school-aged children are enrolled in schools across the United States, with all race/ethnicities, socioeconomic and geographic groups being represented.<sup>38</sup> Thus, schools present a great opportunity to address necessary changes in childhood and adolescent health-related behaviors. While the epidemiology and science of childhood obesity and overweight are understood, effective methods to prevent or reduce childhood obesity are lacking. This capstone reviewed 10 school-based childhood obesity programs. The results show that programs that focus solely on one approach to childhood obesity prevention (be it either nutrition or physical activity alone) are not effective in reducing BMI or improving dietary and/or physical activity behavior in children. In contrast, school-based programs that target both diet and physical activity behavior in their programs produce more significant results, particularly with respect to modification of dietary and physical activity behaviors.

A notable limitation with the majority of the study programs is the short timeframe of intervention. The timeframe of the interventions ranged from 5 months to 3 years (Table 3), but as several authors explained in their reports, extended time is often needed to for significant results to become apparent, particularly with respect to changes in BMI over time.<sup>36,37</sup>

Based on the results from the ten school-based intervention programs, my model program will adopt the following components:

1. Utilize a multi-component approach where school staff, parents, community leaders and health care professionals will all provide input and support to the intervention.
2. Utilize Social Cognitive Theory, where participating students will not only receive educational information on healthy behaviors, but will also receive motivation interviewing so that they will develop the self-esteem and empowerment needed to take initiative and transform the educational information into modification of behavior.
3. Education curriculum will be incorporated into the science classrooms and will be taught by science teachers.
4. Parents will be receiving health-promotion tips as well to incorporate in the household.
5. Policy changes will be made in the schools, such that sugary drinks and whole milk will be substituted with healthier options.

Obesity rates increased by 10 percent among U.S. children 10- to 17-years old between 2003 and 2007, but by 23 percent during the same time period among low-income children.<sup>1</sup> An additional study found that low-income children are 1.7 times more likely of becoming severely obese as compared to urban children of the same age.<sup>23</sup> Such data support the claim that rural, underserved regions experience unique challenges for children attempting to live a healthy lifestyle. Several factors place rural residency as a risk factor: lack of access to healthy food options, lack of access to preventive health services, inadequate public transportation, and limited community resources.<sup>23</sup> These factors also make implementation of health promotion programs difficult, as proper

infrastructure for program implementation and sustainability are not present. Because rural communities are almost universally qualified as underserved regions due to low socio-economic status, programs must focus on providing an intervention that uses coordinated efforts from multiple resources in the community in an effort to avoid unnecessary financial costs. The model school program I will propose will consider these limited resources and living challenges faced by children in rural, underserved communities.

## **CHAPTER 6 PROPOSED MODEL SCHOOL PROGRAM**

### **Program Name**

The HEARTY Program (Health Experience And Readiness Targeting our Youth)

### **Program Description**

The HEARTY program is a 3-year, multi-component approach to educating students about healthy diet and physical activity behaviors. This program will prepare students to act on healthy behaviors in and out of the school environment. The curriculum consists of basic lessons on diet and nutrition and ways to convert acquired knowledge into positive behavioral modification in the students' daily lives. Also, curriculum will encompass public health issues as it pertains to the particular characteristics in a rural community setting.. Multiple parties will be involved in the planning and implementation process of the program including School District Leaders, teachers and employees, community organizations, local non-profits, churches, parents and health professionals. This program is designed to require minimal financial resources. It relies on enthusiastic volunteers within the school and throughout the community passionate about improving the lives of the children in Cuero, TX. The program is set to run for 3 years, so that adequate time can progress to obtain measureable outcomes. Curriculum will remain the same for all three years.

### **Program Goals:**

1. Increase knowledge of healthy diet and exercise behavior
2. Understand impact one's environment makes on healthy choices
3. Develop self-efficacy and proactive mentality to take action of one's health
4. Increase knowledge of community resources available for children
5. Decrease frequency of fast-food meals

6. Increase physical activity outside of school
7. Generate community awareness on Childhood obesity epidemic through yearly Public Health awareness campaign and Childhood obesity month
8. Increase parent's awareness of their influence on their children's diets

### **Measured Program Objectives**

1. Body Mass Index (BMI)
2. Student knowledge on nutrition and physical activity facts
3. Parent knowledge on healthy home environment
4. Teacher perception of program

### **Target Population and Location**

The target population will be low-income middle school students from 6<sup>th</sup> to 8<sup>th</sup> grade attending Cuero Middle School. The setting of the intervention will be in a rural, underserved community in Southeast Texas. The program is structured to function in a limited community resource region so that it can be easily implemented in any rural underserved community in the United States.

### **Intervention**

The intervention will consist of several components:

Delegating Tasks – A Community Affair: An integral part of the HEARTY Program is widespread community support. To avoid the cost of hiring professionals to oversee the intervention, the HEARTY Program will rely on concerted effort from the community in delegating tasks so that time investment for the program remains manageable for those involved. School officials (Principle, VP, counselors) will be responsible for overseeing the program. School Officials will create a committee made up of 10 community leaders (including the city mayor, business leaders, and church leaders) that will work together

alongside school officials, but will specifically work on ways to promote a healthier environment for children in the community. School officials will delegate a monthly meeting at Cuero Middle School where progress of the program is presented to the committee and local health practitioners. Local Primary care practitioners will be recruited to volunteer their time in providing educational support and guidance to school staff and parents. A copy of the We Can! Curriculum will be given to each practitioner for him or her to review. Practitioners will participate in the following: 1.) Heading the one-day curriculum training session with science teachers at Cuero Middle School, 2.) Participating in a fall and spring Parent/Teacher school meeting, and 3.) Answering any questions presented by students or their parents related to the program during regular doctor appointments (this will ensure students and parents understand the physician's interest and commitment to the program).

Education Curriculum: Curriculum material will come from the National Institute of Health's We Can! Program, which is offered free on the NIH website. The We Can! Curriculum offers both nutrition and physical activity education, and aims to empower children to make the necessary behavioral modifications to live healthier lives. We Can! is originally set for four sessions at 90 minutes each, but in the HEARTY program, it will be broken into 18 lessons, taught by science teachers during the first 20 minutes of science class. Education lessons will be taught Mondays, Wednesdays and Fridays of each week. The curriculum will encompass four major themes that build upon one another throughout the year: 1.) Maintaining a healthy weight: the Energy Balance Equation, 2.) What to Eat: Managing ENERGY IN, 3.) Less sit, More Fit: ENERGY OUT, and 4.) Applying the knowledge.<sup>39</sup> Each mini-session is built to be interactive, with multiple interactive games and activities set to engage students with active learning of the material. All participating science teachers will undergo a one-day training session taught by local health practitioners. Parents will also be provided with education materials during the course of the 3-year program through two methods. First, parents

will receive a monthly single-page newsletter that summarizes the lessons taught to the students during the previous month. It will also provide tips to creating a more health-conscious environment for their children at home. The Vice Principle of Cuero Middle School will create the newsletters. Second, the HEARTY Program will team up with the local Cuero newspaper to provide weekly editorials on health and behavioral modification tips on diet and exercise. Local health practitioners will write these editorials and the HEARTY committee will ensure the editorials are published every week.

Policy/Regulation Changes: The school policy changes that will occur in Cuero Middle School with the HEARTY Program include the following: a.) There will be a school-wide “Eliminate Bad Sugars” campaign that will involve eliminating sugar-sweetened drinks from school vending machines and cafeterias. Instead, milk, water, and 100% fruit juice will be offered. School counselors will run the “Eliminate Bad Sugars” campaign. b.) All school staff and employees will be advised to serve as models of healthy eating, through their behavior and nutrition habits.

Activities: The community of Cuero will host 2 citywide health promotion events. The first will be a walk-a-thon held during the Month of September in recognition of childhood obesity prevention month. The event will be run by the HEARTY committee and will be staffed by the middle school students. The goal is to promote physical activity. The second community-wide event will be held in April to commemorate Public Health Week. It will be a month-long Cuero’s Biggest Loser event and people in the community will be able to sign up for a chance to be the participate. Results of the biggest loser will be held at the end of April in a festive community-wide fair held at the school gym and hosted by the middle school students. This will serve to instill inspiration and moral in students as they watch people successfully lose weight and become healthier. To engage students towards increasing their physical activity, the school will have an end-of-the-year Cuero Olympics, where all students will engage in a



friendly daylong competition through fun interactive games. Prizes will be awarded to children who excel in different categories, and all participants are awarded with a class party at the completion of the games.

**Method of Outcomes Assessment:**

1. Survey questionnaires on Diet and physical activity knowledge will be given to all participating students at the beginning and at the end of each year
2. Height and Weight will be assessed at the beginning and the end of the school year, and BMI will be calculated to assess change in score over time. Changes in BMI score will be compared at the end of each year and a final change will be reported from start of the program to completion
3. Teachers will receive program evaluations at the end of each year to assess perceived effectiveness of the program
4. Parents will receive a program evaluation at the end of each year to assess perceived effectiveness of program on self-reported knowledge and on behavioral changes noted in the students. Surveys will be sent home via letter given to students

**Sustainability**

Sustainability of any program is crucial to addressing any chronic, long-term public health concern. Ensuring the same players that help initiate the program will remain through the program's entirety will maximize sustainability of the program. The HEARTY committee is a 3-year commitment and all its members will serve to maintain continuity of the program with each passing year. Furthermore, the program is created to be financially independent from any outside funding source, which will allow the school to maintain the same quality of education for its students without the added stress of modifying its infrastructure to offset added costs for the program. Having multiple

players responsible for successful program execution will promote accountability among individuals to complete their assigned duties, and will additionally help break down duties to manageable portions among each participating individual. Such benefits will create a more positive experience with participating individuals, thus increasing their productivity and level of investment to the program. Data will be continually updated and saved and records will be kept with the HEARTY committee so that past information can always be referenced, and new data can be compared to previous data.

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## VITA

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