

USING THE ECOLOGICAL MODEL OF PREDICTORS TO ADDRESS GAPS IN
CHILDHOOD OBESITY PREVENTION RESEARCH

A Dissertation

by

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Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PUBLIC HEALTH

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May 2016

Major Subject: Health Promotion and Community Health Sciences

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ABSTRACT

Childhood obesity is a public health issue that must be addressed using interventions that increase physical activity, reduce sedentary behaviors and reduce the consumption of unhealthy food and beverages. Although researchers have identified the primary factors that increase a child's risk for obesity, there is still very little scientific understanding of how context influences the outcomes of childhood obesity prevention interventions. The purpose of this dissertation is to provide additional insight into how researchers and practitioners can strengthen obesity prevention interventions to reach children in multiple contexts.

The first study is a systematic literature review that examines the impact of school characteristics, including school climate and school culture, on the adoption, implementation and sustainability of school-based obesity prevention interventions. . Organizational characteristics related to access to resources, staff training/professional development, internal support and organizational values influenced the adoption, implementation and sustainability of school-based obesity prevention interventions. The findings also highlight the need for validated tools to aid researchers in defining and measuring school climate and culture related to health.

The second study examines parent encouragement as a moderating variable between parent physical activity and child screen time. Parent encouragement was a moderating variable among White children and for children whose parents reported that it was safe for their child to play in their neighborhood with other children. This study

highlights the importance of community and parent perceptions in the delivery of interventions that seek to reduce sedentary behaviors.

The final study examines the relationship between organized sports and child physical activity. Multi-level modeling was used to examine the association between school, child/ family characteristics and participation in organized sports. The results of this study suggest that children who participate in organized sports are more active than their peers who do not participate in organized sports. Surprisingly, girls were more likely to report participation in organized sports than boys. Physical activity did not vary between schools or by race/ethnicity or weight status.

The findings from this dissertation highlight the importance of researchers exploring the influence of context on childhood obesity risk. Gaining additional insight into how context influences a child's risk for obesity may assist in the development of obesity prevention interventions that reach children in multiple environments.

DEDICATION

I dedicate this dissertation to my mom and dad, Willie and Ramona Fair. Thank you for being my biggest cheerleaders and support system! I am so blessed to have such supportive and loving parents. Thank you for instilling the value of education in me from an early age and supporting me.

ACKNOWLEDGEMENTS

I thank God for this amazing experience and the opportunity to achieve a lifelong goal. I have been blessed to be mentored and encouraged by the kindest faculty and staff. I could not have asked for a more supportive dissertation committee! Dr. Ory, thank you so much for your amazing mentorship and support throughout this entire process. I am so grateful for the patience and kindness that you have shown me. Thank you for taking an interest in my professional and personal success and for believing in me! Dr. Luo, thank you for all of your feedback and support. I am especially grateful for your willingness to meet with me, sometimes on very short notice. Dr. McKyer, thank you for your support and guidance throughout this process. Dr. Warren, thank you for your support, encouragement and for providing an opportunity for me to work with the TGEG team!

I would also like to acknowledge and thank the Health Promotion and Community Health Sciences faculty and staff as well as the many other supportive faculty and staff from other departments at the School of Public Health. Many thanks to the entire TGEG family for welcoming me to the project with open arms. A special thank you to the students who have encouraged me during my time at Texas A&M. My heart is full knowing that I leave Texas A&M with lifelong friendships and wonderful memories.

NOMENCLATURE

AAP	American Academy of Pediatrics
AHA	American Heart Association
BMI	Body Mass Index
CDC	Centers for Disease Control and Prevention
HHS	U.S. Department of Health and Human Services
MVPA	Moderate to Vigorous Physical Activity
PA	Physical Activity

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CHAPTER I

INTRODUCTION

The most recent statistics from the National Health and Nutrition Examination Survey estimate that 17% of children in the United States are obese (Ogden, Carroll, Kit & Flegal, 2014). The prevalence of obesity is even higher among Black and Hispanic children with 20% of Black and 22% of Hispanic youth classified as obese, compared to 14% of White youth (Ogden et al., 2014). These statistics are even more alarming for children residing in the state of Texas (Hoelscher et al., 2004; University of Texas School of Public Health, 2012). The results from the 2011-2012 School Physical Activity and Nutrition (SPAN) report reveal that 23.8% of 4th graders, 23% of 8th graders and 21.6% of 11th graders are obese in the state of Texas (University of Texas School of Public Health, 2012).

Most cases of childhood obesity are the result of environmental and cultural factors that promote increased calorie consumption, reduced physical activity and increased sedentary behaviors (Ebbeling, Pawlak & Ludwig, 2002). Over the last 30 years, children have experienced increased access to high calorie and low nutritional value food items, such as fast food, salty and sweet snacks and sugar-sweetened beverages (Ebbeling, Pawlak & Ludwig, 2002; Story, 1999). In addition to the increasing availability and preference for food items that are high in calories and provide little nutritional value, cultural preferences for more sedentary forms of entertainment have resulted in a significant reduction in physical activity (Anderson & Butcher, 2006; Ebbeling, Pawlak & Ludwig, 2002). Furthermore, children in households with less

supervision and opportunities for outdoor play may engage in more screen time activities, which is highly correlated with obesity (Ebbeling, Pawlak & Ludwig, 2002; Robinson, 2001).

Childhood obesity is associated with several negative physical, emotional and academic consequences. Obese children are at increased risk for developing chronic conditions typically associated with adulthood, such as Type II diabetes, fatty liver disease, hypertension and elevated cholesterol (Ebbeling, Pawlak & Ludwig, 2002; Ludwig, Peterson, & Gortmaker, 2001). Children with chronic medical conditions are at increased risk for experiencing poor academic outcomes from health-related absences and may also suffer mental and emotional anguish from bullying and weight-related discrimination (Must & Strauss, 1999; Janssen, Craig, Boyce & Pickett, 2004).

Childhood obesity is a complex public health problem that requires interventions that address the multiple risk factors that contribute to the high prevalence of childhood overweight and obesity (Anderson & Butcher, 2006; Centers for Disease Control and Prevention, 2011; Institute of Medicine, 2013; Ogden, Carroll, Kit & Flegal, 2014). This dissertation will focus on three childhood obesity research gaps while considering each of the three contextual environments in which children reside: home, school and community using the ecological model of predictors for childhood overweight as a conceptual framework (Davison & Birch, 2001). The ecological model of predictors was created to prompt researchers and practitioners to consider the multiple contexts in which children live and to illustrate how parenting style/family characteristics, child

characteristics and community/societal characteristics interact to influence child weight status (Davison & Birch, 2001).

The first paper examines the effect of school culture and climate on the adoption, implementation and sustainability of school-based interventions. This project also explores how researchers and practitioners measure and define school characteristics, including school climate and culture. Gaining a better understanding of how school characteristics influence the adoption, implementation and sustainability of childhood obesity programs may support schools with the task of identifying school-based obesity prevention interventions that are suitable for their setting and promote successful outcomes.

The second paper examines the potential for parent/guardian encouragement to moderate the effect of parent/guardian physical activity on a child's sedentary behavior habits. The sedentary behavior of interest is screen time in the form of watching television and playing video or computer games. Given the limited research on the determinants of sedentary behavior, this paper will add more insight into how practitioners can develop interventions that promote the reduction of sedentary behaviors.

The third paper explores both organizational and individual characteristics associated with increased participation in organized sports among elementary school children. This research seeks to identify the characteristics of children who participate in organized sports in 28 Title I schools in the state of Texas. This paper will also explore

the physical activity habits and behaviors among children who participate in organized sports compared to children who do not participate in organized sports.

CHAPTER II

THE INFLUENCE OF ORGANIZATIONAL CULTURE AND CLIMATE ON SCHOOL-BASED OBESITY PREVENTION INTERVENTIONS: A SYSTEMATIC REVIEW OF THE LITERATURE

INTRODUCTION

Although schools have the potential to address many of the risk factors that contribute to childhood obesity, many school-based obesity prevention research findings are mixed and are plagued with methodological limitations (Katz, O'Connell, Njike, Yeh & Nawaz, 2008; Thomas, 2006). Many school-based obesity prevention interventions are implemented with a “one size fits all” approach that operates under the assumption that the intervention should easily translate to all settings (Baranowski, Cullen, Nicklas, Thompson & Baranowski, 2002; Katz, O'Connell, Njike, Yeh & Nawaz, 2008; Khambalia, Dickinson, Hardy, Gill, & Baur, 2012; Kropski, Keckley, & Jensen, 2008; Thomas, 2006). Unfortunately, this “one-size fits all” approach fails to consider how context in the form of organizational characteristics may have influenced the adoption, implementation and sustainability of the intervention. Furthermore, this approach may not provide adequate information about how compatible that particular intervention may be in other school settings (Glasgow, Vogt & Boles, 1999; Klesges, Dzewaltowski & Glasgow, 2008).

School culture and climate have been examined in relation to a variety of student outcomes, including smoking, risk-taking, and violence (Aveyard et al., 2004, Astor, Benbenishty, Zeira & Vinokur, 2002.) Findings from school climate research highlight

the importance school-based interventions matching the collective goals and values of the organization (Giacquinta, 1973; Elmore, 2000; Weick, 1976). School leaders must also clearly define organizational goals and outline the roles and responsibilities of all involved to facilitate the adoption of innovative programs (Giacquinta, 1973; Elmore, 2000; Weick, 1976).

In recent years, many schools have experienced a shift towards a school climate that focuses on improving academic outcomes and standardized test scores at the expense of other school activities, including physical and health education (Winter, 2009). The increasing focus on academic outcomes and standardized test scores has resulted in the perception among school administrators and staff that there is too little time for health promotion activities (Lytle, Ward, Nader, Pedersen & Williston, 2003; Parcel et al., 2003; Winter, 2009). Given that schools are complex organizations, it is important for researchers to develop interventions that consider the complexity of schools and assist schools with the challenging task of meeting the needs of multiple stakeholders (Giacquinta, 1973).

In addition to addressing the demands of multiple stakeholder groups, school-based obesity prevention interventions must also tackle a multitude of factors that increase the risk of childhood obesity. However, these multi-component obesity prevention interventions may be more challenging to implement in the school setting (Leviton, 2008; Story, 1999). Such programs often require behavior change from more than one person or what Giacquinta (1973) describes as “complex cooperation”. Understanding the organizational characteristics, including the collective values and

goals, among those within the organization is important to ensure that new programs align with existing school values (Giacquinta, 1973; Rosenholtz, 1985). Many times new programs are implemented on a volunteer basis which provides teachers with the autonomy to decide what program components, if any, are delivered in their classroom (Elmore, 2000 & Rosenholtz, 1985). These programs are usually implemented by a small group of teachers and are rarely aligned with the larger goals and values of the organization, which may prevent the program from being adopted and institutionalized throughout the organization (Elmore, 2000 & Rosenholtz, 1985). School leadership must somehow promote programs that give staff the flexibility to maintain autonomy while also establishing common goals and objectives that should be met (Giacquinta, 1973; Rosenholtz, 1985).

Most research on school-based obesity interventions has focused on outcomes and fails to consider how organizational characteristics may have influenced these outcomes (Klesges, Dzewaltowski & Glasgow, 2008; Thomas, 2006). Given what is already understood about the importance of school characteristics on the adoption of innovative programs (Elmore, 2000; Giacquinta, 1973; Rosenholtz, 1985), researchers need to gain a better understanding of how to align health promotion programs with existing school climate and organizational goals. The purpose of this review is to identify organizational characteristics, including school climate and culture, that may have influenced the adoption, implementation and sustainability of school-based obesity prevention programs.

Defining Organizational Culture and Climate

Organizational culture and climate are defined a number of different ways by organizational researchers and theorists (Schien,1990; Schien, 2010; Schultz & Hatch, 1996). Since organizational climate and culture are abstract constructs, Schien's Model of Organizational Culture was used to clearly define the organizational characteristics examined in this review (Schien, 1990; Schien, 2010. The author selected Schien's model as it separates organizational culture into three distinct levels and considers organizational climate to be a manifestation of culture rather than synonymous with culture.

Schien (2010) defines organizational culture as: “ (a) a pattern of basic assumptions; (b) invented, discovered or developed by a given group; (c) as it learns to cope with it's problems of external adaptation and internal integration; (d) that has worked well enough to be considered valid and, therefore is taught to new members as the (f) correct way to perceive, think, and feel in relation to those problems” (Schien, 1990, page 111).

Although organizational culture and climate refer to two different constructs, many researchers erroneously use the terms interchangeably (Schien, 2010). According to Schien (2010), organizational culture has three levels:

1. Artifacts: the most basic level which also includes organizational climate.
2. Espoused beliefs and values
3. Basic underlying assumptions

Schien cautions that while the artifact level is the easiest level to observe, as it includes observable behavior, it may also be the hardest level to interpret by those outside of the organization (Schien, 2010). Organizational culture is difficult to change and has structural stability, meaning that it remains even after members of the organization change (Schien, 2010). Schien describes one way of looking at culture as examining what new members of the organization are taught (Schien, 2010).

Research Questions

This review examines three questions regarding school characteristics, including climate and culture, and school-based obesity prevention interventions:

1. How do organizational characteristics, including school climate or culture and/or perceptions of school climate or culture, influence the implementation of school-based obesity prevention interventions?
2. What tools do researchers use to define and measure “school climate” or “school culture”?
3. What strategies can schools use to create a more supportive school climate and culture towards health?

METHODS

Literature Search

The literature review was conducted using the guidelines from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses-The PRISMA Statement (Moher, Liberati, Tetzlaff & Altman, 2009). The author enlisted the help of an academic librarian who specializes in systematic literature reviews to help with selecting search terms and the identification of relevant databases. The databases EBSCO (CINAHL, ERIC, Agricola), Web of Science, Medline (Pubmed) and Scopus were searched to examine the school-based obesity prevention literature. Each database was searched using the following key words with Boolean connections: school (elementary, middle/junior high school), school climate, school culture, school characteristics, organizational climate, organizational culture, organizational characteristics, health promotion, obesity prevention, implementation, adoption, and sustainability. The reference lists of relevant articles were also reviewed for additional articles to include in the review.

Inclusion/Exclusion Criteria

In order to meet inclusion criteria, studies had to: (a) be a primary research article published in a peer-reviewed journal between January 1990 and September 2015; (b) written in the English language; (c) describe a school-based obesity prevention intervention that was delivered in an elementary and/or middle school located in the United States; (d) collect organizational level data from at least one level of Schien's

organizational culture framework (Schien, 2010) and (e) examine how organizational factors may have influenced the adoption, impact or sustainability of the intervention. Studies were excluded if the intervention was not delivered during the school day or was implemented for less than six months. Studies that did not collect data on organizational characteristics or evaluate how organizational characteristics influenced the adoption, implementation and sustainability of the program were also excluded.

Study Selection/ Data Abstraction

After the initial key word search and duplicate articles were removed, the author reviewed the titles and abstracts of potential articles. The full texts of abstracts that met the inclusion criteria were reviewed. A second coder independently reviewed 22 (35%) of the articles that were included in the full text screen. Selecting this number of articles exceeded the recommendation by Schlosser (2007) that authors of systematic literature reviews select a sample of at least 20-30% for independent review by a second coder with a goal of inter-rater reliability between 80%-100%.

RESULTS

Article Characteristics

A total of 1475 records were retrieved using the key word search. Three additional articles were identified after reviewing references of articles meeting inclusion criteria. Once duplicate articles were eliminated, the author reviewed 919 abstracts and excluded articles that did not meet inclusion criteria. The two most common reasons articles were excluded from the review were: (a) not covering the topic of childhood obesity (n= 645) and (b) not describing a school-based intervention (n=125). A total of 66 articles were eligible for the full-text screen. A second coder independently reviewed a sample of 22 articles (35%) included in the full text screen to calculate inter-rater reliability. Any disagreements between coders on whether or not the article met inclusion criteria were resolved by discussion to achieve 100% agreement.

Figure 2.1 below describes the search and screening process in more detail.

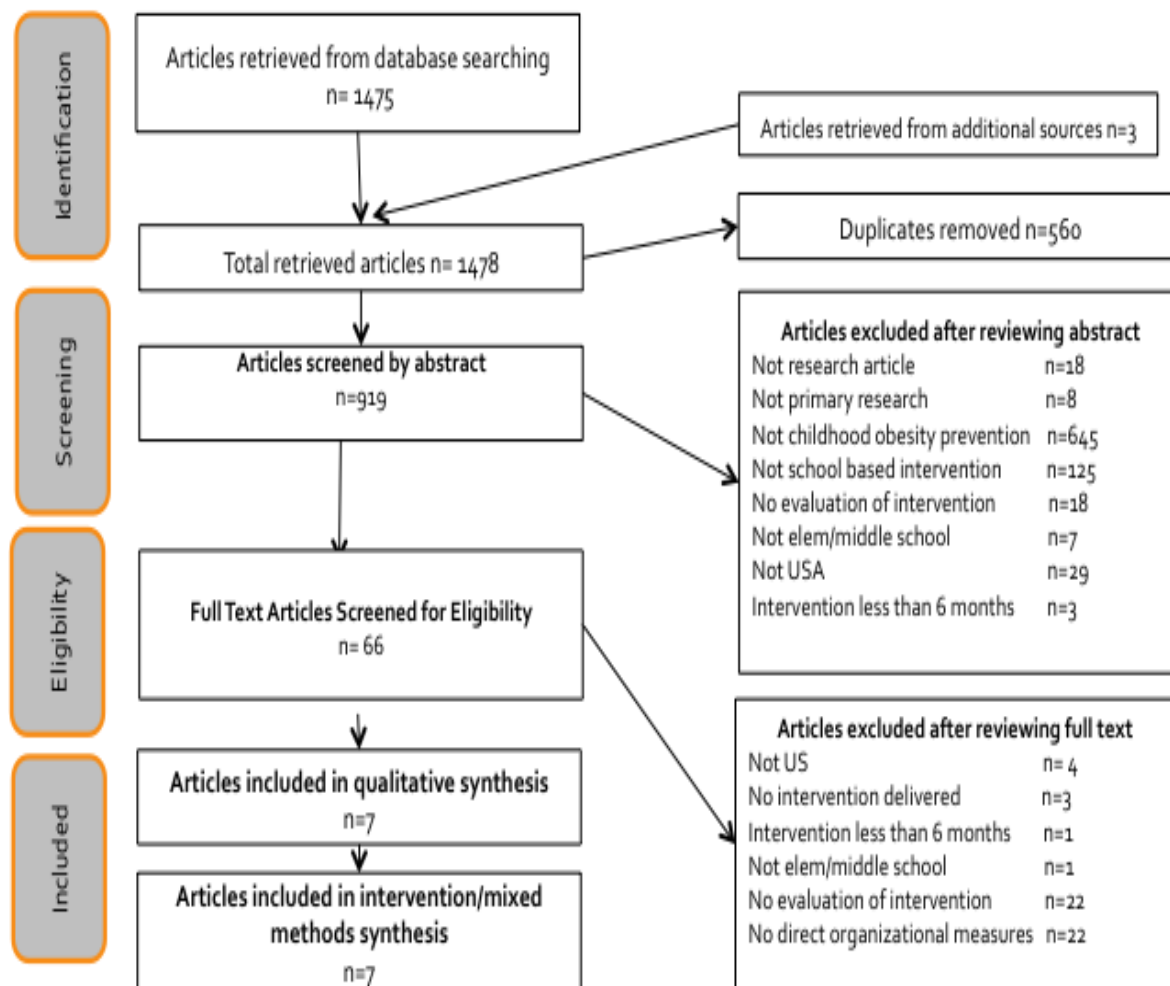


Figure 2.1: PRISMA Flow Diagram of Search and Screening Process

The articles were equally divided between qualitative articles that focused on staff perceptions of the obesity prevention intervention and intervention studies that described the adoption, implementation and sustainability of the intervention using mixed methods or survey data. Among the intervention studies, only two studies relied solely on survey data. The overall purpose of each of the studies was to reflect how school characteristics influenced the adoption, implementation and sustainability of a school-based obesity prevention intervention. General study characteristics, including title, journal name, publication year, data collection methods, were extracted from each study and presented in **Table 2.1** using the Matrix Method (Garrard, 2013).

Table 2.1: Literature Review Matrix

Lead author/year	Journal	Program Name	Program Components	Sample Characteristics (site/participants)	Data Collection Methods	Purpose of Study
Bauer, 2006	<i>Preventing Chronic Disease</i>	Planet Health	Integration of healthy eating and physical activity promotion in classroom curriculum.	5 urban middle schools in Boston, MA 35 school administrators and classroom teachers	Focus groups	To assess school environment and policies to identify facilitators and barriers to the implementation of nutrition and physical activity interventions.
Centeio, 2014	<i>Journal of Teaching in Physical Education</i>	Comprehensive School Physical Activity Program	Increase student physical activity during physical education, before/after and during school hours by delivering professional development to physical education teachers to promote school wide increases in physical activity.	10 elementary school physical education teachers in 10 schools in one US state	Semi-structured interviews. Document review Teacher surveys Site visits/observation Online forum monitoring	To examine the attitudes and perceptions of physical education teachers on the Comprehensive School Physical Activity Program.

Table 2.1 Continued

Lead author/year	Journal	Program Name	Program Components	Sample Characteristics (site/participants)	Data Collection Methods	Purpose of Study
Gittelsohn, 2003	<i>Preventive Medicine</i>	Pathways	Promote increased physical activity and healthy eating among American Indian elementary students through classroom curriculum, food service changes and family events.	21 elementary schools in 4 Southwest states in U.S. 290 school staff members (administrators, food service personnel, classroom teachers and P.E. teachers)	In-depth interviews	To assess how school climate may influence the implementation and sustainability of the program.
Greaney, 2014	<i>Journal of Nutrition Education and Behavior</i>	Healthy Choices-Planet Health	Integration of healthy eating and physical activity promotion in classroom curriculum. Before, during and after-school opportunities for nutrition education and physical activity. Health campaigns promoting increased consumption of fruits and vegetables and reduction in sedentary behaviors.	8 middle schools in Massachusetts 56 school staff members (teachers, administrators, food service personnel)	Interviews	To identify barriers and facilitators to program implementation and sustainability through interviews with staff from the 4 highest implementing and 4 lowest implementing schools.

Table 2.1 Continued

Lead author/year	Journal	Program Name	Program Components	Sample Characteristics (site/participants)	Data Collection Methods	Purpose of Study
Hoelscher, 2004	<i>Preventive Medicine</i>	Child and Adolescent Trial for Cardiovascular Health (CATCH)	<p>Nutrition education and physical activity integrated into classroom curriculum.</p> <p>Improvement to Physical Education.</p> <p>Environmental changes to school to promote PA and healthy eating.</p>	<p>88 schools (56 intervention, 20 control and 12 non-exposed) in California, Louisiana, Minnesota and Texas</p> <p>645 PE lessons observed</p> <p>741 teachers</p> <p>Principal/administrator and cafeteria staff from all schools</p>	<p>Surveys</p> <p>Observation</p>	To examine institutionalization of CATCH in schools 5 years after the completion of research trial.
Jain, 2013	<i>Journal of School Health</i>	Activate for Kids	<p>School nurse training in obesity screening and obesity prevention policy development.</p> <p>District wellness coordinators to support school nurses.</p> <p>BMI screening and referral to community-based intervention for overweight/ obese children.</p>	<p>100 schools (includes elementary, middle and high schools) in 6 school districts</p> <p>19 key informants (school nurses, wellness coordinators, parent/child participant, district administrators)</p>	Key informant interviews	To obtain information from key informants about the facilitators and barriers to implementing Activate for Kids.

Table 2.1 Continued

Lead author/year	Journal	Program Name	Program Components	Sample Characteristics (site/participants)	Data Collection Methods	Purpose of Study
Johnson, 2003	<i>Health Education and Behavior</i>	Child and Adolescent Trial for Cardiovascular Health (CATCH)	Nutrition education and physical activity integrated into classroom curriculum. Improvement to Physical Education Environmental changes to school to promote PA and healthy eating.	88 schools (56 intervention, 20 control and 12 non-exposed) 890 classroom teachers	Teacher surveys	To identify facilitators and barriers to the long-term institutionalization of the CATCH classroom curriculum among intervention schools.
Kelder, 2003	<i>Health Education and Behavior</i>	Child and Adolescent Trial for Cardiovascular Health (CATCH)	Nutrition education and physical activity integrated into classroom curriculum. Improvement to Physical Education (PE). Environmental changes to school to promote PA and healthy eating.	96 schools in California, Louisiana, Texas and Minnesota 903 classroom teachers and 90 PE specialists surveyed 199 interviews with food service personnel, classroom and PE teachers 645 PE classes observed	Surveys Classroom observations Interviews	To identify factors which support the institutionalization of school-based physical activity programs.

Table 2.1 Continued

Lead author/year	Journal	Program Name	Program Components	Sample Characteristics (site/participants)	Data Collection Methods	Purpose of Study
Lederer, 2015	<i>Journal of School Health</i>	Healthy, Energetic, Ready, Outstanding, Enthusiastic, Schools Initiative (HEROES)	<p>Health promotion integrated into curriculum.</p> <p>Increased opportunities for improved nutrition and PE among students and staff.</p> <p>Family events to promote family involvement.</p>	<p>10 elementary schools</p> <p>4 middle schools</p> <p>3 high schools</p> <p>School administrator, wellness director and cafeteria manager at each school</p>	<p>Key informant interviews</p> <p>Classroom observations</p> <p>Review of wellness documents (newsletters, flyers, etc)</p>	To examine the relationship between school characteristics and program fidelity.
Lucarelli, 2014	<i>Journal of School Health</i>	School Nutrition Advances Kids (SNAK) project	<p>School self-assessment of nutrition environment and planning.</p> <p>Implementation of state nutrition policy.</p>	<p>8 middle schools in Michigan</p> <p>24 interviews with 3 members of school staff at each school (administrator, member of coordinated school health team and food service director)</p>	Key informant interviews	Identify barriers/facilitators to promoting healthy eating in the school setting and gain a better understanding of the factors that contribute to organizational change in schools.

Table 2.1 Continued

Lead author/year	Journal	Program Name	Program Components	Sample Characteristics (site/participants)	Data Collection Methods	Purpose of Study
Lytle, 2003	<i>Health Education and Behavior</i>	Child and Adolescent Trial for Cardiovascular Health (CATCH)	Nutrition education and physical activity integrated into curriculum. Improved Physical Education. Environmental changes to school to promote PA and healthy eating.	96 elementary schools in California, Texas and Minnesota 199 interviews with food service personnel, classroom teachers and PE teachers	Key informant interviews	To identify factors that impacted the adoption and institutionalization of CATCH.
Parcel, 2003	<i>Health Education and Behavior</i>	Child and Adolescent Trial for Cardiovascular Health (CATCH)	Integration of nutrition education and physical activity into classroom curriculum. Improvement to Physical Education.	56 intervention schools in California, Texas and Minnesota 903 classroom teachers and 56 PE specialists surveyed. 401 PE classes observed	Nutrient analysis of menus. PE teacher survey Classroom teacher survey	Examine the influence of school climate on the institutionalization of CATCH components.

Table 2.1 Continued

Lead author/year	Journal	Program Name	Program Components	Sample Characteristics (site/participants)	Data Collection Methods	Purpose of Study
Slawson, 2013	<i>Journal of School Health</i>	Winning with Wellness- Go, Slow, Whoa	Integration of nutrition into classroom curriculum. Classification of food items in school cafeteria.	7 elementary/middle schools in Tennessee 37 cafeteria staff participated in focus groups 131 teachers surveys	Focus groups and teacher surveys	Examine cafeteria staff and teacher perceptions of the influence of the Go! Slow! Whoa! on student food choices.
Wiecha, 2004	<i>Journal of Pediatric Psychology</i>	Planet Health	Integration of healthy eating and physical activity promotion in classroom curriculum.	6 middle schools located in Boston Teachers and administrator completed fall/spring surveys for 3 years. Year 1: n=38 Year 2: n=36 Year 3: n=46	Staff surveys	Examine staff perceptions of acceptability and feasibility of the Planet Health Program.

Methodological Quality of Reviewed Articles

Quantitative/Intervention Studies. The author adapted the RE-AIM Criteria for Conducting Literature Reviews: Coding Sheet for Publications Reporting on RE-AIM elements to rate each of the intervention articles. The RE-AIM framework was selected given the framework's focus on reporting elements related to internal and external validity (Glasgow, Vogt & Boles, 1999). The RE-AIM framework prompts researchers to report on five elements: (a) reach; (b) effectiveness; (c) adoption ;(d) implementation and (e) maintenance. Each of these elements may provide useful information for other sites considering the intervention in their setting (Glasgow, Vogt & Boles, 1999).

All of the intervention articles reported information related to the inclusion criteria used to select participants, the expertise level of the delivery agent, type of intervention delivered and the intensity of the intervention. However, none of the intervention articles described the characteristics of non-participants, attrition rates, or costs associated with program implementation. The author reported on each of the five elements of the RE-AIM framework and described the findings in detail on **Table 2.2**.

A random selection of 43% of the intervention articles was independently reviewed by a second coder to assess methodological criteria using RE-AIM criteria. There was greater than 95% agreement between the two coders, which demonstrates good inter-rater reliability.

Table 2.2: *Distribution of RE-AIM Elements Reported in Studies*

RE-AIM Element	Percentage of articles that reported on RE-AIM component (n=7)
Reach	
Reach 1: Describes method to identify target population.	57%
Reach 2: Describes inclusion criteria.	100%
Reach 3: Describes exclusion criteria.	0%
Reach 4: Describes sample and participation rate.	57%
Reach 5: Describes characteristics of both participants and non-participants.	0%
Effectiveness	
Effectiveness 1: Describes measures and results.	50%
Adoption	
Adoption 1: Describes level of expertise of the delivery agent.	100%
Adoption 2: Describes adoption rate.	71%
Adoption 3: Describes characteristics of adopters and non-adopters.	14%
Implementation	
Implementation 1: Describes intervention type and intensity.	100%
Implementation 2: Describes program fidelity (measures if delivered as intended).	48%
Implementation: Describes attrition rate.	0%
Implementation 3: Measure cost to implement.	0%
Maintenance	
Maintenance 1: Health behavior assessed at least 6 months after intervention completed/delivered.	100%
Maintenance 2: Program in place at completion of the study.	86%
Maintenance 3: Was the program modified?	71%

Adapted from the RE-AIM Criteria for Conducting Literature Reviews. Source: Virginia Tech College of Agriculture and Life Sciences

Qualitative Studies. Critical appraisals of the qualitative articles included in the review were conducted using a modified version of the Critical Appraisal Skills Programme (CASP) quality checklist (CASP, 2014). The CASP quality checklist reviews research methodology, clarity of research aims, acknowledgment of research bias and evaluates whether the research adds valuable information to the field of

childhood obesity prevention research. **Table 2.3** describes the percentage of studies that met each of the criteria. A second coder independently assessed the quality of three (43%) of the qualitative articles that met inclusion criteria. Agreement between the author and the second coder on the methodological quality of each study was over 95% demonstrating good inter-rater reliability.

Table 2.3: *Distribution of CASP Elements Reported in Studies*

Quality Measurement	Percentage of Studies meeting criteria (n=7)
Clear Aims	100%
Appropriate Methodology?	100%
Examined relationship between researcher/participants?	29%
Clear findings?	100%
Rigorous data analysis?	100%
Do findings contribute something of value?	100%

Adapted from the Critical Appraisal Skills Programme Checklist (2014)

Themes of Relevant Organizational Characteristics

Four themes were identified as organizational characteristics related to school climate or culture that influenced the adoption, implementation and sustainability of school-based obesity prevention interventions. Each theme is listed and described below.

Organizational Behavior in Response to Challenges related to Limited Resources. Schien (2010) describes culture as how an organization responds to challenges. One of the most prevalent challenges identified in each of the articles was limited resources in the school environment. Schools who were able to navigate the challenges related to limited resources were more likely to adopt, implement and sustain

school-based childhood obesity prevention interventions. Resources included access to healthy food options, funding, staff, equipment and physical space.

Nutritional Resources. Nutritional resources refer to both access to healthy food items and access to a physical environment that provides an opportunity for schools to prepare and serve healthy meals. Many schools did not have a full-service kitchen and either had ready-to-eat meals delivered from a vendor service or were limited to heat-and-serve options (Bauer, Patel, Prokop & Austin, 2006; Lucarelli et al., 2014; Lytle, Ward, Nader, Pedersen & Williston, 2003). Many staff expressed concerns that outside vendors may not offer the healthiest food options (Bauer et al., 2006; Lucarelli et al., 2014; Lytle et al., 2003). In addition to limited kitchen space, several studies discussed how food budgets might have prevented schools from purchasing healthier food items that were more expensive (Greaney et al., 2014; Lytle et al, 2003; Lucarelli et al., 2014). Some school staff even reported concerns about wasting limited funding on healthier food items that children would not consume (Lederer, King, Sovinski, Seo & Kim, 2015; Slawson et al., 2013).

Physical layout and school environment. Several studies reported how limited space, either indoors or outdoors, for physical activity resulted in the inconsistent delivery of physical education and how schools often used a multi-purpose room for physical education (Bauer et al., 2006; Gittelsohn et al, 2003; Lytle et al., 2003). The use of a multipurpose room, rather than a room dedicated solely for the purpose of physical education, sometimes resulted in physical education classes being cancelled to allow the space to be used for other purposes unrelated to physical activity (Bauer et al,

2006; Gittelsohn et al., 2003, Lytle et al., 2003). School staff also reported that missing, limited, broken or worn out physical activity equipment, such as balls, resulted in some children not being able to fully participate in physical education (Johnson et al., 2003; Lytle et al., 2003; Kelder et al., 2003). The lack of proper exercise equipment was a major barrier for implementation as well as sustainability (Lytle et al., 2003).

Staff workload/ demands. Another common theme throughout several of the studies was the additional burden that health promotion programs place on busy staff. The additional time burden to prepare lesson plans, prepare meals/snacks in the classroom and implement guidelines was considered a barrier to the implementation and sustainability of school-based obesity prevention interventions (Gittelsohn et al., 2003, Greaney et al., 2014, Johnson et al., 2003; Lytle et al., 2003; Slawson et al., 2013). Additionally, schools that experienced significant turnover or were understaffed due to budget cuts reported increased workload among teachers, decreased implementation of school-based obesity prevention interventions, and eventual discontinuation of the program in some cases (Hoelscher et al., 2004, Johnson et al., 2003; Lytle et al., 2003; Wiecha, et al., 2004). Some administrators were hesitant to adopt school-based obesity prevention interventions as they were concerned about overwhelming existing staff who were already burdened with additional responsibilities and expanded roles (Gittelsohn et al., 2003).

Academic mandates and testing were most commonly cited as the primary competing demand interfering with the delivery of obesity prevention interventions as school staff and administrators expressed how preparing for academic testing resulted in

schools viewing school-based obesity prevention interventions as less of a priority (Jain & Langwith, 2013; Johnson et al., 2003; Lucarelli et al., 2014; Wiecha et al., 2004). Programs that were easily integrated into existing workload and curriculum were more likely to be adopted, implemented and sustained (Hoelscher et al., 2004, Kelder et al., 2003; Lytle et al., 2003; Wiecha et al., 2004).

Staff training and Professional Development. Training was also considered an organizational resource that assisted in the promotion and delivery of school-based obesity prevention interventions. Schools that properly trained staff, had staff members educated in health promotion techniques or staff who were comfortable with health promotion topics were more successful at implementing school-based obesity prevention interventions (Centeio, Erwin & Castelli, 2014; Jain & Langwith, 2013; Johnson et al., 2003; Kelder et al., 2003; Lytle et al., 2003; Wiecha et al., 2004). Furthermore, access to resources in the form of technical assistance and supplies, especially after the completion of the program, was associated with long-term implementation of the program and sustainability (Greaney et al, 2014; Lytle et al., 2003; Wiecha et al., 2004). Staff training and development may also prompt physical education teachers to expand their roles in an effort to improve the health of children (Centeio, Erwin & Castelli, 2014).

Internal Support. Internal support refers to the support of administrators within the school setting as well as support that staff receive from other teachers and staff. Teachers who perceive they have the full support of administrators and their peers report more consistent implementation and higher satisfaction with school-based obesity

prevention interventions (Centeio, Erwin & Castelli, 2014; Greaney et al., 2014; Parcel et al., 2003). This support is further strengthened when teachers and staff report that they have the resources and equipment to carry out obesity prevention interventions as intended (Greaney et al., 2014 & Parcel et al., 2003). Although additional responsibilities for classroom teachers was perceived as a barrier to implementation and sustainability for some schools (Gittelsohn et al., 2003; Hoelscher et al., 2004, Lytle et al., 2003), findings from Centeio, Erwin & Castelli (2014) suggest that physical education teachers may be receptive to taking on additional responsibilities related to their job role to reduce the burden on other staff.

In addition to support from school leadership, the inclusion of all employees, especially food service managers and cafeteria staff, may increase staff morale, help increase buy-in and support implementation efforts (Baur et al., 2006; Gittelsohn et al., 2003; Greaney et al., 2014; Slawson et al., 2013). Having a strong relationship with school health coordinator and having a program champion that uses a team approach and obtains staff buy-in are all positively associated with program implementation and sustainability (Greaney et al., 2014).

Value Congruence. Value congruence refers to how well school-based obesity prevention interventions align with the espoused values and mission of the school. School leaders who do not endorse school-based obesity prevention interventions in the form of supportive school policies or enforce existing policies at the school level can create an environment where students and teachers convey and receive mixed messages regarding organizational values in relation to obesity prevention (Baur et al., 2006,

Gittelsohn et al., 2003; Jain & Langwith, 2013; Slawson et al., 2013). Teachers may see no use in teaching healthy eating habits in the classroom when practices such as using food as a reward, the sale of competitive food items and bakes sales are allowed to continue (Baur et al, 2006; Slawson et al., 2013). When school policies do not address unhealthy organizational practices, teachers, administrators and staff may not have the authority to discourage or limit the consumption of unhealthy food items that are served in the cafeteria, at bake sales or through competitive food sales (Baur et al., 2006; Slawson et al., 2013; Wiecha et al., 2004). Addressing unhealthy food items that are sold in vending machines and snack bars may be especially challenging for schools who receive additional revenue from the sale of these items and may be dependent on this income to fund school activities and programs (Lederer et al., 2015, Lucarelli et al., 2014; Wiecha et al., 2004).

Capturing School Climate and Culture

The second purpose of this literature review was to examine how researchers capture school culture or climate when examining the adoption, implementation and sustainability of school-based obesity prevention interventions. Only three of the fourteen articles explicitly measured school climate and none of the articles attempted to measure school culture. This was expected as organizational climate is a more tangible variable to measure than organizational culture and is often captured using surveys rather than more intensive data collection methods such as interviews (Schien, 2010; Schneider, Ehrhart & Macey , 2013). The majority of the researchers selected either

qualitative methods (50%) or mixed methods (36%) for data collection. Despite surveys being a popular method to capture information on organizational climate in the literature, only 14% of the articles in this systematic review relied solely on survey data. However, the lack of depth in many of the articles in regards to organizational culture reflects a missed opportunity among researchers to examine the “why” behind organizational behaviors.

Among the articles that explicitly measured school climate, Parcel et al. (2003) was the only article that used a validated tool to capture school climate and selected two different tools: Hoy’s Organizational Health Inventory (Hoy, Tarter & Bliss, 1990) and Halpin’s Organizational Climate Description Questionnaire (Halpin, 1966). Other research teams either developed a scale or used qualitative methods to capture information related to school culture or climate. Gittelsohn et al. (2003) ranked the health climate of each school on a scale from one-to-five with one representing a very negative school climate, five representing a very positive school climate and three representing a neutral school climate. Researchers from Lucarelli et al. (2014) divided schools into three categories of “health climate” which represented school support for health promotion activities: positive, moderate and unsupportive. Each research team used diverse strategies to capture the personality of schools and how the schools go about navigating the challenges of promoting the health of children while accomplishing the organizational mission of accomplishing academic goals.

Relationship between School Climate and Obesity Prevention. Both Gittelsohn et al. (2003) and Parcel et al. (2003) found that school climate did not

significantly impact the delivery of food service or physical education components of obesity prevention programs; however, there was a significant relationship between the adoption and implementation of classroom curriculum and school climate. Both Parcel et al. (2003) and Gittelsohn et al. (2003) suggest that school climate may more heavily influence the adoption and implementation of new organizational behaviors and processes rather than program components that only require modifications to existing school processes. This finding was expected as these behaviors were likely in alignment with existing organizational goals and already embedded in the culture of the organization (Schien, 2010).

In the Parcel et al. (2003) study, the researchers also examined the impact of school staff and principal “openness” on the implementation of the Child and Adolescent Trial for Cardiovascular Health (CATCH). Schools where principals and teachers were described as more “open” were more likely to spend more time covering CATCH curriculum, had higher numbers of teachers trained on CATCH curriculum materials and had an increased likelihood of using CATCH lesson plans; however, these schools were also more likely to serve school meals with a higher percentage of saturated fat (Parcel et al., 2003). Having an “open” principal was also associated with the school serving meals with a larger percentage of fat and saturated fat (Parcel et al., 2003). Additionally, schools with high ratings for organizational health were more likely to serve a higher percentage of calories from saturated fat (Parcel et al., 2003). Parcel et al. (2003) also measured process variables and found that there was no significant relationship between the openness of schools and process variables for physical education or food service

components, but identified a positive association between process measures for classroom curriculum and school openness.

Lucarelli et al. (2014) divided schools into different categories of health climate based on how supportive the school environment was in regards to health promotion. Lucarelli et al. found that schools with the most supportive health climate had strong administrative support, active coordinated school health teams, visible and enforced health policies and the highest number of positive changes to nutrition.

Promoting a Climate/ Culture of Health

The final purpose of this review is to examine the literature for strategies that may be used to improve the climate and culture of health related to obesity prevention in school settings. The leaders of the organization set the climate and culture of their organization (Schien, 2010). Schien (2010) describes twelve strategies that organizational leaders can use as tools to embed and reinforce organizational behaviors. Six of the behaviors are primary behaviors that should be conducted consistently to embed certain organizational behaviors and guide organizational beliefs. The remaining six are secondary/ reinforcing behaviors that are essential to maintaining the existing climate and culture. **Table 2.4** lists the primary and secondary embedding mechanisms.

Table 2.4: *Description of Schien’s Embedding Mechanisms*

Schien’s Embedding Mechanisms	
Primary Embedding Mechanism	Secondary/ Reinforcement
<ul style="list-style-type: none"> ➤ Behaviors that leaders give attention, measure and control ➤ Leader’s handling of problems and crises in the organization ➤ Resource allocation ➤ Intentional use of teaching and role modeling ➤ Allocation of rewards and status ➤ Recruitment, promotion and termination of organizational members 	<ul style="list-style-type: none"> ➤ Design of the organization and structure ➤ Systems and procedures ➤ Rites and rituals ➤ Design of physical space ➤ Stories about important events and people ➤ Formal statement of organizational philosophy

Schien, E. (2010). *Organizational Culture and Leadership*. Jossey-Bass, San Francisco.

The results of this systematic literature review demonstrate how several of the barriers related to the adoption, implementation and sustainability of school-based obesity prevention programs were related to the limited use of embedding mechanisms among school leadership. **Table 2.5** describes eight strategies that school leaders should consider using to promote the creation of a supportive health climate and lists the primary and secondary embedding mechanism that are addressed by each strategy.

Table 2.5: *Strategies and Embedding Mechanisms to Promote Supportive Health Climate/ Culture in the School Setting*

Strategy	Schien's Embedding Mechanism Addressed
Identify and allocate dedicated physical space for students to engage in consistent physical activity (Baur et al., 2006, Gittelsohn et al., 2003, Lytle et al., 2003)	<ul style="list-style-type: none"> • Behaviors that leaders give attention, measure and control • Resource allocation • Design of physical space
In the event of limited physical activity (PA) equipment, implement PA that does not require additional equipment to ensure that all children participate and that the program is sustainable (Johnson et al., 2003; Kelder et al., 2003; Lytle et al., 2003)	<ul style="list-style-type: none"> • Behaviors that leaders give attention, measure and control • Leader's handling of problems and crises in the organization • Resource allocation • Design of physical space
Involve all staff in program planning, problem solving and creating an action plan to address barriers related to workload/ demands (Gittelsohn et al., 2003; Greaney et al., 2014; Jain & Langwith, 2013; Johnson et al., 2003; Lucarelli et al., 2014; Lytle et al., 2003; Slawson et al; 2013; Wiecha et al., 2004)	<ul style="list-style-type: none"> • Behaviors that leaders give attention, measure and control • Leader's handling of problems and crises in the organization • Resource allocation • Design of the organization and structure • Systems and procedures
Adopt programs that are easily integrated into existing curriculum and work flow (Gittelsohn et al., 2003; Hoelscher et al., 2004; Lucarelli et al., 2014; Parcel et al., 2003)	<ul style="list-style-type: none"> • Behaviors that leaders give attention, measure and control • Resource allocation • Design of the organization and structure • Systems and procedures
Consistently endorse the program in public by monitoring program implementation, the creation and enforcement of policies that support program goals, role modeling, and rewarding staff who actively participate in furthering the goals of obesity prevention (Baur et al 2006, Greaney et al., 2014; Parcel et al., 2003; Slawson et al., 2013)	<ul style="list-style-type: none"> • Behaviors that leaders give attention, measure and control • Leader's handling of problems and crises in the organization • Resource allocation • Intentional use of teaching and role modeling • Allocation of rewards and status • Design of the organization and structure • Systems and procedures • Formal statement of organizational philosophy

Table 2.5 Continued

Strategy	Embedding Mechanism
<p>Create system to train new staff on obesity prevention strategies and offer professional development on health promotion topics (Centeio et al., 2014; Jain & Langwith, 2013; Johnson et al., 2003; Kelder et al., 2003; Wiecha et al., 2004)</p>	<ul style="list-style-type: none"> • Behaviors that leaders give attention, measure and control • Intentional use of teaching and role modeling • Recruitment, promotion and termination of organizational members • Design of the organization and structure • Systems and procedures • Rites and rituals
<p>Hire and promote staff members who are comfortable with health promotion topics (Greaney et al., 2014; Lucarelli et al., 2014; Lytle et al., 2003)</p>	<ul style="list-style-type: none"> • Behaviors that leaders give attention, measure and control • Intentional use of teaching and role modeling • Recruitment, promotion and termination of organizational members
<p>Establish clear organizational goals, clearly outline the roles and responsibilities of all staff, and tie in obesity prevention goals with the organization's mission and values (Baur et al., 2006; Gittelsohn et al., 2003; Jain & Langwith, 2013; Slawson et al., 2013)</p>	<ul style="list-style-type: none"> • Behaviors that leaders give attention, measure and control • Design of the organization and structure • Systems and procedures • Rites and rituals • Formal statement of organizational philosophy

DISCUSSION

The overall goal of this systematic literature review was to identify ways that organizational characteristics, including school climate and culture, may influence the adoption, implementation and sustainability of school-based obesity prevention interventions. Data such as these may be used to inform school leaders as well as childhood obesity researchers on factors that should be considered before implementing a school-based obesity prevention intervention. School staff should only deliver interventions that are aligned with the overall goals and values of the organization.

As stated earlier, only two of the studies relied solely on survey data and the remaining articles used qualitative methods, either alone or to supplement survey data. The history and values of an organization are reflected in the climate and culture of that organization (Schien, 2010). Researchers that use qualitative methods can enrich the data and obtain more information about the experiences among those within the organization (Hesse-Biber & Leavy, 2004). One of the main differences between the data collected in the qualitative articles and the articles that relied on survey data is that the inclusion of qualitative data was to provide an additional level of insight into the factors that may have influenced specific organizational behavior. The two articles that used survey data (Johnson et al., 2003 & Parcel et al., 2003) did not report in-depth information on staff perceptions. Johnson et al. (2003) focused primarily on process outcomes and asked teachers about participation and barriers to participation. Articles that used interviews and focus groups were able to capture the perceptions of staff and report differences among groups within the same organization. For example, Centeio, Erwin & Castelli

(2014) discussed the reluctance of classroom teachers to take on additional responsibilities related to health promotion; however, physical education teachers in the same schools were receptive to taking on more job responsibilities related to their role. Another example of capturing information on different staff perceptions was the article written by Slawson et al. (2013). This article described the tension between classroom teachers and cafeteria staff and data such as these may be more challenging to collect on a pre-determined survey (Schien, 2010).

Limitations of the Review

Organizational climate and culture are abstract concepts that are challenging to measure (Schien, 2010). Although Schien's Model was used to frame the organizational characteristics in question for this review, there is a possibility that important organizational features that were relevant to the adoption, implementation and sustainability of school-based obesity prevention interventions were omitted. This issue is further complicated by the fact there is a lack of validated tools to measure school climate or culture related to health. The lack of validated tool presents challenges when one attempts to compare findings across studies as there is no certainty that each of the studies were measuring the same construct. Another issue to note is that several studies only interviewed or surveyed key informants, which may have omitted front-line staff who may have provided additional information of value on the adoption, implementation and sustainability of the intervention in their setting. Most studies included in this review captured data from the surface level or climate level (i.e. behaviors and environment)

and failed to address the underlying assumptions of what drives the behavior (organizational culture). Although climate is more tangible and easier to observe than culture, researchers must also explore culture or the “why” certain behaviors occur to enact real organizational change and embed certain behaviors within the organization (Schien 2010; Schneider, Ehrhart & Macey, 2013). Several studies included in this review are at least ten years old which highlights the need for more recent research on how school climate influences the adoption, implementation and sustainability of school-based obesity prevention interventions. Finally, this review focuses on only fourteen articles which examined eight school-based interventions and may not provide a thorough assessment of how school culture or climate influences school-based obesity prevention interventions.

Future Directions

In his definition of organizational culture, Schien describes culture as something that is taught to new members of an organization by existing members (Schien, 2010). Organizational culture is not easily changed and is described as having “structural stability” (Schien, 2010). Several of the studies discuss how health promotion programs were discontinued after a leader or champion resigned; one could easily argue that this demonstrates that the health promotion program was not embedded within the organization. If obesity prevention interventions do not reflect the values of the organization and are not taught to new members, it is unlikely that school-based obesity prevention interventions will be embedded into the culture of the school or make a

significant impact on the health of children within the organization (Giaquinta, 1973; Schein, 2010). Recent studies have shown how programs that improve the health of children can have promising results in improving academic outcomes (Edwards, Mauch & Winkelman, 2011; Welk, Jackson, Morrow Jr, Haskell, Meredith & Cooper, 2010). Collecting additional data on the potential for health promotion programs to improve academic outcomes may promote more widespread adoption and support for school-based obesity prevention interventions among both staff and administrators. This also supports the strategy of integrating health promotion topics into existing school curriculum when possible (Edwards, Mauch & Winkelman, 2011; Welk, Jackson, Morrow Jr, Haskell, Meredith & Cooper, 2010).

To best capture culture and underlying assumptions that guide organizational behavior and lead to sustained organizational change, researchers must obtain a better understanding of how organizations work; this is best captured through open-ended interviews as surveys may exclude dimensions that researcher failed to consider (Schien, 2010). Capturing organizational culture at the level of underlying assumptions and organizational values and beliefs usually requires an even more in-depth level of analysis, such as intense observations and focused questions (Schien, 1990; Schien, 2010).

Although this review provides some insight into strategies that school leaders may use to create a supportive health climate and culture in schools, this review also identifies areas that should be explored by researchers related to the role of relationships between school staff and teachers. Parcel et al. (2003) and Gittelsohn et al. (2003)

conclude that school climate did not have a significant impact on the adoption, implementation and sustainability of elements delivered in physical education and food service; however, several of the articles included in the review suggest programs were more likely to be successful if collaboration and shared decision-making occurred between food service staff and teachers (Baur et al., 2006; Greaney et al., 2014; Slawson et al., 2013). Another gap that this review highlights is the need for more in-depth analysis on how the characteristics of a school, including climate and culture, impact health promotion efforts in school settings. The findings reported in Parcel et al. (2003) related to the openness of teachers and principals identify even more opportunities for research. Having an open principal or teacher had a positive influence on classroom curriculum; however, these schools were more likely to serve meals higher in saturated fat (Parcel et al., 2003). What remains unclear is whether openness promoted the increased likelihood of serving higher fat meals in the cafeteria or if there were other moderating factors that contributed to the increased fat in school meals. Further work needs to explore the relationship between staff openness, school culture and climate on classroom as well as food service components. Finally, seven of the articles discussed in this review are older than ten years. In 2010 the United States Congress passed the Healthy, Hunger-Free Act of 2010, which required schools maintain certain nutritional standards. Many of these studies were conducted before the implementation of these guidelines. Future research should examine how school climate and/or culture has influenced the implementation and adherence to these guidelines.

School districts have the challenging task of meeting the needs and demands of various stakeholder groups, and this task can be especially difficult when school leaders fail to set clear organizational goals or adequately define the roles of staff in achieving these goals (Giacquinta, 1973; Rosenholtz, 1985). Assessing organizational characteristics can help researchers identify and address barriers to sustainability which may include lack of time, training, funding and school culture that placed a low priority on health promotion in relation to other competing interests (Lytle et al., 2003; Parcel et al., 2003).

This review seeks to lend support to the importance of researchers collecting data on organizational characteristics to provide information for other school leaders about the types of school settings who have had success with particular obesity prevention programs as well as strategies to promote organizational change to support these programs. This is not an easy task and may be especially burdensome in the school setting; however, the creation of validated tools for researchers to collect data such as these may be useful to gaining insight into the factors that influence the adoption, implementation and sustainability of school-based obesity prevention interventions (Lucarelli et al., 2014). Rather than taking the “one size fits all” approach, schools should be equipped with tools that allow them to assess whether a particular obesity prevention program will be suitable for their setting and/or strategies to help create a more supportive climate and/or culture of school health.

CHAPTER III

SEDENTARY BEHAVIOR AMONG THIRD GRADERS IN TEXAS: MODERATING EFFECTS OF PARENTAL ENCOURAGEMENT

INTRODUCTION

Increased sedentary behavior among school-aged children is associated with a multitude of negative physical, emotional and social consequences. School-aged children who consistently engage in more than two hours of sedentary behavior per day are more likely to suffer from low self-esteem, decreased fitness levels, poor eating habits and poor academic outcomes (Borghese et al., 2015; Mitchell, Pate, Beets & Nader, 2013; Pearson & Biddle, 2011; Salmon, Tremblay, Marshall & Hume, 2011; Tremblay et al., 2011). Excessive amounts of sedentary behavior among children has been linked to the child being classified as either overweight or obese (Han, Lawlor, & Kimm, 2010; Salmon, Tremblay, Marshall & Hume, 2011; Tremblay et al., 2011). Sedentary behavior may even further complicate the weight gain of children already at risk for obesity as a study conducted by Mitchell, Pate, Beets and Nader (2013) found an association between sedentary behavior and an increase in body mass index (BMI) among children in the 50th, 75th and 90th percentile of BMI for their gender and age.

Although sedentary behavior does not directly result in obesity, engaging in more than the recommended amount of sedentary behaviors may lead to an increase in other unhealthy behaviors. High amounts of sedentary behaviors are associated with poor eating habits among children (Borghese et al., 2015; Marsh, Mhurchu & Maddison, 2013; Pearson & Biddle, 2011). Children who watch television for more than two hours

a day may be at increased risk of consuming additional calories in front of the television and have increased exposure to advertisements promoting the consumption of unhealthy food items (Borghese et al., 2015; Marsh, Mhurchu & Maddison, 2013; Pearson & Biddle, 2011). In addition to promoting the consumption of excessive calories, some researchers have suggested that sedentary behaviors increase a child's risk for obesity by displacing physical activity (Marshall, Biddle, Gorely, Cameron & Murdey 2004). However, other reviews question displacement theory citing methodological concerns and recommend further research to test this theory (Must & Tybor, 2005; Pearson, Braithwaite, Biddle, Sluijs & Atkin, 2014). Although there appears to be an inverse relationship between physical activity and sedentary behaviors, the displacement theory may oversimplify a more complex relationship as physical activity and sedentary behavior are not mutually exclusive (Pearson, Braithwaite, Biddle, Sluijs & Atkin, 2014; Must & Tybor, 2005).

Parent role modeling and support have increasingly become research topics of interest. Parent role modeling and encouragement have been shown to play a major role in influencing the physical activity and sedentary behaviors of children (Beets, Cardinal & Alderman, 2010; Marques, Sallis, Martins, Diniz & Carreiro, 2014; Springer, Kelder, & Hoelscher, 2006; Tandon et al., 2014). In addition to encouragement, negative attitudes among parents about sedentary behaviors that result in the restriction of screen time is associated with reduced sedentary behavior among children (Jago et al., 2011; McMinn, Griffin, Jones & van Sluijs, 2013).

This study aims to examine the association between the number of parent/guardian reported days of moderate to vigorous physical activity (MVPA) and sedentary behaviors and weight status of third grade students in the state of Texas. This research seeks to provide additional insight into the role of parents in reducing sedentary behavior among children and the relationship between PA and sedentary behavior. There is an abundance on research of the determinants of physical activity among school-aged children; however, there is a need for more research on the determinants of sedentary behavior and the role of parental encouragement (He, Piché, Beynon & Harris, 2010; Leatherdale & Wong, 2009; Leech, McNaughton, & Timperio, 2014; Leung, Agaronov, Grytsenko & Yeh, 2011). Furthermore, even among studies that examine the correlates of sedentary behavior among youth, there is no general agreement on many of the findings (Norman, Schmid, Sallis, Calfas & Patrick, 2005).

Although sedentary behavior and physical activity are not mutually exclusive, I anticipate that children of active parents who are encouraged to be physically active will spend less time on sedentary behaviors such as playing video games and watching television than their peers who come from households led by less physically active parents who do not encourage the child to be physically active. Furthermore, I anticipate that parental encouragement will be most influential among children whose parents are the most physically activity. Parent encouragement was tested as a moderator variable for sedentary behavior of children and a child's BMI.

Research Questions

A total of three research questions related sedentary behavior among youth and parents were explored. The questions are as follows:

1. Are parents who report more days of moderate to vigorous physical activity more likely to have children who engage in two or more hours of screen time than children of less active parents?
2. Are there differences in sedentary behavior among children of more physically active parents when compared to children of less active parents with parental encouragement used as a moderating variable?
3. Are there differences in BMI z-scores among children of more physically active parents when compared to children of less active parents with parental encouragement used as a moderating variable?

Conceptual Framework

To gain a better understanding of how multiple factors interact to influence a child's risk for obesity, researchers should consider the multiple contexts in which children exist (Davison and Birch, 2001). Rather than focusing solely on bivariate relationships, researchers should consider how individual characteristics of the child, parenting characteristics and community characteristics influence a child's risk for obesity (Davison & Birch, 2001). This study uses Davison & Birch's (2001) ecological model of predictors to examine how parent, child and community characteristics influence sedentary behaviors among children.

METHODS

Participant Characteristics

This study was a secondary data analysis of baseline data from the Texas Grow! Eat! Go! (TGEG) study. TGEG is a five-year study consisting of a factorial group randomized controlled trial to examine the impact of garden and physical activity school-based interventions on weight status and weight-related behaviors of ethnically diverse, low-income students. The study was conducted in 28 Title I elementary schools in 5 diverse regions across the state of Texas. Schools were randomly assigned to one of four treatment groups: 1) Coordinated Approach to Child Health (CATCH) only (Comparison), 2) CATCH plus school garden intervention [Learn, Grow, Eat Go (LGEG)], 3) CATCH plus physical activity intervention [Walk Across Texas (WAT)], and 4) CATCH plus LGEG and WAT (Combined). TGEG promoted the increased consumption of fruits and vegetables and increased physical activity through the integration of school gardening and physical activity exercises into existing classroom curriculum. The pilot study from the TGEG project showed improvements to child weight status, increased consumption of fruits and vegetables among participants, increased physical activity and a reduction in child sedentary behavior (Spears-Lanoix et al., 2015).

This study analyzes baseline data that was collected for Cohorts 1 and 2 during the Fall of 2012 and Fall of 2013, prior to program implementation. A total of 1169 parents of third graders and 1326 third graders completed either a parent or student survey examining health behaviors. A total of 984 surveys were matched pairs between

parent and student. From the total sample of 984 matched-pair surveys, this study examines 864 surveys from parent/student dyads of children who identified as White, Black or Hispanic and had no physical or medical conditions that placed limits on their physical activity.

Parent consent forms and surveys were sent home by the school. Parents completed the surveys at home and returned the completed survey to the school. Student surveys were administered during the school day by trained research staff. Prior to participation, parents consent and student assent was obtained. The Institutional Review Boards at Texas A&M University and the University of Texas Health Science Center approved the study.

Measures

Anthropometric Measures. Anthropometric measures were collected at baseline. Trained research staff used a digital scale to collect student weight in kilograms, body fat percentage, and impedance. Height was collected using a stadiometer. Body mass index was calculated using these measurements and children were assigned to weight categories using the Centers for Disease Control Clinical Growth Charts (2016) and definition of childhood obesity (2015). Overweight is defined as a child being in the 85th or larger percentile for weight for age and gender (Centers for Disease Control, 2015). Obese is defined as the child being in the 95th percentile or greater for weight for age and gender (Centers for Disease Control, 2015).

Sedentary Behavior. Information about sedentary behavior of the child was collected from the parent survey. Parents were asked to recall how many hours a day their child spends during after-school hours watching television and/or playing computer/video games. Children who exceeded the American Academy of Pediatric's (2015) recommendations for screen time behaviors (two or more hours per day) were the reference group and coded as 1. Children who engaged in less than two hours of screen time were coded as 0.

Parent/Guardian Moderate to Vigorous PA (MVPA). Parent/guardian physical activity was assessed using two separate questions on the parent survey. Parents were asked (1) "During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at regular pace or doubles tennis? Do not include walking." and (2) "During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling? Do not include walking."

Parent/Guardian Encouragement. A scale was constructed based on five items used to assess whether or not the child was encouraged to be more physically active. The Cronbach's Alpha for all of the items included in the Parent Encouragement Scale was 76%. The five items that were measured on the Parent Encouragement Scale were:

1. I encourage my child to play sports or do physical activity.
2. I watch my child when she or he is physically active or playing sports.
3. I spend time teaching my child how to play a sport or do a physical activity.

4. I give reasons why my child should be more physically active.
5. I show approval when my child is more physically active.

Items were measured on a five point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A mean score of the combined items was calculated for each parent. Once a mean was calculated for each parent/guardian participant, a dichotomous variable was created. Parents who had a mean score of at least 4 (which represents agree) were coded as 1, meaning they were in agreement with most items on the scale. Parents with a mean score of 3 or less (neither agree or disagree, disagree or strongly disagree) were coded as 0 representing a neutral or negative attitude towards the questions on the encouragement scale.

Covariates

To account for factors that may increase a child's risk for sedentary behaviors, each of the models were adjusted for potential confounders for sedentary behavior. Each model, unless stratified to identify differences among groups of interest, was adjusted for demographic variables (race/ethnicity, gender, parent BMI and high school education of parent), child preference for sedentary behavior (measured as the child preferring to "watch television" instead of playing a "running game with friends") and the number of days of PA (excluding walking) the parent performed with child during the previous week.

Analysis

All analyses were conducted using Stata version 13 (StataCorp, College Station, Texas). Descriptive statistics and correlations were conducted on all variables of interest. Given the clustering effect of the data, null models and intra-class correlations were calculated for each outcome variable and failed to show differences in baseline outcomes of interest between schools. Therefore, logistic regression with the VCE robust standard error option to account for clustering of the data was used. Models were calculated to examine the influence of caregiver encouragement on the odds of a parent reporting that their child receives two or more hours of screen time on a typical school day and differences in weight status taking into account the number of days of reported physical activity of the parent.

Model Stratification

To obtain insight into differences in how parent/guardian encouragement may moderate the effect of sedentary behavior among children of different groups, eight separate models examining the moderating effects of parent encouragement were created. The first model examined the moderating effects of parent encouragement on child sedentary behavior for all children adjusting for race, gender, parent education, the number of days of parent PA with the child, and parent BMI. An additional seven models examining the moderating effects of parent encouragement were created for boys, girls, White children, Black children, Hispanic children, normal weight children, obese children. The final two models examined the moderating effects of encouragement

among children whose parents reported that it was safe for their child to play with other children in their neighborhood and parents who perceived their neighborhood was not safe. Each of these models explored whether the moderating effect of encouragement varied in different contexts.

RESULTS

Descriptive Statistics of the Sample

Table 3.1 below highlights the sample characteristics of students and caregivers. The sample of students was evenly divided by gender. The majority of children in the sample identified as Hispanic of any race (58%). Nearly half (47%) of the children in the sample were either overweight or obese, with more children classified as obese than overweight. Adults who completed the parent/guardian survey were mostly female (88%) and listed their relationship to the child as a parent (96%).

The average body mass index score for parent/guardians was nearly 31. The sample had a significant number of families from economically disadvantaged homes with 43% of the sample reporting running out of food at least some of the time and 20% of the sample having less than a high school education.

Table 3.1: *Descriptive Statistics of the Sample*

Sample Characteristics	
Children	
	<i>n=864</i>
Gender	Value (%)
Male	432 (50.06%)
Female	431 (49.94%)
Race/ethnicity	
White- non Hispanic	188 (22%)
Black- non Hispanic	177 (20%)
Hispanic (any race)	499 (58%)
Weight Status	
Obese	236 (29%)
Adult	
Role	Value (%)
Parent	799 (96%)
Grandparent	25 (3%)
Other	12 (1%)
Gender of adult respondent	
Male	99 (12%)
Female	741 (88.21%)
Mean Adult Body Mass Index (s.d)	30.7 (7.84)
Adult Education Level /Economic Status	Value (%)
Less than High School	168 (20%)
High school	280 (34%)
College/ post graduate	106 (13%)
Married Households	492 (58%)
Food secure	488 (57%)

Parent/Guardian PA, Encouragement and Sedentary Behavior

Table 3.2 below compares the mean number of days of moderate and vigorous physical activity, mean parent/guardian encouragement scale and student screen time behaviors between groups.

Table 3.2: *Physical Activity, Encouragement Score and Sedentary Behavior Comparisons By Group*

Group	Days of Parent Moderate PA	Days of Parent Vigorous PA	Mean Parent Encouragement Score	Percentage of Children who Exceeded 2 hours of Screen time
	<i>Mean (standard deviation)</i>			
All children	2.46 (2.20)	2.14 (2.18)	3.94 (.59)	35%
Boys	2.5 (2.15)	2.13 (2.23)	3.97 (.58)	37%
Girls	2.41 (2.26)	2.14 (2.15)	3.90 (.59)	33%
White children	3.18 (2.27)*	2.37 (2.31)	3.98 (.038)	35%
Black children	2.38 (2.19)	2.16 (2.08)	4.0 (.045)	44%
Hispanic children	2.19 (2.13)*	2.02 (2.16)	3.90 (.027)*	32%
High encouragement	2.91 (2.23)*	2.47 (2.19)*		30%
Low/no encouragement	1.89 (2.06)*	1.73 (2.17)*		40%
Safe Neighborhood	2.46 (2.18)	2.28 (2.22)*	4.01 (.025)*	34%
Unsafe Neighborhood	2.16 (2.15)	1.80 (2.10)*	3.70 (.05)*	38%

*Statistically significant difference at the 0.05 level

Parent/Guardian MVPA. The most active group of parents in both the moderate and vigorous physical activity categories were White parents and parents who reported that it was safe for their child to play with other children in their neighborhood. Parents who scored below the mean on the encouragement scale reported a lower number of days of moderate and vigorous physical activity than parents scoring high on the encouragement scale. There were also significant differences in days of moderate physical activity between parents of White and non-White students, parents of Hispanic and non-Hispanic students and parents who resided in neighborhoods they described as not safe for their child to play with other children in the neighborhood. Parents who reported that it was not safe for their child to play in the neighborhood and low/neutral encouragement households consistently reported the lowest number of days of moderate or vigorous PA. No other significant differences were noted in physical activity levels between groups.

Parent/Guardian Encouragement. The average score on the parent encouragement scale among all parent/guardians was 3.94. The highest mean score on the encouragement scale was from parents who reported it was safe for their child to play in the neighborhood with other children. The second highest score was among parents of Black students. There were differences in encouragement score means between parents of Hispanic children of any race and non-Hispanic children. There were also differences in mean encouragement score between parents residing in neighborhoods where they reported that it was safe for their child to play with other

children in the neighborhood and parents who did not consider their neighborhood safe enough for their child to play with other children.

Screen Time Comparisons. A total of 35% of parents reported that their child spent at least two or more hours of the typical school day watching television or playing computer/ video games. Black children had the highest number of parents/caregivers reporting that their child engaged in more than the recommended amount of screen time (44%), followed by children residing in low encouragement households and neighborhoods where parents did not perceive it was safe for their child to play with other children. Children residing in high encouragement households had the lowest percentage of parents/guardians reporting that their child exceeded the recommended amount of screen time (30%) followed by Hispanic children (32%).

Parent/Guardian Physical Activity Levels and Child Sedentary Behavior

Table 3.3 describes the results of the regression analysis examining the relationship between parent/guardian days of moderate or physical activity and the parent/guardian reporting that their child exceeds the recommended amount of screen time on a typical school day. Models were completed for all children and then stratified along race, gender, weight status and perceptions of neighborhood safety.

Table 3.3: Association between Parent PA and Child’s School Day Screen Time

Group	Days of Moderate PA	Days of Vigorous PA
	Odds ratio (95% C.I.)	Odds ratio (95% C.I.)
All children ^a (n=700)	.992 (.942, 1.05)	.944 (.874, 1.02)
Boys ^b	1.05 (.947,1.15)	.904 (.882, .995)*
Girls ^b	.946 (.874, 1.02)	.991 (.896, 1.10)
Black children ^c	1.14 (.991, 1.33)	1.05 (.892, 1.24)
Hispanic children ^c	.975 (.899,1.06)	.930 (.842, 1.03)
Children residing in “safe” neighborhoods ^a	.961 (.882, 1.05)	.868 (.783, .961) *
Children residing in “unsafe” neighborhoods ^a	1.11 (.971, 1.26)	1.16 (.976, 1.37)
Obese children ^a	.973 (.883, 1.09)	1.03 (.903, 1.18)
Normal weight children ^a	.960 (.878, 1.04)	.990 (.886, 1.11)

a= adjusted for race/ethnicity, parent education, gender

b=adjusted for parent education, race/ethnicity

c= adjusted for gender, parent education

*= statistically significant at 0.05 level

C.I.= confidence interval

Parent reported days of moderate physical activity did not have a significant relationship with child screen time for any of the groups. However, parent reported days of vigorous physical activity was negatively associated with a reduction in odds of exceeding the recommended screen time for boys and for children whose parents perceived it was safe for their child to play with other children. Both of these predictors were significant at the 0.05 level. None of the other predictors were significant in the model.

Parent/Guardian Encouragement as a Moderator

The next set of analyses focuses on the potential for parent/guardian encouragement to moderate the effect that parent/guardian physical activity has on their child's sedentary behavior. The outcome of interest is whether or not the parent reports their child consistently spends two or more hours watching television or playing video/computer games during out of school hours on a typical weekday.

Logistic regression analyses were conducted to examine the effect of high levels of parent/guardian encouragement on children when parents met the recommended number of days of moderate to vigorous physical activity. For this set of analyses, the MVPA variable was created. Parents who reported at least five days of moderate to vigorous aerobic PA, excluding walking, were classified as meeting the American Heart Association's (2015) recommended guidelines. Parents were placed in one of two categories, either meeting or not meeting the American Heart Association's (AHA) recommended guidelines for days of moderate to vigorous PA.

Both main effects models and models with encouragement as a moderator were created (**Table 3.4**). Parent encouragement was only a significant moderator among White children and children residing in "safe" neighborhoods (**Table 3.5**). The main effects models for the groups where encouragement was not a moderator are presented first. Although the interaction terms were not significant for any of the groups listed in **Table 3.5**, both models are included in the table for reference.

Main Effects Models

Main Effects of MVPA. Meeting the recommended amount of MVPA was a significant predictor for only two groups: Black children and children residing in neighborhoods where parents reported that it was not safe for their child to play with other children in the neighborhood. Black students whose parents met the recommended PA guidelines had nearly two times the odds of reporting two or more hours of screen time than Black children whose parents did not meet the recommended amount of PA per week. There were similar findings among children residing in neighborhoods where parents reported that it was not safe for their child to play with other children in the neighborhood. Parents who did not perceive the neighborhood as being safe for play had almost three times the odds of reporting their child exceeded the recommended amount of screen time. Additionally, the main effects for parent encouragement were not significant among children whose parents did not perceive their neighborhood as safe for play.

Table 3.4: Testing Moderating Effects of Parental Encouragement on Child Screen Time: Models with Non- Significant Interaction Term

	Main Effects Only Model	Encouragement as Moderator
<i>Odds ratio (95% Confidence Interval)</i>		
All children		
MVPA	1.28 (.971, 1.69)	1.00 (.614, 1.64)
High encouragement	.497 (.337, .732)**	.407 (.256, .648)*
MVPA*Enc		1.59 (.830, 3.03)
Boys		
MVPA	1.15 (.757, 1.76)	.969 (.448, 2.10)
High encouragement	.483 (.279, .834)*	.422 (.202, .880)*
MVPA*Enc		1.38 (.505, 3.75)
Girls		
MVPA	1.45 (.914, 2.31)	1.00 (.509, 1.99)
High encouragement	.503 (.311, .812)**	.365 (.180, .737)*
MVPA*Enc		2.06 (.768, 5.53)
Obese		
MVPA	1.20 (.717, 2.00)	.845 (.353, 2.02)
High encouragement	.391 (.160, .953)*	.263 (.109, .636)*
MVPA*Enc		2.19 (.642, 7.51)
Normal weight		
MVPA	1.15 (.748, 1.76)	1.00 (.478, 2.10)
High encouragement	.491 (.252, .956)*	.438 (.191, 1.00)
MVPA*Enc		1.28 (.471, 3.48)
Black		
MVPA	1.99 (1.16, 3.41)*	1.71 (.384, 7.57)
High encouragement	.370 (.131, 1.03)	.331 (.092, 1.19)
MVPA*Enc		1.26 (.163, 9.79)
Hispanic		
MVPA	1.28 (.868, 1.90)	1.32 (.765, 2.30)
High encouragement	.490 (.275, .873)*	.502 (.259, .976)
MVPA*Enc		.938 (.423, 2.08)
“Unsafe” Neighborhoods		
MVPA	2.94 (1.21, 7.10)*	3.28 (1.27, 8.48)*
High encouragement	.845 (.415, 1.72)	.932 (.453, 1.92)
MVPA*Enc		.747 (.240, 2.32)

*= statistically significant at 0.05 level

Main Effects of Encouragement. For the adjusted model for all children in the sample, high levels of parent encouragement was associated with reduced odds of reporting two or more hours of screen time. However, model stratification reveals different relationships among the various groups. A high level of encouragement was not significant among children residing in neighborhoods classified as not safe for play or among Black children. Although the parents of Black children reported the highest encouragement levels among racial/ethnic groups, there was no significant difference in screen time behaviors among black children who reside in low/neutral encouragement households and children living in high encouragement households. High encouragement was negatively associated with the parent reporting their child spent two or more hours a day on screen time activities for boy, girls, obese and normal weight children.

Models with Significant Interaction Terms

Main Effect of MVPA and Encouragement. Parent encouragement had a significant moderating effect on the influence of parent PA on child screen time for White students and children of parents who perceived it was safe for their child to play with other children in the neighborhood (**Table 3.5**). Among White children and children residing in neighborhoods where parents perceived it was safe for their child to play with other children, the parent meeting the recommended number of days of MVPA each week and having high encouragement was negatively associated with odds of spending 2 or more hours on screen time activities. Each of the interaction terms were significant at the 0.05 level.

Table 3.5: Moderating Effects of Parental Encouragement Among White Children and Children Residing in “Safe” Neighborhoods.

	Main Effects only Model	Encouragement as Moderator
	Odds Ratio (95% C.I.)	
White Children		
MVPA	.989 (.508, 1.92)	.364 (.141, .937)*
High encouragement	.667 (.315, 1.41)	.294 (.110, .785)*
MVPA*Enc		5.95 (1.63, 21.76)*
Model Fit		
AIC	185.22	182.33
BIC	208.65	208.68
“Safe” Neighborhoods		
MVPA	.894 (.619, 1.29)	.423 (.202, .885)*
High encouragement	.491 (.300, .804)*	.286 (.143, .573)*
MVPA*Enc		3.62 (1.20, 10.92)*
Model Fit		
AIC	386.22	382.61
BIC	423.33	423.43

*= statistically significant at 0.05 level

Interaction Terms. For both children residing in “safe” neighborhoods and White children, the interaction between parent encouragement and meeting the recommended number of days of MVPA was significant at the 0.05 level. In order to gain a better understanding of how parent encouragement moderates the relationship between parent physical activity and child screen time, the interaction effects were placed on a plot. **Figure 3.1** illustrates how parent encouragement influences the relationship between parent physical activity and child screen time for both White students and students residing in safe neighborhoods.

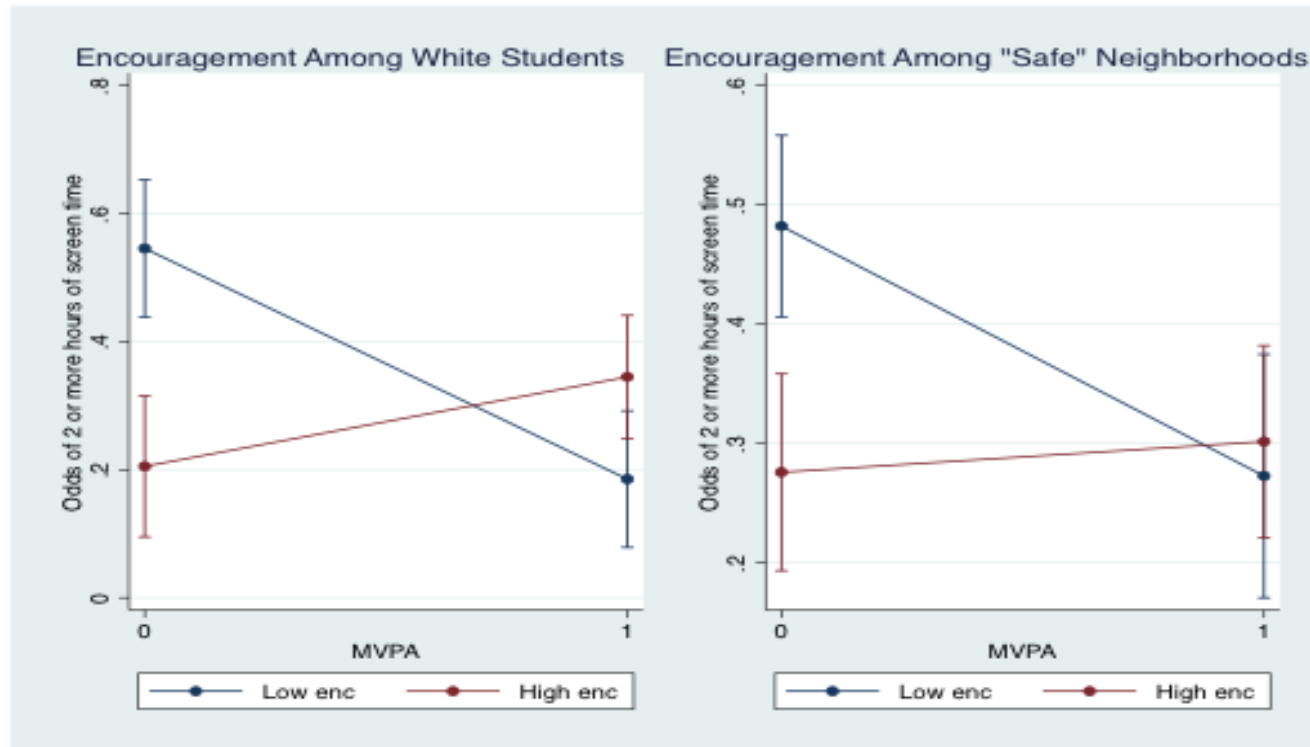


Figure 3.1: Plot of Interaction Effect Among White Students and Students Residing in “Safe” Neighborhoods

Both plots support data from **Table 3.5** that the main effect for encouragement has a negative association with the odds of a parent or guardian reporting their child engages in two or more hours of screen time on the typical school day. The plots also illustrate how children in the low encouragement group have a greater response to parent physical activity than children in the high encouragement group.

Child Weight Status, Parent/Guardian Physical Activity Level and Sedentary Behavior

The next set of analyses focuses on child weight status in the form of BMI z-scores and the potential for parent encouragement to moderate the effect of parent PA on child BMI. Linear regression analysis was conducted with BMI z-scores used as the outcome variable for the model which included all children, adjusted for race/ethnicity, gender and parent education. Stratified models were also created to examine moderating effects for boys, girls, Black children, White children, children in “safe” neighborhoods, children in “unsafe” neighborhoods, obese and normal weight children. **Table 3.6** describes the relationship between parents meeting the guidelines for recommended days of moderate to vigorous physical activity, parent encouragement and the child’s BMI z-score. Parent encouragement was not a significant moderator for any of the groups. Even though these models were not significant, they are displayed in Table 3.6 for reference.

Table 3.6: Testing Encouragement as Moderator for Child BMI

	Main Effects Only Model	Parent Encouragement as Moderator
<i>Linear Regression Coefficient and 95% Confidence Intervals</i>		
All children		
MVPA	.051 (-.153, .256)	-.096 (-.399, .206)
High encouragement	.001 (-.191, .192)	-1.07 (-.351, .136)
High Encouragement * MVPA		.258 (-.082, .598)
Boys		
MVPA	-.043 (-.297, .210)	-.287 (-.656, .083)
High encouragement	.049 (-.232, .331)	-.125 (-.529, .278)
High Encouragement * MVPA		.414 (-.142, .970)
Girls		
MVPA	.141 (-.156, .438)	.073 (-.354, .500)
High encouragement	-.048 (-.265, .168)	-.10 (-.355, .156)
High Encouragement * MVPA		.123 (-.378, .623)
Black		
MVPA	-.087 (-.520, .345)	-.198 (-.509, .113)
High encouragement	.068 (-.208, .345)	-.014 (-.510, .482)
High Encouragement * MVPA		.179 (-.517, .876)
Hispanic		
MVPA	-.136 (-.149, .423)	-.079 (-.536, .379)
High encouragement	-.194 (-.486, .097)	-.340 (-.746, .065)
High Encouragement * MVPA		.381 (-.243, 1.00)
White		
MVPA	-.054 (-.344, .236)	-.203 (-.565, .158)
High encouragement	.419 (.099, .739)	.010 (-.352, .375)
High Encouragement * MVPA		.312 (-.100, .723)
“Safe” neighborhoods		
MVPA	-.012 (-.257, .233)	-.203 (-.565, .158)
High encouragement	.142 (-.139, .423)	.010 (-.353, .375)
High Encouragement * MVPA		.311 (-.100, .723)
Children in “not safe” neighborhoods		
MVPA	-.250 (-.707, .208)	-.128 (-.717, .461)
High encouragement	-.281 (-.709, .147)	-.176 (-.763, .412)
High Encouragement * MVPA		.317 (-.100, .723)

*= statistically significant at 0.05 level

DISCUSSION

Parent encouragement only moderates the relationship between parent MVPA and child screen time among White children and children who live in neighborhoods where parents report it is safe for their child to play with other children. Being in the low encouragement group was associated with the child having a stronger response to their parents meeting the recommended amount of MVPA. Furthermore, this study found that parental encouragement does not moderate the effect of parent MVPA on child BMI. The anticipated outcomes of this study were that encouragement would strengthen the relationship between parent physical activity and child sedentary behavior and child weight status. It was expected that children who were encouraged to be physically active and had a parent or guardian who met the weekly requirements for MVPA would have less screen time and would have BMI z-scores at or below the mean. However, parent encouragement was only a moderator among homes where the caregiver reported it was safe for their child to play with other children in the neighborhood and among White children. Furthermore, children in the low encouragement group were more responsive to parent MVPA than children in the high encouragement group.

It is not surprising that encouragement is only a moderating factor between parent PA and child sedentary behavior among children residing in safe neighborhoods. Children whose parent or guardian perceives their neighborhood as a safe place are likely to have more opportunities to play outdoors and engage in physical activity. Children who are instructed to remain indoors may spend more time on the computer or watching television. The findings from this study align with the findings from Budd,

Hipp, Geary & Dodson (2015) that found parent a positive correlation between perceptions of an unsafe neighborhood and increased sedentary behavior among children.

In addition to children residing in safe homes, encouragement was also a moderator for White children. There were no significant differences between the number of White and Black parents who perceived their neighborhood as “unsafe”. However, there were significant differences between White and Black parents on MVPA levels. White parents had the highest average number of days of MVPA.

One assumption of the study is that meeting the requirements for moderate to vigorous physical activity should have translated into less sedentary behavior among children. For Black children and children residing in neighborhoods where it was not safe for them to play with other children, having parents who met the requirements for MVPA was associated with more sedentary behavior, not less. Meeting the MVPA requirements was only protective among White children and children whose parents perceived that it was safe for their child to play with other children in the neighborhood. The finding that children who are in low encouragement groups are more responsive to parent physical activity than children in the high encouragement group was unexpected. One potential reason for this is that this particular subset of children (children residing in “safe” neighborhoods and White children) may require less encouragement to be physically active and are more physically active than their peers. Given the finding that children in low encouragement/ low parent MVPA households have higher odds of receiving two or more hours of screen time on a typical school day, the increased

response to MVPA physical activity may be the result of successful role modeling behavior for children residing in households where the parents meet MVPA requirements.

There are several limitations to this study. First, this was a cross-sectional study so one cannot imply causality. Additionally, the majority of the data used to answer the questions was self-report and may be subject to recall bias or social desirability. In an effort to adjust for confounders, covariates that may have influenced the screen time behaviors of children were adjusted for in the model. Although the researcher attempted to adjust for confounders, potential confounders may have been inadvertently omitted. Another limitation is our definition of MVPA. Parents were asked to specify the number of days they engaged in moderate and vigorous PA but did not provide specific information on the type of PA that was performed. Given the low economic status of our sample, it is likely that some of the MVPA reported was related to strenuous jobs or blue collar employment. It was not possible to distinguish between parents who engaged in PA for health reasons and parents who reported PA related to work activities. Additional information on the types of PA performed and the rationale behind engaging in PA may have provided additional insight into differences in sedentary behaviors among children. Furthermore, our MVPA measure did not include walking. Walking is a popular form of PA that may be considered moderate PA if the pace is fast enough to raise heart rate (AHA, 2015). Finally, parent BMI was used as a proxy to reflect lifestyle habits of parents; however, we did not have data on parent screen time habits. Assuming children

reflect the sedentary behavior of their parents, information related to parent screen time may have strengthened the models.

Conclusions

Encouragement moderates the relationship between parent MVPA and child screen time among White children and children of parents who perceive it is safe for their child to play with other children in the neighborhood. Children who receive less encouragement to be physically active tend to be more responsive to parent MVPA than children who are encouraged more. The data reflect the importance of context in the development and delivery of childhood obesity interventions.

The determinants of sedentary behavior are complex. In order to address sedentary behaviors, researchers must have a better understanding of the barriers to reducing sedentary behavior and uncover strategies to make PA opportunities available for all children. Studies who fail to consider context may not accurately reflect how parenting, child and community factors interact to influence a child's risk for obesity. Simply running a model for all children with no consideration of the environments in which the child is embedded would have resulted in the conclusion that parent encouragement is not a moderating variable. However, stratifying by demographic information and community characteristics provided additional information. Future research should examine more potential moderators as well as replicate this study.

CHAPTER IV

USING MULTI-LEVEL MODELING TO EXAMINE ORGANIZED SPORTS PARTICIPATION AND PHYSICAL ACTIVITY AMONG 3RD GRADERS IN TEXAS **INTRODUCTION**

In order to reduce the prevalence of obesity among children and adolescents, multi-level interventions must promote increased physical activity and reduced sedentary behavior among youth (Anderson & Butcher, 2006; Dehghan, Akhtar-Danesh & Merchant, 2005; Ebbeling, Pawlak & Ludwig, 2002). The U.S. Department of Health and Human Services recommends that children and adolescents receive at least 60 minutes of moderate to vigorous physical activity (MVPA) per day (HHS, 2015). Unfortunately, many children fail to meet this recommendation (Pearson & Biddle, 2011). Girls and ethnic minorities are especially at risk for not meeting the recommended physical activity guidelines (Jago, Anderson, Baranowski, & Watson, 2005; Sallis, Prochaska, & Taylor, 2000).

Although children who participate in organized sports are more active than their peers who do not participate in organized sports (Nelson, Stovitz, Thomas, LaVoi, Bauer & Neumark-Sztainer, 2011; Vella, Cliff, Okely, Scully & Morley, 2013), participation in organized sports does not always translate into meeting the national recommendations for physical activity (Bergeron, 2007; Leek et al., 2011; Sacheck, Nelson, Kafka, Kuder & Economos, 2011). In fact, some children who participate in organized sports may remain sedentary on the sidelines during practice and game days (Leek et al., 2011; Sacheck, Nelson, Kafka, Kuder & Economos, 2011).

Children who participate in organized sports may experience several psychosocial and physical benefits (Le Menestrel & Perkins, 2007; Pate, Trost, Levin, & Dowda, 2000); however, the relationship between organized sports and childhood weight status is still unclear (Nelson, Stovitz, Thomas, LaVoi, Bauer & Neumark-Sztainer, 2011; Vella, Cliff, Okely, Scully & Morley, 2013). Recommendations released by the American Academy of Pediatrics (2001) support organized sports as an opportunity to promote increased physical activity among youth. However, these recommendations emphasize that organized sports should supplement moderate to vigorous physical activity (MVPA) among young people and not be the only source of MVPA.

Purpose

The purpose of this study is to examine the characteristics of those who participate in organized sports across the state of Texas to identify who is most likely to take part in organized sports. Secondly, this project will compare the activity levels of children who participate in organized sports with children who do not participate in organized sports. Finally, this project will explore the characteristics, including weight status, of those who participate in organized sports and are the most active. Learning more about who is involved in organized sports and their activity levels may provide insight that researchers can share with parents, guardians and coaches to identify strategies to expand opportunities and benefits of organized sports participation and physical activity to more children.

METHODS

Participant Characteristics

This study was a secondary data analysis of baseline data from the Texas Grow! Eat! Go! (TGEG) project. TGEG is a five-year study consisting of a factorial group randomized controlled trial to examine the impact of garden and physical activity school-based interventions on weight status and weight-related behaviors of ethnically diverse, low-income students. The study was conducted in 28 Title I elementary schools in five diverse regions across the state of Texas in which schools were randomly assigned to one of four treatment groups: 1) Coordinated Approach to Child Health (CATCH) only (Comparison), 2) CATCH plus school garden intervention [Learn, Grow, Eat Go (LGEG)], 3) CATCH plus physical activity intervention [Walk Across Texas(WAT)], and 4) CATCH plus LGEG and WAT(Combined). TGEG promoted the increased consumption of fruits and vegetables and increased physical activity through the integration of school gardening and physical activity exercises into existing classroom curriculum. For more information on the TGEG project and the results of the pilot testing of program components, please refer to Spears-Lanoix et al. (2015). This study analyzes baseline data that was collected during Cohort 1 and Cohort 2 during the Fall of 2012 and Fall of 2013 before implementation of TGEG activities. A total of 1326 third graders and 1169 of their parents completed either a parent or student survey examining health behaviors. A total of 984 surveys were matched pairs between parent and student. These matched pair surveys were analyzed to examine the

relationship between physical activity habits and organized sports participation among 3rd grade students attending Title I schools in Texas.

Parent consent forms and surveys were sent home by the school. Parents completed the surveys at home and returned the completed survey to the school. Student surveys were administered during the school day by trained research staff. Prior to participation, parent consent and student assent were obtained. The Institutional Review Boards at Texas A&M University and the University of Texas Health Science Center approved the study.

Aims of Research

This study focuses on three aims. The first aim was to identify which students are most likely to report participation in organized sports among 3rd grade students in participating Title I schools. The second aim of this project was to identify whether students who participate in organized sports were more likely to report in engaging in vigorous physical activity “almost every day”. The third aim explores the perceptions of parents of children who participate in organized sports on the frequency of their child’s physical activity. Multi-level modeling that examines predictors from both the individual and school level was used to explore each of these aims.

Measures

Anthropometric Measures. Anthropometric measures were collected at baseline. Trained research staff used a digital scale to collect student weight in kilograms, body fat percentage, and impedance. Height was collected using a stadiometer. Body mass index was calculated using these measurements and children were assigned to weight categories using the Centers for Disease Control (CDC) Clinical Growth Charts. Overweight is defined as a child being in the 85th or larger percentile of weight for age and sex. Obese is defined as the child being in the 95th percentile or greater of weight for age and sex.

Organized Sports Participation. Organized sports participation was measured by asking children how many sports teams they played on during the past 12 months. Sports participation was a categorical variable that was dichotomized into a dummy variable (0=did not participate in any sports teams in the past 12 months, 1= participated in at least one sports teams in the past 12 months). This variable was also used as a categorical variable (number of sports teams 0, 1, 2, or 3 or more) later in the analysis to compare physical activity among children who participated in sports.

Child Physical Activity Level. Both parents and students were asked about the student's level of physical activity.

Parent report of child physical activity. Parents were asked "In the last week, how many times after school did your child do sports, dance, or play outdoor games in which he/she was very active?" Parents were to select one of the following options: (a) None; (b) 1 day; (c) 2 or 3 days; (d) 4 or 5 days or (e) 6 or more days. Based on the

answer to this question, children were dichotomized into two groups: children whose parents reported they were active at least four days the previous week (1) and children whose parents reported they were active less than four days during the previous week (0).

Self-reported physical activity of child. Children were asked to respond to the question: “ I do vigorous activity almost every day.” Children were dichotomized into two groups (yes=1, no=0).

Covariates. The following covariates were used in the models.

Race. Each model was adjusted for race/ethnicity. Four racial/ethnic categories were entered into the model with White being the reference group: White, Hispanic of any race, Black and Other. Children who selected more than one race or were in less represented in racial/ ethnic groups (American Indian, Pacific Islander and Asian) were categorized as Other due to small sample sizes.

Gender. The models were adjusted for whether the child was a boy or girl. This dichotomous variable used girls as the reference group (0).

Parent education. Parent education was a categorical variable. Categories included: less than high school, high school graduate, some college, technical school, college and post graduate.

Parent encouragement. A scale was constructed based on five items used to measure the level of encouragement to become more physically active children receive. The Cronbach Alpha for all of the items included in the Parent Encouragement Scale were 76%. The five items that were measured on the Parent Encouragement Scale were:

1. I encourage my child to play sports or do physical activity.
2. I watch my child when she or he is physically active or playing sports.
3. I spend time teaching my child how to play a sport or do a physical activity.
4. I give reasons why my child should be more physically active.
5. I show approval when my child is more physically active.

These items were measured on a five point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A mean score of the combined items was calculated for each parent and entered as a parent encouragement score.

Outdoor play. Children were asked to respond to the following question regarding outdoor play: “Yesterday, did you play outdoors for about 30 minutes (e.g., the time it takes to watch a cartoon) when away from school?” This variable was dichotomized into (yes=1, no=0).

Parent role modeling. Parents were asked to respond to the following question: “Please tell us how often your child observes you being physically active.” Choices were: (1) Never; (2) Once a Month; (3) Once a week and (4) Every day. Children were placed in one of two groups: children who observed parents being active at least once a day (1) and children who observed parents being active less than once a day (0).
Free Lunch. The models were adjusted for whether or not the parents reported their child received free lunch. Those who did not receive free lunch were the reference group (0).

School Level Predictors

Two school level predictors were included in the model. Minority percent refers to the number of ethnic/ racial minority children enrolled at the school. School size refers to the total number of children enrolled at the school. Both of these variables were group mean centered before entering into the analysis. This information on each of the 28 schools was collected from the Texas Education Agency (TEA) website.

Analysis

The analysis was completed using Stata Version 13 (StataCorp, College Station, Texas). Multi-level models were completed for three outcomes: characteristics associated with participation in organized sports, the association between organized sports participation and daily vigorous activity, and factors associated with daily physical activity among children participating in organized sports. Data were analyzed at the individual (student) level and at the school level (28 clusters).

Model Building

Multilevel modeling was used to examine between school as well as within school differences in organized sports participation. Before running analyses, the residuals and descriptive statistics were examined to ensure the assumptions for multilevel logistic regression were met. For each model, the steps outlined by Hox (2010) were followed. Each model began with a null model with only the predictor. Following the construction of the null model, lower level explanatory variables selected

by theory were entered into the model. After entering the individual level predictors, two school level predictors (minority percent and school size) were entered. The school level predictors were group centered before entering into the model and grand mean centered once placed into the model. Once the school level predictors were entered into the model, the slopes of each of the individual predictors were tested to see if they varied between schools. None of the individual level variables varied between schools, so this was the final step.

RESULTS

Descriptive Statistics

The total sample size of the sample was 984. A total of 981 of the children in the sample provided information on sports participation. Table 4.1 describes the percentage of children who reported participating in organized sports. The mean for organized sports participation across all schools was 68%. In our sample, the two highest participating groups were Black children (75%) and girls (72%). Obese children participated in organized sports at rates that were similar to their normal weight peers.

Table 4.1: *Organized Sports Participation by Group*

Population	Percentage of Children who Participate in Organized Sports
	(%)
All children (n=981)	68%
Boys (n= 475)	65%
Girls (n=475)	72%
Hispanic (n=460)	67%
Black (n=173)	75%
White (n= 185)	68%
Other (n=100)	61%
Obese (n= 307)	67%
Normal Weight (n= 483)	69%
Free Lunch (n=704)	68%

Characteristics of Children who participate in Organized Sports

Table 4.2 describes the characteristics of children who reported participation in at least one organized sports team. Both random intercept models were adjusted for race/ethnicity and parent education level. Outdoor play and gender were significant in both the random intercept model with individual predictors and the random intercept model accounting for the school level predictors of school minority percent and school size. Outdoor play for the previous day was positively associated with children reporting that they participated in at least one organized sport. The fixed intercept model with school level predictors was selected as the best fitting model based on the smaller Akaike Information Criterion and noting the significant Level 2 predictor of school size. Boys in this sample have .69 odds of girls in this sample of reporting participation in organized sports, [95% Confidence Interval (CI): .51, .94]. Additionally, students attending larger schools had .80 times the odds of reporting participation in organized

sports than those in larger schools [95% C.I.: .69, .96]. Finally, a child who reported outdoor play the day before had 1.8 times the odds of reporting organized sports participation than a child who did not report outdoor play [95% C.I.: 1.3, 2.5]. Free lunch, race/ethnicity, parent education level and child weight status were not significant at the 0.05 level.

Table 4.2: Association between Organized Sports Participation, Individual and School Level Predictors of Minority Percent and School Size

Parameters	Unconditional model	Random Intercept Model with Individual predictors	Random Intercept Model with School predictors
	<i>Odds Ratio (95% Confidence Intervals)</i>		
Fixed Effects			
Constant	2.24 (1.90, 2.64)	2.25* (1.04, 4.88)	2.19* (1.01, 4.74)
Free Lunch		0.861 (.549, 1.35)	0.851 (.542, 1.33)
Outdoor Play		1.80* (1.30, 2.48)	1.80* (1.30, 2.48)
Gender		0.685* (.505, .929)	0.69* (.510, .938)
BMI Percentile		0.997 (.992, 1.00)	0.998 (.993, 1.01)
Variance Components			
Random Intercept	0.204 (.069, .643)	0.242 (.080, .731)	.16* (.022, 1.18)
School Level Predictors			
Minority percent			1 (.992, 1.01)
School Size			.802* (.668, .962)
Model Fit			
Akaike Information Criterion	1183.80	1002.843	1000.353
Bayesian Information Criterion	1193.50	1049.884	1056.673

* Significant at the 0.05 level

Comparison of Daily Vigorous Physical Activity

Table 4.3 describes the differences in 24-hour recall of vigorous physical activity between students who participate in organized sports and students who did not participate in organized sports. Participation in organized sports was positively associated with self-reported vigorous physical activity on most days. The lower Akaike Information Criterion and Bayesian Information Criterion suggest that the best fitting model is the Random Intercept Model with Level 1 predictors only.

According to this model, students who report organized sports participation have 2.34 times the odds of reporting vigorous physical activity on “most days” [95% CI: 1.55, 3.51] than students who do not report participation in organized sports. The random intercept was significant at the 0.05 level, which demonstrates variability in vigorous physical activity between schools. However, neither of the school level predictors in the model were significant at the 0.05 level.

Table 4.3: Association between Organized Sport Participation and Student Reported Daily Vigorous PA

Parameters	Unconditional model	Random Intercept Individual predictors	Random Intercept with School predictors
<i>Odds Ratio (95% Confidence Intervals)</i>			
Fixed Effects			
Constant	6.08 (4.70, 7.88)	3.60* (1.55, 3.52)	3.37* (1.57, 7.22)
Sports participation		2.34* (1.55, 3.52)	2.51* (1.66, 3.77)
Gender		0.93 (.626, 1.40)	0.91 (.610, 1.36)
Free Lunch		1.02 (.592, 1.77)	1.14 (.670, 1.95)
BMI percentile		.999 (.992, 1.00)	.999 (.992, 1.00)
Variance Components			
Random Intercept	.46* (.249, .841)	.36* (.138, .939)	0.000004 (0)
Group Level Predictors			
Minority percent			.998 (.986, 1.00)
School Size			.999 (1.00, 1.004)
Model Fit			
Akaike Information Criterion	774.67	676.64	670.42
Bayesian Information Criterion	784.39	719.10	722.32

* Significant at the 0.05 level

Physical Activity of Children Who Report Organized Sports Participation

The final set of models (**Table 4.4**) examined the factors contributing to parent-reported frequency of physical activity among children who participate in organized sports. Both the random intercept model with only individual level predictors and the random intercept model with school level predictors found that parent encouragement and parent activity observed by the child were positively associated with parents reporting their child was active at least 4 days the previous week. Number of sports teams, gender and BMI percentile did not have any association with the frequency that parents reported their children to be physically active. The smaller Akaike Information Criterion and Bayesian Information Criterion suggest that the best fitting model was the Random Intercept Model with Level 1 predictors only. Children who are encouraged to be physically active have 1.45 the odds [95% C.I.: 1.07, 1.98] of being active at least four days the previous week than children who were not encouraged to be active. In addition to encouragement, a child observing parent physical activity was significant at the 0.05 level. Children who observe their parents being active at least once a day had 1.42 times the odds [95% C.I.: 1.10, 1.88] of engaging in physical activity at least four times the previous week. The significant random intercept shows how the frequency of child physical activity varied between schools; however, none of the group level predictors were significant at the 0.05 level.

Table 4.4: *Factors Influencing PA of Children Involved in Organized Sports*

Parameters	Unconditional model	Random Intercept Individual predictors	Random Intercept with School predictors
<i>Odds Ratio (95% Confidence Intervals)</i>			
Fixed Effects			
Constant	.67* (.551, .819)	.150* (1.09, 1.85)	.144* (.043, .484)
Parent Encouragement		1.43* (1.04, 1.95)	1.42* (1.04, 1.94)
Gender		1.003 (.705, 1.43)	1.002 (.705, 1.42)
Number of sports teams		.936 (.767, 1.14)	.930 (.762, 1.14)
BMI percentile		1.002 (.997, 1.01)	1.002 (.997, 1.01)
Parent Activity		1.42* (1.09, 1.85)	1.42* (1.09, 1.84)
Variance Components			
Random Intercept	.297* (.125, .705)	.328* (.132, .818)	.277* (.088, .868)
Group Level Predictors			
Minority percent			.992 (.981, 1.002)
School Size			.999 (.998, 1.00)
Model Fit			
Akaike Information Criterion	878.80	767.54	769.163
Bayesian Information Criterion	887.80	811.03	821.35

* Significant at the 0.05 level

DISCUSSION

The Texas Education Code §28.002 requires that all children in grades K-5 enrolled in public schools in the state of Texas receive a minimum of 135 hours a week of moderate to vigorous physical activity. Even if children receive the full 135 minutes each week, they are only engaging in half of the recommended time for physical activity (American Heart Association, 2015; Sallis, Prochaska, & Taylor, 2000). Therefore, it is important for children to engage in multiple types of moderate to vigorous physical activity to make sure they receive the recommended levels of physical activity (American Academy of Pediatrics, 2015; United States Department of Health and Human Services, 2015). Organized sports may provide an opportunity for children to receive additional physical activity; however, researchers have only scratched the surface of uncovering the type of relationships that exist between organized sports, physical activity behaviors, and obesity (Bergeron, 2007; Leek et al., 2011; Sacheck, Nelson, Kafka, Kuder & Economos, 2011).

The findings from this study emphasize that further research on this topic is needed before the association between physical activity, organized sports, the influence of gender and child weight status is more clearly understood. In this particular sample, girls were more likely to report organized sports participation than boys. Sports participation did not differ by weight status or receipt of free lunch benefits. Additionally, organized sports participation was associated with student reported vigorous physical activity almost every day. Our final aim identified that among children who participate in organized sports, those who are encouraged to be active and have

parents role modeling active behavior on a daily basis have increased odds of engaging in physical activity at least four days a week.

Much of the existing literature on patterns of physical activity among children highlight that boys generally have higher rates of organized sports participation and physical activity than girls (Duncan, Strikey & Chaumeton, 2015; Jago, Anderson, Baranowski & Watson, 2005; Marques, Ekelund, Sardinha, 2016; Sallis, Prochaska, & Taylor, 2000). In fact, a study of Icelandic adolescents suggests that low enrollment in organized sports among girls may play an important role in the physical activity level differences between boys and girls (Vilhjalmsson & Kristjansdottir, 2003). However, a study by Bengoechea, Sabiston, Ahmed & Farnoush (2010) on Canadian youth found that girls had organized sport participation rates that were equal to boys. Therefore, gender differences in PA may be related to girls engaging in less unorganized or unstructured physical activity (Bengoechea, Sabiston, Ahmed & Farnoush, 2010). Although both studies had different conclusions on the state of organized sports participation among girls, the studies had similar conclusions concerning gender differences in physical activity. In this study, however, 3rd grade girls were more likely to report participation in organized sports than boys, but there were no significant differences in physical activity by gender. Findings such as the ones from this study, the Canadian and Icelandic studies highlight the importance of context and bring to light the need for more extensive research on the determinants of physical activity among those who participate in organized sports and among those who do not participate in organized sports.

All of the significant differences, with the exception of school size, were at the individual level rather than the school level. However, only two school level predictors were examined (minority percent and school size). Although the range for minority percent ranged from nearly 18% to 99% between the 28 schools, a school's percentage of minority students did not appear to influence organized sports participation. Furthermore, minority children were no less active than White children which differs from the findings of Sallis, Prochaska, & Taylor (2000).

This study has several limitations and should be interpreted with caution. Our sample of students consisted of students attending Title I schools in the state of Texas and their parent or guardian. One major limitation was that the survey was self-report and may be subject to recall bias. Another limitation is that the study was cross-sectional so one cannot establish a temporal relationship to the findings. This study was not able to calculate the exact number of minutes of physical activity for each child; rather, each of the measures focused on days of physical activity. Therefore, we were unable to determine whether or not the child received the recommended 60 minutes each day. Another limitation was that this study only focused on two school level predictors (school size and minority percent). Other school level predictors may have provided more insight into between school differences. Further, there was limited information on the type of sport, whether the sports teams were school sponsored versus community sponsored and whether these sports were completed concurrently or during different seasons. Specific information about the type of organized sports that children participate

in may have provided additional insight into the factors that contribute to organized sports participation and physical activity.

Conclusions

The findings from this project provide additional insight into the physical activity behaviors of children who participate and who do not participate in organized sports. The number of sports teams a child reported being involved in did not have an association with the number of days the child reported being physically active. One potential reason for this may be that the child participates in different sports for different seasons and not concurrently. The increased odds for girls to report organized sports participation, the lack of statistical difference in levels of physical activity between normal weight and overweight children and the lack of gender difference in physical activity levels was unexpected. There was an expectation that girls would have less physical activity than boys; however, that was not the case in this particular sample of 3rd graders. Organized sports may provide an opportunity for children to obtain additional physical activity, but this paper highlights the need for further exploration of how researchers and public health practitioners can extend the benefits of organized sports participation to more children.

Future research should examine the role that context plays in facilitating how often children engage in physical activity. Our sample focused on children in Title I schools in five geographically diverse regions in the state of Texas. This particular sample of girls had higher organized sports participation than boys and there were no

significant differences in physical activity and sports participation by race or weight status. How might these children differ in regards to physical activity and what role may organized sports play in increasing opportunities for physical activity? Why were there no observed differences by race/ethnicity in physical activity participation? Organized sports provide opportunities for increased physical activity; however, it is uncertain whether this translates off the field and into everyday physical activity habits of children. Further exploration of these questions may provide additional insight into overcoming some of the barriers to increased physical activity both on the field and off.

CHAPTER V

CONCLUSION

INTRODUCTION

Each of the studies covered in this dissertation highlight the importance of context in childhood obesity prevention research. Childhood obesity is one of the most complex public health issues and requires interventions that address the multiple factors that contribute to decreased physical activity, increased sedentary behaviors and unhealthy eating habits (Anderson & Butcher, 2006; Centers for Disease Control and Prevention (CDC), 2011; Ogden, Carroll, Kit & Flegal, 2014). Therefore, it is crucial that researchers and public health practitioners consider the role of context and environment when researching the determinants of childhood obesity and the effectiveness of interventions (Davison & Birch, 2001).

This goal of this dissertation was to examine obesity risk factors and prevention strategies in each of the three ecological niches in which children live (Bronfenbrenner, 1986) Gaining a better understanding of how children respond to interactions between the three ecological niches may provide additional insight into how public health interventions may be tailored to work in each environment that a child is embedded, whether that is home, school or in the community. Each of the three manuscripts examined the role of the school, parents and organized sports in reducing childhood obesity and improving the health of children.

Summary of Chapter II

The first study examined the role of school climate and school culture on the adoption, implementation, and sustainability of school-based obesity prevention interventions. Fourteen articles met inclusion criteria and were examined to identify organizational characteristics, including school culture and climate that influenced the delivery of childhood obesity interventions. One of the major findings of this study is the importance of embedding school-based interventions into the goals and values of the organization. School-based obesity interventions that are not aligned with the values and goals of the organization are not likely to be adopted, implemented with fidelity or sustained in the long term. Furthermore, school staff and leadership need to feel supported and included in the process. There are strategies that school leadership can use to embed school-based obesity prevention interventions into their organization.

Another conclusion from the first study is the vast number of definitions that researchers use for “climate” and “culture”. These terms are often used interchangeably and it becomes challenging to determine whether researchers are measuring the same construct. The lack of tangible measures for culture makes it an even more challenging construct to measure than climate (Schien, 2010). Furthermore, many of the studies included in the review failed to go below the surface level when exploring school culture or school climate.

Summary of Chapter III

Chapter III explored the role of parent encouragement on moderating the effects of parent physical activity on the screen time behavior of their children. Parent encouragement was only found to moderate the effects of screen time on White children and children who resided in neighborhoods where parents reported it was safe for their child to play with other children in the neighborhood. These findings highlight the importance of community in reducing sedentary behavior among children. The relationship between parent encouragement, parent physical activity and child sedentary behavior is more complex than simply instructing parents to role model and encourage their child to be more active. Other factors, including community and cultural background, influence the relationship that parent encouragement has on children's sedentary behavior habits.

This research also found that parent encouragement did not moderate the effects of parent physical activity on child BMI. In fact, BMI was not associated with parents meeting the recommended amount of moderate to vigorous physical activity. BMI was only associated with the main effect of parent encouragement for White children; however, there was a positive association between BMI and encouragement for White children. This finding suggests that White children in higher BMI categories are more likely to be encouraged than children in low BMI categories. The cross-sectional nature of the study does allow one to conclude whether the high encouragement is a result of the child being overweight or due to something else.

Summary of Chapter IV

Chapter IV explored the role of organized sports on physical activity. This study found that children who participate in organized sports are more likely to report they engaging in vigorous physical activity “most days” of the week than students who did not participate in organized sports. Furthermore, children who participate in organized sports are more likely to be active at least four days a week if they observe their parents being active at least once a week and if they are encouraged to be active. Although organized sports participation was positively associated with a child being physically active, there was no relationship between the number of sports teams and the odds of a child being active at least four days a week.

Several finding in this study warrant further research. In our sample, girls were more likely to report organized sports participation, which contradicts previous studies (Duncan, Stryker, Chaumeton, 2015; Jago, Anderson, Baranowski, & Watson, 2005; Sallis, Prochaska, & Taylor 2000) Additionally, BMI and race/ethnicity did not have a significant association with organized sports participation or physical activity levels of children which further supports more exploration of context to gain a clearer understanding (Nelson, Stovitz, Thomas, LaVoi, Bauer & Neumark-Sztainer, 2011; Vella, Cliff, Okely, Scully & Morley, 2013). Further exploration of these findings may provide additional insight into how context influenced the outcomes.

DISCUSSION

The overall theory connecting each of the three research topics is the ecological model of predictors of childhood overweight (Davison & Birch, 2001). The ecological model of predictors is based on ecological systems theory (Bronfenbrenner, 1977; Bronfenbrenner, 1986) which theorizes that a child's behavior is influenced by three ecological niches (home, school and community). Each of these three papers explored a different niche in an effort to provide a well-rounded assessment of the multitude of factors that increase or reduce a child's risk for obesity. Rather than relying on individual characteristics alone, each study sought to identify strengths related to each niche that may be used to improve the health of children. Recent data suggest that interventions that target childhood obesity may be slowing the incidence of obesity, especially among younger aged children (Ogden et al., 2014). Research that explores context and meeting children, families, schools and communities where they are may be the link to ensuring that childhood obesity is reduced for all groups of children instead of just a few groups of children.

Limitations

Each of these studies have several limitations. The systematic literature review was based on only 14 articles. Half of these articles were published at least ten years ago and may not reflect barriers to school-based obesity prevention interventions related to recent national school policy changes. The review was further limited by the lack of

validated tools to measure school climate and culture and the vast number of definitions that exist for school climate or culture.

Chapter III and Chapter IV used secondary data analysis to answer research questions. The survey tool used to explore the research questions in each of these papers was not specifically designed for these research questions. Some measures, such as parent screen time habits, were not available and would have strengthened the data. The data are cross-sectional and the nature of the relationships cannot be determined more than positive or negative associations. This research also relied on student and parent report which is at risk for recall bias and social desirability. Furthermore, the sample was collected from children attending one of 28 Title I schools across the state of Texas. Hispanic children and children from families with limited economic resources were heavily sampled, so the data may not be generalizable to children from other economic or cultural backgrounds inside or outside the state of Texas. Finally, data were collected during the school year and may not reflect the health behaviors of children and families during the out-of-school months.

Implications for Public Health

Each paper highlights how context can influence the success of a childhood obesity intervention. For example, a child who attends a school where obesity prevention is valued, is encouraged by their physically active parents to play in a safe neighborhood and participates in organized sports may have more opportunities to maintain a healthy weight than a child who attends a more academic focused school in an unsafe

neighborhood with no opportunities to play organized sports. Therefore, researchers must be mindful that studies that rely only on bivariate relationships with no contextual background tell some of the story but not all of the story. Children are influenced by a number of interacting elements that either increase or reduce the likelihood that a particular intervention will be helpful.

Opportunities for Future Research

This dissertation sought to provide additional insight into how the niches in which children reside influence their risk for obesity. Each of these three papers provide additional insight into missed opportunities for obesity prevention research and highlights several opportunities for future studies.

The results of the systematic review reveal the need for more studies on how school characteristics influence the outcomes of school-based obesity prevention interventions. A great starting point may be the creation and validation of a tool that measures school climate and culture related to health. The paucity of research on the determinants of sedentary behavior calls for more researchers to examine what factors may contribute to increased sedentary behavior and how sedentary behavior may be reduced. Sedentary behavior and physical activity are not mutually exclusive. Therefore, researchers may want to conduct additional studies examining sedentary behavior as an outcome variable and explore potential moderators to interventions seeking to reduce sedentary behavior. Finally, the role of organized sports in increasing physical activity opportunities for children should be explored. This dissertation highlights the

tremendous need for childhood obesity prevention research that explores the interacting elements of home, school and community.

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