This is to certify that the
dissertation entitled

EXAMINATION OF THE FACILITATORS, BARRIERS, AND RELATIONSHIPS AMONG SCHOOL NUTRITION POLICIES, SCHOOL NUTRITION ENVIRONMENTS AND PRACTICES, AND STUDENT DIETARY INTAKES IN LOW-INCOME MICHIGAN MIDDLE SCHOOLS

presented by

JENNIFER FAY MOSACK

has been accepted towards fulfillment
of the requirements for the

Ph.D. degree in Human Nutrition

K Alaimo
Major Professor's Signature

5/7/2010
Date

EXAMINATION OF THE FACILITATORS, BARRIERS, AND RELATIONSHIPS AMONG SCHOOL NUTRITION POLICIES, SCHOOL NUTRITION ENVIRONMENTS AND PRACTICES, AND STUDENT DIETARY INTAKES IN LOW-INCOME MICHIGAN MIDDLE SCHOOLS

By

Jennifer Fay Mosack

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Human Nutrition

2010

ABSTRACT

EXAMINATION OF THE FACILITATORS, BARRIERS, AND RELATIONSHIPS AMONG SCHOOL NUTRITION POLICIES, SCHOOL NUTRITION ENVIRONMENTS AND PRACTICES, AND STUDENT DIETARY INTAKES IN LOW-INCOME MICHIGAN MIDDLE SCHOOLS

By

Jennifer Fay Mosack

Trends in adolescent obesity and current dietary intake are of concern due to their association with chronic diseases, disability, and reduced quality of life in adulthood. Schools have been identified as a setting in which health promotion efforts may help reverse these trends. This dissertation research aims to improve understanding of school nutrition to enhance the effectiveness of school health intervention efforts. Baseline data from 65 low-income Michigan middle schools participating in the School Nutrition Advances Kids (SNAK) research project were utilized. First, federally-mandated local wellness policies from 48 SNAK districts were examined. The primary determinant of wellness policy quality was the template used to create the policy. There was little agreement between written wellness policies and administrator or food service director (FSD) reported policies and practices. Next, this dissertation examined associations between the availability of competitive foods in schools and student dietary intake using data from 1544 students in 51 SNAK schools. Compared to schools with no competitive foods available: having both a la carte and vending in schools was associated with increased saturated fat intake; having a la carte only or vending only available was associated with an increased fruit intake; having only healthy beverages available in vending machines was associated with decreased energy, vegetable, fruit + vegetable intake; having mixed healthy and less healthy beverages available or mixed foods and

beverages available in vending was associated with increased fat intake, and mixed beverages was associated with increased saturated fat intake. Availability of a la carte or vending individually revealed no significant associations. These results are likely due to differences in the nutrient content of foods available in these venues and/or limitations of the food frequency questionnaire used to assess dietary intake. Lastly, this dissertation identified barriers and accomplishments to promoting healthy eating and factors that facilitated change in schools using qualitative case studies of 8 SNAK schools. Administrators, FSDs, coordinated school health team members, and students at each school were interviewed. Barriers to promoting nutrition in these schools included budgetary constraints that led to low prioritization of health initiatives; the economic situation of the community that may lead to consumption of less healthy foods at home; quality of schools meals; widespread availability of unhealthy competitive foods; and perceptions that students would not eat healthy foods. Despite these challenges, many schools had made improvements to school meals and competitive foods and were increasing nutrition education efforts within and outside of the school setting. Support from school administrators, teamwork among staff members, and acknowledging student preferences helped to make positive changes in the food service program. Schools with a more health-promoting school culture (e.g., presence of a coordinated school health team, enforcement of nutrition policies, and a school health champion) made more changes to promote health and nutrition to students than other schools. These research results will inform future intervention and policy efforts aimed at improving school nutrition environments and policies in order to improve adolescent dietary intake.

This work is dedicated to the children of the world, for they are the future and my inspiration.

ACKNOWLEDGMENTS

I am very proud of the work that I have put into this dissertation research; however, none of it would have been possible without support from a very long list of individuals who have assisted and influenced me over the years. First and foremost, I must thank the students, parents, and school staff members who participated in the School Nutrition Advances Kids (SNAK) project and allowed me and my colleagues into their schools. Additionally, I must also thank those that provided funding for this research and my education, including: the Robert Wood Johnson Foundation Healthy Eating Research program; USDA's Supplemental Nutrition Assistance Program – Nutrition Education program by way of the Michigan Nutrition Network at Michigan State University Extension in partnership with the Michigan Fitness Foundation and supported in part by the Michigan Department of Human Services, under contract number ADMIN-10-99010; and the Michigan Department of Community Health who funded the School Nutrition Advances Kids (SNAK) project; Michigan State University (MSU) Department of Food Science and Human Nutrition, the John Harvey Kellogg Endowed Fellowship, and MSU Graduate School who helped to fund my education.

I am grateful for the support of my Master's advisor Bill Saltarelli, who found me as an undergraduate student who didn't quite know what she wanted to be when she grew up, and saw my potential. If it were not for the opportunities and encouragement that Bill gave me, I likely would not have made it as far as I have today. I must also greatly acknowledge my dissertation advisor, Katherine Alaimo, who graciously allowed me to come into her lab, and work with her research projects, and gave me countless opportunities to develop my professional skills. Katherine took the time to work

intensively with me to develop as both a researcher and a person. I must also thank the members of my guidance committee including Mike Hamm, Kim Chung, and Beth Olson, who were instrumental in helping me develop my dissertation from the proposal to the many changes that were necessary as my research progressed, and helped me to develop a quality end product. I also thank Ellen Velie, who I consider an honorary member of my dissertation committee, for the insight that she was able to provide me with regarding measuring dietary intake.

A special thanks to project staff members Deanne Kelleher, Richard Miles, and Deb Bailey, friends and colleagues who always made time to discuss my latest thoughts about school nutrition and helped to shape my thinking about children's diets, and whose friendships and professional insights I value immensely. There are many other past and present members of the SNAK project planning team who must be acknowledged for their contributions to the planning and development of the SNAK project and guiding the project with their real-world knowledge of schools including: Elaine Belansky, Julie Marshall, Diane Golzynski, Shannon Carney Oleksyk, Nick Drzal, Ann Guyer, Dru Sczerba, Paul McConaughy, Connie Page, Hui "Cathy" Liu, Paul Baumgartner, Donna Hensey, Larry Merx, Whitney Vance, Robynn Corey, and Christian Hanna; the numerous research assistants that have assisted with all parts of the SNAK project including Caroline Martin, Leah Simpson, Meaghan Snowdin, Allison Krusky, Stephanie Gorte, Caitlin Fisher, Kati Garrison, Alexandra Strucel, Jessica Jenkins, and especially Ellen Mang, who worked very closely with me to code wellness policies and interview transcripts, and whose positive attitude and humor made this process a pleasure.

Lastly, I must thank all of my family and friends, whose faith in me and support helped me to keep going when I wasn't sure if I had it in me! Thanks to my husband and best friend, Chris, who found it possible to love a doctoral student, and whose unwavering love and support will always be appreciated and reciprocated; to my much wiser sister, Jill, who has always been there for me throughout my life, and perhaps understands me more than anyone else; and to my parents, Jack and Nancy, who ingrained in me at an early age that I could do anything if I put my mind to it. Mom and Dad, you can finally tell everyone that your daughter is a doctor!

TABLE OF CONTENTS

APPE

BIBL

LIST OF TABLES

LIST OF FIGURES

growth

includi

Srinive

prevale

decade

indicat

meetin

student

Diseas

12-19 y

higher

al. 200

for nutr

promot

disease

Commu

al. 2006

among

and to a

CHAPTER 1: INTRODUCTION

Healthy eating during childhood and adolescence is critical to ensuring proper growth, development, and functioning, as well as to prevent many chronic diseases including cardiovascular disease, diabetes, obesity, and osteoporosis (Berenson, Srinivasan et al. 1998; Weaver 2000; Prentice, Schoenmakers et al. 2006). The prevalence of overweight in U.S. adolescents has more than tripled over the last several decades from 5.0% to 17.4%, (Ogden, Flegal et al. 2002; Ogden, Carroll et al. 2006), indicating that children are not receiving optimal nutrition. Many U.S. children are not meeting important nutrition recommendations. For example, in Michigan only 17% of students consume 5 or more servings of fruits and vegetables per day (Centers for Disease Control and Prevention. 2005). Nationally, the mean intake of fat in adolescents 12-19 years old is 32% of total calories, and saturated fat intake is 11% of total calories, higher than the recommended levels of <30% and <10%, respectively (Wright, Wang et al. 2003).

Many organizations and researchers have identified schools as an important site for nutrition promotion and interventions to reduce the prevalence of childhood obesity, promote overall health and wellbeing, and prevent adult chronic diseases such as heart disease and diabetes (Michigan Department of Education, Michigan Department of Community Health et al. 2001; American Dietetic Association 2006; Story, Kaphingst et al. 2006). The goal of this dissertation research is to provide insight into the associations among school nutrition policies, environments, practices, and student dietary behaviors and to advance knowledge of the school-specific factors associated with healthy eating in

low

fac

amo

envi

thes

furt

(Fre

Salh

Eng

Woj

prom

Rea

all l

estab

scho

scho

and p

Fink

preva

adopt

Asso

low-income Michigan middle schools. A better understanding of these school-specific factors will inform legislative and intervention efforts to promote health and well-being among children.

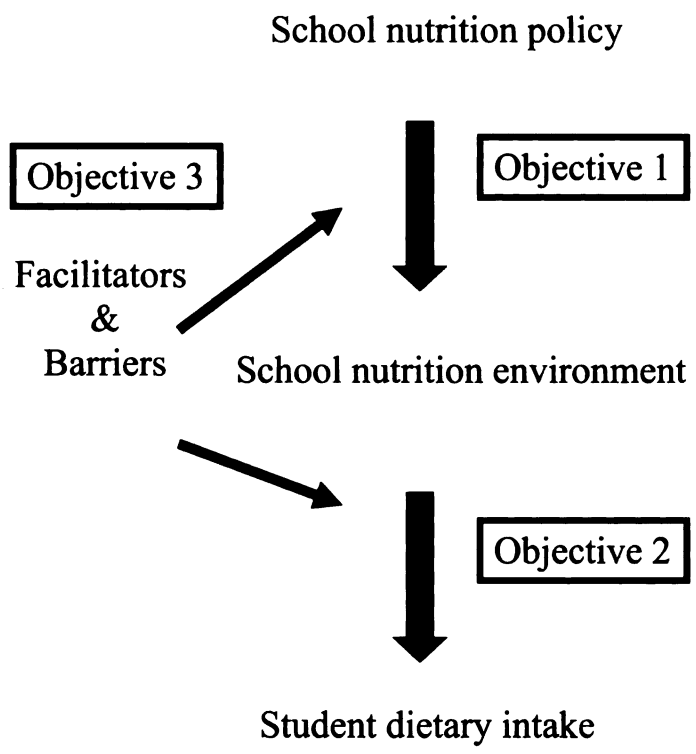
School nutrition interventions commonly include changes to the nutrition environment, nutrition education, and/or implementation of nutrition policies. Results of these interventions have been mixed and lack consistency, emphasizing the need for further research to understand how to effectively promote healthy eating within schools (French, Story et al. 1997; Baranowski, Davis et al. 2000; French, Jeffery et al. 2001; Sallis, McKenzie et al. 2003; Fulkerson, French et al. 2004; Lytle, Murray et al. 2004; Engels, Gretebeck et al. 2005; Cullen, Watson et al. 2006; Lytle, Kubik et al. 2006; Wojcicki and Heyman 2006; Slusser, Cumberland et al. 2007).

The U.S. Federal government also acknowledges the important role of schools in promoting lifelong health and well-being to children. The Child Nutrition and WIC Reauthorization Act of 2004 (Section 204 of Public Law 108-265 June 3, 2004) required all local education agencies (school districts) receiving funding for school meals to establish a local wellness policy by July 1st, 2006. Several nation-wide studies examined school nutrition policies prior to this federal mandate, at which time less than half of all school districts had adopted wellness policies or other policies to promote healthy eating and physical activity (Greves and Rivara 2006; O'Toole, Anderson et al. 2007; Finkelstein, Hill et al. 2008). Studies of individual states and national wellness policy prevalence after the federal mandate took effect indicate that the majority of schools have adopted a policy and are in compliance with federal regulations (School Nutrition Association 2006; Metos and Nanney 2007; Moag-Stahlberg, Howley et al. 2008;

Probart, McDonnell et al. 2008; Belansky, Cutforth et al. 2009; Longley and Sneed 2009). However, most of these researchers note that wellness policy language is often weak and suggestive, using phrases such as "shall strive to," "when possible," or "will attempt to," (Metos and Nanney 2007; Probart, McDonnell et al. 2008; Belansky, Cutforth et al. 2009). School wellness policies may hold promise for improving school nutrition and health practices; however, it is important to determine whether these policies are being translated into school practices, and how to assist schools in creating effective wellness policies.

Figure 1 illustrates the three primary objectives of this dissertation research. The first objective is to examine the associations between written school wellness policies and school nutrition policies and practices reported by school administrators and food service directors (FSDs). The second objective is to examine the associations between the school nutrition environment and student dietary intake. The third objective is to qualitatively examine the facilitators and barriers to promoting healthy eating in low-income Michigan middle schools. This qualitative component adds an in-depth understanding of the challenges and accomplishments schools experience in promoting healthy eating.

Figure 1: Dissertation objectives



The remainder of this chapter is devoted to reviewing the relevant school nutrition literature. First, the importance of a healthy diet during childhood and adolescence, and current dietary and health trends are reviewed. Next, an ecological model that describes the various levels of influence on adolescent dietary behaviors both in a general context, as well as those influences specific to the school context is discussed. The school-specific influences on adolescent dietary intake directly related to this dissertation are reviewed in detail including: the federal wellness policy mandate, related resources, and current research; environmental influences on student dietary intake including school meals (breakfast and lunch) and competitive foods (e.g. a la carte, vending machines); and interpersonal (e.g. peer influence, role modeling) and intrapersonal (e.g. knowledge) dietary influences associated with the school setting. Additionally, the importance of

sc

di

sc

int

of

var

thes

just

desc

THE

ADO

devel

physi

Schoe

intake

disprop

childho

disease.

1998; W

Schoenr

lower ris

school administrators and other leaders in influencing these school-related factors is discussed. Next, school nutrition intervention studies are reviewed. As hundreds of school nutrition interventions have been published to date, an exhaustive review of these interventions is not necessary. Selected intervention studies that represent the diversity of the current literature are reviewed to provide the reader with an appreciation of: 1) the variety of interventions that have been implemented, 2) the inconsistency in the results of these studies, and 3) the limitations of the school nutrition literature. Lastly, the justification for the research presented in the remaining chapters of this dissertation is described.

THE IMPORTANCE OF NUTRITION DURING CHILDHOOD AND ADOLESCENCE

Dietary intake can have both short and long-term impacts on growth and development, cognitive, emotional, and behavioral functioning, as well as academic and physical performance (Murphy, Pagano et al. 1998; Weaver 2000; Taras 2005; Prentice, Schoenmakers et al. 2006; Stevenson 2006; Fanjiang and Kleinman 2007). Poor dietary intake during childhood and adolescence can have long-term health consequences, which disproportionately affect low-income and minority populations. Proper nutrition during childhood and adolescence can help to prevent chronic diseases such as cardiovascular disease, diabetes, obesity, osteoporosis, and certain cancers (Berenson, Srinivasan et al. 1998; Weaver 2000; Joint FAO/WHO expert consultation on diet 2003; Prentice, Schoenmakers et al. 2006). Intake of fruits and vegetables has been associated with a lower risk of obesity, type 2 diabetes, certain cancers, stroke, and cardiovascular disease

(U.S. Department of Health and Human Services and U.S. Department of Agriculture 2004). Low calcium intake may result in a lower peak bone mass, which has been correlated with an increased risk of hip fracture later in life (Heaney, Abrams et al. 2000). Low-income children have been shown to have lower intakes of calcium and fruits and vegetables (Neumark-Sztainer, Story et al. 1996; Fox and Cole 2004). Consumption of foods high in added sugars has been associated with dental caries, which are more common in low-income children and certain ethnic groups including African Americans, Hispanics, and American Indians (Lingstrom, Holm et al. 2003; DHHS 2004).

The impact of poor nutrition goes beyond physiological consequences related to growth, development, and disease relationships. Malnutrition and food insecurity have been shown to have negative effects on psychosocial and cognitive development and behavior (Murphy, Wehler et al. 1998; Alaimo, Olson et al. 2001; Taras 2005; Fanjiang and Kleinman 2007). Iron deficiency has been consistently associated with cognitive, behavioral, and learning difficulties in children (Pollitt 1997). Academic performance has been associated with dietary patterns such as eating dairy products, nutrient dense foods, and low-quality foods (Fu, Cheng et al. 2007).

These findings are especially relevant to school professionals, because it is clear that in order to be able to learn, a child must be properly nourished. With the No Child Left Behind Act (Bush 2001) placing an emphasis on academic achievement, and funding sources that are tied to standardized test scores, schools often prioritize core subjects such as math and reading over health and physical education, which do not appear on standardized tests. Oftentimes, the schools' limited financial resources are reserved for activities directly related to core subjects, which could negatively impact the amount of

funding available to other programs, such as school meals. Compounding the problem, some schools rely on food service sales of competitive foods through a la carte and vending machines to provide additional revenue for the school. However, it is apparent that academic achievement depends, at least partially, on the health and nutritional status of the students. Many schools are acutely aware of this relationship, as indicated by provision of breakfast and snacks to students during standardized testing periods. Results from one study indicated that some schools provide more nutritious lunches to students during testing periods, which resulted in improved performance (Figlio and Winicki 2005). However, unless this effort is continued throughout the school year, it will have a minimal impact on overall student learning. Consistent prioritization of health and nutrition programs may be a more effective means of improving student academic achievement and test scores.

TRENDS IN OBESITY AND DIETARY INTAKE

Health and dietary trends indicate that adolescents are not receiving optimal nutrition, and that low-income and minority groups may be at increased risk. The prevalence of obesity (those having a body mass index (BMI) above the 95th percentile for age and gender) in adolescents aged 12-19 years old in the U.S. has more than tripled over the last three decades from 5.0% in 1976-80 to 17.4% in 2003-04 (Ogden, Flegal et al. 2002; Ogden, Carroll et al. 2006). Another 16.9% of adolescents are considered at risk for obesity (those having a BMI between the 85th and 95th percentile) (Ogden, Carroll et al. 2006). Minorities consistently have a higher prevalence of obesity (Sorof, Lai et al. 2004; Jago, Harrell et al. 2006; Ogden, Carroll et al. 2006). The relationship between

socioeconomic status or food security and obesity rates is unclear and varies by age, sex, and ethnicity (Chang and Lauderdale 2005; Wang and Zhang 2006; Dinour, Bergen et al. 2007).

Trends in adolescent dietary intake also indicate adolescents are not receiving optimal nutrition. Our youth typically eat foods that are high in energy-density but low in nutrient-density (Subar, Krebs-Smith et al. 1998; Kant 2003). National Health and Nutrition Examination Survey (NHANES) data from 1999-2000 and 2001-2002 indicate dietary intake of fruits, vegetables, calcium, magnesium, potassium, phosphorous, vitamin A, vitamin E, vitamin C, and fiber are below the recommended levels in both boys and girls, and dietary intake of iron, zinc, and folate are lower in female adolescents than in males (Wright, Wang et al. 2003; Ervin, Wright et al. 2004; Moshfegh, Goldman et al. 2005; Institute of Medicine 2006). At 32.0% and 11.3% of total energy intake, total fat and saturated fat intakes were higher than the recommended levels of <30% and <10%, respectively (Wright, Wang et al. 2003). Dietary trends in adolescents show that sodium intake has increased by approximately 50% while calcium intake has decreased (Briefel and Johnson 2004).

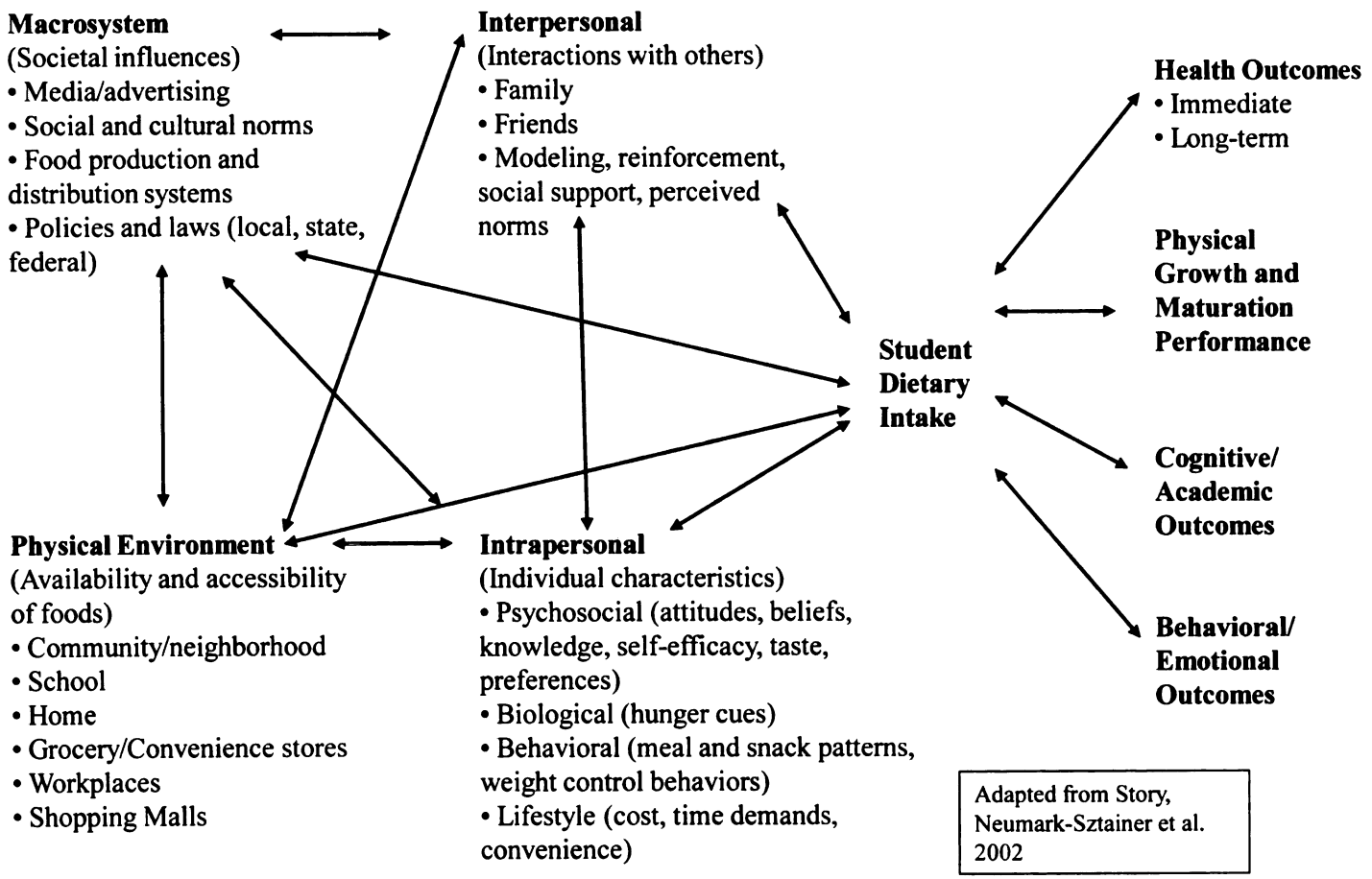
Socio-demographic characteristics have been associated with dietary intake. For example, Caucasian children typically consume more added sugars, soft drinks, and milk while African American and Hispanic children consume more fat and saturated fat and less milk (Institute of Medicine 2007). Using 1988-1994 NHANES data, nutrient intakes of school-age children and adolescents (5-18 years) were compared based on household income level: lowest income (≤130% of poverty); low income (131-185% of poverty); and higher income (≥185% poverty) (Fox and Cole 2004). The lowest income group had

significantly lower intake of iron and calcium, significantly higher intakes of fat, saturated fat, cholesterol, and fiber than the low and higher income group did (Fox and Cole 2004). Other studies have also shown that low-income youth are less likely to have a healthy diet, and consume more fat and saturated fat, and fewer fruits and vegetables, further emphasizing disparities in dietary intake by income group (Neumark-Sztainer, Story et al. 1996).

INFLUENCES ON ADOLESCENT DIETARY BEHAVIORS – AN ECOLOGICAL MODEL

Individually-focused intervention efforts to improve dietary intake and prevent overweight and obesity in adolescents have had varied success; some researchers believe this is due to the fact that they typically don't address environmental or societal influences on eating and physical activity (Sallis and Owen 2002). Interventions that address multiple levels of factors that influence adolescent dietary intake are beginning to emerge. Story and colleagues (Story, Neumark-Sztainer et al. 2002) developed a conceptual model of the various levels of influence on adolescent dietary behaviors based on ecological and social cultural models of health behavior theory. These models emphasize not only the characteristics of the individual, but also the interaction between an individual and their environment (Sallis and Owen 2002). In Story's model, there are four primary levels of influence: individual (intrapersonal); social environmental (interpersonal); physical environmental (community settings); and macro-system (societal) (Story, Neumark-Sztainer et al. 2002).

Figure 2: Ecological model of the influences and outcomes of adolescent dietary behaviors



At each level, many factors influence dietary behavior, as shown in Figure 2 adapted from Story (Story, Neumark-Sztainer et al. 2002). At the individual level, psychosocial (e.g., food preferences, knowledge, self-efficacy), biological (e.g., hunger, gender), behavioral (e.g., meal and snacking patterns, weight control practices), and lifestyle factors (e.g., convenience, cost, meal patterns) influence adolescents' decisions of what to consume. Social environmental influences include family characteristics (e.g., demographics, family meal patterns, and availability of foods) and peer influences (e.g., social norms). Physical environmental influences include all of the settings in which adolescents can obtain foods and beverages or are exposed to food and nutrition messages. These include, for example, homes, schools, fast-food restaurants, vending machines, convenience stores, and worksites. Macro-system (societal) influences on adolescent eating behaviors include media and advertising (e.g., television commercials, billboards), cultural and societal norms, the food production and distribution systems, and policies related to foods and beverages (at local, state, and national levels).

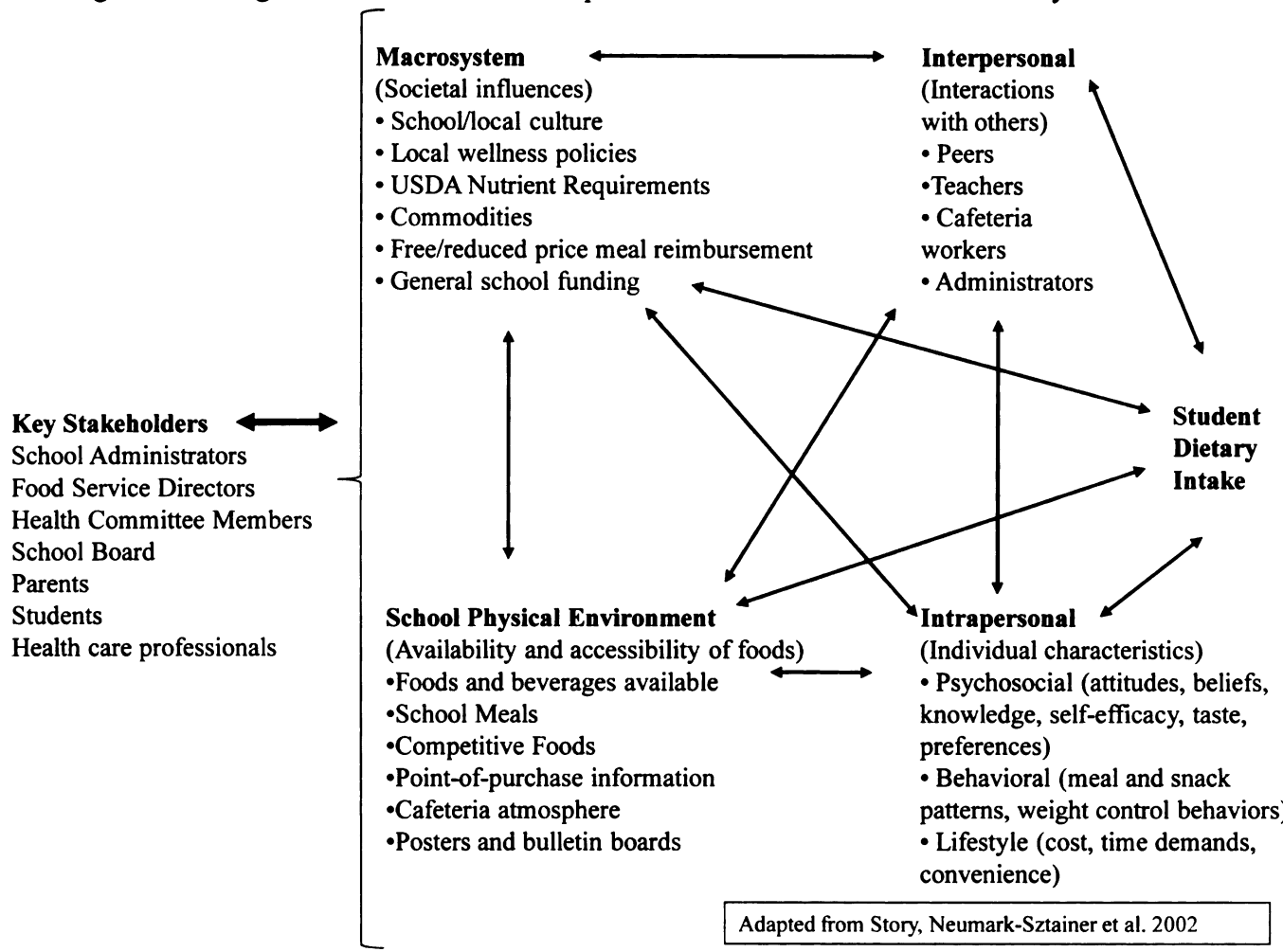
One key concept in ecological and social cultural theoretical perspectives is reciprocal determinism, meaning that all levels have the potential to influence one another, represented by the double-headed arrows between each level of influence in Figure 2 (Sallis and Owen 2002; Story, Neumark-Sztainer et al. 2002). Although ecological models hold promise for improving adolescent dietary intake by addressing the multiple levels of influence on dietary behaviors, little evidence currently exists examining the efficacy of these models (Sallis and Owen 2002). Additionally, because multiple intervention activities are taking place simultaneously, it is difficult to determine the effectiveness of individual components within a multi-level intervention.

The research in this dissertation examines multiple levels of influence on adolescent dietary behaviors (policies, practices, and the nutrition environment) using cross-sectional data. Results will help identify school-related factors associated with adolescent dietary behaviors, which may assist researchers and practitioners in designing intervention activities most likely to result in dietary improvements.

WHY STUDY SCHOOLS? APPLYING THE ECOLOGICAL MODEL TO THE SCHOOL SETTING

Schools have been identified as an important setting for nutrition promotion and interventions to reduce the prevalence of childhood obesity, promote overall health and wellbeing, and prevent chronic disease (Michigan Department of Education, Michigan Department of Community Health et al. 2001; American Dietetic Association 2006; Story, Kaphingst et al. 2006). Schools reach over 95% of U.S. children, and provide a cost-effective opportunity to reach low-income and minority children (who are at a higher risk of nutritional inadequacy) that might not be reached through traditional means, such as doctors' visits (Story 1999; Story, Kaphingst et al. 2006). The nation's Healthy People 2010 goals also recognize the importance of schools in promoting health by calling for an increase in "the proportion of children and adolescents aged 6 to 19 years whose intake of meals and snacks at schools contributes proportionally to good overall dietary quality" (U.S. Department of Health and Human Services 2000).

Figure 3: Ecological model of the school-specific influences on adolescent dietary behaviors



intak

prov

heal

stud

and

oppo

of he

influ

teach

avail

carte

classr

the at

repea

foods

prefer

suppo

choice

nutrier

Figure 3 applies Story's ecological model of influences on adolescent dietary intake (Story, Neumark-Sztainer et al. 2002) to factors specific to the school setting. This provides a theoretical framework for understanding the role schools play in promoting health and nutrition to students. There are school-specific factors that can influence student dietary behaviors at each level.

At the individual level, schools have the ability to impact students' knowledge and attitudes about food and nutrition through formal and informal educational opportunities. Schools can also manipulate lifestyle factors such as cost and convenience of healthy foods. Social-environmental influences in the school setting include peer influence from classmates and friends, and role modeling of nutrition behavior from teachers, food service personnel, administrators, and other influential adults.

Physical environmental factors include the types of foods and beverages that are available in school meals as well as competitive food venues (vending machines, a la carte, fundraisers, class parties, celebrations, concession stands), informational posters in classrooms and throughout the school, point of purchase nutrition information, as well as the atmosphere of the dining area. Children's food acceptance patterns are influenced by repeated exposure to food (Pliner 1982; Wardle, Herrera et al. 2003); thus, the types of foods students are exposed to in schools may have a lifelong impact on their dietary preferences. Therefore, on order to complement the school nutrition curriculum and support teachers' efforts, students should be provided with healthy food and beverage choices in school (Contento, Balch et al. 1995; U.S. Department of Agriculture 2001).

Macro-system influences include federal policies related to school nutrition (e.g., nutrient requirements for school meals, availability of certain commodity food items,

reimbursement rates for free and reduced-priced student meals, federally mandated school wellness policies), overall school funding levels and requirements (e.g., standardized test scores impacting school funding levels), and the local or school culture (degree of prioritization of health and nutrition). The following sections review the literature on school influences on adolescent dietary behaviors relevant to this dissertation.

SCHOOL POLICY

The Child Nutrition and WIC Reauthorization Act of 2004 (Section 204 of Public Law 108-265 June 3, 2004) required all local education agencies receiving funding for school meals (National School Lunch program, School Breakfast Program, After School Snack Program) to establish a local wellness policy by July 1st, 2006. Wellness policies are required to include the following components: goals for nutrition education and physical activity; nutrition guidelines for all foods available on campus; guidelines for reimbursable meals; a plan for measuring implementation of the wellness policy; and involvement of key stakeholders in development of the policy (parents, students, school food authority, administration, school board, and the public) (Section 204 of Public Law 108-265 June 3, 2004). Requiring stakeholder input was thought to help increase participation and support for wellness policy development and implementation (Story, Nanney et al. 2009). Recognizing that each school district has unique strengths and challenges, no specific details were given, allowing districts to tailor their policy to their needs (Story, Nanney et al. 2009). This method has resulted in a wide variety in the quality of wellness policies adopted and has allowed many schools to create weak

pol

imp

hea

Sch

to Ju

46.6

surv

scho

each

polic

food

of fo

More

recon

lower

and P

distric

breakf

recomm

district

or in ve

policies (Story, Nanney et al. 2009). While school wellness policies hold promise for improving school nutrition, little research has shown translation of written policies into healthier school practices.

School policies before child nutrition reauthorization

Several nation-wide studies examined the extent of school nutrition policies prior to July 1st, 2006, when the school wellness policy legislation took effect. In 2005, only 46.6% of elementary schools, 38.8% of middle schools, and 35.4% of high schools surveyed in the third School Nutrition Dietary Assessment (SNDA-III) study had a school wellness policy (Finkelstein, Hill et al. 2008). Of the largest school district in each state, 39% had adopted competitive food policies in 2004; however, while these policies had been adopted, they usually did not apply to all venues in which competitive foods were available, did not address portion size, or required only a certain percentage of foods and beverages available meet nutrient standards (Greves and Rivara 2006). Moreover, policy language can be written to either *require* a certain action or simply *recommend* the practice, with the latter leaving room for interpretation and potential for a lower level of commitment and enforcement of that policy. The School Health Policies and Programs Study of 2006 showed that less than half of all states (42%) and school districts (38.9%) surveyed required schools to prohibit junk food in a la carte during breakfast or lunch; however, additional states (36.0%) and districts (29.4%) recommended this practice (O'Toole, Anderson et al. 2007). Some states (32%) and districts (18.9-29.8%) required schools to prohibit junk food in school stores/snack bars or in vending machines, with about as many recommending this policy. Even fewer

states and districts (<15%) required policies that prohibit junk foods being sold in concession stands, at meetings, during class parties, in after-school programs, but more (between 20-32%) recommended these policies (O'Toole, Anderson et al. 2007).

Studies of individual states also showed that there were very limited nutrition policies in place prior to the federal mandate. A study of North Carolina school food service directors showed that only one-fourth of school districts had coordinated nutrition policies (Barratt, Cross et al. 2004). A study of vending machine policies of school districts in Delaware had similar findings. Of 10 schools surveyed (representing approximately half of the school districts in Delaware), only one had a policy regarding the content of vending machines, while 7 had policies related to accessibility of vending machines (Gemmill and Cotugna 2005).

Two studies examined policies at secondary schools in Minnesota (French, Story et al. 2002; French, Story et al. 2003). The first study, a survey of principals at 336 high schools in 2001, found that only 32% of schools had a nutrition policy (French, Story et al. 2002). The number of school food policies was positively associated with more favorable attitude of school principals toward the school food environment (French, Story et al. 2002). In the second Minnesota study, a survey of 20 secondary schools in 2000, 5.9% of principals and 27.8% of food service directors stated their school had any policies about nutrition and food (French, Story et al. 2003).

After the federal wellness policy legislation had passed, but before the mandate went into effect, McDonnell et al. (McDonnell, Probart et al. 2006) examined the existence and enforcement of sixteen various school nutrition policies in a representative sample of Pennsylvania school districts. Surveys completed by 228 food service

directors indicated that, with the exception of a policy prohibiting students from leaving campus during lunch (80.8%), less than half of the districts had a policy that was enforced for all other nutrition policies examined (0.5 - 44.8%). The 79 principals in this survey indicated somewhat higher policy existence and enforcement, but still reported that the majority of policies examined (13 of 16) existed and were enforced in less than half of the districts (McDonnell, Probart et al. 2006). Principal-reported policies with the highest degree of enforcement included having a closed-campus during lunch (96.2%), prohibiting students and parents from bringing fast food into cafeteria (57.0%), and requiring approval for club sales involving foods (74.7%).

In general, less than half of school districts had policies in place related to health and nutrition prior to the wellness policy mandate. Fewer policies were reported in the earlier studies, with increases in policy existence being reported closer to the wellness policy mandate, but before the mandate took effect. This indicates an increasing awareness of the importance of written policies to promote health and nutrition in schools. This could be an effect of the CDC's emphasis of the Coordinated School Health Model, or the increased awareness of the child obesity epidemic.

Support for wellness policy development

Recognizing that school districts may need guidance in creating and adopting a wellness policy, many organizations created model wellness policy templates and/or websites to assist school districts in creating their wellness policy. Some school districts hire companies to manage their written policies to ensure they are in compliance with all state and federal legislation. These companies also provide schools with template

wellne

presun

the m

specif

differ

the C

pract

wellr

to fit

varia

befo

idea

scho

Un

enti

sch

mo

also

sam

imp

wellness policies. The content and focus of the wellness policy templates varies, presumably based on the priorities and intent of the sponsoring organizations. Several of the most common wellness policy templates and resources, as well as those that are specific to Michigan schools, are reviewed briefly below.

The depth and quality of these policy templates varies widely, and may be due to differences in the organizations and individuals that created the document. For example, the Center for Ecoliteracy template policy emphasizes local and sustainable agricultural practices, while most other policies do not mention this. Most organizations with wellness policy templates encourage school districts to modify the template as necessary to fit their unique strengths, limitations, and needs to be most effective. Given the variation in templates, school districts should examine multiple wellness policy templates before adopting a policy. Ideally, districts would create their own policy that combines ideas from various templates, along with their own unique ideas, in order to best fit their school.

United States Department of Agriculture (USDA)

The USDA Local Wellness Policy website can guide school districts through the entire wellness policy process, from creating a wellness team, performing a baseline school wellness assessment, drafting and adopting a policy, to implementing and monitoring the policy (www.fns.usda.gov/tn/Healthy/wellnesspolicy.html). This website also provides sample statements that districts can use for their wellness policies, links to sample policies from states and other organizations, as well as additional resources and implementation tools.

National Alliance for Nutrition and Activity (NANA)

NANA (www.nanacoalition.org) convened a working group of more than 50 national and state experts in the areas of nutrition, physical activity, health, and education to develop a model wellness policy (www.schoolwellnesspolicies.org). NANA suggests schools complete a baseline self-assessment, such as the Center for Disease Control and Prevention's (CDC) School Health Index, (https://apps.nccd.cdc.gov/shi/default.aspx), Team Nutrition's Changing the Scene (http://www.fns.usda.gov/tn/Resources/changing.html), or the National Association for Sport and Physical Education's (NASPE) Opportunity to Learn Standards for Elementary, Middle, and High School Physical Education (http://www.aahperd.org/Naspe/pdf_files/Opportunity%20to%20learn%20final%20%20Middle%20School.pdf) to identify and prioritize goals for their wellness policy. The NANA wellness policy website also contains a list of resources that can help districts develop, implement, and evaluate their wellness policy. NANA also emphasizes use of CDC's Coordinated School Health Model (Centers for Disease Control and Prevention 2009) to address other aspects of wellness that are not required in the federal mandate and are not included in model wellness policies, such as mental health and food safety policies.

Center for Ecoliteracy

Inspired by the work of the Child Nutrition Advisory Council of the Berkeley Unified School District, the first school district in the nation to create and adopt a wellness policy in 1999, the Center for Ecoliteracy, Slow Food USA, and the Chez

Panisse Foundation created a Model Wellness Policy Guide (www.ecoliteracy.org/programs/wellness_policy.html). This is more of a guide rather than a template policy, and provides instructions that districts are encouraged to follow as they create their wellness policy. This guide emphasizes collaboration between the school and community, and creating a school culture that supports health and wellness. This guide focuses on local and sustainable agricultural and environmental practices more than other template policies.

Action for Healthy Kids

The Action for Healthy Kids coalition developed a website that guides school districts through a set of eight steps to create their local wellness policy (www.actionforhealthykids.org/wellnesstool/index.php). These steps include: gathering relevant information; developing a wellness team; conducting a needs assessment; drafting a policy; building awareness and support; adopting the policy; implementing the policy; and maintaining, measuring, and evaluating the policy. For each of these steps, the website provides links to relevant resources and to a "Virtual Wellness Policy Team" that provides answers to common questions that districts have.

Michigan Department of Education

The Michigan Department of Education, in collaboration with other state and local organizations, agencies, and citizens, developed a model wellness policy that was adopted by the Michigan State Board of Education (Michigan Action for Healthy Kids Fall 2007). This template policy focuses on creating a school environment that provides

stude

healt

polic

"Hea

(www

Kids

health

Policy

by a c

that th

contai

statem

wellne

Other

nutriti

Genera

that lin

and mi

while h

students with consistent messages and opportunities to practice what they learn about healthy eating and physical activity. Also to assist schools in adopting a local wellness policy, the Michigan Action for Healthy Kids and partnering organizations created the "Healthy School Toolkit: Your Guide to Action" (www.tn.fcs.msue.msu.edu/HealthySchoolToolkit.html) (Michigan Action for Healthy Kids Fall 2007). This comprehensive guide provides schools with resources to support healthy eating and physical activity.

Policy Company

Another wellness policy template is available to schools in several states served by a company that provides school districts with template school board policies to ensure that they are in compliance with all local, state, and federal mandates. This template contains introductory paragraphs in each section, followed by a checklist of optional statements. Districts check the boxes of statements that they want included in their local wellness policy. No other resources are provided with this template policy.

Other school health and nutrition policies

Several organizations also provide model policies for specific topics, such as nutrition standards for competitive foods in schools. The Alliance for a Healthier Generation partnered with beverage manufacturers to create school beverage guidelines that limit the sales of certain drinks to students during the instructional day. Elementary and middle schools are restricted to water and 8 oz servings of milk and 100% juice, while high schools are able to sell other low-calorie beverages. The Alliance provides

the "I

bever

nutrit

(www

conv

comp

satur

(only

provi

water

that l

Schoo

prom

Sneed

federa

363 f

place.

been i

nation

the "Beverage Guide Implementation Kit" to assist schools in implementing a healthy beverage policy. The Alliance also partnered with major food manufacturers to create nutrition guidelines for competitive foods available in schools (www.healthiergeneration.org).

The Institute of Medicine (IOM) along with the CDC, as directed by Congress, convened a team of national experts in order to set nutrition recommendations for competitive foods available in schools. These guidelines set limits on total calories, fat, saturated fat, trans fat, sugar, sodium, beverages containing non-nutritive sweeteners (only allowed in high schools after the instructional day), and caffeine. Also included are provisions prohibiting use of food as a reward, ensuring access to free potable drinking water; and sports drinks are only available to students participating in sports activities that last one hour or more (Institute of Medicine 2007).

School policies after child nutrition reauthorization

Evidence indicates that the federal wellness policy mandate has increased health-promoting policies in school districts across the nation. Longley and Sneed (Longley and Sneed 2009) examined the extent of wellness policy components before and after the federal mandate took effect in a national sample of school districts. Prior to the mandate, 363 food service directors reported one-third of wellness policy components were in place. After the wellness policy mandate, nearly three-quarters of these components had been implemented (Longley and Sneed 2009).

Several studies have examined the extent and content of local wellness policies in national samples of school districts after the mandate took effect. The first study by the

School Nutrition Association examined wellness policies from a national sample of 140 school districts in late 2006, just after the mandate took effect (School Nutrition Association 2006). Nearly all district wellness policies mandated nutrition standards for school meals (99%) and competitive food standards (89% addressed a la carte, 87% addressed vending machines); addressed nutrition education (85%) and physical activity (94%); and had a plan for wellness policy implementation and evaluation (89%) (School Nutrition Association 2006). Another study examined 256 wellness policies from 49 states (Moag-Stahlberg, Howley et al. 2008). Results indicate that the majority of policies (68%) addressed all of the federal requirements (Moag-Stahlberg, Howley et al. 2008). More specifically, 81% included goals for nutrition education, 79% included goals for physical education, 88% addressed other school-based activities, 81% involved the community and/or families, and 78% addressed school meal standards. Lastly, while 73% of district wellness policies addressed policy implementation, oftentimes they included little detail regarding the manner in which the policy was to be implemented, or how implementation would be tracked. Without a specific plan for implementation and evaluation, wellness policies may lose their momentum and may not have the intended impact of creating a healthier school environment.

Several studies have also examined wellness policies in individual states. Wellness policies from 75% of the public school districts in Utah were evaluated to determine if they met federal policy requirements (Metos and Nanney 2007). Analysis results showed that 78% of district policies met all of the federal requirements. Probart and colleagues examined local wellness policies in all Pennsylvania public school districts in early 2007, shortly after the wellness policy mandate went into effect (Probart,

McDo
the st
nutrit
based
schoo
(85.6%
2009)
Policy
items
Schoo
evalua
(thoug
Cutfor

the nu
manda
create
high d
implen
Resear
policy
strive t
statem

McDonnell et al. 2008). All public school districts had submitted a wellness policy to the state. The majority of districts met each of the federal requirements including nutrition education goals (100%), physical activity goals (99.8%), goals for other school-based activities (100%), nutrition guidelines for all foods available (99.8%), ensuring school meals meet USDA standards (99.0%), and a plan for measuring implementation (85.6%) (Probart, McDonnell et al. 2008). Belansky et al. (Belansky, Cutforth et al. 2009) evaluated wellness policies from 32 rural, low-income school districts in Colorado. Policy evaluation indicated that wellness policies only addressed about half of the 96 items examined, however only 15% of these items had required and specific strategies. School districts scored highest in goals for nutrition education and a plan for policy evaluation, and lowest in standards for school meals and goals for physical education (though physical education goals are not included in the federal mandate) (Belansky, Cutforth et al. 2009).

These studies indicate that the federal mandate has been successful at increasing the number of schools that have written school nutrition/wellness policies. The federal mandate did not give districts specific guidelines, which gave schools the freedom to create a policy that meets their specific needs. Unfortunately, this has also resulted in a high degree of variability in the quality of wellness policies, as well as the implementation and enforcement of such policies (Institute of Medicine 2007). Researchers from the studies in Utah, Pennsylvania, and Colorado all noted that wellness policy wording included weak statements that often included qualifiers such as "will strive to," "when possible," "is encouraged," and "will attempt." These ambiguous statements make goals difficult to implement and measure. These types of statements act

more

non-s

little

envir

oppor

health

under

nutriti

mand

SCHO

Schoo

dietary

school

and re

the Sc

nutriti

Lunch

breakf

iron, vi

nutrien

more like recommendations rather than requirements, and are difficult to enforce due to non-specific language that can result in differences in interpretation.

School wellness policies hold promise for improving school nutrition; however, little research on the efficacy of these policies at influencing school nutrition environments and practices has been published to date. This provides an ideal opportunity for researchers to examine the ability of local wellness policies to encourage healthy school environments and practices. The research in this dissertation aims to understand the impact the degree that wellness policies are associated with school nutrition practices, to better understand the impact of the federal wellness policy mandate.

SCHOOL NUTRITION ENVIRONMENT

School Meals

The next section reviews the school environmental influences on adolescent dietary behaviors, primarily the foods and beverages that students are exposed to in the school setting, beginning with school meals (breakfast and lunch). In order to improve and regulate the nutritional quality of foods served in school meals, the USDA enacted the School Meals Initiative for Healthy Children (SMI) in 1995, setting minimum nutrition standards for foods served in the School Breakfast Program and National School Lunch Program (U.S. Department of Agriculture 2001). SMI guidelines require school breakfasts to provide at least of one-fourth the RDA for total calories, protein, calcium, iron, vitamin A, and vitamin C, and school lunches must provide one-third of these nutrients (U.S. Department of Agriculture 2001). School meals must also meet the

Diet

fat tc

SMI

targe

mg sc

and b

distin

conter

prefer

consur

conten

studen

repres

offere

three q

total er

Only 1

27.4%

lunche

Agricu

offered

Dietary Guidelines for American recommendations to limit total fat to 30% and saturated fat to less than 10% of total energy intake (U.S. Department of Agriculture 2001). The SMI guidelines suggest, but do not require, that school lunch provide one third the daily target for dietary fiber (varies based on age), and contain <100mg cholesterol and <800 mg sodium (U.S. Department of Agriculture 2001).

Mean nutrient content of school meals can be represented in two ways: 1) foods and beverages *offered* to students, or 2) foods and beverages *served* to students. The distinction between these two representations is that *offering* data averages the nutrient content of all of the items available, whiles *serving* data takes into account student preferences by weighting the data to represent what students are purchasing and consuming. In this way, the school menu might *offer* foods that average <30% fat content, but if students are only purchasing the higher fat foods, what is *served* to students may be >30% fat content.

The SNDA-III study examined the nutrient content of school meals in a nationally representative sample of schools. In the 2004-05 school year, nearly all middle schools *offered* lunches that met requirements for protein, calcium, and vitamin C, approximately three quarters met requirements for iron and vitamin A, and 58% met requirements for total energy (U.S. Department of Agriculture, Food and Nutrition Service et al. 2007). Only 16.7% of middle schools offered lunches that met requirements for total fat, and 27.4% met requirements for saturated fat, with the average total fat content of school lunches offered at 34% and saturated fat 11% of calories (U.S. Department of Agriculture, Food and Nutrition Service et al. 2007). Most middle school lunches offered met recommendations for cholesterol and dietary fiber, however almost none met

sodium
al. 200

schools
met the
middle
vitamir
Nutriti
higher
approx
(U.S. I
indicat
likely
betwee
the US

school
most d
2007).
rates t
et al. 2
total d
provid

sodium recommendations (U.S. Department of Agriculture, Food and Nutrition Service et al. 2007).

When taking into account what students actually choose to consume, fewer schools met the SMI standards. Nearly all middle schools *served* lunches to students that met the protein requirements; however, only 38.5%, 42.8%, 66.1%, 83.4%, and 55.2% of middle schools served lunches that met SMI requirements for total energy, vitamin A, vitamin C, calcium, and iron, respectively (U.S. Department of Agriculture, Food and Nutrition Service et al. 2007). Middle school lunches served to students were slightly higher in % energy from total and saturated fat than those offered to students, with approximately the same proportion of schools meeting SMI requirements for fat content (U.S. Department of Agriculture, Food and Nutrition Service et al. 2007). These data indicate that even though schools may offer healthier options, that students are more likely to choose the less-healthy options. These data also highlight the difference between the nutrient content of foods and beverages available within school meals and the USDA SMI requirements.

According to the SNDA-III study of a nationally representative sample of U.S. schools, 22.1% and 73.8% of students report consuming school breakfast and lunch on most days of the week (U.S. Department of Agriculture, Food and Nutrition Service et al. 2007). Students who are eligible for free and reduced-price meals participate at higher rates than those not eligible (U.S. Department of Agriculture, Food and Nutrition Service et al. 2007). Foods and beverages consumed at school are an important contributor to the total dietary intake of adolescents. School lunch (which most students consume) provides nearly a third of students' total daily energy intake, and generally provides a

greate

lunch

Agric

certai

they a

consu

sweet

Frenc

2009)

(BMI)

is clea

studen

status

fries in

high sc

foods

associa

fresh fr

associa

offering

Crepins

greater proportion of total vitamin and mineral intake in students that consume school lunch, compared with those that do not eat school-provided meals (U.S. Department of Agriculture, Food and Nutrition Service et al. 2007).

Students that participated in school breakfast and lunch were less likely to have certain nutritional inadequacies, compared with children that did not participate, however they also had higher sodium intakes (Clark and Fox 2009). School meal participants consumed fewer energy-dense foods at school, consumed fewer calories from sugar-sweetened beverages, but had higher intakes of low-nutrient energy dense foods (e.g. French fried, baked goods) when compared to non-participants (Briefel, Wilson et al. 2009). School breakfast participation has been associated with lower body mass index (BMI) in a nationally representative cross-sectional sample (Gleason and Dodd 2009). It is clear that school meals can play an important role in providing important nutrients to students.

Specific school meal practices can also impact the dietary quality and weight status of schoolchildren. Analysis from the SNDA-III study show that not serving French fries in school meals resulted in decreased consumption of sugar-sweetened beverages in high school students (41 calories) and reduced consumption of low-nutrient energy dense foods (43 calories) (Briefel, Crepinsek et al. 2009). School meal practices were also associated with positive dietary intake trends in elementary school students. Offering fresh fruit and raw vegetables daily, and not offering French fries in school meals were associated with increased intake of vegetables (Briefel, Crepinsek et al. 2009). Not offering desserts in school meals was associated with increased intake of fruit (Briefel, Crepinsek et al. 2009). In elementary schools, offering French fries or desserts more than

once

Dodd

and h

optio

Comp

not ad

define

Natior

2001).

anywh

(FMN

the sch

compe

brough

conces

nationa

elemen

availab

Agricu

specific

once per week in school lunches was associated with a higher likelihood of obesity (Fox, Dodd et al. 2009). Clearly, school meals have a significant impact on the dietary intake and health outcomes of students. Thus, it is imperative that school meals provide healthy options and make a positive contribution to dietary intake.

Competitive foods

The SMI regulates only foods and beverages available in school meals, but does not address competitive foods sold or served within the school. Competitive foods are defined by the USDA as any foods or beverages available in schools outside of the National School Lunch and School Breakfast programs (U.S. Department of Agriculture 2001). These include foods available individually (not as part of a school meal) anywhere in the school anytime of the day, as well as foods of minimal nutritional value (FMNV), which cannot be sold in the foodservice area (but can be sold elsewhere) during the school meal periods (U.S. Department of Agriculture 2001). Examples of competitive foods include vending machines, a la carte offerings, fundraisers, treats brought into the classrooms by teachers or parents for celebrations or rewards, and concession stands at school events.

Competitive foods and beverages are widely available in schools. Several national studies in 2005 estimate that approximately 73-83%, 97%, and 99-100% of elementary, middle, and high schools had any type of competitive foods and beverages available to students (U.S. Government Accountability Office 2005; U.S. Department of Agriculture, Food and Nutrition Service et al. 2007; Fox, Gordon et al. 2009). More specifically, 64%, 89%, and 92% of elementary, middle, and high schools had a la carte

food

midd

And

beca

dens

Wild

2003

2009

dietar

assoc

2006

vitam

has b

assoc

comp

middl

middl

fruit a

(Cull

practi

Schoo

foods (Fox, Gordon et al. 2009); and 17-26%, 62-87%, and 86-98% of elementary, middle, and high schools had vending machines available on school grounds (O'Toole, Anderson et al. 2007; Finkelstein, Hill et al. 2008; Fox, Gordon et al. 2009).

The high prevalence of competitive foods available in schools is concerning because competitive foods and beverages sold in schools are often low in nutrient density, and high in energy, fat, sodium, and added sugars (Harnack, Snyder et al. 2000; Wildey, Pampalone et al. 2000; U.S. Department of Agriculture 2001; French, Story et al. 2003; Wiecha, Finkelstein et al. 2006; O'Toole, Anderson et al. 2007; Fox, Gordon et al. 2009). Additionally, competitive foods have consistently been associated with poor dietary habits in students. Purchase of competitive foods in middle schools has been associated with a higher intake of sugar-sweetened beverages (Wiecha, Finkelstein et al. 2006); a higher intake of calories, total and saturated fat, and lower intakes of protein, vitamins A and C, and calcium (Templeton, Marlette et al. 2005). A la carte availability has been negatively associated with fruit and vegetable consumption and positively associated with intake of total and saturated fat (Kubik, Lytle et al. 2003). When comparing students from elementary schools with no competitive foods available to middle schools that sell competitive foods, or those transitioning from elementary to middle school, availability of competitive foods was associated with decreased intake of fruit and fruit juices, vegetables, and milk and increased intake of sweetened beverages (Cullen, Eagan et al. 2000; Cullen and Zakeri 2004).

Results from the SNDA-III study indicate that school nutrition environments and practices are associated with student dietary intake (Briefel, Crepinsek et al. 2009). School-level characteristics associated with a decreased consumption of energy from

sugar-sweetened beverages included not having a contract with a beverage company, not having a store or snack bar, and not having a la carte foods available (Briefel, Crepinsek et al. 2009). Availability of vending machines in or near the cafeteria that contain low-nutrient energy-dense foods was associated with a higher BMI z-score in middle school children (Fox, Dodd et al. 2009). However, having these foods available in a la carte was associated with a lower BMI z-score (Fox, Dodd et al. 2009). Despite this contradictory finding, the majority of research has found that competitive foods are associated with unhealthy dietary behaviors in adolescents.

Furthermore, the USDA recognizes that competitive foods in schools may directly undermine nutrition and health education that students may be receiving in the classroom, as well as compete with, stigmatize participation in, and compromise the financial viability of the National School Lunch and School Breakfast program (U.S. Department of Agriculture 2001). In fact, sales of competitive foods are inversely associated with sales of school lunch (Fox, Crepinsek et al. 2001). Efforts to reduce the availability of competitive foods in schools and to enhance the nutritional quality of school meals may help to improve adolescent dietary behaviors and health outcomes.

INDIVIDUAL INFLUENCES ON ADOLESCENT DIETARY BEHAVIORS

Many studies have examined intrapersonal and interpersonal factors that influence adolescent dietary behavior. Story (Story, Neumark-Sztainer et al. 2002) and Baranowski (Baranowski, Cullen et al. 1999) provide excellent reviews of the current knowledge in the field. One of the factors most relevant to the school setting is provision of nutrition education; however, there appears to be no consistent relationship between nutrition

know

progr

behav

reinfo

Psych

value

Furthe

this gr

import

used fo

O'Dea

Austral

using 2

Sztainer

7th and

understa

what su

explored

using 16

districts

of foods

aged 11

knowledge and dietary intake. A review of nutrition education interventions showed that programs that focused solely on providing information had limited successes, but behaviorally-focused interventions and those that included environmental changes to reinforce knowledge had more positive results (Contento, Balch et al. 1995). Psychosocial correlates (such as self-efficacy) have been shown to have low predictive value in dietary intake of fat, fruits and vegetables (Baranowski, Cullen et al. 1999). Further understanding of how adolescents make dietary choices is imperative in helping this group choose healthy diets.

Qualitative exploration of influences on adolescent dietary behaviors is an important method to better understand adolescent dietary behaviors. Several studies have used focus groups and interviews to elucidate factors that are important to adolescents. O'Dea et al. (O'Dea 2003) conducted 38 focus groups with 213 students in grades 2-11 in Australia. Croll et al. examined adolescent's perceptions of healthy eating in Minnesota using 25 focus groups with 203 junior and senior high-school students (Croll, Neumark-Sztainer et al. 2001). A study by Neumark-Sztainer et al. used 21 focus groups with 141 7th and 10th grade students in St. Paul, Minnesota (Neumark-Sztainer, Story et al. 1999) to understand why adolescents eat what they eat, what makes healthy eating difficult, and what suggestions adolescents have for making it easier to eat healthy. Cullen et al. explored the social and environmental influences on fruit, juice, and vegetable intake using 16 focus group discussions with 180 students from six low-income parochial school districts (Cullen, Baranowski et al. 2000). Chapman and Maclean examined the meaning of foods and social context surrounding eating occasions in a group of female adolescents aged 11-18 years old (Chapman and Maclean 1993). The Minnesota Youth Poll explored

adolescents' opinions of nutrition-related topics through small group discussions with 900 high school students (Story and Resnick 1986). Major findings of these studies are compared below.

Children and adolescents were consistently able to identify healthy foods (e.g. fruits and vegetables) and their characteristics (e.g. low-fat, low-cholesterol) (Chapman and Maclean 1993; Neumark-Sztainer, Story et al. 1999; O'Dea 2003). Croll noted that adolescents rarely mentioned milk as a healthy item, and that adolescents were able to list many more unhealthy foods (e.g. candy, chips, soda pop) than healthy items (Croll, Neumark-Sztainer et al. 2001).

Adolescents were able to identify many short-term benefits of healthy eating including enhanced cognitive functioning, physical performance, and appearance (Croll, Neumark-Sztainer et al. 2001; O'Dea 2003); enhanced self-esteem and pride (O'Dea 2003), and higher self-control (Chapman and Maclean 1993); and references to increased energy and endurance (Croll, Neumark-Sztainer et al. 2001; O'Dea 2003), and weight loss (Chapman and Maclean 1993). Few adolescents mentioned long-term health consequences (such as prevention of heart attack) (Croll, Neumark-Sztainer et al. 2001). Adolescents were also able to articulate adverse physical and psychological effects of eating unhealthy foods including: experiencing guilt (Chapman and Maclean 1993; O'Dea 2003), disgust, and not being in control of oneself (Chapman and Maclean 1993); being in a bad mood (Story and Resnick 1986); gaining weight (Story and Resnick 1986; Chapman and Maclean 1993); poor health and cavities (Story and Resnick 1986); a slowing down of the mind and body (O'Dea 2003).

D

acknowl

the prima

this age g

with whi

Neumark

Healthy f

and Resni

appeared

home env

Neumark-

experience

(Chapman

Neumark-

for not con

et al. 2000)

Add

spent prepa

healthy foo

Neumark-S

also indicat

school and i

(Story and R

Despite adolescents' knowledge of healthy eating and its consequences, they also acknowledge that most youth do not have healthy diets (Story and Resnick 1986). One of the primary influences on adolescent dietary intake was taste and preferences. In general, this age group seems to prefer the taste of sweets and salty snack, as well as foods that with which they are familiar (Story and Resnick 1986; Chapman and Maclean 1993; Neumark-Sztainer, Story et al. 1999; Croll, Neumark-Sztainer et al. 2001; O'Dea 2003). Healthy foods were generally perceived as not looking appealing or tasting good (Story and Resnick 1986; Neumark-Sztainer, Story et al. 1999). The social context also appeared to influence what adolescents consume. Healthy foods were associated with the home environment, relatives, and family meals (Chapman and Maclean 1993; Croll, Neumark-Sztainer et al. 2001). Junk foods were associated with many positive experiences, such as parties, socializing, having money, being able to do what you want (Chapman and Maclean 1993), and with social events or hanging out with friends (Croll, Neumark-Sztainer et al. 2001). Students in one study reported peer influence as a reason for not consuming FVJ, as well as advertising for less healthy foods (Cullen, Baranowski et al. 2000).

Adolescents in these studies also cited numerous barriers to healthy eating. Time spent preparing food was mentioned in several studies as a barrier, with the belief that healthy foods take longer to prepare and were not convenient (Story and Resnick 1986; Neumark-Sztainer, Story et al. 1999; Croll, Neumark-Sztainer et al. 2001). Adolescents also indicated that healthy foods are not readily available where they eat, such as at school and in their homes, but especially in vending machines and fast food restaurants (Story and Resnick 1986; Neumark-Sztainer, Story et al. 1999; Croll, Neumark-Sztainer

et al. 2001

they may

prohibit ac

barrier to h

consequen

al. 1999; C

identify lor

themselves

The

to delineate

of healthy e

recognized t

adolescents

included tast

prevent them

In ma

barriers to he

Sztainer, Ston

Resnick 1986

education abo

easier to eat h

term benefits

Sztainer et al.

et al. 2001; O'Dea 2003). When healthy foods are available in places such as the home, they may not be in a form that is ready to eat (e.g. not peeled or cut up), which can prohibit adolescents from consuming them (Cullen, Baranowski et al. 2000). Another barrier to healthy eating in adolescents was a general lack of concern for the health consequences of an unhealthy diet (Story and Resnick 1986; Neumark-Sztainer, Story et al. 1999; Croll, Neumark-Sztainer et al. 2001). Even though adolescents were able to identify long-term consequences of poor dietary behaviors, adolescents appear to view themselves as "invincible."

The combined results of these studies provide evidence that adolescents are able to delineate healthy and less healthy foods. They were also able to articulate the benefits of healthy eating, and the consequences of unhealthy eating. However, they also recognized that most people their age did not consume healthy diets. Even though adolescents know about healthy eating, the perceived barriers to healthy eating, which included taste preferences, inconvenience, and a lack of prioritization of healthy eating, prevent them from translating this knowledge into healthy dietary behaviors.

In many of these studies, adolescents were asked to identify strategies for these barriers to healthy eating. Responses included increased parental support (Neumark-Sztainer, Story et al. 1999; O'Dea 2003); advance planning and preparation (Story and Resnick 1986; O'Dea 2003); use of cognitive motivational strategies; and increasing education about and advertising for healthy foods (O'Dea 2003); methods to make it easier to eat healthy in social situations and to emphasize both the immediate and long-term benefits of healthy eating may be beneficial in this age group (Croll, Neumark-Sztainer et al. 2001); eating more meals with their families (Story and Resnick 1986);

making hea

of these iter

on macrosy

product pac

Story et al.

Whi

behaviors, it

setting. Onl

environment

context (Bau

26 students i

faculty and st

Adolescents a

noted in gene

food availabl

competitive f

lunch, which

behaviors, tea

concerns.

Additi

understanding

research under

income schools

making healthy food look and taste better, and increase the availability and accessibility of these items (Neumark-Sztainer, Story et al. 1999). In one study, adolescents focused on macrosystem influences by suggesting use of and using media, advertising, and product packaging to make healthy foods cool, or the "thing to do" (Neumark-Sztainer, Story et al. 1999).

While these studies provide insight on the overall influences on adolescent dietary behaviors, it is important to explore the contextual influences specific to the school setting. Only one qualitative study was identified that explored the social and environmental factors that relate to healthy eating in adolescents specific to the school context (Bauer, Yang et al. 2004). In this study, seven focus groups were conducted with 26 students in two suburban public middle schools in Spring 2000. Additionally, 23 faculty and staff members participated in focus groups and individual interviews. Adolescents and adults identified a number of barriers to healthy eating similar to those noted in general studies of adolescent dietary behaviors. These included the types of food available in the cafeteria (described as greasy, high fat); availability of less healthy competitive foods in vending machines and snack carts; not having enough time to eat a lunch, which forces some students to choose competitive foods; and unhealthy dieting behaviors, teasing other students about weight and appearance, and other weight-related concerns.

Additional qualitative studies exploring school nutrition will lead to a better understanding of the school-specific influences on adolescent dietary behaviors. The research undertaken in this dissertation examined school nutrition in a group of low-income schools, which may reveal barriers specific to this at-risk population.

THE R

dietary

school-l

have in

Adminis

commur

can crea

of these

S

school p

impleme

identifie

(Greenb

superinte

Bartee 2

financial

support.

(standard

last two i

training (

factors th

THE ROLE OF ADMINISTRATORS IN NUTRITION PROMOTION

Until this point, this review has focused on school factors that impact student dietary behaviors, but it is important that we take into account what influences these school-level factors. It is important to recognize the central role that school personnel have in shaping a school's culture, and the degree to which health initiatives are valued. Administrators, school board members, teachers, food service personnel, parents, and community members can influence school nutrition promotion policies and programs and can create a health-focused school culture. Limited research to date has studied the role of these stakeholders in promoting health and nutrition to students.

Several surveys have examined the perceived barriers to health initiatives of school personnel. In a survey of school administrators assessed the barriers to implementing CSHPs in Ohio (Greenberg, Cottrell et al. 2001). The top barriers identified were a lack of prioritization, funding, personnel, time, and leadership (Greenberg, Cottrell et al. 2001). In a study of the top priorities and concerns of school superintendents, a lack of prioritization of health initiative was also evident (Winnail and Bartee 2002). Of the top ten concerns reported, half were directly or indirectly related to financial issues (funding, salaries, attraction and retention of quality teachers, teacher support, and declining student enrollment); three were related to academic priorities (standards and assessment, content improvement, and graduation requirements); and the last two included a lack of time, and provision of staff development and in-service training (Winnail and Bartee 2002). School board members in California listed similar factors that inhibit school nutrition policies including nutrition not being considered a

priority

Akintobi

lunch an

2004). F

funding a

as primar

identified

and lack

staff felt t

messages

nutrition

Se

school nut

members a

(Shahid 2(

not transla

nutrition, a

studies, adı

health or nu

areas (Shah

Evi

are reflected

principals' p

priority by school board and the impact of the food program on school budget (Brown, Akintobi et al. 2004). One study examined the barriers to implementing a quality school lunch and providing nutrition education in Massachusetts's schools (Cho and Nadow 2004). Food service directors, administrators and other relevant staff identified lack of funding and time, academic requirements, and students' preference for unhealthy foods as primary barriers (Cho and Nadow 2004). Food service directors and other staff identified lack of communication and leadership, lack of support materials and training, and lack of parental support as additional challenges (Cho and Nadow 2004). Also, other staff felt that the media focus on junk foods, and a lack of reinforcement of nutrition messages in the home and school (e.g. vending machines) were challenges to providing nutrition education (Cho and Nadow 2004).

Several studies have explored the attitudes of school administrators regarding school nutrition issues. Two studies have noted that school administrators and board members are aware of the relationship between nutrition and academic performance (Shahid 2003; Brown, Akintobi et al. 2004). In one of these studies, these beliefs were not translated into school practices, as principals did not encourage teachers to promote nutrition, and often permitted competitive foods in schools (Shahid 2003). In both studies, administrators and board members expressed an interest in being involved in health or nutrition initiatives, and were interested in receiving additional training in these areas (Shahid 2003; Brown, Akintobi et al. 2004).

Evidence suggests that administrator knowledge and attitudes towards nutrition are reflected in school practices. In a survey of school principals in Minnesota, principals' positive attitudes toward the school nutrition environment were positively

related t

2002). I

that allo

get these

relationsl

compare

promote

2003).

It

concerns

strategies

concerns

school sys

be more ef

education

means of p

Thi

low-incom

the things t

This will pr

do to assist

will identify

related to the total number of school nutrition practices reported (French, Story et al. 2002). In another study, motivating factors for nutritional decisions differed in schools that allowed vending machines (need for revenue, belief that kids will find other ways to get these types of foods, other schools have vending machines, and there is not a relationship between consumption of these foods and academic performance), when compared with those that do not allow vending machines (they are not necessary, do not promote learning, create trash in the school, and the district does not allow them) (Shahid 2003).

It is important that health and nutrition practitioners recognize the priorities and concerns of school administrators and other personnel, and design health promotion strategies that do not exacerbate these issues. Programs that can enhance the top concerns of school administrators would have the best chance of being welcomed into school systems. Identifying administrators' primary areas of concern can help researchers be more effective when working with school districts. Additionally, efforts to provide education and training to school administrators and other personnel may be an effective means of prioritizing health initiatives in schools.

This study examines not only the barriers to promoting health and nutrition in low-income middle schools, but also the accomplishments that schools have made, and the things that have helped schools to make improvements that promote student health. This will provide valuable information about things that practitioners and researchers can do to assist schools in prioritizing health initiatives. The focus on low-income schools will identify any additional barriers experienced by this population.

SCHOOL

DIETAR

G

many res

health an

including

environm

nutrition

are not di

interventi

However,

environm

the multip

making ch

combined

School nu

Th

ecological

interventi

environme

that focus

(Contento,

SCHOOLS AS AN INTERVENTION SETTING TO IMPROVE ADOLESCENT DIETARY INTAKE

Given the many school-specific factors that influence adolescent dietary intake, many researchers and practitioners turn to schools as intervention sites for promoting health and nutrition. School nutrition interventions include a variety of approaches including nutrition education curriculum to increase knowledge of healthy eating, environmental changes in the foods and beverages available in schools, and adoption of nutrition policies. Nutrition education interventions are reviewed briefly below, as they are not directly pertinent to the research in this dissertation. School environment interventions, as a primary focus of the current research, are reviewed in more depth. However, due to the large number of studies that have been published involving environmental interventions, select studies are reviewed to provide an understanding of the multiplicity of the literature. Additionally, most "policy" interventions involve making changes to the school nutrition environment; therefore, these studies are combined with the environmental interventions for this review.

School nutrition education interventions

The literature on school nutrition education interventions supports the use of ecological models of health behavior change. A review of nutrition education interventions showed that behaviorally-focused interventions and those that included environmental changes to reinforce knowledge had more positive results, while programs that focused solely on providing information and teaching skills were less successful (Contento, Balch et al. 1995). School nutrition education programs have been shown to

be effecti

Moschan

foods (K

al. 1996;

vegetabl

program

consump

(James,

improve

1999).

School n

T

A variety

reviewed

represent

performe

research, i

well as sch

Ma

foods and b

pricing and

secondary sc

be effective at increasing knowledge of healthy eating (Davis, Clay et al. 1999; Manios, Moschandreas et al. 1999; Moreno, Denk et al. 2004) enhancing preferences for healthy foods (Kelder, Perry et al. 1995), decreasing intake of high fat foods (Luepker, Perry et al. 1996; Gortmaker, Cheung et al. 1999), and increasing consumption of fruits and vegetables (Gortmaker, Cheung et al. 1999; Perry, Bishop et al. 2004). An educational program aimed at decreasing consumption of carbonated beverages resulted in decreased consumption, as well as a reduction in the mean % of overweight in intervention children (James, Thomas et al. 2004). One study showed maintenance of some dietary improvements three years after a nutrition education intervention (Nader, Stone et al. 1999).

School nutrition environment interventions

The results of school nutrition environment interventions have been inconsistent. A variety of environmental intervention approaches have been employed, and are reviewed below. While this review is not comprehensive in nature, it provides representative examples of the variety of school nutrition interventions that have been performed. It also shows the diversity of outcome measures used in school intervention research, including individual psychosocial, behavioral, and physiological parameters, as well as school-level environmental variables.

Many interventions focus on increasing the availability and marketing of healthy foods and beverages. The Changing Individuals' Purchase of Snacks (CHIPS) explored pricing and promotion strategies to encourage purchasing of healthy options in 12 secondary schools (French, Jeffery et al. 2001); a similar study was conducted in two

high scho

strategies

vending

2001). I

year inte

no chan

2003). I

M-SPAN

Achievi

availabi

(Cassad

available

changes,

saturated

decreased

Cafeteria

lower-fat

in the mea

2004). Stu

lower-fat o

and purchas

However, th

high schools (French, Story et al. 1997). In these studies, pricing and promotion strategies were successful at increasing sales of low-fat snacks, carrots and fruit from vending machines and a la carte lines (French, Story et al. 1997; French, Jeffery et al. 2001). In the Middle-School Physical Activity and Nutrition (M-SPAN) study, a two-year intervention to provide and market healthy food choices in all middle school venues, no changes were observed in total fat or saturated fat intake (Sallis, McKenzie et al. 2003). It is possible that addition of pricing strategies to promote healthier options in the M-SPAN study could have resulted in decreases in fat intake. The Students Today Achieving Results for Tomorrow (START) after-school program increased the availability of fruits and vegetables during the snack period in 44 after-school programs (Cassady, Vogt et al. 2006). No pricing efforts were necessary, as these snacks were available to students at no cost. These changes resulted in positive nutrition environment changes, including increased availability of fresh fruit and fruit juice and decreased saturated fat content of snacks; however, negative changes were also observed including decreased availability of milk, calcium, and vitamin A (Cassady, Vogt et al. 2006).

Multiple levels of outcome variables were assessed in the Trying Alternative Cafeteria Options in Schools (TACOS) study, which aimed to increase availability of lower-fat foods in a la carte (French, Story et al. 2004). Sales data showed an increased in the mean percentage of lower-fat food sales in the second year (French, Story et al. 2004). Students reported improved perceptions about the school environment providing lower-fat options, social support for choosing lower-fat foods, and ease of identification and purchase of lower-fat foods in the school cafeteria (French, Story et al. 2004). However, there were no significant differences in intentions to buy lower-fat foods from

the cafet

appears

sales of

improv

compet

to prom

sweet d

from th

school l

consum

vitamin

decreas

2006).

vending

schools

Watson e

Th

school lu

reported l

hour dietar

policy regu

carbonated

the cafeteria or self-reported choices of lower-fat items (French, Story et al. 2004). It appears that while the TACOS study was successful at enhancing the availability and sales of lower-fat a la carte options and increased student awareness, that these improvements were not translated into improved dietary behaviors. It is possible that compensation occurred in other venues, such as at vending machines or at home.

Interventions have also tried removing less-healthy options available to students to promote healthy eating. An intervention study that removed snack chips, candies, sweet desserts, and sweetened beverages from snack bars and removed vending machines from three middle school cafeterias in Texas resulted in mixed changes at the student and school levels (Cullen, Watson et al. 2006). Positive changes included decreased consumption of sweetened beverages and increased consumption of milk, calcium, and vitamin A. Negative consequences included increased intake of saturated fat and sodium, decreased intake of vegetables, and increased sales of ice cream (Cullen, Watson et al. 2006). Additionally, following the removal of less-healthy items from the snack bar and vending machines from the cafeterias, the overall number of vending machines in the schools doubled, and sales of chips and candy from vending machines increased (Cullen, Watson et al. 2006), indicating that compensation was occurring.

The Go for Health project improved the fat, saturated fat, and sodium content of school lunches (Simons-Morton, Parcel et al. 1991). Students from intervention schools reported lower intakes of fat, saturated fat, and sodium (significance not reported) in 24-hour dietary recalls (Simons-Morton, Parcel et al. 1991). In another study, a district-wide policy regulating the types of foods and beverages allowed in schools (e.g. plain or carbonated water or 100% juice with no added sweeteners, 1% or fat-free milks) as well

as the nutrient content of individual foods and beverages (e.g. 30% or less calories from fat, 10% or less calories from saturated fat, no more than 35% sugar by weight) was adopted in San Francisco (Wojcicki and Heyman 2006). Results included healthier food and beverage options in school meals and a la carte/snack bars, increased participation in and revenue from the school meals program, and decreased a la carte and snack bar sales (Wojcicki and Heyman 2006). It appears that in order to be effective, school environmental changes must be applied to all food venues within a school, or students will continue to seek unhealthy items from alternative sources.

Several studies have used multiple intervention methods to promote healthy eating and physical activity to students in schools. The Teens Eating for Energy and Nutrition at Schools (TEENS) study in 16 middle schools in Minneapolis included classroom education, family newsletters and behavioral coupons, and school-wide environmental changes to promote lower-fat food service and a la carte offerings and increased fruits and vegetables (Lytle, Murray et al. 2004). Results showed no differences in the fruits, vegetables, and salads offered in school meals (Lytle, Kubik et al. 2006). Intervention schools increased the proportion of healthier foods available in a la carte ($p = .04$) (Lytle, Kubik et al. 2006). Student dietary intake measured by 24-hour recalls and by a fruit and vegetable screener survey revealed no significant differences for the intervention group (Lytle, Murray et al. 2004). The only significant difference was seen in the student survey-reported usual food choice score, indicating students in intervention schools made lower fat choices (Lytle, Murray et al. 2004).

The Child and Adolescent Trial for Cardiovascular Health (CATCH) study, considered to be one of the best school intervention studies to date, provides an excellent

example of t
level interve
students, and
study showe
however the
1996). Psyc
increased stu
social reinfo
or self-effica
limited behav
schools had c
intake, but al
significant di
Lytle et al. 19
pressure, and

Result
in general, the
beverages ava
behavioral and
availability of
to see changes
options, decrea
to highlight hea

example of the mixed outcomes seen in the majority of school interventions. This multi-level intervention included food service changes, nutrition education curriculum for students, and take-home lessons and activities for families. Results from the CATCH study showed some improvements in the fat content of school breakfasts and lunches, however there were increases in sodium content of these meals (Osganian, Ebzery et al. 1996). Psychosocial correlates of diet showed mixed changes. The intervention increased student-reported dietary intentions, usual food choice, nutrition knowledge and social reinforcement; however there were no differences in positive or negative support or self-efficacy for dietary behaviors (Edmundson, Parcel et al. 1996). There were limited behavioral and physiological changes in students. Students in the intervention schools had decreased intake of fat and saturated fat as a percentage of total caloric intake, but also had an increase in sodium intake (Lytle, Stone et al. 1996). No significant differences between groups were seen in intake of fruits or vegetables (Perry, Lytle et al. 1998), or in cardiovascular disease risk factors including obesity, blood pressure, and serum lipids (Webber, Osganian et al. 1996).

Results from individual school nutrition environmental interventions indicate that, in general, these programs can be successful in creating positive changes in the foods and beverages available to students; however, these changes do not always result in positive behavioral and physiological results. It may also be necessary not only to increase the availability of healthy options, but also to reduce the availability of less healthy options to see changes in adolescent dietary intake. Combining increased availability of healthy options, decreased availability of less healthy options, and utilization of pricing strategies to highlight healthy items may be necessary to have the maximum impact on adolescent

dietary behaviors. Interventions that include strategies at multiple levels, such as nutrition education and family outreach could potentially increase the likelihood that behavioral changes will occur, however results from the TEENS and CATCH studies still reported mixed results, with some negative changes in dietary behavior. One difficulty with multi-level interventions is determining the individual factors that create positive and negative changes in student behaviors. Additionally, interventions that require numerous changes at multiple levels may be overwhelming to individual schools, resulting in decreased commitment and buy-in to the project. Therefore, it is necessary to identify which specific strategies seem to be most effective and tailor these activities to the specific needs of the schools.

LIMITATIONS OF THE SCHOOL NUTRITION INTERVENTION LITERATURE

Some of the inconsistency in results of school nutrition interventions may be attributable to the methods used in the field. When reviewing the school nutrition intervention literature, many limitations become apparent, several of which are outlined below. Many of the school intervention studies have small sample sizes, both in number of school and students, which decreases statistical power to detect differences between intervention groups. Many studies use a case-study approach with only one or a few schools, oftentimes with no comparison group. The largest school intervention thus far is the CATCH study involving 96 elementary schools in four regions of the United States (Luepker, Perry et al. 1996).

Additionally, the outcome measures of interest vary among published studies. Many school nutrition interventions do not measure student-level indicators, such as the

CHIPS study (French, Jeffery et al. 2001), which collected sales data only at the school level. Student-level indicators commonly measured in intervention studies include both dietary intake, as well as psychosocial variables. Studies that measure dietary intake have used a wide variety of instruments. Methodologies used in several key studies include: a single 24-hour recall in the TEENS study (Lytle, Murray et al. 2004); one 24-hour recall supplemented with a qualitative diet record in the CATCH study (Lytle, Stone et al. 1996); seven-day food records as used in the Gimme 5 study (Baranowski, Davis et al. 2000); or a food-frequency type survey including a checklist of low and high fat foods with frequency response options (not much, some, a lot) in the Cardiovascular Health in Children (CHIC) study (Harrell, Gansky et al. 1998). Lack of consistent methods of assessing dietary intake makes it difficult to quantify changes in dietary intake as a result of interventions, and limits the ability to compare results between studies.

The choice of methods used to assess student dietary changes may have a significant impact on the results of the study, and are important when interpreting the results of school intervention studies. Results may vary when researchers measure total dietary intake (such as 24-hour recall) compared with a limited scope (such as plate waste or visual observation of a single meal). For example, the "Go for Health" school nutrition intervention uses two methods to assess dietary intake (Parcel, Simons-Morton et al. 1989). Direct observation of school lunch showed improvements in fat and sodium intake for the intervention group; however no significant differences were seen when analyzing 24-hour recall data (Parcel, Simons-Morton et al. 1989). This may reflect differences in measurement precision, or could also be an indication that students are compensating for changes in foods eaten in schools with foods eaten outside of the school

and at h

measur

beverag

machin

foods ir

only foo

fruits an

% fat, to

validity

2000; Ly

quantifie

Standard

literature

understar

PROJEC

Th

demonstra

trend (Ogo

income an

dietary qua

2004; Jago

and at home. When interpreting study results it is necessary to take into consideration the measurement tools used.

Measuring the school nutrition environment, including the types of foods and beverages available in school meals, as well as competitive foods such as vending machines and a la carte has also proven to be difficult. Some researchers categorize foods into healthy or less healthy options (using varying criteria to categorize foods), or only focus on a specific type of food or beverage (e.g., chips, carbonated beverages, or fruits and vegetables). Others report nutrient composition of foods and beverages (e.g., % fat, total calories). There are currently no instruments that have been tested for validity or reliability to assess the school nutrition environment (McGraw, Sellers et al. 2000; Lytle and Fulkerson 2002). Differences in the way environmental variables are quantified makes interpretation and comparison of results between studies difficult. Standardizing measurement and reporting methods used at all levels in the intervention literature, and measuring outcome variables at multiple levels would enhance understanding of the factors that influence adolescent dietary behaviors.

PROJECT JUSTIFICATION

The rapid increase in the prevalence of overweight and obese adolescents demonstrates the need for innovative and effective intervention strategies to reverse this trend (Ogden, Flegal et al. 2002; Ogden, Carroll et al. 2006). Evidence suggests that low-income and minority adolescents are at increased risk for overweight, obesity, and poor dietary quality (Neumark-Sztainer, Story et al. 1996; Fox and Cole 2004; Sorof, Lai et al. 2004; Jago, Harrell et al. 2006; Ogden, Carroll et al. 2006).

Schools have been identified by researchers and public policy makers as a logical setting to work with children because: a) they reach the large majority of children; b) students spend a large amount of their time at schools; and c) students typically consume at least one meal in the school setting each day (usually lunch, and sometimes breakfast and after-school snacks as well) (Story 1999; Michigan Department of Education, Michigan Department of Community Health et al. 2001; American Dietetic Association 2006; Story, Kaphingst et al. 2006).

While school nutrition interventions involving education, environment, and policy changes (or a combination thereof) have been moderately successful at improving intrapersonal factors (such as knowledge, attitudes, and self-efficacy) and environmental factors (such as the nutrient contents of school meals), there have been limited and mixed changes in behavioral outcomes (such as dietary intake) or physiological disease markers (such as blood lipids and BMI) (Webber, Osganian et al. 1996; Atkinson and Nitzke 2001). These results clearly indicate a gap between the theory and practice of influencing dietary behaviors in adolescents. Lack of positive individual level results supports the need for multi-level interventions that target multiple factors that influence adolescent dietary intake.

The lack of consistency and effectiveness of school nutrition interventions can partially be attributable to the many limitations of the literature mentioned above including: lack of valid and reliable assessment methods; variation in the measurement of outcome variables; inconsistency in reporting of results; use of small non-representative samples; and short-term follow-up periods. However, the most important problem could be the lack of clear theoretical basis in many intervention programs. Social ecological

models of health behaviors have been proposed for addressing adolescent dietary behaviors (Story, Neumark-Sztainer et al. 2002), however the efficacy of these models has not been proven (Sallis and Owen 2002). It is imperative that researchers strive to better understand the relationships between the various school-related influences on adolescent dietary behavior in order to design and evaluate more effective school nutrition interventions.

There is very limited literature regarding the efficacy of school policies at creating change in school environment and practices, and ultimately resulting in changes in student dietary behaviors. The Child Nutrition Reauthorization Act of 2004 (Section 204 of Public Law 108-265 June 3, 2004) required all schools participating in the National School Lunch Program to establish a school wellness policy by fall of 2006. Given the novelty of the federal wellness policy mandate, now is the time to explore the effect that wellness policies have had on school nutrition and physical activity environments, policies, and practices.

The goal of this dissertation research was to examine the associations between school nutrition policies, physical environments, and dietary behaviors to better understand what intervention strategies will be most effective at influencing adolescents' dietary behaviors. Baseline data from an intervention study in low-income Michigan middle schools were used to examine these associations in a cross-sectional manner. The focus on low-income schools provides valuable information specific to this vulnerable population that is historically at a higher risk of obesity and nutritional deficiencies.

This research helps to fill two major gaps in the school nutrition literature. First, it is the second known study to explore whether school wellness policies are associated

with school

studies to ex

dietary intak

al. 2009; Fox

which utilize

tool for expl

cross-sectior

causational.

be ideal to e

Thus, result

determine c

identify wh

adolescent

Wh

design), sc

multi-leve

collected

school ar

students

number c

an unequ

assumes

with school nutrition environments and practices. Second, this research is among the first studies to examine the association between school nutrition environments and student dietary intake in a cross-sectional manner (Kubik, Lytle et al. 2003; Briefel, Crepinsek et al. 2009; Fox, Dodd et al. 2009; Gleason and Dodd 2009). Cross-sectional analysis, which utilizes observations made at a single point in time without intervention, is a useful tool for exploratory analysis in order to assess associations. However, due to the fact that cross-sectional data is collected at one point in time, it cannot be interpreted as causational. Longitudinal studies of a nationally representative group of schools would be ideal to establish and to observe the changes in environments and policies over time. Thus, results are best interpreted as providing direction for further intervention studies to determine causational relationships. Results from this dissertation research will help identify which school-level intervention activities are most likely to have an impact on adolescent dietary behaviors.

When analyzing data involving students nested within schools (a cluster sample design), several methodological issues arise that must be addressed through appropriate multi-level statistical modeling techniques (which take into account the fact that data are collected at two different levels – students and schools). First, the students within one school are not independent of other students within that school; thus, the error terms from students within the same school will be correlated with each other. Furthermore, the number of students sampled within each school can impact the results of the analysis if an unequal number of students are sampled from schools but the statistical method assumes an equal number of students in each school. Results must be weighted so that

schools with more students responding are weighted more heavily in the analysis that schools with only a few students.

The SNDA-III study data are cross-sectional in nature and were analyzed for similar associations as examined in this dissertation (Briefel, Crepinsek et al. 2009; Fox, Dodd et al. 2009; Gleason and Dodd 2009). While the SNDA-III study contained a large number of schools (287), dietary data were only gathered from approximately 10 students in each school. Because of the large number of schools, multi-level modeling techniques were not used to accommodate the data structure of students nested within schools; however, the single-equation model accounted for the fact that the error terms from students within a single school would be correlated. Additionally, it was not necessary to weight observations from different schools, as there were approximately the same number of students sampled from each school. In contrast, in this dissertation research analysis, hierarchical linear modeling (HLM) software is used to fit the multi-level data structure of students nested within schools because of the smaller number of schools (65) and the variation in the number of students from each school sampled from 10 to 68 students (schools with less than 10 students participating were removed from analysis due to a lack of statistical power). The HLM program weights the results from each school based on the number of students sampled.

The qualitative component of this dissertation utilized interviews and focus groups with school administrators, food service directors, coordinated school health team members, and students to assess the facilitators and barriers schools experience when promoting nutrition. Few studies have explored the influence of these key adults in promoting school health (Greenberg, Cottrell et al. 2001; Winnail and Bartee 2002;

Shahid 2003; Brown, Akintobi et al. 2004; Cho and Nadow 2004), with only one focusing on nutrition specifically (Shahid 2003). Similarly, while several studies have qualitatively explored how adolescents perceive healthy eating (Story and Resnick 1986; Chapman and Maclean 1993; Neumark-Sztainer, Story et al. 1999; Cullen, Baranowski et al. 2000; Croll, Neumark-Sztainer et al. 2001; O'Dea 2003; Bauer, Yang et al. 2004), only one has focused on the school setting (Bauer, Yang et al. 2004). Both the student and adult perspectives are necessary to understand the full context of nutrition promotion in schools, and to aid researchers in developing interventions and programs that recognize and address the challenges schools experience.

Furthermore, it is important to explore barriers in low-income schools with both students and adults to determine unique challenges they may experience in promoting school nutrition that may not be apparent in the other populations that have been studied. Taken together, the results from this dissertation help define and justify use of social ecological theories in the school setting. Researchers and policymakers can use this information to design programs, policies, and resources to enhance the dietary behaviors of adolescents, especially those in low-income schools.

The next three chapters are written as articles for publication. Chapter Two examines the associations between local wellness policies and healthy school environments and practices. Chapter Three examines the effect of school nutrition environments and practices on student dietary intake. Chapter Four uses a qualitative approach to examine the facilitators and barriers to healthy eating in the school setting from the perspective of food service directors, school administrators, coordinated school health team members, and from students themselves. The concluding chapter brings the

three articles together, further discusses the results and overall conclusions that can be drawn from this research, as well as the implications for school practice and future research steps.

CHAPTER TWO:

THE QUALITY OF SCHOOL WELLNESS POLICIES AND ASSOCIATION WITH SCHOOL PRACTICES IN LOW-INCOME MICHIGAN MIDDLE SCHOOLS

BACKGROUND

Schools have been identified as an important setting for nutrition promotion and interventions to reduce the prevalence of childhood obesity, promote overall health and well-being, and prevent chronic diseases such as heart disease and diabetes (Michigan Department of Education, Michigan Department of Community Health et al. 2001; American Dietetic Association 2006; Story, Kaphingst et al. 2006). The Child Nutrition and WIC Reauthorization Act of 2004 (Section 204 of Public Law 108-265 June 3, 2004) required all local education agencies (school districts) receiving funding for school meals (National School Lunch program, School Breakfast Program, or After School Snack Program) to establish a local wellness policy by July 1st, 2006. These local wellness policies serve as a written document that outlines the actions schools will take to promote health to students and staff. Wellness policies must include: goals for nutrition education, physical education, and physical activity; nutrition guidelines for school meals that meet or exceed USDA requirements; nutrition guidelines for all other foods available on campus (i.e., competitive foods); a plan for measuring implementation of the wellness policy; and involvement of key stakeholders in development of the policy including parents, students, school food authority, administration, school board, and the public (Section 204 of Public Law 108-265 June 3, 2004). Recognizing that each school district has unique strengths and challenges, no specific details were given for each of the six

areas, allowing districts to tailor their policy to their needs. This lack of structure has resulted in a high degree of variability in the quality, implementation, and enforcement of such policies (Institute of Medicine 2007; Story, Nanney et al. 2009).

Several nation-wide studies examined the existence of school nutrition policies *prior to the* federal mandate, at which time less than half of all school districts studied had adopted a wellness policy or other policies to promote healthy eating and physical activity (Greves and Rivara 2006; O'Toole, Anderson et al. 2007; Finkelstein, Hill et al. 2008). After the federal mandate took effect, the majority of districts had adopted a policy (School Nutrition Association 2006; Metos and Nanney 2007; Moag-Stahlberg, Howley et al. 2008; Probart, McDonnell et al. 2008; Belansky, Cutforth et al. 2009; Longley and Sneed 2009); however, wellness policy language is often vague, making it difficult to implement and evaluate wellness policy effectiveness (Metos and Nanney 2007; Probart, McDonnell et al. 2008; Belansky, Cutforth et al. 2009).

School wellness policies may hold promise for improving school nutrition; however, few studies have examined the association between written policy and actual school health practices; those that have show mixed results. A Connecticut report indicated that wellness policy strength was associated with fewer unhealthy competitive foods available (Friedman 2009). Another study found significant improvements in wellness practices following the wellness policy mandate (Longley and Sneed 2009). In contrast, a Colorado study found little change in physical activity provisions or school nutrition environments after the wellness policy mandate (Belansky, Cutforth et al. 2009; Belansky, Cutforth et al. 2009). Another study found little concordance between written

policies and school fundraising practices (Kubik, Lytle et al. 2009). It is unclear whether or not wellness policies are being translated into the intended healthier school practices.

The current study describes the association between written wellness policies and school-reported nutrition policies and practices to better understand the impact of the federal wellness policy mandate. The goal of the current study to examine the relationships among written wellness policies and school nutrition policies and practices as reported by school administrators and food service directors. This study is among the first to evaluate the associations between written wellness policies and parallel school practices.

METHODS

School Nutrition Advances Kids project

The current study utilized baseline data collected as part of the School Nutrition Advances Kids (SNAK) project. The SNAK project, funded by the Robert Wood Johnson Foundation Healthy Eating Research program, Supplemental Nutrition Assistance Program Education (SNAP-ed), and the Michigan Department of Community Health, is a collaboration between researchers at Michigan State University (MSU), the Michigan Departments of Education and Community Health, and several partnering organizations of the Michigan Action for Healthy Kids coalition. The SNAK project aims to improve school nutrition environments through Coordinated School Health, Michigan's Healthy School Action Tool (HSAT), and implementation of the Michigan

State Board of Education nutrition policy. All study procedures and instruments were approved by the MSU Institutional Review Board.

Study sample

Schools were recruited to participate in the SNAK project through an application for small grant funding to collect data and implement a nutrition environment and policy intervention or act as a comparison school. Eligibility criteria included having 50% or more of students eligible for free or reduced price meals, and having 7th and 8th grades within the same building (for follow-up purposes). School recruitment methods included direct mailings, e-mails, and phone calls to eligible schools and a posting on the Michigan Team Nutrition website.

The SNAK project is a two-year intervention study with an overlapping design including two cohorts. The first cohort included 32 schools in 30 districts participating from October 2007 – June 2009, and the second cohort included 33 schools in 20 districts participating from September 2008 – June 2010.

Wellness policy evaluation

Local wellness policies were collected for 48 of the 50 school districts participating in the SNAK project (one district had not created a policy, and one was not able to locate their policy). For districts with more than one school building participating in the SNAK project, one building was randomly selected to represent the district in the wellness policy analysis.

The quality of the local wellness policies from each district was quantified using the School Wellness Policy Evaluation Tool (Schwartz, Lund et al. 2009). This tool contains 96 items within seven sections that correspond with the federal wellness policy requirements (Table 2-2). Each item received zero points if the item is not addressed in the written policy; one point if the item is addressed, but the statement is weak or only suggestive (e.g., schools should provide an adequate amount of time for lunch); and two points if the statement is specific and required (e.g., schools will provide at least 20 minutes daily to eat lunch). Response options were condensed into "No" (0 points) and "Yes" (1 or 2 points) categories. Each section, and the assessment as a whole, received two scores: 1) the comprehensiveness score represents the percent of items within the section addressed at all in the written policy (those receiving one or two points); and 2) the strength score represents the percent of items within the section that had strong and required statements (those receiving two points). Evaluation of the tool indicates it has adequate internal consistency and inter-rater reliability (Schwartz, Lund et al. 2009).

Two researchers independently scored each policy using the Wellness Policy Evaluation Tool, and discrepancies between coders were discussed and reconciled with a third researcher. A comprehensive set of decision rules was created based on these decisions. Each policy was then rescored by both researchers, and results were compared once again to ensure consistency of scoring.

It became apparent during the wellness policy scoring that the majority of policies were based on two common wellness policy templates that were made available for districts to use and modify to fit their needs, and that wellness policy quality differed based upon the template used. The first template was the Michigan Association of

School Boards (MASB) recommended policy developed by the Michigan Department of Education in collaboration with other state and local organizations, agencies, and citizens. The second was from a company that schools can hire to provide template school board policies that ensure schools are in compliance with all federal and state mandates (designated "Policy Company"). In addition, two schools utilized a template from the National Alliance for Nutrition and Activity (NANA) (www.schoolwellnesspolicies.org), and four schools did not follow a recognizable policy template. Policies were therefore categorized based on the template type used to create them (MASB, Policy Company, NANA, Other). The MASB policies were also further categorized based on how districts modified the policy – shortened, left as intended, or enhanced the template policy.

School Environment and Policy Survey

The School Environment and Policy Survey (SEPS) was used to gather data regarding the nutrition and physical activity policies, practices, and environmental features as reported by school personnel. The SEPS was developed by Dr. Elaine Belansky and the Rocky Mountain Prevention Research Center for use in Colorado elementary schools, and preliminary validation findings suggest little reporting bias (Belansky, Cutforth et al. 2009). The SEPS contains 3 modules with unique questions for administrators, food service directors (FSDs), and physical education (PE) teachers, based on their areas of expertise. Each module takes approximately 30 minutes to complete.

The SEPS was adapted for use in Michigan middle schools based on a literature review, best practice recommendations for schools, and experience in working with

middle schools. The adapted SEPS was reviewed by project team members from various areas of expertise relating to school nutrition and by several school food service and administration representatives to establish face and content validity.

The first cohort of schools completed the SEPS between January and March 2008, and the second cohort between November 2008 and March 2009. Individuals were mailed a paper survey and also e-mailed with a link to the survey online. Follow-up phone calls, e-mails, and mailings encouraged survey completion, and a $25 gift card was used as an incentive. Response rates were 85% for administrators, 91% for FSDs, and 86% for PE teachers. Table 2-1 describes the school nutrition policy and practice variables from the SEPS survey as reported by administrators and FSDs.

School characteristics

Information regarding the following school characteristics was gathered in several ways. Schools were asked to indicate the number of 7th grade students and the total building enrollment on their application to participate in the SNAK project. The percent of students eligible for free or reduced price school meals at each school was obtained through the Michigan Department of Education. School setting (urban, rural, or suburban) was determined using U.S. Census data (2000) for each community. Presence of a coordinated school health team (CSHT) prior to joining the SNAK project, and public vs. charter were determined through interactions with each school. The Healthy School Action Tool (HSAT) website and information from the Michigan Department of Community Health were used to determine whether schools had completed the HSAT self-assessment prior to enrollment in the SNAK project. Questions from the SEPS

survey indicated the percentage of minority students, whether the food service director had a nutrition-related degree, and whether the school had participated in any extra nutrition or physical activity programming.

ANALYSIS

All analyses were performed using Stata statistical software (Stata Corporation, Release 10.0, College Station, Tex, 2008). Descriptive statistics were used to express the quality of written local wellness policies as assessed by the Wellness Policy Evaluation Tool (represented by the mean comprehensiveness and strength scores for each section, and the total policy score) and the number of districts meeting all federal wellness policy requirements. Analysis of variance was used to examine differences in wellness policy quality based on the policy template type and school characteristics, and estimates of proportions were used to determine associations between school characteristics and wellness policy template type used. Multivariate regression analysis was used to determine associations between school characteristics and wellness policy quality scores, while controlling for wellness policy template type. Fisher's exact test (one-sided) was used to evaluate degree of agreement between written wellness policies and the school nutrition policies and practices reported in the SEPS.

Table 2-1: Description of variables from the School Environment and Policy Survey reported by administrators and food service directors (FSD)

Variable	Description
Administrator-reported school nutrition policies	
Prohibits use of food as a reward or punishment	No (no written policy, written policy not enforced)/Yes (unwritten policy always enforced, written policy sometimes or always enforced)
Healthy foods in vending machines	
Healthy foods in a la carte	
Healthy foods in fundraising	
Healthy foods in class parties	
FSD-reported food service practices	
Breakfast available	Yes/No
Serving low-fat options in school meals	Yes (everyday, 1-2 times/week, or 3-4 times/week)/No (never)
Strategies to encourage participation in school meals	Yes (any of the following: offering mini-servings of new healthy foods, taste tests, incentives for school lunch, announcing menu, discarding damaged produce, displaying foods in a way that is visually appealing, surveying students about foods, beverages, preferences, time to eat, or general opinion of food service)/No (none of the above)
Adequate time to eat lunch	Yes (an average of 15 minutes or more to eat after being served)/No (less than 15 minutes)
Provide training for food service	Yes (school provided training/education opportunities to food service staff)/ No
FSD Degree	Yes (FSD has a nutrition-related degree)/No
Administrator-reported school nutrition practices	
Coordinates nutrition education with the entire school	Yes (any of the following: posters encouraging healthy eating can be found throughout the school, bulletin boards feature healthy eating information, school announcements include messages about healthy eating)/No (none of the above)
Teachers model healthy eating behaviors	Yes (teachers model healthy eating behaviors to students)/No
Integrate nutrition education into classroom curriculum	Yes (the classroom curriculum integrates healthy eating messages)/No
Presence of a coordinated school health team	Yes (existence of coordinated school health team prior to start of SNAK project)/No

RESULTS

Schools enrolled in the SNAK project had an average of 134 seventh grade students (range: 23-431) and an average building enrollment of 490 students (range: 131-1217). Two-thirds of schools were located in urban settings, 20% were rural, and 14% were suburban. The majority of schools were public (85%), and 57% had >50% minority population. Twenty-two percent of SNAK schools used the same food service management company. Schools had an average of 71% of students eligible for free or reduced-price school meals (range: 50-100%). Demographic characteristics were similar for school buildings selected for wellness policy analysis compared with the total sample (data not shown).

The results for each item scored in the Wellness Policy Evaluation Tool are shown in full in Appendix A. The comprehensiveness (percentage of items receiving one or two points) and strength (percentage of items receiving two points) of wellness policies for each section, and the overall policy are shown in 2- 2. The total comprehensiveness score indicates that local wellness policies on average addressed 40% of the all items, and the total strength score indicates only 18% of items had specific and required strategies. Wellness policies scored highest in the nutrition education section (mean comprehensiveness: 62%; mean strength: 31%), and lowest in the nutrition standards for competitive food section (mean comprehensiveness: 33%; mean strength: 5%).

Local wellness policies were categorized based on the policy template type used to create the policy. Of the 48 policies examined, most districts used either the MASB (n

= 21) or the Policy Company (n = 21) policy template, two schools used the NANA policy template, and four others had policies that did not clearly resemble any model policy template. The MASB policies were further categorized based on how districts modified the template policy. Of the 21 districts using the MASB template, 2 enhanced the policy by adding additional requirements, 11 adopted the template with minimal changes, and 8 adopted a shortened version that either included only the introductory pages of the template, or removed other sections of the policy.

The wellness policy quality scores by section and for the overall policy are shown in full by policy type in Appendix B. In general, the NANA-based policies had higher than average scores in most sections, and the policies that did not use a recognizable template were shorter and scored lower than average in most sections (Appendix B).

For further analysis, the policies were grouped together into three categories: MASB, Policy Company, and NANA + Other. Analysis of variance was used to compare mean strength and comprehensiveness scores by policy template type. MASB-based policies scored significantly higher than Policy Company-based policies in nutrition education comprehensiveness, competitive food standards comprehensiveness, physical education comprehensiveness and strength, communication and promotion comprehensiveness and strength (Table 2-2). The MASB-based policies mean strength scores for competitive food standards were higher than Policy Company-based policies, which all received zero points in this section. MASB-based policies also scored significantly higher in the total comprehensiveness and total strength scores. NANA + Other policies scored significantly lower than MASB-based policies in physical

education comprehensiveness scores, but there were no differences in any other sections or for the total assessment.

There was a high level of variation in wellness policy quality within districts using the same policy template type, based on how districts modified the template. Table 2-3 shows that both the enhanced MASB policies and as-intended MASB policies scored significantly higher in total comprehensiveness and total strength when compared to the shortened MASB policies.

Less than half of the local wellness policies (46%) met all of the federal requirements (Table 2-4). Most wellness policies met the minimum requirements for nutrition education (96%), school meal standards (93%), and physical activity goals (67%), with the majority of policies having strong and required statements, receiving the maximum of two points. While most district wellness policies addressed competitive food standards (77%) and policy evaluation (81%), the large majority of policies received only 1 point for having statements that were vague or suggestive.

Associations between school characteristics and policy template were determined by comparison of proportions (Appendix C). Having a high percent of students eligible for free or reduced-price school meals, completing the HSAT assessment, and having a CSHT were not found to be associated with schools selecting any particular policy template type. Schools implementing extra nutrition or physical activity programs were significantly more likely to use the Policy Company policy template. Small, rural, and public schools, those with a high percentage of minority students, and those using the food service management company were significantly less likely to use other wellness policy templates. Analysis of variance and multivariate regression analysis were used to

examine the associations between school characteristics and wellness policy quality (total comprehensiveness and strength). No school characteristics were found to be significantly associated with wellness policy quality independently or after controlling for policy template type (Appendix D).

Fisher's exact test (one-sided) was used to explore the degree of concordance between written local wellness policies and: administrator-reported school nutrition policies (Table 2-5); administrator-reported school nutrition practices (Table 2-6); and FSD-reported school food service practices (Table 2-7). A concordant pair is when a practice has been reported in the SEPS survey, and that item is included in the written wellness policy; a discordant pair indicates that the SEPS-reported practice is not included in the wellness policy, or vice-versa). The overall concordance is the percentage of responses that were similarly classified in written wellness policies and the SEPS survey (Yes/Yes or No/No pairs). The only practice that showed significant concordance was having a policy regarding healthy foods in fundraising activities (71% similarly classified, $p = 0.01$) (Table 2-5). The percent of concordant policies and practices ranged from 9-71%.

Table 2-2: Mean wellness policy comprehensiveness and strength scores by section and template type used among SNAK school districts

Wellness Policy Section	All policies (n = 48)	MASB Policies (n = 21)	Policy Company Policies (n = 21)	NANA + Other policies (n = 6)
	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)
Nutrition Education - Comprehensiveness [a, b]	62.04 (55.39, 68.69)	73.55 (66.07, 81.02)	58.73 (52.53, 64.93)	33.33 (2.79, 63.87)
Nutrition Education - Strength	31.48 (27.88, 35.09)	33.86 (30.60, 37.13)	32.28 (28.22, 36.33)	20.37 (-1.54, 42.28)
School Meals – Comprehensiveness	35.09 (28.88, 41.31)	34.07 (24.60, 43.53)	32.60 (27.27, 37.93)	47.44 (14.15, 80.73)
School Meals – Strength	21.15 (16.38, 25.93)	18.32 (11.52, 25.11)	20.51 (16.20, 24.83)	33.33 (7.54, 59.12)
Competitive Foods - Comprehensiveness [a]	33.19 (25.71, 40.46)	48.93 (39.32, 58.55)	15.44 (8.71, 22.16)	40.23 (14.86, 65.60)
Competitive Foods - Strength [a]	5.46 (1.78, 9.14)	6.08 (2.90, 9.25)	0 (n/a)	22.41 (-1.26, 46.09)
Physical Education - Comprehensiveness [a, b]	35.42 (29.78, 41.05)	46.78 (37.60, 55.96)	28.57 (24.72, 32.43)	19.61 (2.41, 36.80)
Physical Education - Strength [a]	24.14 (20.29, 27.99)	30.81 (24.87, 36.75)	19.61 (16.21, 23.01)	16.67 (1.57, 31.76)
Physical Activity – Comprehensiveness	45.21 (37.44, 52.97)	53.33 (42.11, 64.55)	40.00 (30.48, 49.52)	35.00 (1.04, 68.96)
Physical Activity - Strength	29.38 (23.52, 35.22)	37.14 (29.40, 44.89)	23.33 (15.69, 30.98)	23.33 (-1.40, 48.06)
Communication - Comprehensiveness [a]	42.36 (35.36, 49.36)	54.37 (43.41, 65.32)	34.13 (27.49, 40.76)	29.17 (3.65, 54.68)
Communication - Strength [a]	25.87 (18.95, 32.79)	40.08 (30.09, 50.07)	12.70 (7.20, 18.20)	22.22 (-4.34, 48.79)
Evaluation - Comprehensiveness	54.86 (47.46, 62.26)	61.90 (50.07, 73.73)	53.97 (47.46, 60.47)	33.33 (0.94, 65.73)
Evaluation – Strength	12.50 (7.46, 17.54)	11.90 (7.80, 16.01)	8.73 (4.99, 12.47)	27.78 (-7.56, 63.12)
Total Comprehensiveness [a]	40.30 (34.47, 46.13)	50.79 (41.82, 59.76)	31.45 (27.11, 35.79)	34.55 (9.93, 59.16)
Total Strength [a]	18.82 (15.23, 22.41)	22.57 (18.30, 26.84)	13.84 (11.53, 16.14)	23.09 (0.41, 45.77)

a = MASB significantly > Policy Company

b = MASB significantly > NANA + Other

Table 2-3: Differences in wellness policy mean comprehensiveness and strength scores based on how districts modified the MASB policy template among SNAK school districts

Wellness Policy Section	MASB - Enhanced (n = 2)	MASB - As intended (n = 11)	MASB - Shortened (n = 8)
	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)
Total Comprehensiveness [a, b]	64.58 (41.53, 87.63)	65.63 (62.62, 68.63)	26.95 (20.97, 32.94)
Total Strength [a, b]	36.46 (21.79, 51.13)	27.65 (25.73, 29.58)	12.11 (8.94, 15.28)

a = MASB - Enhanced > MASB - Shortened, $p<0.05$
b = MASB - As intended > MASB - Shortened, $p<0.05$

Table 2-4: Percentage of school districts meeting federal wellness policy requirements among SNAK school districts

Requirement	0 points # (%)	1 point # (%)	2 points # (%)
Goals for nutrition education	2 (4.17)	1 (2.08)	45 (93.75)
Minimum USDA school meal standards	4 (8.33)	1 (2.08)	43 (89.58)
Standards for competitive foods	11 (22.92)	33 (68.75)	4 (8.33)
Goals for physical activity	16 (33.33)	3 (6.25)	29 (60.42)
Involvement of key stakeholders	13 (27.08)	7 (14.58)	28 (58.33)
Plan for policy evaluation	9 (18.75)	37 (77.08)	2 (4.17)
All Requirements	26 (54.17)	22 (45.83)	

Note: Physical education is not included, as it is not a federal requirement.

Table 2-5: Concordance between written wellness policies and administrator-reported school nutrition policies

		SEPS-reported practice				
Policy	Included in written wellness policy	No	Yes	n	% similarly classified	Fisher's p-value (one-sided)
Prohibits use of food as a reward	No	8	14	37	49%	0.57
	Yes	5	10			
Healthy food in vending machines	No	2	4	21	67%	0.45
	Yes	3	12			
Healthy food in a la carte	No	4	4	33	67%	0.23
	Yes	7	18			
Healthy food in fundraising	No	18	3	38	71%	0.01
	Yes	8	9			
Healthy food in class parties	No	11	4	40	50%	0.40
	Yes	16	9			

Table 2-6: Concordance between written wellness policies and administrator-reported school nutrition practices

		SEPS-reported practice				
School nutrition practice	Included in written wellness policy	No	Yes	n	% similarly classified	Fisher's p-value (one-sided)
Coordinates nutrition education throughout school	No	0	8	41	66%	0.25
	Yes	6	27			
Teachers role-model healthy eating	No	6	3	41	44%	0.57
	Yes	20	12			
Integrate nutrition education into broader curriculum	No	8	7	41	51%	0.55
	Yes	13	13			
Presence of a Coordinated School Health Team	No	7	12	41	56%	0.37
	Yes	6	16			

Table 2-7: Concordance between written wellness policies and FSD-reported food service practices

		SEPS-reported practice				
Food service practice	Included in written wellness policy	No	Yes	n	% similarly classified	Fisher's p-value (one-sided)
Breakfast available	No	0	34	46	26%	n/a
	Yes	0	12			
Serving low-fat options in school meals	No	2	41	45	9%	0.91
	Yes	0	2			
Strategies to encourage participation in school meals	No	3	40	46	13%	0.81
	Yes	0	3			
Adequate time to eat lunch	No	8	14	46	46%	0.36
	Yes	11	13			
Training provided for food service staff	No	7	12	46	46%	0.32
	Yes	13	14			
FSD has a nutrition-related degree	No	20	14	46	50%	0.26
	Yes	9	3			

DISCUSSION

In this study, differences in wellness policy quality were primarily attributed to the policy template used to create a policy in this sample of low-income Michigan middle schools participating in the SNAK project. The MASB template generally scored higher; however, when districts shortened the template their policies scored lower. Results from previous studies indicate that the majority of school districts adopted the state-recommended wellness policy template (Probart, McDonnell et al. 2008; Belansky, Cutforth et al. 2009). In this sample of low-income Michigan middle schools participating in the SNAK project, approximately half of the districts adopted the state-recommended MASB policy template, while the other half utilized the wellness policy template provided to them through the Policy Company. It is reasonable to assume that school districts that contracted with Policy Company for the rest of their school board policies also adopt Policy Company's wellness policy template. The only school-level characteristic associated with choice of wellness policy template was schools that participated in any extra nutrition or physical activity programming were more likely to use the Policy Company template. One possible explanation for this association is that extra health programming may be an indicator of higher financial resources, suggesting these schools have a greater ability to pay for a company to manage their school policies.

Results from the current study did not find differences in wellness policy quality based on school-level characteristics. On average, policies had a comprehensiveness score of 40%, but a strength score of only 19%, indicating few items had clearly defined and required mandates within their policies. Low wellness policy strength scores were due to the characteristic weak and suggestive wording found in most templates that

included statements such as "shall offer and promote healthy foods in all venues," or "all foods available on school grounds shall strive to comply with the current USDA Dietary Guidelines for Americans." This weak language is consistent with that seen in previous research evaluating the quality of wellness policies (Probart, McDonnell et al. 2008; Story, Nanney et al. 2009). Non-specific language can be problematic as it makes implementation of wellness policy provisions difficult.

When comparing written wellness policies with administrator and FSD-reported practices, many inconsistency were found. The percentage of similarly classified responses (Yes/Yes, No/No) between written policies and reported practices ranged from 9-71%. Another recent study had similar findings where the concordance between fundraising policies and practices ranged from 15-68% (Kubik, Lytle et al. 2009). Several plausible explanations exist for these discrepancies. First, it is important to recognize that wellness policies are written at the district level, and may not reflect practices at the school building level. As seen when examining the quality of wellness policies, language was often non-specific. Districts may intentionally keep written policies vague so that each building can tailor the policy to their specific needs. Districts may also intentionally use vague language in wellness policies so they can't be held accountable if not meeting policy requirements.

When an administrator or FSD reports a practice but that practice is not included within the written wellness policy, it is possible that this information is contained in other policies or documents, such as staff and student handbooks. Studies examining written policies in the future should consider all health-related policies in addition to the local wellness policy. Other potential explanations exist for those cases when an item is

included in the written wellness policy, but the administrator or FSD does not report that practice as occurring at their school. The most obvious reason for this might be that wellness policies are simply not being translated into school practices. It could also be that school districts are adopting wellness policies that include goals they hope to achieve in the future, but they have not implemented them at this point in time. It is also possible that administrators and food service directors are unaware of some of the practices that were asked in the SEPS survey, and that these practices are in fact happening at their schools but were not reported. The lack of agreement between wellness policies and food service practices may be an indication that FSDs are not included in making decisions regarding wellness policy language.

Another reason that may explain the discrepancy between written wellness policies and school practices could be because districts are utilizing a wellness policy template without modifying it to match school practices. During scoring of the SNAK schools' wellness policies, it was observed that some schools failed to insert their district name into the policy template where indicated. Furthermore, one policy template consisted of a list of statements districts could select for their policy, and some districts simply checked every single box in the template policy, even though many of the statements were nearly identical and overlapped. Guidance was clearly necessary to aid school districts in creating their wellness policies; however, these observations indicated that the widespread availability of policy templates allowed districts to adopt a policy template without modifying it to reflect their practices, missing the spirit of collaboration and personalization that was intended (Story, Nanney et al. 2009).

The "What's Working" project assessed the impact of the wellness policy mandate in low-income rural Colorado schools. Results indicated no improvements in opportunities for physical activity, and few improvements in the school nutrition environment one year after the wellness policy mandate took effect (Belansky, Cutforth et al. 2009; Belansky, Cutforth et al. 2009). In a 2007 survey of Michigan school districts regarding wellness policy implementation, 86% reported that no changes had occurred or that it was too early to determine any changes (Michigan Department of Education October 2007). Only 23% of these districts indicated that there were no barriers to implementing their policy, with other schools citing barriers such as no funding or staff time, no one in charge of implementation, and no system to track implementation (Michigan Department of Education October 2007). Conversely, a national survey showed significant improvements in implementation of nutrition components following the wellness policy mandate (Longley and Sneed 2009). Food service directors in this survey also reported barriers to wellness policy implementation including the need to use sales of food as fundraisers, and a lack of time by administrators and teachers due to the No Child Left Behind Act (Longley and Sneed 2009).

Differences between results in these studies could be due to differences in measurement of wellness policy implementation. With few wellness policies including a timeline for implementation or details regarding evaluation, it is not surprising that few changes have been made (Action for Healthy Kids 2007; Moag-Stahlberg, Howley et al. 2008). In the future, as schools implement their wellness policies and make improvements, it is possible that the degree of concordance between written policies and

school practices will increase. Until then, researchers should avoid the assumptions that written policies are equivalent to school practices.

This is the second known study to evaluate the concordance between wellness policies and school practices (Kubik, Lytle et al. 2009). Use of multiple sources of school environment and practice data adds strength to the study. Use of the Wellness Policy Evaluation Tool in the current study provided an objective and quantifiable measure of wellness policy quality. One concern with this tool is the unequal number of items in each section (ranging from 6-29), meaning some sections had greater influence on the total assessment scores. This study included a non-random sample of low-income middle schools recruited through a small grant application, which may have resulted in self-selection bias. While it is important to study low-income school districts because they serve some of the most vulnerable children, it also limits the ability to generalize results.

The federal wellness policy mandate was a momentous step in validating the importance of health and wellbeing of students in the school setting, rather than focusing solely on academic achievement. Requiring school districts to form a diverse team of stakeholders supports use of the Center for Disease Control and Prevention's (CDC) Coordinated School Health Model. Unfortunately, the mandate lacks oversight and funding for implementation, thus limiting the impact on creating healthy school environments (Action for Healthy Kids Fall 2008). Results from a program in the state of Connecticut where schools receive additional funding for adhering to competitive food standards indicates that providing a financial incentive for school districts who achieve

policy implementation might be necessary to see significant improvements in school nutrition practices (Friedman 2009).

Evidence from this study and others suggests that school districts are receptive to state recommendations regarding wellness policies, therefore state government suggestions may be an important means of improving quality and adherence to wellness policies. State governments should emphasize use of a team approach, modification of template wellness policies to reflect current practices, and encourage schools to include specific, achievable goals for the future as well as detailed steps for policy implementation and evaluation. Future research should concentrate on removing barriers to policy development and implementation, and identifying strategies to assist schools in creating meaningful wellness policies that are translated into healthier school practices.

CHAPTER 3:

ASSOCIATION BETWEEN AVAILABILITY OF COMPETITIVE FOODS AND STUDENT DIETARY INTAKE IN LOW-INCOME MICHIGAN MIDDLE SCHOOLS

BACKGROUND

Healthy eating during childhood and adolescence is critical to ensuring proper growth and development; cognitive, emotional, and behavioral functioning; academic and physical performance; as well as to prevent many chronic diseases including cardiovascular disease, diabetes, obesity, and osteoporosis (Berenson, Srinivasan et al. 1998; Murphy, Pagano et al. 1998; Weaver 2000; Taras 2005; Prentice, Schoenmakers et al. 2006; Stevenson 2006; Fanjiang and Kleinman 2007). Health and dietary trends in children and adolescents indicate this group is not receiving optimal nutrition, and that low-income and minority groups may be at increased risk. The prevalence of overweight in U.S. adolescents has more than tripled over the last several decades from 5.0% to 17.4%, (Ogden, Flegal et al. 2002; Ogden, Carroll et al. 2006). Minority children consistently have a higher prevalence of obesity than Caucasian children (Sorof, Lai et al. 2004; Jago, Harrell et al. 2006; Ogden, Carroll et al. 2006). U.S. youth typically eat foods that have a high energy-density but low nutrient-density (Subar, Krebs-Smith et al. 1998; Kant 2003). Poor dietary habits are typically more prevalent in low-income populations (Neumark-Sztainer, Story et al. 1996; Fox and Cole 2004).

Schools have been identified as an important setting for nutrition promotion and interventions to reduce the prevalence of childhood obesity, promote overall health and well-being, and prevent chronic diseases (Michigan Department of Education, Michigan Department of Community Health et al. 2001; American Dietetic Association 2006;

Story, Kaphingst et al. 2006). Foods and beverages consumed at school are an important contributor to the total dietary intake of adolescents. School-provided lunch (which approximately two-thirds of students consume each day) provides nearly a third of students' total daily energy intake, and generally provides a greater proportion of total vitamin and mineral intake in students that consume school lunch, compared with those that do not eat school-provided meals (U.S. Department of Agriculture, Food and Nutrition Service et al.; Gleason and Dodd 2009). National studies estimate that competitive foods and beverages (e.g., vending machines, a la carte, fundraisers) are available in three quarters of elementary schools and nearly all middle schools (U.S. Government Accountability Office 2005; U.S. Department of Agriculture, Food and Nutrition Service et al.; Fox, Gordon et al. 2009). Competitive foods and beverages available in schools are often low in nutrient density, and high in energy, fat, sodium, and added sugars (Harnack, Snyder et al. 2000; Wildey, Pampalone et al. 2000; U.S. Department of Agriculture 2001; French, Story et al. 2003; Wiecha, Finkelstein et al. 2006; O'Toole, Anderson et al. 2007; Fox, Gordon et al. 2009), and have consistently been associated with poor dietary intake (Cullen, Eagan et al. 2000; Kubik, Lytle et al. 2003; Cullen and Zakeri 2004; Templeton, Marlette et al. 2005; Wiecha, Finkelstein et al. 2006).

Evidence suggests that the school nutrition environment influences student dietary intake and health outcomes. For example, results from the third School Nutrition Dietary Assessment study in 2005 in a nationally-representative sample of U.S. schools indicate that school meal participants consumed fewer energy-dense foods at school, fewer calories from sugar-sweetened beverages, but had higher intakes of low-nutrient energy

dense foods (e.g. french fries, baked goods) when compared to non-participants (Briefel, Wilson et al. 2009). Offering fresh fruit and raw vegetables daily and not offering french fries in school meals were associated with increased intake of vegetables, and not offering desserts in school meals was associated with increased intake of fruit (Briefel, Crepinsek et al. 2009). In elementary schools, offering french fries or desserts more than once per week in school lunches was associated with a higher likelihood of obesity (Fox, Dodd et al. 2009).

School nutrition environment interventions have had mixed effects on dietary intake. For example, in one study, removing certain snack foods from a la carte in the cafeteria and removing vending machines from the cafeteria resulted in decreased consumption of sweetened beverages and increased consumption of milk, calcium, and vitamin A; however, there were also negative consequences including increased intake of saturated fat and sodium, decreased intake of vegetables, increased ice cream sales, an increase in the total number of vending machines elsewhere in the schools, and increased sales from the vending machines (Cullen, Watson et al. 2006).

Given the mixed results of school nutrition intervention studies and the varying associations between the school nutrition environment, practices, and student dietary intake, further research should continue to explore the school nutrition environment to determine which school intervention efforts are most likely to be effective at improving students' diets. The current study examines the associations between availability of competitive foods with student dietary intake in a sample of low-income Michigan middle schools. The goal of this study was to determine if availability of competitive

foods were associated with dietary intake of energy, fat, saturated fat, fruits, vegetables, and fiber.

METHODS

School Nutrition Advances Kids (SNAK) project

The SNAK project, funded by the Robert Wood Johnson Foundation Healthy Eating Research program, Supplemental Nutrition Assistance Program Education (SNAP-ed), and the Michigan Department of Community Health, is a collaboration between researchers at Michigan State University (MSU), the Michigan Departments of Education and Community Health, and several partnering organizations of the Michigan Action for Healthy Kids coalition. The SNAK project aims to improve school nutrition environments through coordinated school health teams (CSHT), Michigan's Healthy School Action Tools (HSAT), and implementation of the Michigan State Board of Education nutrition policy for schools. The current study utilized baseline data collected as part of the SNAK project to examine the cross-sectional associations between the school nutrition environment and student dietary intake. The MSU Institutional Review Board approved all study procedures and instruments, and student assent and parent consent was obtained.

Study Sample

Schools were recruited to participate in the SNAK project through an application for small grant funding with award values ranging from $2,000-$4,600 (depending on the

level of intervention). Eligibility criteria included having 50% or more of students eligible for free or reduced price meals, and having 7th and 8th grades within the same building (for follow-up purposes). Recruitment methods included direct mailings, e-mails, and phone calls to eligible schools and a posting on the Michigan Team Nutrition website.

Baseline data was collected from 65 schools in 50 school districts. The SNAK project is a two-year intervention study with an overlapping design including two cohort study groups. The first cohort included 32 schools in 30 districts participating from October 2007 – June 2008, and the second cohort included 33 schools in 20 districts participating from September 2008 – June 2010.

INSTRUMENTS AND PROCEDURES

Student dietary intake

The Block Kids Food Frequency Questionnaire (FFQ) 2004 (ages 8-17) was used to assess usual student dietary intake. The Block FFQ is a self-administered 77-item semi-quantitative FFQ developed from NHANES 1999-2002 24-hr dietary recall data. The survey takes approximately 25 minutes to complete. The Block FFQ has been validated against total energy, protein, fat, saturated fat, fiber, calcium, fruit and fruit juice servings in adolescent populations (Smith and Fila 2006; Cullen, Watson et al. 2008). Students in the first cohort of SNAK schools completed the survey between November 2007 and March 2008, and those in the second cohort of SNAK schools completed the FFQ between November 2008 and February 2009. For the first cohort of

SNAK schools, there were two recruitment periods. In the first round of recruitment in November/December 2007, information packets were mailed directly to each student's home by the school. The packet included general information about the SNAK project and the FFQ, parental consent and student assent forms, a raffle prize selection form, a postage paid envelope to return consent forms, and a website link and an online code to access the FFQ.

To enhance the response rate, a second round of recruitment occurred from January-March 2008. Based on feedback from schools during the first round of recruitment, changes in recruitment strategy were necessary, and multiple strategies were used to accommodate the unique situation of each school. In the second round, SNAK researchers visited most schools and held an educational assembly/rally to explain the SNAK project, the FFQ, prizes, and to get students excited about the project. In several schools, SNAK personnel recruited students in individual classrooms (e.g. homerooms, physical education, or health classes). In other schools, school personnel were trained in IRB procedures and were directly involved in recruitment efforts. Regardless of recruitment strategy, students were given a packet containing information about the SNAK project and the FFQ, parent consent and student assent forms, a pencil, and a paper version of the survey to be returned directly to the school. All students who returned a completed survey and consent forms to their school received a SNAK project highlighter as an incentive. Schools were instructed to mail all surveys and consent forms back to MSU for processing and analysis. Students in both recruitment periods that returned the student assent, parent consent forms and completed the FFQ were

entered into a raffle drawing to win prizes including i-Pods, bicycles, gift certificates for sporting goods stores, and sports equipment.

A total of 1810 students responded with a completed consent form and survey. To remove unreliable FFQs from analysis, several criteria were used. First, surveys with "playful" patterns upon visual inspection (n = 11) and those with physiologically implausible values for energy intake (<500 kcal/day, n = 28, or >5,000 kcal/day, n = 94) were removed from analysis. Next, surveys with the most extreme values for several error-checking variables (e.g., the number of solid foods consumed per day, the percentage of foods eaten every day or never in the previous week, the percentage of foods with the same portion size) were again visually examined for "playful" patterns; however, no clearly unreliable patterns were discovered, and none of these surveys were removed.

Schools with fewer than 10 complete surveys were removed from analysis due to a lack of statistical power (11 schools, n = 62 students). Schools with no baseline data other than student surveys were also removed from analysis (2 schools, n= 21 students). In preliminary analyses, race was found to be significantly associated with many dietary intake outcome variables, thus surveys with missing race were removed (n = 50). The final sample for this dissertation consisted of 51 schools with 1544 students (the number of schools and students varies for each individual analysis due to missing school-level data). The mean response rate of surveys analyzed for all SNAK schools was 24% (range: 0% to 66%).

School nutrition environment

Data collection forms were created to gather information about the foods and beverages available in school meals, a la carte, and vending machines and provided to the Food Service Director (FSD) twice a year as a packet. Baseline data collection occurred for a one-week time period during November/December 2007 for the first cohort and during November/December 2008 for the second cohort. During the data collection period, the FSD (or other food service personnel) at each school reported all foods and beverages available to students in meals (breakfast and lunch) and a la carte every day. FSDs were asked to write down all items available in vending machines on one day during the data collection period, as the items available in vending machines were not expected to change as frequently. As an incentive for data collection, school food service programs received $325 for each packet returned.

Information gathered in these forms was used to identify availability of competitive foods in these schools. Availability of competitive foods was examined in several ways. First, schools were divided into 4 categories based on availability of both vending and a la carte. The four groups included no competitive foods available, only a la carte available, only vending available, and both a la carte and vending available. Next, each competitive food venue was characterized individually. A la carte available (yes/no) and vending available (yes/no) variables were created. Lastly, vending machines were further categorized into by the type of items available. Groups included no vending machines; healthy beverage only vending machines that contained only water, 100% fruit juice, and very low calorie sports drinks; mixed beverage only vending machines which contained a mix of healthy and less healthy beverages but no food items;

and mixed vending machines which contained a combination of healthy and less healthy beverages and food items.

The availability of fruits and vegetables in school lunches was calculated from the food service data collection forms reporting all foods available in school lunch for a one week time period. The mean number of fresh fruits, vegetables, and entree salads available per day were calculated. Availability of a salad bar (yes/no) and a fruit bar (yes/no) was assessed for each school.

School characteristics

Information regarding school characteristics was gathered using several methods. The percent of students eligible for free or reduced price school meals at each school was obtained through the Michigan Department of Education. School setting (urban, rural, or suburban) was determined using 2000 U.S. Census data for each community. Presence of a coordinated school health team (CSHT) prior to joining the SNAK project, and public vs. charter were determined through interactions with each school. The Healthy School Action Tools (HSAT) website and information from the Michigan Department of Community Health were used to determine whether schools had completed the HSAT assessment prior to enrollment in the SNAK project. Eleven schools were from the same district, and a "district" variable was created to represent this grouping. Type of food service program was determined through interactions with each school and was characterized as traditional (with a full service kitchen, or a satellite kitchen in the district where foods were prepared on site) or other (a heat and serve kitchen without full cooking capacity or a vendor-based operation where fully cooked foods were delivered to

the school). Similarly, 12 schools used the same food service management company, and were grouped into a "management company" variable.

ANALYSIS

Stata statistical software (Stata Corporation, Release 10.0, College Station, Tex, 2008) was used for descriptive analysis of school-level variables. Due to the hierarchical nature of the data (students within schools), hierarchical linear modeling was used to examine the associations between school-level variables and student dietary intake. Linear regression analyses using restricted maximum likelihood ratio were performed using HLM version 6.08 software (Scientific Software International 2009). The dietary intake variables of interest included energy intake, percentage of energy intake from total fat, percentage of energy intake from saturated fat, servings of fruits, servings of vegetables, servings of fruits + vegetables, and fiber intake. Variables other than energy intake were energy-adjusted (intake/1,000 kcal/day) to account for potential under- and over-reporting (Willett 1998). In order to reduce skewness and enhance normality of distribution, variables other than total and saturated fat were log-transformed, and results are reported based on geometric means rather than absolute means.

For descriptive analysis of dietary intake variables by race, models were constructed using individual nutrients as the outcome variable, and entering race categories (white as reference group, African American, Hispanic/Latino, and other) into the model for females and males separately. Next, individual models were created for each racial category to examine gender differences in dietary intake. To determine the association between school nutrition environmental features and student dietary intake of

individual nutrients, several models were used. In all models, student characteristics (gender and race) and school characteristics (presence of CSHT, completion of HSAT, setting, district, food service management company, % students eligible for free/reduced-price meals, other foodservice, and public vs. charter) were included in the regression model as covariates. Total energy intake was included as a student-level covariate in all models (except for those with energy intake as the outcome variable) to adjust for potential under- and over-reporting of dietary intake. Student race and gender were allowed to have random error terms when the variance was found to be significant in the full model (all student and school-level covariates) for each dietary intake variable. The following random effects were discovered: Hispanic/Latino had random effects for % energy from fat and vegetable intake; sex had random effects for fruit intake, and African American had random effects for fruit + vegetable intake.

Additional school-level covariates were included for specific nutrient outcome variables. With fruit intake as the outcome variable, the mean number of fruits available per day in school lunch and availability of a fruit bar were included as covariates. With vegetable intake as the outcome variable, the mean number of vegetables available per day in school lunch, mean number of entree salads available in lunch, and availability of a salad bar were included as covariates. With fruit + vegetables and fiber intake as outcome variables, availability of a salad bar and mean number of fruits, vegetables, and entree salads available per day were included as covariates.

RESULTS

Schools enrolled in the SNAK project had an average of 134 7th grade students (range: 23-431) and an average building enrollment of 490 students (range: 131-1217). Two-thirds of schools were located in urban settings, 20% were rural, and 14% were suburban according to 2000 U.S. census data. The majority of schools were public (85%), and 57% of schools had >50% minority population. Twenty-two percent of SNAK schools used the same food service management company. Schools had an average of 71% of students eligible for free or reduced-price school meals (range: 50-100%).

Mean dietary intake was examined by gender and race (Table 3-1). All racial groups (except males in the other racial group) had a significantly higher intake of calories and lower percentage of energy intake from saturated fat compared with white students in both males and females. Hispanic/Latino males had a lower percentage of energy intake from total fat compared with white males, and Hispanic/Latino females had a lower percentage of energy intake from total fat than all other racial groups. Among males, all other racial groups had a higher intake of fruits compared with white males; Hispanic/Latino students had a lower vegetable intake than white males; the African American and other racial groups had a higher intake of fruits + vegetables combined than white males; and the Hispanic/Latino and other males had a higher fiber intake than white males. Among females, the other racial group had a lower fruit intake than white females; the Hispanic/Latino females had a lower vegetable intake and fruit + vegetable intake compared with white females; and the Hispanic/Latino females had a higher fiber intake compared with white and other females. Hispanic/Latino females also had a lower

vegetable intake than African American females, while Hispanic/Latino males had a lower vegetable intake than males in the other racial group. When comparing gender differences in dietary intake, white females had significantly lower energy intake and percentage of energy intake from saturated fat, and a higher fruit, vegetable, fruit + vegetables, and fiber intake compared with white males. African American females had a significantly higher vegetable intake than African American males.

Table 3-2 shows the associations between availability of competitive foods and student dietary intake. In the first analysis, availability of both vending and a la carte in a school was associated with a higher percentage of energy intake from saturated fat (0.43% of energy intake; $p = 0.032$), while availability of only a la carte or only vending were significantly associated with an increase in fruit intake (0.08 servings/1,000kcal/day; $p = 0.042$ and 0.15 servings/1,000kcal/day; $p = 0.011$, respectively) when compared with schools that have no competitive foods available. When examined individually, availability of vending and availability of a la carte were not significantly associated with student dietary intake.

When examining the types of vending machines available in schools, many interesting associations were seen. Availability of vending machines that contained only healthy beverages (e.g., water, very low-calorie sports drinks) was associated with a significant decrease in energy intake ($p = 0.009$), and availability of vending machines with mixed beverages but no foods showed a trend for decreased energy intake ($p = 0.063$) compared with schools that did not have vending machines. Furthermore, having vending machines with mixed foods and beverages was associated with a significantly

higher energy intake than schools with only healthy beverages in their vending machines ($p<0.05$).

Availability of mixed beverage and mixed food and beverage vending machines was associated with higher percentage of energy intake from fat ($p = 0.032$ and $p = 0.040$, respectively), and mixed beverage vending was associated with higher percentage of energy intake from saturated fat ($p = 0.032$) compared with schools with no vending. Lastly, availability of healthy beverage only vending machines was associated with lower vegetable, and fruit + vegetable intake ($p = 0.019$ and $p = 0.049$, respectively).

Table 3-1: Differences in student dietary intake by race and gender

		Energy Intake (kcal)			Fat Intake (% of energy from fat)			Saturated Fat Intake (% of energy from saturated fat)		
	n	Mean	SE	P-value	Mean	SE	P-value	Mean	SE	P-value
Female										
White (ref)	397	1463^			31.94			11.31^		
African American	243	1861	73	0.000	32.28#	0.44	0.439	10.70	0.20	0.003
Hispanic/ Latino	148	1839	70	0.000	29.55#	0.66	0.001	10.14	0.25	0.000
Other	128	1818	63	0.000	31.95#	0.38	0.984	10.72	0.15	0.000
Male										
White (ref)	308	1669			32.57			11.65		
African American	153	2013	103	0.001	31.75	0.52	0.115	10.71	0.18	0.000
Hispanic/ Latino	84	1852	81	0.020	29.80	0.78	0.001	10.06	0.19	0.000
Other	83	1765	130	0.465	31.76	0.56	0.151	10.88	0.27	0.005

Table 3-1: (cont'd.)

		Fruit Intake (svgs/1,000kcal/day)			Vegetable Intake (svgs/1,000kcal/day)			Fruit + Vegetable intake (svgs/1,000kcal/day)			Fiber Intake (g/1,000kcal/day)		
	n	Mean	SE	P-value	Mean	SE	P-value	Mean	SE	P-value	Mean	SE	P-value
Female													
White (ref)	397	0.80*			0.74*			1.73*			7.83*		
African American	243	0.79	0.04	0.737	0.79*#	0.07	0.436	1.78	0.10	0.585	8.08	0.23	0.273
Hispanic/ Latino	148	0.77	0.05	0.494	0.50#	0.06	0.002	1.42	0.09	0.003	8.60#	0.24	0.001
Other	128	0.69	0.04	0.014	0.72	0.06	0.820	1.58	0.09	0.107	7.66#	0.23	0.483
Male													
White (ref)	308	0.59			0.64			1.41			7.45		
African American	153	0.83	0.05	0.000	0.57	0.06	0.262	1.62	0.09	0.015	7.85	0.26	0.128
Hispanic/ Latino	84	0.79	0.07	0.003	0.46	0.04	0.000	1.40	0.10	0.925	8.99	0.32	0.000
Other	83	0.83	0.07	0.000	0.69	0.06	0.469	1.69	0.11	0.011	8.29	0.28	0.003

* = females significantly higher than males within racial group, $p<0.05$
^ = females significantly lower than males within racial group, $p<0.05$
# = significant difference between groups, $p<0.05$

Table 3-2: Availability and type of competitive foods available and association with student dietary intake [a]

	Schools	Students	Energy Intake (kcal)			Fat Intake (% of energy)			Saturated Fat Intake (% of energy)		
	n	n	Mean [e]	SE	P-value	Mean	SE	P-value	Mean	SE	P-value
Competitive foods available											
None (ref)	9	149	1652	0		31.72			11.05		
Only a la carte	16	554	1558	60	0.146	31.98	0.53	0.614	11.34	0.19	0.13
Only vending	4	120	1598	115	0.660	32.39	0.69	0.332	11.36	0.29	0.274
Both vending and a la carte	22	721	1527	61	0.060	32.56	0.51	0.106	11.48	0.20	0.032
A la carte available											
No (ref)	13	269	1636	0		31.97			11.13		
Yes	38	1275	1554	63	0.221	32.23	0.34	0.446	11.33	0.15	0.204
Vending available											
No (ref)	25	703	1637	0		31.76			11.10		
Yes	26	841	1602	42	0.419	32.35	0.28	0.044	11.26	0.12	0.183
Type of vending											
No vending (ref)	25	703	1620	0		31.68			11.09		
Only healthy beverages	4	147	1464 [f]	53	0.009	31.91	0.47	0.636	11.15	0.13	0.621
Mixed beverages	13	376	1527	47	0.063	32.44	0.34	0.032	11.36	0.12	0.032
Mixed food and beverages	9	318	1686 [f]	51	0.208	32.37	0.32	0.040	11.20	0.16	0.459

Table 3-2: (contd.) [a]

	Schools	Students	Fruit Intake (svgs/1,000kcal/day) [b]			Vegetable Intake (svgs/1,000kcal/day) [c]			Fruit + Vegetable Intake (svgs/1,000kcal/day) [d]			Fiber Intake (g/1,000kcal/day) [d]		
	n	N	Mean [e]	SE	P-value	Mean [e]	SE	P-value	Mean [e]	SE	P-value	Mean [e]	SE	P-value
Competitive foods available														
None (ref)	9	149	0.58			0.69			1.40			7.19		
Only a la carte	13	416	0.66	0.04	0.042	0.69	0.12	0.993	1.50	0.15	0.507	7.11	0.34	0.831
Only vending	4	120	0.73	0.06	0.011	0.78	0.14	0.561	1.66	0.16	0.111	7.74	0.37	0.145
Both vending and a la carte	22	721	0.57	0.04	0.814	0.60	0.11	0.492	1.34	0.13	0.659	7.12	0.32	0.841
A la carte available														
No (ref)	13	269	0.58			0.68			1.39			7.26		
Yes	35	1137	0.53	0.04	0.196	0.58	0.06	0.176	1.26	0.08	0.157	6.93	0.20	0.118
Vending available														
No (ref)	22	565	0.60			0.69			1.42			7.20		
Yes	26	841	0.54	0.03	0.108	0.61	0.06	0.215	1.30	0.07	0.146	7.22	0.20	0.931
Type of vending														
No vending (ref)	22	565	0.60			0.69			1.42			7.19		
Only healthy beverages	4	147	0.55	0.04	0.247	0.54	0.05	0.019	1.25	0.07	0.049	7.12	0.22	0.775
Mixed beverages	13	376	0.57	0.04	0.503	0.65	0.06	0.499	1.37	0.09	0.585	7.39	0.25	0.436
Mixed food and beverages	9	318	0.51	0.05	0.091	0.59	0.07	0.227	1.26	0.09	0.124	7.08	0.24	0.663

a - all models adjusted for student level (race, gender, energy intake) and school level (presence of a coordinated school health team, completion of the HSAT assessment, public vs. charter, setting, % students eligible for free/reduced price school meals, food service management company, and district cluster)

b - model includes the mean number of fresh fruits available per day and presence of a fruit bar

c - model includes the mean number of vegetables available per day, mean number of entrée salads available per day, and presence of a salad bar

d - model includes all covariates in c and mean number of fresh fruits available per day

e - outcome variable was log-transformed, therefore the mean represents the geometric mean

f - significant difference between groups, $p < 0.05$

DISCUSSION

Many significant differences were seen when examining dietary intake by race. Previous research has also identified differences amongst various racial groups in dietary intake of energy, percentage of energy intake from fat and saturated fat, certain vegetables (dark-green leafy vegetables and other starchy vegetables) and fruit (U.S. Department of Agriculture, Food and Nutrition Service et al. 2001). The racial differences in dietary intake seen in the current study may be due to true differences in food intake patterns, but may also be a limitation of the food FFQ if cultural foods commonly consumed in minority groups are not included in the food list. Only two published studies to date have examined the reliability and validity of the Block FFQ, and both were conducted in primarily minority populations (Smith and Fila 2006; Cullen, Watson et al. 2008). The first study found that in a group of 61 Native American adolescents aged 9-13, the Block FFQ was not significantly different than a 24-hr recall for estimation of energy, protein, grams of fat and saturated fat intake, and some vitamins and minerals; other nutrients such as percentage of energy from fat and saturated fat, carbohydrate, and some vitamins and minerals were significantly different (Smith and Fila 2006). The second study found in a sample of 83 Hispanic/Latino, African American, and white adolescents aged 10-17 that there were not significant differences in dietary intake of percent of energy from fat, fruit, and fruit juice servings, but other food groups and nutrients did show significant differences including energy, percent of energy from protein and carbohydrate, vegetables, grains, milk products, and calcium (Cullen, Watson et al. 2008). Additional studies examining the validity of FFQ results against

multiple 24-hr recalls in ethnically diverse samples of adolescents would help to determine whether the FFQ is an adequate representation of adolescent dietary intake.

Differences were seen when examining dietary intake by gender in each individual racial group. In white students, females had significantly lower energy intake, and significantly higher saturated fat, fruit, vegetables, fruit + vegetables, and fiber intake than white male students. African American female students had a significantly higher vegetable intake than African American male students. Previous research has also found differences in adolescent dietary intake of energy, grams of fat and saturated fat, percentage of energy intake from saturated fat based on gender (U.S. Department of Agriculture, Food and Nutrition Service et al. 2001; Wright, Wang et al. 2003; Ervin, Wright et al. 2004; Institute of Medicine 2007).

Several competitive food variables were associated with an increase in fat or saturated fat intake. These results are likely due to the types of items available in competitive food venues; many are high in fat. For example, many schools have dairy products such as plain and flavored milks, string cheese, and yogurt available because then are deemed more nutritious than typical snack foods, but they contain fat and saturated fat as well.

The results that indicated that having only vending or only a la carte being associated with a higher intake of fruits was in the unexpected direction, as fruits are not often available in these venues. After extensive examination of SNAK school-level characteristics, it was observed that over half of schools with either vending or a la carte offer fruit snacks in those venues (e.g., Welch's fruit snacks, Fruit Roll-Up, etc.) that contain very little real fruit juice and are not fruits, but high sugar candies. Upon further

examination of the FFQ used, it was discovered that one of the questions measuring fruit intake asks students to report intake of "Any other fruit, like grapes, peaches, watermelon, cantaloupe, fruit roll-ups". It is likely that many students reported intake of these fruit snack items in this category, which could explain how having vending or a la carte available would be associated with a higher fruit intake.

Another plausible explanation is the high prevalence of fruit juice-like beverages available in schools today. Four questions in the Block FFQ ask about sugar-sweetened beverages including soda, "Slurpees, snow cones, popsicles," "Hawaiian Punch, Kool-Aid, Sunny Delight, Gatorade, ice tea, Snapple," "Hi-C, Tang, Tampico, Mr. Juicy, Ssips punch". There are a wide variety of these sugar-sweetened fruit-flavored beverages available (e.g., Capri Sun) that are can easily be confused as fruit juice, and may have been reported by students under the question where they are asked to indicate consumption of "Any other real juices like apple juice or grape juice. (Remember juice boxes)". Furthermore, there are no questions that address many of the new artificially sweetened beverages available such as fruit-flavored waters, which students may be reporting as fruit juice. Research examining how students report these types of items would add to the current field of dietary assessment in adolescents. Future studies utilizing the Block FFQ should clarify instructions to adolescents on these questions to more accurately assess dietary intake of fruits.

The results for the type of vending machine available showed the lowest energy intake in schools with healthy beverage-only vending machines, slightly higher energy intake with mixed beverage vending, and the highest energy intake with mixed food and beverage vending. Three out of four schools in the only healthy beverage vending

category only had plain or flavored water available, and the fourth school had water and 100% juice. Schools in the mixed beverage category typically carried sports drinks, other fruit-flavored drinks and teas, and occasionally soda in addition to water and fruit juice. The differences in the calorie content in the beverages typically offered in healthy beverage only compared with the mixed healthy and less healthy beverage only vending machines likely accounts for the differences seen in energy intake between students in these schools. Schools with only healthy beverages available in vending had a lower energy intake most likely because they mostly only had water available, whereas the sports drinks and other beverages available in mixed beverage vending machines offered more calories than water. Furthermore, the mixed food and beverage vending machines offered a wide variety of foods and drinks with a high energy content. It may seem counterintuitive that the reference group (no vending available) had the third highest energy intake, however it is important to note that over half of these schools had a la carte available.

Results from this study support previous evidence that competitive foods in schools are associated with student dietary intake. Purchasing competitive foods in middle schools has been associated with a higher intake of sugar-sweetened beverages (Wiecha, Finkelstein et al. 2006); a higher intake of calories, total and saturated fat, and lower intakes of protein, vitamins A and C, and calcium (Templeton, Marlette et al. 2005). Results from the SNDA-III study indicate that not having a store or snack bar, and not having a la carte foods available were associated with a decreased consumption of energy from sugar-sweetened beverages (Briefel, Crepinsek et al. 2009). Availability of vending machines in or near the cafeteria that contain low-nutrient energy-dense foods

was associated with a higher BMI z-score in middle school children (Fox, Dodd et al. 2009).

In previous studies, availability of competitive foods has been negatively associated with fruit and vegetable consumption and positively associated with intake of total and saturated fat (Cullen, Eagan et al. 2000; Kubik, Lytle et al. 2003; Cullen and Zakeri 2004). Similarly, in the current study, having both vending and a la carte available was associated with an increased percentage of energy intake from saturated fat. The current study also found that having mixed healthy and less healthy beverages in vending machines was associated with increased energy intake from total and saturated fat, and mixed food and beverage vending machines was associated with increased percent of energy intake from saturated fat. Also, availability of vending machines with only healthy beverages was associated with a lower consumption of vegetable and fruit + vegetable intake. In contrast, results from the current study also indicated that availability of vending machines only or a la carte only was associated with an increased fruit intake, though these results were likely due to inadequacy of the FFQ used to assess dietary intake.

The small sample size of schools and students in each group in some analyses may have reduced the statistical power to detect differences between groups. Future studies conducted with more schools and students might reveal statistically significant associations.

The results of the current study were mixed in their association between student dietary intake and competitive foods. Some findings indicated that competitive foods may be associated with better student dietary intake (e.g., having only healthy beverages

available was associated with a decreased energy intake compared with schools that did not have vending, and with schools that had mixed food and beverage vending), while other findings indicated competitive foods are associated with poor dietary intake (e.g., availability of both vending an a la carte was associated with increased saturated fat intake). It is clear that there are associations between the school nutrition environment and student dietary intake. Therefore, improving the overall healthfulness of competitive foods available in schools by increasing healthy options such as water, fruit, and vegetables, and removing less healthy options may be an effective strategy for improving adolescents' dietary intake.

CHAPTER FOUR:

A QUALITATIVE EXPLORATION OF THE ACCOMPLISHMENTS AND CHALLENGES TO PROMOTING HEALTHY EATING IN LOW-INCOME MIDDLE SCHOOLS

BACKGROUND

Healthy eating during childhood and adolescence is critical to ensuring proper growth, development, and functioning, as well as to prevent many chronic diseases including cardiovascular disease, diabetes, obesity, and osteoporosis (Berenson, Srinivasan et al. 1998; Weaver 2000; Prentice, Schoenmakers et al. 2006). The prevalence of overweight in U.S. adolescents has more than tripled over the last several decades from 5.0% to 17.4%, (Ogden, Flegal et al. 2002; Ogden, Carroll et al. 2006), one indication that children are not receiving optimal nutrition. Low-income children are less likely to have a healthy diet, and more likely to consume more fat and saturated fat, and lower amounts of fruits and vegetables (Neumark-Sztainer, Story et al. 1996).

Foods and beverages consumed at school are an important contributor to the total dietary intake of adolescents. However, the school food environment does not always have a positive influence on adolescents' diets. Competitive foods (those available outside of school meals, including vending machines, a la carte, fundraisers, class parties, etc.) are widely available in schools (Fox, Gordon et al. 2009), and often include items that are low in nutrient density, and high in energy, fat, sodium, and added sugars (Harnack, Snyder et al. 2000; Wildey, Pampalone et al. 2000; U.S. Department of

Agriculture 2001; French, Story et al. 2003; Wiecha, Finkelstein et al. 2006; O'Toole, Anderson et al. 2007; Fox, Gordon et al. 2009). Additionally, competitive foods have consistently been associated with poor dietary habits in students (Cullen, Eagan et al. 2000; Kubik, Lytle et al. 2003; Cullen and Zakeri 2004; Templeton, Marlette et al. 2005; Wiecha, Finkelstein et al. 2006), and are inversely associated with sales of school lunch (Fox, Crepinsek et al. 2001).

In order to provide appropriate educational, environmental, and policy supports to encourage healthy eating in schools, it is necessary to understand students' perceptions of healthy eating and of the school nutrition environment. Studies indicate that adolescents have sufficient knowledge about healthy eating, are able to identify healthy and unhealthy foods, and can identify short-term physical and psychological benefits of healthy eating (Story and Resnick 1986; Chapman and Maclean 1993; Croll, Neumark-Sztainer et al. 2001; O'Dea 2003). However, nutrition knowledge and psychosocial correlates have been shown to have low predictive value for dietary intake (Baranowski, Cullen et al. 1999; Story, Neumark-Sztainer et al. 2002).

It is also important to understand the perspectives of those individuals that are directly involved in making decisions regarding nutrition education and the school nutrition environment, namely administrators, teachers, food service directors, coordinated school health teams, and the community. Studies exploring barriers to health and nutrition initiatives in schools have consistently found a lack of prioritization of health initiatives (sometimes due to a focus on academic performance) and a lack of funding often being cited by school personnel (Greenberg, Cottrell et al. 2001; Meyer, Conklin et al. 2001; Winnail and Bartee 2002; Brown, Akintobi et al. 2004). In several

qualitative studies, students and school personnel cited challenges to eating healthy in schools that included the widespread availability of unhealthy competitive foods, low-quality school meals, insufficient time to eat, peer pressure, weight-related concerns, media promotion of unhealthy foods, and a lack of support from parents and the community (Meyer, Conklin et al. 2001; Bauer, Yang et al. 2004; Cho and Nadow 2004).

While it is important to understand the challenges schools experience in promoting healthy eating, it is also important to learn from the accomplishments schools make despite these barriers and listen to their advice regarding what they need to be able to further promote health to students. Few studies have focused on school successes. Several resources available to schools share case studies of successful health promotion efforts in schools, including "Making it Happen! School Nutrition Success Stories" (Food and Nutrition Service U.S. Department of Agriculture, Centers for Disease Control and Prevention et al. January 2005), and the Michigan Healthy School Success Story website (http://mihealthtools.org/schoolsuccess/).

This study explored the topic of healthy eating in schools in a sample of low-income middle schools from both the student and staff perspective. We chose to study low-income schools, as the factors influencing these schools may differ from those found in wealthier school districts. The goals of this study were: 1) to describe challenges to promoting healthy eating experienced by low-income middle schools; 2) to illustrate accomplishments low-income schools have made that promote healthy eating; and 3) to understand factors that facilitate school change to promote healthy eating.

METHODS

The qualitative data used in this study were collected as part of the School Nutrition Advances Kids (SNAK) project, which is funded by the Robert Wood Johnson Foundation Healthy Eating Research program, Supplemental Nutrition Assistance Program Education (SNAP-ed), and the Michigan Department of Community Health (MDCH). SNAK is a collaboration between researchers at Michigan State University (MSU), the MDCH, the Michigan Department of Education, and partnering organizations of the Michigan Action for Healthy Kids coalition. The SNAK project aims to improve school nutrition policies and environments through school self-assessment, action planning, and implementation, and/or adoption of a Michigan State Board of Education nutrition policy. All study procedures and instruments were approved by the MSU Institutional Review Board. Informed consent was obtained from all adult participants, and parental consent and student assent were obtained for all student participants.

Procedures

Eight schools (of 65 total schools enrolled in the SNAK project) were selected as case study schools and invited to participate in the qualitative component of the study. All schools were low-income Michigan middle schools (50% or more students eligible for free or reduced price school meals). Case study schools were selected based on demographic characteristics to explore the diversity of experiences in these schools (Table 4-1). These characteristics included setting (rural, suburban, or urban), public vs. charter school, type of food service program (traditional kitchen, food service management company, heat-and-serve only kitchen, or no outside vendors that deliver

ready-to-eat food to the school), size (based on the number of 7th grade students), and building type (middle grades only; elementary and middle grades; middle and high grades; or elementary, middle, and high grades). Schools were not selected to represent all schools with middle-level grades, but to explore the topic of healthy eating in this diverse group of schools, so that the themes can be further explored in a larger sample of schools.

At each case study school, interviews were conducted with one school administrator, the food service director (FSD), and one member of the coordinated school health team (CSHT), for a total of 24 school personnel interviewed. Group or individual interviews were conducted with middle school students, with the number of students interviewed ranging from 1-5 students at each school, for a total of 23 students interviewed. School personnel received a $25 gift card as an incentive to participate, and schools received $50 towards student activities as an incentive for student participation.

Interviews typically lasted 30-60 minutes. Interviews were digitally recorded when consent was given (20 school personnel, 7 student groups); otherwise, detailed notes were taken during the data collection and expanded immediately thereafter (4 school personnel, 1 student group). Recordings were transcribed verbatim using word processing software.

Interviews were conducted in May-June 2008, at the end of the first school year that schools participated in the SNAK Project. Follow-up interviews with school personnel were conducted in May-June 2009, after completion of SNAK project. The interviews were conducted with two goals, to understand the barriers and facilitators to promoting

healthy eating in this group of low income Michigan schools, and to evaluate the SNAK program activities. This paper reports on the challenges and accomplishments for promoting healthy eating described by these schools during the May-June 2008 interviews only.

Instruments

Interview guides were developed by the research team and partnering organizations based on review of the existing school nutrition literature and the team's experience working in low-income middle schools. Separate interview guides were created for school administrators, FSDs, and CSHT members based on their areas of expertise; however, a number of cross-cutting questions were asked of all school personnel, including the challenges their school faced and accomplishment they have made in promoting health and nutrition. The administrator interview guide included thirteen questions, with a focus on school nutrition policies and their enforcement. The FSD interview guide included twenty-six questions related to school food service operations and competitive foods. The CSHT member interview guide included thirty questions with a focus on CSHT characteristics and SNAK project intervention activities. A separate interview guide was created for students that contained fourteen questions. The student interviews were designed to describe students' experiences with food in the school setting, and to understand their perceptions of healthy eating.

ANALYSIS

Transcripts and notes were entered into Atlas.ti (version 5.0.66, 2005), and thematic analysis was used to establish a comprehensive list of relevant ideas, or "codes". A codebook was created that contained the code name, definition, rules for use, and examples. Initially, codes corresponded directly to questions in the interview guides. Next, a sample of transcripts was reviewed to identify additional themes and to categorize responses to interview questions. The codebook was further refined during analysis to accommodate new codes, or clarify existing codes. Codes were then attached to relevant quotations in the transcripts.

Each of the student group interview transcripts was independently coded by two researchers. Inter-coder reliability was >90% after the second transcript was coded by both researchers. These transcripts were then reviewed by a third researcher, who resolved any discrepancies in coding. Six of the school personnel interview transcripts were independently coded by two researchers. Coding was compared and refined until an inter-coder reliability of >75% was achieved. The remaining 18 transcripts were coded by one researcher and reviewed by a second researcher to maximize accuracy and comprehensiveness.

Once transcript coding was complete, all quotations associated with each code were reviewed, and summary statements of each code were created for each school personnel and student group. Responses were compared across schools and across participant type (administrator, FSD, CSHT member, students) when appropriate. Many common ideas were identified across interview participants, thus results are presented by

theme, and results from the various school personnel and students are presented together when it was suitable.

RESULTS

Table 4-1 describes the diversity of characteristics of the eight SNAK case study schools. Five schools were public and three were charter schools. Four types of food service operations were observed. The five public schools all used "traditional" kitchens where food was prepared at each school or at central kitchen located within the district. Three of these five public schools utilized a food service management company, which oversaw the food service operations, negotiated with vendors for pricing, and provided FSDs with recipes, nutrition information, marketing materials, and educational opportunities. The three charter schools all utilized "alternative" food service programs. Two charter schools had no physical kitchen and used an outside vendor that delivered ready-to-serve foods to the schools daily. One charter school had a heat-and-serve kitchen where they were only able to warm pre-cooked frozen foods.

The percent of students eligible for free or reduced price meals ranged from 50-97%. One school was classified as rural, three as suburban, and four as urban, based on U.S. census data. The number of 7^{th} grade students in the school building ranged from 49 to 248 seventh grade students. Half of the schools had middle grades only, two had elementary and middle grades, one had middle and high grades, and one served elementary, middle, and high grades in their building.

Table 4-1: Characteristics of SNAK case study schools and interview participants

	Type of School	Interviewed school personnel	Interviewed students	Type of food service	% students eligible for free or reduced meals	Setting	Total # 7th grade students	Grades in building
1.	Public	1. FSD 2. Principal 3. PE Teacher (CSHT member)	2 female	Traditional	50	Rural	49	7-12
2.	Charter	1. FSD 2. Superintendant/Principal 3. School Nurse (CSHT member)	2 female, 1 male	Vendor	50	Urban	114	K-8
3.	Public	1. FSD 2. Assistant Principal 3. District Coordinated School Health Leader (CSHT member)	2 female, 1 male	Traditional	50	Suburban	248	7-8
4.	Public	1. FSD 2. Principal 3. Parent (CSHT member)	4 male, 1 female	Traditional + Management company	57	Suburban	100	6-8
5.	Charter	1. FSD 2. School Director 3. Social Worker (CSHT member)	2 male, 2 female	Heat and serve	72	Urban	72	2-12
6.	Public	1. FSD 2. Assistant Principal 3. Health Educator (CSHT member)	1 male	Traditional + Management company	80	Urban	199	6-8
7.	Charter	1. FSD 2. Chief Academic Officer 3. Parent Liaison (CSHT member)	1 male, 1 female	Vendor	97	Urban	58	K-8
8.	Public	1. FSD 2. Principal 3. Science Teacher (CSHT member)	2 female, 1 male	Traditional + Management company	53	Suburban	102	6-8

Challenges to promoting healthy eating

Financial challenges

School personnel described a number of challenges to promoting healthy eating that could be attributed to decreased school funding. In all schools, budget cuts had led to reductions in both teaching and food service staff, requiring remaining staff to pick up additional responsibilities. School personnel felt there was just not enough time in the day to accomplish all of their tasks, which led to low prioritization of health initiatives compared to the day-to-day operational requirements of schools. Furthermore, health initiatives were not a priority. Rather, school personnel reported prioritization of activities viewed as directly related to academic achievement in order to improve standardized test scores. One individual from each of three schools voiced frustration about inequity in funding for low-income schools based on factors such as the property values in the surrounding community and standardized test scores. These individuals felt that all schools should be funded equally on a per-pupil basis, not based on their location.

Economic influences

School personnel were often troubled by the dire economic situation of their communities, citing high rates of unemployment, reliance on government food assistance and food banks, and a large proportion of students being eligible for free and reduced-price school meals. Nine school personnel were worried that students weren't getting meals outside of the school setting, especially during summer months when some schools did not have a summer food service program. Several of the FSDs expressed a desire to

serve meals students liked (which were not necessarily the healthiest foods) to ensure that they had "at least one good meal" during the day that they would actually eat.

Despite these concerns, hunger was only discussed by students in one school, all of whom stated that being hungry during the school day was a source of distress. This charter school had a heat-and-serve kitchen, and the students were generally displeased with the food that was typically served for lunch. The students were able to clearly articulate both the physical effects (e.g., having a stomachache, headache, being tired, falling asleep in class) as well as emotional/behavioral effects (e.g., feeling sad, frustrated, irritable, mad, angry, and getting into fights with other students and teachers) that negatively impacted their learning and behavior in school. It is important to note that the hunger reported by students in this school may have been due to the fact that the students disliked the heat-and-serve meals they were offered for lunch and didn't eat for that reason; however, the detailed description of the effects of hunger was concerning and clearly impeded their ability to learn at school.

Family influences

Two-thirds of the school personnel also expressed concern over the foods that students were exposed to at home. They felt parents weren't providing healthy choices at home, often relying on fast foods and prepackaged foods for cost and convenience. Students' perspectives did not support this view, with students in half of the schools describing family as having a positive influence on healthy eating, either through education, or by not having junk foods available at home. Students in one school felt that

their peers didn't eat healthy because they were not taught to at home. School personnel expressed frustration due to the perceived societal pressure put on schools to get students to eat healthy when the home and community environments did not support their efforts.

School foods – meals

School food service programs faced additional challenges related to financial issues. Half of the FSDs acknowledged that the food service budget influenced what was served for school meals, and two FSDs stated that healthy foods were more expensive and thus were more difficult to integrate into meals. One FSD described trying to balance nutrition with food costs when she discussed adding whole wheat products to the menu: *"the only thing I hadn't on a consistent basis changed to was the hot dog and hamburger buns. We offer wheat a couple of times a month, but... because they are double the costs, I don't offer them on a regular basis."* Furthermore, the increasing cost of food, partially due to increased fuel/transportation costs, made balancing food service budgets more difficult.

Students felt that having healthy options available in school helped them to eat healthy, but they described many barriers to healthy eating including sensory characteristics (taste, smell), and the widespread availability of appetizing competitive foods. Between schools, student opinion and description of school meals varied, and differences were observed based on the type of food service program. Students in schools using alternative food service operations (vendor or heat and serve) had stronger negative opinions of the school lunch. In schools that used traditional kitchens, student

opinions depended on the type of food that was being served. Students were happy to eat the school lunch when it was something that they were familiar with and tasted good. They were less likely to eat school lunch when it did not appeal to their senses (e.g., food doesn't taste good, is cold, greasy, soggy, under- or over-cooked), which was more common in schools with alternative food service operations. Another factor that motivated students included convenience, and a few stated they ate school lunch because they were "too lazy" to pack a lunch, or reported eating other foods that were easy to get, such as fast food.

In five schools, the physical layout of the kitchen (e.g., where drains were located in the floor) prohibited changes in the way the food service lines were arranged, thus limiting their ability to relocate foods to showcase healthy options. In two schools, outdated facilities were cited as a limiting factor. Two of the charter schools did not have kitchen facilities, the other had only a heat and serve kitchen, which limited the ability of these schools to prepare fresh foods, such as salads.

School foods – competitive foods

School personnel in seven schools and students in all eight schools reported a wide variety of competitive foods available, and that these included primarily unhealthy options. In the one school where school personnel reported no competitive foods available, student interviews revealed that several students were selling snacks out of their lockers and that one teacher was also selling snacks out of his classroom as part of an "entrepreneurial" lesson for his class. In four schools, it was evident that many

students purchased competitive foods in addition to, or instead of eating a school lunch.

In five schools, FSDs stated that a la carte sales helped to balance the budget, and one additional school had recently started selling a la carte foods to supplement the budget. In the two charter schools that did not sell a la carte, FSDs believed they had a deficit in their food service budget. In three schools, profits from concession stands were used for student activity accounts that supported student events such as dances and parties (which typically featured less healthy foods such as pizza and ice cream), athletic programs, and field trips. Student preferences for less healthy items were often accommodated in competitive food venues because those items were "big sellers."

Students in two schools indicated that the cost of food influenced what they ate. Healthier items were more expensive, which led them to purchase the less healthy items. One student explained, *"like I said, a cookie's a dollar. My mom said the salads are a good deal, but compared to everything else here... it's like you can get three or four [bags of] chips for one of those [salads]?"* Despite the fact that they felt that a la carte was overpriced and a waste of their money, they continued to purchase a la carte foods, or chose the inexpensive less healthy options.

Perceptions about students

Student preferences were cited by school personnel in seven schools as an important factor in determining which foods were available. Many school personnel stated that students preferred unhealthy foods and that is why they served them. Common perceptions included that students would not eat healthy foods because they

preferred the unhealthy foods they were exposed to at home, were unfamiliar with some healthy foods because they had not tried them before, and were not willing to try new foods. In contrast, when students were asked what they would change about their school lunches, students in six schools requested an increased variety of healthy foods including fruits, vegetables, sandwiches and salads.

Peer influences

Three FSDs thought peer influence encouraged unhealthy eating in this age group. Similarly, students generally described their peers as not eating healthy and not caring about healthy eating. In three schools, students agreed that harassment from their peers or the desire to "not be an outcast at lunch" discouraged them from eating healthy. Only two FSDs thought stigmatization of students receiving free/reduced-price school meals occurred, but only in reference to breakfast; however, stigmatization of breakfast was not discussed by the students. The foods described by students as "cool" were simply the foods that tasted good or that the majority of students ate (e.g., pizza). The only instance of stigmatization based on socioeconomic status was the ability to purchase a la carte foods, as described by a student in one school:

> *"sometimes it is kind of cool to go to the a la carte line, showing that you have the money to buy up a whole bunch, like sometimes when people get a lot of money, they'll go buy a whole big box pizza, knowing that they won't eat it anyways, they just throw it out."*

Accomplishments to promoting healthy eating in middle schools

School food improvements

Despite the financial challenges faced by these schools, several SNAK case study schools were making improvements to the nutrition environment, most of which did not require significant financial resources. Four schools were promoting breakfast consumption by offering universal free breakfast, hosting an all-school breakfast event, or adding hot breakfast items to the menu on some days. Three schools had undergone (or were in the process of) building renovations to improve the food service area. As a lower-cost alternative to building renovations, two schools had added mobile serving stations where students could purchase made-to-order salads and sandwiches.

Provision of healthy foods in school meals was a priority mentioned by at least one school personnel in each of seven schools, and personnel at four schools reported using nutrition standards such as the USDA school meal guidelines or their district's wellness policy requirements in selection of foods and beverages. Six schools had made improvements to the foods available in school meals (such as more variety of fruits and vegetables, substituting whole grain and low-fat products); the other two schools (charter schools that used vendors) discussed the possibility of using a different vendor to improve the quality of foods in school meals in the future.

Seven schools had made some improvements to competitive foods including switching to healthier options, removing vending machines, prohibiting sales of unhealthy foods in fundraising activities, or regulating the foods available for class parties. This was discussed more often for vending machines and a la carte (typically

controlled by FSDs); whereas event concessions (typically controlled by administrators rather than FSDs) were described as having primarily unhealthy options available because the healthier items did not sell well.

School personnel in seven schools showed a commitment to accommodating student preferences in school meals and competitive foods. In four schools, student input was limited to vocal students telling the food service personnel if they didn't like something that was served, or to informally asking students what they think of the meal. In three schools, more extensive input was gathered through surveys, taste-tests, student committees, and taking students to food shows to help select new items.

Individuals at four schools stated that the Alliance for a Healthier Generation agreement with beverage manufacturers, which limited on the types of beverages that could be sold in schools, impacted which competitive foods were available. However, in two of these schools, FSDs were frustrated with the restrictions, because they wanted to be able to offer a wider variety of products to students, such as flavored waters.

Nutrition education

In spite of reporting a lack of time and financial resources, personnel in all SNAK case study schools described nutrition education efforts, though the extent of these activities varied. At a minimum, teachers emphasized the nutrition portion of the health education curriculum. School personnel also reported integrating nutrition topics into the physical education curriculum, life skills classes, or homeroom, sometimes to replace health education classes that had been cut from the curriculum. Four schools hosted

health fairs, two held a nutrition week/month, and one school was preparing to implement a semester-long nutrition class. Students demonstrated basic knowledge about nutrition as they were able to describe healthy and unhealthy food options, and understood the relationship between caloric intake and expenditure due to physical activity. Other efforts included reaching out to parents and community members through newsletters, local radio stations, and hosting events for parents; however school personnel were frustrated by low parent participation in these events.

Factors that facilitate change in schools

Several questions were asked of school personnel to elicit factors that facilitate change to promote healthy eating in schools. FSDs indicated that support from their staff and administration, teamwork, and listening to student preferences helped them to accomplish their food service goals. Four FSDs (including those at all three schools with food service management companies) stated that education and information had helped them to make healthy choices. Sources of education included the food service management company, the state of Michigan, the School Nutrition Association, and food vendors. Three FSDs stated that manufacturer development of higher-quality healthy products had helped them to include healthier options that students enjoyed in meals and competitive foods.

One interesting observation was the attitude of the FSD varied when comparing schools with a food service management company (all public schools) with schools that contracted with outside vendors (both charter schools), which either facilitated or

hindered change. The FSDs utilizing a food service management company were provided with educational opportunities, marketing resources, recipes and menus, thus encouraging them to make their own decisions for their food service operations. In contrast, FSDs in schools utilizing outside vendors were provided with a predetermined menu with little room for changes. These FSDs appeared to take less ownership of the program, lacked nutrition education, and had little influence over the foods available. Also in these schools, the food service budget was managed by the school's business office rather than by the food service program, but this could be due to the fact that they were charter schools.

When asked what would help schools overcome the challenges to promoting healthy eating, individuals at five schools thought that increased school funding (both in general, and for kitchen improvements) would be necessary. Several administrators also talked about equalizing funding for all schools and allowing Title I funding to be used for health promotion efforts. Only one FSD talked about the types of commodity foods available to schools, and she suggested to *"go directly to USDA and say, 'Stop subsidizing meat and start subsidizing fruits and vegetables'."* In three schools, individuals expressed frustration at the lack of a "consistent nutrition environment," which is degree to which the *entire* school environment, from what is being taught in classes, the foods available in the cafeteria and in competitive foods, and information and advertisements in the school, support the messages of health and nutrition promotion. These individuals suggested integrating food service and health classes with the rest of the curriculum to enhance consistency. Eleven personnel mentioned education was

essential, not just in relation to students, but also for food service staff, teachers, parents, and the community.

School culture

During interactions with the SNAK case study schools, it became apparent that there was a combination of characteristics that describe the school's overall attitude and willingness to prioritize health initiatives, which we termed their "school culture". These characteristics included things such as presence or absence of one or more individuals that was passionate about health promotion and understood the relationship between health and academic success (a school health champion); the degree of consistency of the school nutrition environment; presence, awareness, and degree of enforcement of health-related policies; general degree of support from staff and administrators; presence of a coordinated school health team that met on a regular basis; and degree of healthy and unhealthy nutrition practices (e.g., positive student behavior or academic success encouraged by food-related or other reward structure). The extent to which each of these characteristics was present varied at each school.

In all of the case study schools, food was being used, at least occasionally, as a reward. Students reported being rewarded with food for academic achievement (e.g., getting a candy bar for performing well on a test) in four schools, and for good behavior (e.g., students receiving a la carte coupons for exhibiting good behaviors) in three schools. Most school personnel reported trying to reduce use of food as a reward and encourage more educational or activity-based rewards; however, they also acknowledged

that students were easily motivated by food rewards such as pizza parties and ice cream socials.

The three schools with the most positive school culture all had coordinated school health teams that had been meeting on a regular basis for several years, and had applied for outside grants to support nutrition initiatives. These schools also had a higher awareness and enforcement of health-related policies than other schools. In two schools identified as having a neutral school culture, there was some awareness of the importance of health and nutrition, and some initiatives had taken place; however, it was clear that health was not prioritized in the school. In these schools, a potential health champion existed, but they had not taken a leadership role in promoting health. The last three schools were characterized as having a negative school culture, and had implemented fewer changes to promote health than other schools. In two of these schools, a potential health champion existed, but they felt isolated and that their efforts wouldn't make a difference because they had little support from others in the school. In the neutral and negative schools, health policies were not enforced outside of food service and a coordinated school health team was formed only because they were required to do so as part of the grant, but it was questionable whether the team would continue to meet.

DISCUSSION

The goals of this study were to explore barriers, accomplishments, and facilitators to healthy eating in a sample of low-income middle schools. The primary challenges reported by school personnel seemed to stem from budgetary constraints, which led to

reduced staffing and more responsibilities, a lack of time and financial resources to promote healthy eating, and an influence of the types of foods available to students. Results of the current study are similar to previous studies which have found low prioritization of health initiatives, inadequate funding, lack of administrative, parental, and community support as barriers to health initiatives in schools (Greenberg, Cottrell et al. 2001; Meyer, Conklin et al. 2001; Winnail and Bartee 2002; Brown, Akintobi et al. 2004).

Students in the current study cited the widespread availability of competitive foods as a barrier to eating healthy, which is also similar to previous studies (Neumark-Sztainer, Story et al. 1999; Bauer, Yang et al. 2004). Despite the common impression that sales of unhealthy competitive foods are necessary to supplement food service revenue, a recent review suggests that applying nutrition standards to competitive food venues does not decrease revenue, and sometimes increased participation in school meals, offsetting any decrease in competitive food revenue (Wharton, Long et al. 2008).

The concept of school culture has not previously been studied in detail; however, it was clear that the overall culture of the school was an important factor in determining the degree to which health was prioritized and promoted to students. Schools with the most positive culture had two distinct characteristics: presence of an active coordinated school health team, and awareness and enforcement of health policies. Efforts to assist schools in developing these characteristics may prove to be beneficial at encouraging healthy changes in schools.

School personnel reported that support from administration and others was one factor that had helped schools to make changes to promote healthy eating. Limited

research on administrative support has shown that administrative attitude, motivations, and support are important determinants of school nutrition practices (French, Story et al. 2002; Shahid 2003). Administrator prioritization and enforcement of nutrition policies can help create a school-wide culture where health promotion is important. Continuing to educate school personnel about the relationship between nutrition and academic performance may be necessary to encourage prioritization of health initiatives.

Differences in school nutrition practices and student satisfaction were observed based on the type of food service operations. In the current study, two types of contract companies were examined, a food service management company that functioned similarly to traditional food service operations, and vendor-based food service operations in which ready to eat food was delivered to the schools. In the vendor-based operations, FSDs appeared to take less ownership over the program compared with those utilizing the management company or with traditional food service operations. Furthermore, students in schools with vendor-based food service programs were less satisfied with the school meals. One previous study found that administrators outsourced food service operations for financial and managerial concerns, and were satisfied with use of contract food service management companies; however, the researchers did not differentiate between a management company and an outside vendor, nor did they examine students' opinions of school meals (Stracener and Boudreaux 1997). One previous study also cited the quality of school meals as a barrier to healthy eating (Bauer, Yang et al. 2004). Efforts should be made to find healthy school meals that are appealing to students, as provision of healthy foods in school meals is ineffective if students are not willing to eat the foods served. Input from FSDs and students, and evaluation of potential negative consequences (e.g.,

lack of control, poor student acceptance) should be considered in the decision whether or not to outsource food service programs to outside vendors.

Differences in how school personnel choose foods for meals and competitive foods, and the factors that influence student dietary behaviors may explain some of the difficulty surrounding encouraging adolescents to eat healthy foods. School personnel were primarily influenced by their perceived student preferences, nutritional content, food costs, and profits; while students were influenced by sensory appeal of food (taste, texture, and appearance), convenience, and pricing. Previous studies have shown that pricing strategies can be successful at increasing the purchase of healthy foods in adolescent populations (French, Story et al. 1997; French, Jeffery et al. 2001). Many of the FSDs in this study made efforts to take into account student preferences; however, their beliefs that students don't like healthy foods and won't try new foods did not match students' requests for a wider variety of healthy foods. In another study, adolescents similarly suggested removing less healthy options and improving the taste and appearance of healthier items as ways to get children to eat healthier (Neumark-Sztainer, Story et al. 1999). A combination of these strategies may be effective at improving student dietary intake.

It is important to note that many of the accomplishments schools had in promoting healthy eating required little or no funding, such as increasing availability of healthy foods in the cafeteria and vending, using alternatives to food as rewards, prioritizing nutrition education for students, and providing educational nutrition materials for educating staff, parents, and the community. These activities do however require time and dedication from school health champions, which can be challenging in negative

economic climates. Results from this study must be interpreted with caution due to the exploratory nature of the study. Schools self-selected to participate in the SNAK project, and case study schools were non-randomly selected to represent diverse characteristics. Additionally, there was a low participation rate in student interviews due to a low return rate of parental consent forms. Further study of these concepts in a larger sample of schools is necessary to validate these findings.

Nonetheless, many of the SNAK case study schools demonstrated that despite financial and other barriers that school face in today's economy, it is possible to implement nutrition programs and policies. In order to be sustainable, school nutrition promotion and intervention efforts should focus on the use of low-cost initiatives that create a health-promoting school culture, educating school personnel to increase prioritization of health initiatives, and creating a positive and consistent school nutrition environment to reinforce the nutrition education messages that students receive.

CHAPTER FIVE:

IMPLICATIONS AND CONCLUSIONS

The research described in this dissertation explored a wide variety of influences on adolescent dietary intake related to the school setting in a group of low-income Michigan middle schools. The ecological model of influences on adolescent dietary behavior developed by Story (Story, Neumark-Sztainer et al. 2002) can be applied to factors that are specific to the school setting (Chapter 1, Figure 2). The research in this dissertation explored factors at multiple levels of influence including the macrosystem (e.g., wellness policies, school culture), physical environmental (e.g., a la carte and vending), interpersonal (e.g., peer influence, family influence), and intrapersonal (e.g., knowledge).

Three distinct approaches were employed. First, written wellness policies were compared with self-reported school practices to determine the degree of concordance between written policy and practice. Secondly, availability of competitive foods was compared with student dietary intake. Lastly, utilization of interviews with school personnel and middle school students provided information about the varying barriers and facilitators to healthy eating in schools. Results from each chapter provide unique insights into important issues in school nutrition.

SCHOOL WELLNESS POLICIES

The associations between federally-mandated local wellness policies and school nutrition environments and practices were described in Chapter 2. The first major concern raised in this chapter was the quality of written wellness policies schools had

adopted. Overall, local wellness policies addressed about half of the items included in the wellness policy evaluation tool; however, less than one-quarter of the items received the highest score for having specific and required strategies. Oftentimes the language included in the policy was non-specific and /or suggestive - for example, "an adequate amount of time should be provided for school lunch". This leaves open for interpretation what an "adequate" amount of time for students to eat their lunch actually is, and use of the word "should" indicates that this is a suggestion, rather than a requirement. Furthermore, this language makes it nearly impossible to evaluate whether or not the school is meeting the standards set forth in their policy, or to enforce those standards.

While most schools were in compliance with the *minimum* federal requirements for wellness policies, the requirements were written in vague terms. The mandate simply requires schools to include "goals" for each of the required topic areas, but does not identify any specific areas to be addressed nor minimum standards schools should be meeting (e.g., minimum amount of time dedicated to physical education or nutrition education). Ideally, this tactic would allow school districts to create an individualized policy that was tailored to their specific needs; however, it appears as if this flexibility has also allowed schools to take a minimalist approach and adopt weak policies.

This research was the second known study to examine the concordance between written policies and school practices. Similar to the previous study (Kubik, Lytle et al. 2009), little concordance was found between policy and practice. Several potential explanations for this incongruence exist. The most optimistic explanation is that school districts have adopted a policy with intentions to improve their practices, and have not implemented these standards at this time, but will do so in the near future. It is also

possible that school personnel did not accurately report their school nutrition policies and practices. However, the most plausible explanation for this incongruence may be attributed to the fact that most districts in this study had adopted one of two popular wellness policy templates with minimal modifications, indicating that the policy did not reflect their actual school practices. This is supported by the fact that differences in wellness policy quality scores were primarily attributable to the policy template adopted by schools.

Despite the lack of association between policy and practice, the federal wellness policy mandate still holds potential for fostering a culture where health is consistently promoted at schools. It is likely that some of the ineffectiveness of this mandate is due to the lack of federal and state-level regulation. There are no guidelines for wellness policy content, no penalties if schools haven't adopted a wellness policy, and there is no monitoring of whether or not the wellness policy has been implemented. In order to be in compliance, a school can put their name on a template wellness policy and submit it to the state without any input from the key stakeholder groups intended to be involved with wellness policy development, including the students, parents, and community members.

Federal regulations such as the wellness policy mandate can be successful at creating improvements when enforcement is regulated and funded. For example, the School Meals Initiative (SMI) of 1995 put forth nutrient requirements for school meals, and enforcement was linked to federal reimbursements for school meals (U.S. Department of Agriculture 2001). After the SMI went into effect, the nutrient profile of school meals improved and are now closer to the Dietary Guidelines for Americans recommendations (Clark and Fox 2009). Furthermore, the importance of a written policy

that is enforced cannot be overlooked, as written policies may help to ensure consistent enforcement of policies, and to ensure that practices are maintained over time and across school personnel changes (Kubik, Lytle et al. 2009).

ASSOCIATIONS BETWEEN THE SCHOOL NUTRITION ENVIRONMENT AND STUDENT DIETARY INTAKE

Chapter 3 described the associations between availability and healthfulness of competitive foods in schools and student dietary intake of energy, percentage of energy intake from fat and saturated fat, servings of fruits and vegetables, and fiber intake. Having a la carte or vending machines available in schools was not associated with any significant differences in student dietary intake when examined separately. When examining competitive foods together, however, having both vending and a la carte available in a school was associated with increased saturated fat intake, while having only vending and only a al carte available was associated with an increased intake of fruits. The increase in saturated fat results are likely due to the types of unhealthy foods that are commonly found in vending and a la carte, such as chips and baked goods (e.g., cookies, cakes). Further examination of these results indicated that the FFQ used to assess dietary intake considered fruit roll-ups in the fruit category, which may have resulted in students reporting consumption of any fruit snacks (both 100% fruit snacks and fruit-flavored candies) in this category. The fact that over half of the SNAK schools had fruit snacks available in competitive food venues could explain the positive association between competitive foods and fruit intake. However, as most of these fruit snack products

contain very little actual fruit, if this is the case, then the results are not indicative of true student fruit intake.

There has been much debate regarding use of FFQs as an accurate dietary assessment measure in epidemiological studies (Kristal, Peters et al. 2005; Kristal and Potter 2006; Willett and Hu 2006). The Block Kids FFQ has been shown to have limited validity in adolescent populations in two studies (Smith and Fila 2006; Cullen, Watson et al. 2008), but additional research is necessary to establish the validity of its use in ethnic groups and for more nutrients. One limitation of FFQs is that they consist of a predetermined set of questions with limited response options. This limits the FFQ's ability to account for the vast complexities of an individual's diet or to take into account the wide variations in the nutrient content of various food items, especially mixed dishes, that are prepared with differing proportions of meat, grains, vegetables, and fats (Kristal and Potter 2006). According to Willet, the appropriate use of FFQs is to rank individuals within a group, rather than assuming an individual's estimated dietary intake as an exact measurement of their diet (Willett 1998). Furthermore, energy-adjusting nutrient intakes improves the accuracy of these estimates (Willett 1998). A single FFQ may not be an adequate dietary intake measure for all research questions, and Willet and Hu suggest supplementing FFQs with additional questions to better assess dietary intake variables specific to the research aims (Willett and Hu 2006). In future school-related research, additional questions clarifying fruit and vegetable intake from sources that may be confusing to adolescents, such as fruit snacks and artificially sweetened fruit-flavored beverages, would be warranted.

The type of vending machines available was also seen to be associated with student dietary intake. Having only healthy beverages available (water or 100% fruit juice) was associated with decreased energy intake, but also with decreased vegetable and fruit + vegetable intake. The decreased in energy intake was likely due to the fact that three of the four schools in the only healthy beverage category had only water (a zero calorie beverage) available, while one had water and 100% fruit juices. The decreased vegetable and fruit + vegetable intake associated with only healthy beverage vending machines may have been due to the fact vending machines with mixed beverages often had 100% fruit juices and vegetable juices such as V-8 available, which could increase students consumption of these food groups.

Having mixed healthy and unhealthy beverages only, or mixed food and beverages was associated with an increased fat and/or saturated fat intake. These results could be due to the fact that many schools are now offering dairy products which contain fats (e.g., plain and flavored milks, string cheese, and yogurt) in vending machines because they are considered more nutritious than other food and beverages typically sold in vending such as chips and candies. Additionally, vending machines that contain both foods and beverages typically contain an array of less healthy snack food items that are high in fat, such as chips and baked goods such as cookies and brownies.

Taken together, these results imply that having competitive foods available in schools may not necessarily result in decreases in dietary quality. Instead, it might be the *quality* of items available in these venues that impacts students' diets. However, many other studies have shown availability and consumption of competitive foods to be negatively associated with dietary intake (Cullen, Eagan et al. 2000; Kubik, Lytle et al.

2003; Cullen and Zakeri 2004; Templeton, Marlette et al. 2005; Wiecha, Finkelstein et al. 2006). A recent review of studies examining competitive foods in schools concluded that in general, students have healthier diets when less healthy competitive foods are not available in schools (Larson and Story 2010). Furthermore, this review also determined that increasing the availability of healthy foods without restricting availability of less healthy items does not improve student dietary intake (Larson and Story 2010). It may not be necessary to completely ban competitive foods in schools, but to regulate the healthfulness of these items, as is done with school meal programs.

There are other important issues to consider in the competitive food debate, such as the impact of competitive foods on the viability of school meal programs. The USDA recognizes that competitive foods in schools compete with and compromise the financial viability of the National School Lunch and School Breakfast program (U.S. Department of Agriculture 2001), and previous research has shown sales of competitive foods to be inversely associated with sales of school lunch (Fox, Crepinsek et al. 2001). Furthermore, availability of unhealthy competitive foods in schools directly undermines nutrition and health education that students receive in the classroom (U.S. Department of Agriculture 2001). Lastly, availability of competitive foods in schools (especially those with a predominantly low-income population) may provide an indirect way of stigmatizing students eligible for free or reduced price school meals who lack money to purchase a la carte of vending items (U.S. Department of Agriculture 2001).

The real question may be whether or not we as a society philosophically believe that competitive foods should be allowed in schools at all. Some will argue that it is a question of choice - students should be able to choose what they consume from a variety

of foods available to them, and it is their responsibility to make healthy choices. This does not mean that students should be forced to choose between healthy school meals that are unappealing to them and the numerous unhealthy but tasty competitive foods typically available in schools. If students were able to choose from high quality school meal components that satisfied their nutrient requirements while being tasty and satisfying, this would potentially gratify their desire to make choices about what they eat without exposing them unnecessarily to unhealthy competitive foods.

A recent article by Brownell and colleagues reviews the concept of personal responsibility within the obesity epidemic (Brownell, Kersh et al. 2010). According to the authors, much of the blame for the obesity epidemic has fallen on individuals who are perceived to lack the ability and/or responsibility to make healthy choices (Brownell, Kersh et al. 2010). However, the authors argue that the environment strongly influences what individuals consume, with the default being the types of foods that are readily available which are most often the less healthy choices (Brownell, Kersh et al. 2010). The authors also cite research regarding organ donation rates, where nearly everyone living in countries where being an organ donor is the default chooses to be a donor, while less than 30% of individuals choose to donate in countries in which you must opt-in to be considered a donor (Johnson and Goldstein 2003). If increased availability and lower prices of healthy foods became the default, it is likely that more individuals would eat healthier.

The issue of personal responsibility and choice deserves special consideration when dealing with adolescent populations. We as a society recognize within other domains that children and adolescents are not always mature enough to make good

choices, which is why we don't allow them to drink alcohol, smoke cigarettes, drive cars, make medical decisions, or vote. It could be argued then that allowing adolescents to have unlimited access in schools to unhealthy competitive foods that may lead to chronic diseases in adulthood is irresponsible. Providing adolescents with a variety of healthful food options to select from in schools can help to teach them to make healthy food choices throughout their lives.

BARRIERS AND ACCOMPLISHMENTS TO HEALTHY EATING, AND FACTORS THAT FACILITATE POSITIVE SCHOOL NUTRITION CHANGES

The last section of this dissertation (Chapter 4) describes the barriers to promoting healthy eating, accomplishments schools have made, and the factors that help to facilitate change described during interviews with school administrators, FSDs, CSHT members, and middle school students. Many of the barriers reported stemmed from financial restraints, such as decreased school personnel, increased responsibilities, a lack of time for health initiatives, lack of prioritization of health initiatives during allocation of time and funding, and concern over funding of food service programs. While many school personnel recognized the importance of healthy eating, and described attempts to improve the health of foods and beverages offered at schools, school meals were often described as unhealthy and competitive foods were widely available. Though FSDs prioritized student preferences, their perceptions that students wouldn't eat healthy foods or try new things may have deterred them from serving healthy foods in school meals and competitive food venues. In contrast, when asked what changes they would like to see, students frequently requested a larger variety of healthy foods. Differences in school

meal quality and student satisfaction were apparent between schools utilizing various food service programs. Schools with traditional kitchens seemed to have healthier foods than schools utilizing outside vendors or a heat and serve kitchen and the students in those schools appeared to like the food better.

SCHOOL CULTURE

One conclusion that came from the qualitative portion of this dissertation work was the concept of school culture influencing the degree to which health was prioritized and promoted at each school. As discussed in Chapter 4, schools that were characterized as having a positive school culture had made more changes to promote health and nutrition than did schools characterized as having a neutral or negative school culture. This distinction has important implications for the way researchers and practitioners plan and implement school health interventions. What this research implies is that the standard "one size fits all" intervention may not be effective at creating change in schools that lack a positive, health-promoting culture and are not ready to make changes yet. Those schools with a neutral or negative school culture may need more basic interventions targeted at school personnel to increase awareness of the relationship between student health and academic success in order to foster a culture where health and wellbeing is valued and prioritized, rather than an afterthought.

This approach is similar to the Transtheoretical Model that has been successfully applied to individual health behavior change (Prochaska, Redding et al. 2002). In this model, individuals are "staged" at varying levels of readiness to engage in health-related changes. Those in the precontemplation stage have no intentions to make behavioral

changes. Those in the contemplation stage plan to make changes within the next six months. Those in the action phase are actively engaging in health-related changes or activities. This stages of change approach has been applied in a community-based childhood obesity prevention effort in the Shape Up Somerville program (Economos 2008). In a lecture given at the Healthy Foods, Healthy Moves conference held in Chicago in October 2008, Dr. Economos described utilization of interviews with key community leaders to score a community's readiness to change. The stages of change included: 1) no awareness; 2) denial/resistance; 3) vague awareness; 4) preplanning; 5) preparation; 6) initiation; 7) stabilization; 8) confirmation/expansion; and 9) high level of community ownership (Economos 2008). The community-wide intervention efforts were then targeted to move the community into a higher stage of change.

Likewise, in the current research, the overall school culture could be an indicator of that school's readiness to make health-related changes to the school policies and practices. Those schools with a negative culture may be in the precontemplation stage and in need of basic information to enhance awareness of the problem. Those schools with a neutral culture may show some signs that they understand why student health promotion is important, but may be in the contemplation stage where they need assistance in taking the next step in prioritizing and implementing health initiatives. Schools with a positive culture were engaging in changes to improve the health-promotion in the school would be considered in the action stage of change. Interventions targeted at schools in the precontemplation and contemplation phases could be individualized to their current "stage of change". This is a dramatic shift from current standard practices where the same intervention is deployed across all schools. Having a better understanding of the

unique school culture and targeting the intervention to those characteristics may help to improve the success of school health programs and interventions.

A COORDINATED SCHOOL HEALTH APPROACH

One attribute seen in schools characterized as having a positive health-promoting culture was presence of an active coordinated school health team that met on a regular basis. The Centers for Disease Control and Prevention's (CDC) coordinated school health (CSH) program supports this approach to creating a consistent school health environment (Centers for Disease Control and Prevention 2009). CDC's CSH model consists of 8 inter-related health components including health education, physical education, health services, nutrition services, counseling/psychological services, healthy school environment, health promotion for staff, and family/community involvement.

This coordinated approach to school health emphasizes the fact that each part of the school is inter-related and together, influences student behaviors. It is likely that it is a combination of these factors that has the biggest impact on student health. In the current study, and in many previous studies, examining single factors (e.g., availability of vending machines) have been shown to have inconsistent or non-significant associations with student behavior. Perhaps these single factors are ineffective at changing adolescent dietary behaviors, and that it is truly a complex interaction between the entire school environment, in addition to the home and community environment, that determines adolescent health-related behaviors.

While the concept of CSH is not new (Allensworth and Kolbe 1987), only limited research has examined the efficacy of implementing this model over a long period of time

using rigorous research methods. In a study of 158 public Delaware schools following adoption of a CSH model, schools with a high level of CSH implementation showed improvements in overall school-level performance indicators, but not for aggregate student performance in math, reading, and writing scores (Rosas, Case et al. 2009). A recent study reviewed the effects of CSH programs on academic achievement (Murray, Low et al. 2007). Results indicated that nutrition services, health services, and counseling/psychological services had a somewhat positive impact on academic outcomes (Murray, Low et al. 2007). These results must be interpreted with caution because the researchers reviewed studies that only addressed any component of the CSH, and not studies which have implemented a comprehensive model, which are rare. However, it is promising that these partial models showed positive changes in students, indicating that a more comprehensive implementation of the CSH program may result in additional positive changes. Furthermore, this research did not examine the effects on health-related outcomes, only academic performance, though academic indicators are important to help justify to schools that CSH programs are worthwhile. Further evaluation of CSH program implementation using additional student-level health indicators would help to justify the widespread adoption of this model in schools.

One of the requirements of the federal wellness policy mandate was that schools gather input from key stakeholder groups including students, parents, school food service, the school board, administrators, and the public. Ideally, this involves districts forming ongoing health councils who are charged with developing, implementing, enforcing, and monitoring the wellness policy. Formation of this ongoing committee could be an

effective way to implement a CSH program and create a positive school culture that values health promotion.

CONCLUSION

Results from the current study and the existing literature indicate that there is no "magic bullet" to improve schools' ability to promote student health and wellbeing. Furthermore, a focus on individual characteristics of schools and their nutrition environments has not yet proven to be an effective means of improving student dietary intake and curbing the childhood obesity epidemic. A more promising approach is examining how the entire school environment, from the teachers in the classrooms, administration and school policy, the foods and beverages served in schools meals and competitive food venues, advertisements in the schools, to recess and physical activity promotion, all work together to create and support an atmosphere where health is valued and prioritized and it is easy for students to make healthy lifestyle choices. One common frustration of those working within schools to promote health is family and community environments which counteract their health-promotion efforts. Therefore, efforts should also be made to work with families and the broader community to communicate how they can support rather than hinder the schools' efforts at encouraging healthy behaviors in adolescents.

Schools can work to create this positive school culture by creation of a coordinated school health team, adoption of a CSH model, and adoption and implementation of quality school wellness policies. Inclusion of parent and community representatives on school health committees may help schools reach out to parents and

the broader community in order to communicate consistent messages to adolescents throughout *all* of the environments they are exposed to, further enhancing effects on adolescent health behaviors. One idea for future research efforts includes creating a better way of identifying a school's culture, and applying these findings to a school-level stages of change model to create individualized interventions that target a school's specific needs.

Appendix A: Scoring for each question in the Wellness Policy Evaluation Tool

		0 points		1 point		2 points	
Item #	Item Description	#	%	#	%	#	%
Nutrition education							
NE1	Includes goals for nutrition education	2	4.17	1	2.08	45	93.75
NE2	Nutrition curriculum provided for each grade level	25	52.08	2	4.17	21	43.75
NE3	Coordinates nutrition education with the larger school community	10	20.83	32	66.67	6	12.50
NE4	Nutrition education extends beyond the school environment	22	45.83	26	54.17	0	0.00
NE5	District provides nutrition education training for teachers	27	56.25	19	39.58	2	4.17
NE6	Nutrition education is integrated into subjects beyond health education	19	39.58	27	56.25	2	4.17
NE7	Teaches skills that are behavior-focused, interactive, and/or participatory	6	12.50	25	52.08	17	35.42
NE8	Specifies number of nutrition education courses or contact hours	48	100	0	0.00	0	0.00
NE9	Nutrition education quality is addressed	5	10.42	0	0.00	43	89.58
Nutrition standards for school meals							
US10	Guidelines for school meals are not less restrictive than USDA regulations	4	8.33	1	2.08	43	89.58
US11	Addresses school breakfast program	34	70.83	13	27.08	1	2.08
US12	Addresses summer food service program	46	95.83	1	2.08	1	2.08
US13	Nutrition standards for school meals beyond USDA minimum standards	35	72.92	10	20.83	3	6.25
US14	Specifies use of low-fat foods and preparation methods	45	93.75	0	0.00	3	6.25
US15	Specifies strategies to increase participation in school meals	44	91.67	0	0.00	4	8.33
US16	Optimizes scheduling of meals to improve student nutrition	18	37.50	12	25.00	18	37.50
US17	Ensures adequate time to eat meals	22	45.83	17	35.42	9	18.75
US18	Addresses access to hand washing before meals	45	93.75	1	2.08	2	4.17
US19	Requires nutrition qualifications for food service staff	36	75.00	2	4.17	10	20.83
US20	Ensures training or professional development for food service staff	19	39.58	28	58.33	1	2.08

Appendix A: (cont'd)

US21	Addresses school meal environment	13	27.08	0	0.00	35	72.92
US22	Nutrition information for school meals available	44	91.67	1	2.08	3	6.25
Nutrition standards for competitive foods							
NS23	Includes nutrition guidelines for all foods available on school campus	11	22.92	33	68.75	4	8.33
NS24	Regulates vending machines	13	27.08	28	58.33	7	14.58
NS25	Regulates school stores	15	31.25	29	60.42	4	8.33
NS26	Regulates food service a la carte	14	29.17	29	60.42	5	10.42
NS27	Regulates class parties and other celebrations	20	41.67	27	56.25	1	2.08
NS28	Regulates food from home for the whole class	20	41.67	27	56.25	1	2.08
NS29	Regulates food sold before school	39	81.25	8	16.67	1	2.08
NS30	Regulates food sold after school	42	87.50	5	10.42	1	2.08
NS31	Regulates food sold at evening and community events	47	97.92	0	0.00	1	2.08
NS32	Regulates food sold for fundraising	27	56.25	19	39.58	2	4.17
NS33	Addresses limiting sugar content of foods	31	64.58	14	29.17	3	6.25
NS34	Addresses limiting fat content of foods	21	43.75	24	50	3	6.25
NS35	Addresses limiting sodium content of foods	33	68.75	13	27.08	2	4.17
NS36	Addresses limiting calorie content per serving size of foods	38	79.17	10	20.83	0	0.00
NS37	Addresses limiting serving size of foods	32	66.67	14	29.17	2	4.17
NS38	Addresses increasing "whole foods"	20	41.67	26	54.17	2	4.17
NS39	Addresses limiting use of ingredients with questionable health effects	46	95.83	2	4.17	0	0.00
NS40	Addresses food not being used as a reward and/or punishment	30	62.50	8	16.67	10	20.83
NS41	Nutrition information for competitive foods available	43	89.58	5	10.42	0	0.00
NS42	Addresses limiting sugar content of beverages	42	87.50	4	8.33	2	4.17
NS43	Addresses limiting fat content of drinks	45	93.75	1	2.08	2	4.17
NS44	Addresses limiting calorie content per serving size of beverages	46	95.83	2	4.17	0	0.00
NS45	Addresses limiting regular (sugar-sweetened) soda	33	68.75	12	25.00	3	6.25

Appendix A: (cont'd)

NS46	Addresses limiting beverages with caloric sweeteners other than soda	38	79.17	8	16.67	2	4.17
NS47	Addresses limiting sugar/calorie content of flavored milk	46	95.83	2	4.17	0	0.00
NS48	Addresses limiting fat content of milk	30	62.50	16	33.33	2	4.17
NS49	Addresses limiting serving size of beverages	31	64.58	16	33.33	1	2.08
NS50	Addresses limiting caffeine content of beverages	44	91.67	3	6.25	1	2.08
NS51	Addresses access to free drinking water	33	68.75	0	0.00	15	31.25
Physical education (PE)							
PE52	Addresses PE curriculum for each grade level	11	22.92	18	37.5	19	39.58
PE53	Addresses time per week of PE for elementary school students	33	68.75	7	14.58	8	16.67
PE54	Addresses time per week of PE for middle school students	33	68.75	5	10.42	10	20.83
PE55	Addresses time per week of PE for high school students	39	81.25	2	4.17	7	14.58
PE56	PE promotes and physically active lifestyle	8	16.67	0	0	40	83.33
PE57	PE specifies competency assessment	34	70.83	13	27.08	1	2.08
PE58	Addresses PE quality	5	10.42	0	0	43	89.58
PE58	PE promotes inclusive play	17	35.42	0	0	31	64.58
PE60	Addresses PE as an important part of the curriculum	45	93.75	3	6.25	0	0.00
PE61	Addresses frequency of required PE classes (daily)	48	100.00	0	0.00	0	0.00
PE62	Addresses teacher-student ratio for PE	34	70.83	14	29.17	0	0.00
PE63	Addresses safe, adequate equipment and facilities	32	66.67	16	33.33	0	0.00
PE64	Addresses amount of time devotes to moderate to vigorous activity	40	83.33	0	0.00	8	16.67
PR65	Addresses qualifications for PE instructors	21	43.75	0	0.00	27	56.25
PE66	District provides training for PE teachers	35	72.92	13	27.08	0	0.00
PE67	Addresses PE waiver requirements	45	93.75	0	0.00	3	6.25
PE68	Requires students to participate in an annual health assessment	47	97.92	1	2.08	0	0.00

Appendix A: (cont'd)

Physical activity (PA) outside physical education							
PA69	Includes goals for PA	5	10.42	1	2.08	42	87.50
PA70	PA provided for every grade	16	33.33	3	6.25	29	60.42
PA71	Includes PA opportunities for staff	46	95.83	2	4.17	0	0.00
PA72	Regular PA opportunities provided throughout the day	16	33.33	21	43.75	11	22.92
PA73	Addresses PA through intramurals or interscholastic activities	26	54.17	14	29.17	8	16.67
PA74	Addresses community use of school facilities for PA	37	77.08	3	6.25	8	16.67
PA75	Addresses safe, active routes to schools	39	81.25	8	16.67	1	2.08
PA76	Addresses not using PA (extra or restricted) as punishment	23	47.92	7	14.58	18	37.5
PA77	Addresses recess frequency or amount in elementary school	21	43.75	17	35.42	10	20.83
PA78	Addresses recess quality to promote PA	34	70.83	0	0.00	14	29.17
Communication and promotion of wellness policy							
CP79	Involved a variety of stakeholders in development of wellness policy	13	27.08	7	14.58	28	58.33
CP80	Includes staff wellness programs	31	64.58	14	29.17	3	6.25
CP81	Addresses consistency of nutrition communication	27	56.25	18	37.50	3	6.25
P82	Encourages staff to be healthy role models	12	25.00	18	37.50	18	37.50
CP83	Specifies who is responsible for wellness/health communication	48	100.00	0	0.00	0	0.00
CP84	Specifies use of a coordinated school health model	33	68.75	3	6.25	12	25.00
CP85	Addresses methods to encourage input from stakeholders	26	54.17	8	16.67	14	29.17
CP86	Specifics how district will engage parents or community	13	27.08	10	20.83	25	52.08
CP87	Specifies what information is communicated to parents	13	27.08	8	16.67	27	56.25
CP88	Encourages marketing to promote healthy choices	46	95.83	0	0.00	2	4.17
CP89	Restricts marketing of unhealthful choices	46	95.83	0	0.00	2	4.17
CP90	Establishes an ongoing health committee beyond policy development	24	50.00	9	18.75	15	31.25

Appendix A: (cont'd)

Evaluation of wellness policy							
E91	Establishes a plan for measuring implementation of wellness policy	9	18.75	37	77.08	2	4.17
E92	Includes a plan for policy implementation	8	16.67	38	79.17	2	4.17
E93	Includes a plan for policy evaluation	33	68.75	13	27.08	2	4.17
E94	Includes the audience and frequency of a report on policy evaluation	10	20.83	34	70.83	4	8.33
E95	Identifies funding support for wellness activities	48	100.00	0	0.00	0	0.00
E96	Includes a plan for revising the policy	22	45.83	0	0.00	26	54.17

Appendix B: Mean wellness policy comprehensiveness and strength scores by section and by template type used among SNAK school districts

	#	Mean (95% CI)
Nutrition Education - Comprehensiveness		
MASB - Enhanced	2	77.78 (55.43, 100.13)
MASB - As intended	11	85.86 (81.50, 90.22)
MASB - Shortened	8	55.56 (48.24, 62.87)
NANA	2	77.78 (55.43, 100.13)
Policy Company	21	58.73 (52.53, 64.93)
Other	4	11.11 (-4.69, 26.92)
Nutrition Education - Strength		
MASB - Enhanced	2	50 (38.82, 61.18)
MASB - As intended	11	31.31 (28.59, 34.04)
MASB - Shortened	8	33.33 (29.11, 37.56)
NANA	2	50 (16.47, 83.53)
Policy Company	21	32.28 (28.22, 36.33)
Other	4	5.56 (-5.62, 16.73)
School Meals - Comprehensiveness		
MASB - Enhanced	2	65.38 (26.70, 104.07)
MASB - As intended	11	45.45 (42.94, 47.97)
MASB - Shortened	8	10.58 (4.08, 17.08)
NANA	2	96.15 (88.42, 103.89)
Policy Company	21	32.6 (27.27, 37.93)
Other	4	23.08 (4.12, 42.03)
School Meals - Strength		
MASB - Enhanced	2	50 (-4.16, 104.16)
MASB - As intended	11	20.28 (17.13, 23.43)
MASB - Shortened	8	7.69 (4.77, 10.62)
NANA	2	73.08 (65.34, 80.81)
Policy Company	21	20.51 (16.20, 24.83)
Other	4	13.46 (6.05, 20.87)
Competitive Foods - Comprehensiveness		
MASB - Enhanced	2	67.24 (56.84, 77.65)
MASB - As intended	11	63.32 (59.22, 67.43)
MASB - Shortened	8	24.57 (14.55, 34.59)
NANA	2	70.69 (67.22, 74.16)
Policy Company	21	15.44 (8.71, 22.16)
Other	4	25 (-0.86, 50.86)

Appendix B: (cont')

	#	Mean (95% CI)
Competitive Foods – Strength		
MASB - Enhanced	2	24.14 (10.26, 38.01)
MASB - As intended	11	6.90 (5.96, 7.83)
MASB - Shortened	8	0.43 (-0.44, 1.30)
NANA	2	58.62 (44.75, 72.49)
Policy Company	21	0 (n/a)
Other	4	4.31 (-2.26, 10.88)
Physical Education – Comprehensiveness		
MASB - Enhanced	2	55.88 (38.13, 73.63)
MASB - As intended	11	60.96 (56.37, 65.55)
MASB - Shortened	8	25.00 (13.43, 36.57)
NANA	2	44.12 (38.20, 50.03)
Policy Company	21	28.57 (24.72, 32.43)
Other	4	7.35 (-3.85, 18.55)
Physical Education – Strength		
MASB - Enhanced	2	26.47 (-3.11, 56.06)
MASB - As intended	11	38.50 (32.67, 44.34)
MASB - Shortened	8	21.32 (13.28, 29.37)
NANA	2	35.29 (11.63, 58.96)
Policy Company	21	19.61 (16.21, 23.01)
Other	4	7.35 (-3.85, 18.55)
Physical Activity – Comprehensiveness		
MASB - Enhanced	2	65.00 (34.82, 95.18)
MASB - As intended	11	71.82 (65.86, 77.77)
MASB - Shortened	8	25.00 (15.69, 34.31)
NANA	2	85.00 (54.82, 115.18)
Policy Company	21	40.00 (30.48, 49.52)
Other	4	10.00 (-4.23, 24.23)
Physical Activity - Strength		
MASB - Enhanced	2	50.00 (29.88, 70.12)
MASB - As intended	11	49.09 (44.05, 54.13)
MASB - Shortened	8	17.50 (12.47, 22.53)
NANA	2	60.00 (39.88, 80.12)
Policy Company	21	23.33 (15.69, 30.98)
Other	4	5.00 (-5.06, 15.06)

Appendix B: (cont'd)

	#	Mean (95% CI)
Communication - Comprehensiveness		
MASB - Enhanced	2	66.67 (49.90, 83.43)
MASB - As intended	11	71.21 (66.49, 75.93)
MASB - Shortened	8	28.13 (13.98, 42.27)
NANA	2	66.67 (49.90, 83.43)
Policy Company	21	34.13 (27.49, 40.76)
Other	4	10.42 (-2.16, 22.99)
Communication - Strength		
MASB - Enhanced	2	58.33 (41.57, 75.10)
MASB - As intended	11	54.55 (50.40, 58.69)
MASB - Shortened	8	15.63 (3.59, 27.66)
NANA	2	62.50 (37.35, 87.65)
Policy Company	21	12.70 (7.20, 18.20)
Other	4	2.08 (-2.11, 6.27)
Evaluation - Comprehensiveness		
MASB - Enhanced	2	50 (-17.06, 117.06)
MASB - As intended	11	81.82 (78.77, 84.87)
MASB - Shortened	8	37.50 (23.69, 51.31)
NANA	2	83.33 (n/a)
Policy Company	21	53.97 (47.46, 60.47)
Other	4	8.33 (-1.35, 18.01)
Evaluation - Strength		
MASB - Enhanced	2	8.33 (-8.43, 25.10)
MASB - As intended	11	18.18 (15.13, 21.23)
MASB - Shortened	8	4.17 (-1.32, 9.65)
NANA	2	83.33 (n/a)
Policy Company	21	8.73 (4.99, 12.47)
Other	4	0 (n/a)
Total Comprehensiveness		
MASB - Enhanced	2	64.58 (41.53, 87.63)
MASB - As intended	11	65.63 (62.62, 68.63)
MASB - Shortened	8	26.95 (20.97, 32.94)
NANA	2	71.88 (61.40, 82.35)
Policy Company	21	31.45 (27.11, 35.79)
Other	4	15.89 (6.58, 25.19)

Appendix B: (cont'd)

	#	Mean (95% CI)
Total Strength		
MASB - Enhanced	2	36.46 (21.79, 51.13)
MASB - As intended	11	27.65 (25.73, 29.58)
MASB - Shortened	8	12.11 (8.94, 15.28)
NANA	2	57.81 (40.00, 75.62)
Policy Company	21	13.84 (11.53, 16.14)
Other	4	5.73 (2.05, 9.41)

Appendix C: Association between school-level characteristics and wellness policy template type used

School Characteristic	MASB (n = 21)					Policy Company (n = 21)					Other (n = 6)				
	n	Prop.	SE	95% CI Lower	95% CI Upper	n	Prop.	SE	95% CI Lower	95% CI Upper	n	Prop.	SE	95% CI Lower	95% CI Upper
%F/R (Higher) (n = 15)	5	0.333	0.126	0.080	0.587	7	0.467	0.133	0.198	0.735	3	0.200	0.107	-0.015	0.415
Completed HSAT Assessment (n = 12)	5	0.417	0.149	0.118	0.716	6	0.500	0.151	0.197	0.803	1	0.083	0.083	-0.084	0.251
Coordinated School Health Team (n = 21)	10	0.476	0.112	0.252	0.701	8	0.381	0.109	0.163	0.599	3	0.143	0.078	-0.015	0.300
Any Program (n = 14)	3	0.214	0.114	-0.016	0.444	10 [a]	0.714	0.125	0.461	0.968	1	0.071	0.071	-0.073	0.216
Minority (n = 28)	12	0.429	0.095	0.236	0.621	15	0.536	0.096	0.341	0.730	1 [a,b]	0.036	0.036	-0.037	0.108
Size - small (n = 20)	8	0.400	0.112	0.174	0.626	10	0.500	0.115	0.269	0.731	2 [a]	0.100	0.069	-0.038	0.238
Size - medium (n = 15)	6	0.400	0.131	0.137	0.663	7	0.467	0.133	0.198	0.735	2	0.133	0.091	-0.049	0.316
Size - large (n = 13)	7	0.538	0.144	0.249	0.828	4	0.308	0.133	0.040	0.576	2	0.154	0.104	-0.056	0.363
Food Service Management Company (n = 12)	4	0.333	0.142	0.047	0.619	7	0.583	0.149	0.284	0.882	1 [b]	0.083	0.083	-0.084	0.251
FSD Degree (n = 17)	9	0.529	0.125	0.278	0.781	7	0.412	0.123	0.164	0.660	1 [b]	0.059	0.059	-0.060	0.177
Setting - urban (n = 26)	14	0.538	0.100	0.338	0.739	7	0.269	0.089	0.091	0.448	5	0.192	0.079	0.034	0.351
Setting - rural (n = 13)	3	0.231	0.122	-0.014	0.475	9	0.692	0.133	0.424	0.960	1 [b]	0.077	0.077	-0.078	0.232
Setting - urban cluster (n = 9)	4	0.444	0.176	0.091	0.798	5	0.556	0.176	0.202	0.909	0	-	-	-	-
Public (n = 40)	19	0.475	0.080	0.314	0.636	18	0.450	0.080	0.290	0.610	3 [a,b]	0.075	0.042	-0.010	0.160

a = significantly different than MASB $p < 0.05$; b = significantly different than Policy Company $p < 0.05$

Appendix D: School-level influences on wellness policy total comprehensiveness and total strength scores

		Total Comprehensiveness		Total Strength	
School characteristic	n	Mean %	SE	Mean %	SE
% Students eligible for free/reduced price school meals					
50-69%	33	42.11	3.36	18.43	1.76
70-100%	15	36.32	5.64	19.65	4.31
Presence of Coordinated School Health Team					
No	27	36.46	3.44	15.51	1.57
Yes	21	45.24	4.81	23.07	3.37
Completed HSAT assessment					
No	36	40.48	3.42	19.01	2.20
Yes	12	39.76	5.66	18.23	2.87
School participated in any nutrition or physical activity programming or grant					
No	26	46.71	4.07	22.36	2.83
Yes	14	36.24	5.04	16.37	2.25
Greater than 50% of students minority					
No	11	44.13	7.75	23.58	5.62
Yes	28	41.82	3.54	18.56	1.91
Size of school (# of 7th grade students)					
Small (<100)	20	39.11	4.39	19.27	2.99
Medium (100-150)	15	42.71	5.29	19.51	3.13
Large (>150)	13	39.34	6.00	17.31	3.29
Food service management company					
No	36	38.89	3.35	18.66	2.24
Yes	12	44.53	5.87	19.27	2.52
Food Service Director has a nutrition-related degree					
No	29	38.00	3.53	18.89	2.62
Yes	17	40.63	5.00	17.10	2.10
School setting					
Urban	26	42.27	4.46	20.23	2.79
Rural	13	35.74	4.25	17.31	3.05
Urban Cluster	9	41.20	6.25	16.90	2.76
School type					
Charter/Private	8	33.59	8.74	19.53	7.23
Public	40	41.64	3.02	18.67	1.65

BIBLIOGRAPHY

Action for Healthy Kids (2007). Local Wellness Policies One Year Later: Showing Improvements in School Nutrition and Physical Activity.

Action for Healthy Kids (Fall 2008). Progress or Promises? What's Working For and Against Healthy Schools. Available at: http://www.actionforhealthykids.org/pdf/Progress%20or%20Promises.pdf

Alaimo, K., C. Olson, et al. (2001). "Food insufficiency and American school-aged children's cognitive, academic, and psychosocial development." Pediatrics **108**(1): 44-53.

Allensworth, D. D. and L. J. Kolbe (1987). "The comprehensive school health program: exploring an expanded concept." J Sch Health **57**(10): 409-12.

American Dietetic Association (2006). "Position of the American Dietetic Association: Local support for nutrition integrity in schools." J Am Diet Assoc **106**(1): 122-133.

Atkinson, R. L. and S. A. Nitzke (2001). "School based programmes on obesity." BMJ **323**(7320): 1018-1019.

Baranowski, T., K. W. Cullen, et al. (1999). "Psychosocial correlates of dietary intake: Advancing dietary intervention." Annu Rev Nutr **19**: 17-40.

Baranowski, T., M. Davis, et al. (2000). "Gimme 5 fruit, juice, and vegetables for fun and health: Outcome evaluation." Health Educ Behav **27**(1): 96-111.

Barratt, R. D., N. A. Cross, et al. (2004). "School policies that promote healthy eating: A survey of foodservice directors in North Carolina public schools." The Journal of Child Nutrition & Management(1).

Bauer, K. W., Y. W. Yang, et al. (2004). ""How can we stay healthy when you're throwing all of this in front of us?" Findings from focus groups and interviews in middle schools on environmental influences on nutrition and physical activity." Health education & behavior **31**(1): 34-46.

Belansky, E. S., N. Cutforth, et al. (2009). "Early impact of the federally mandated local wellness policy on school nutrition environments appears modest in Colorado's rural, low-income elementary schools." In submission.

Belansky, E. S., N. Cutforth, et al. (2009). "Early impact of the federally mandated local wellness policy on physical activity in rural, low-income elementary schools in Colorado." J Public Health Pol **30**(S1): S141-S160.

Berenson, G. S., S. R. Srinivasan, et al. (1998). "Atherosclerosis: A nutritional disease of childhood." Am J Cardiol **82**(10B): 22T-29T.

Briefel, R. R., M. K. Crepinsek, et al. (2009). "School food environments and practices affect dietary behaviors of US public school children." J Am Diet Assoc **109**(2 Suppl): S91-107.

Briefel, R. R. and C. L. Johnson (2004). "Secular trends in dietary intake in the United States." Annu Rev Nutr **24**: 401-431.

Briefel, R. R., A. Wilson, et al. (2009). "Consumption of low-nutrient, energy-dense foods and beverages at school, home, and other locations among school lunch participants and nonparticipants." J Am Diet Assoc **109**(2 Suppl): S79-90.

Brown, K. M., T. H. Akintobi, et al. (2004). "California school board members' perceptions of factors influencing school nutrition policy." J Sch Health **74**(2): 52-8.

Brownell, K. D., R. Kersh, et al. (2010). "Personal responsibility and obesity: a constructive approach to a controversial issue." Health Affairs **29**(3): 379-387.

Bush, G. W. (2001). No Child Left Behind. Washington, DC: Office of the President.

Cassady, D., R. Vogt, et al. (2006). "The power of policy: A case study of healthy eating among children." Am J Public Health **96**(9): 1570-1571.

Centers for Disease Control and Prevention (2009). Coordinated School Health Program. Available at: http://www.cdc.gov/HealthyYouth/CSHP/.

Centers for Disease Control and Prevention. (2005). Youth Risk Behavior Survey, Available at: www.cdc.gov/yrbss.

Chang, V. W. and D. S. Lauderdale (2005). "Income disparities in body mass index and obesity in the United States, 1971-2002." Arch Intern Med **165**(18): 2122-2128.

Chapman, G. and H. Maclean (1993). ""Junk Food" and "Healthy Food": Meanings of food in adolescent women's culture." J Nutr Educ **25**(3): 108-113.

Cho, H. and M. Z. Nadow (2004). "Understanding barriers to implementing quality lunch and nutrition education." Journal of Community Health **29**(5): 421-435.

Clark, M. A. and M. K. Fox (2009). "Nutritional quality of the diets of US public school children and the role of the school meal programs." J Am Diet Assoc **109**(2 Suppl): S44-56.

Contento, I., G. Balch, et al. (1995). "The effectiveness of nutrition education and implications for nutrition education policy, programs, and research: A review of research." J Nutr Educ **26**(6): 284-418.

Croll, J., D. Neumark-Sztainer, et al. (2001). "Healthy eating: What does it mean to adolescents?" J Nutr Educ **33**(4): 193-198.

Cullen, K. W., T. Baranowski, et al. (2000). "Social-environmental influences on children's diets: Results from focus groups with African-, Euro- and Mexican-American children and their parents." Health Educ. Res. **15**(5): 581-590.

Cullen, K. W., J. Eagan, et al. (2000). "Effect of a la carte and snack bar foods at school on children's lunchtime intake of fruits and vegetables." J Am Diet Assoc **100**(12): 1482-1486.

Cullen, K. W., K. Watson, et al. (2008). "Relative Reliability and Validity of the Block Kids Questionnaire among Youth Aged 10 to 17 Years." J Am Diet Assoc **108**(5): 862-866.

Cullen, K. W., K. Watson, et al. (2006). "Exploring changes in middle-school student lunch consumption after local school food service policy modifications." Public Health Nutr **9**(6): 814-820.

Cullen, K. W. and I. Zakeri (2004). "Fruits, vegetables, milk, and sweetened beverages consumption and access to a la carte/snack bar meals at school." Am J Public Health **94**(3): 463-467.

Davis, S. M., T. Clay, et al. (1999). "Pathways curriculum and family interventions to promote healthful eating and physical activity in American Indian schoolchildren." Prev Med **37**(Supplement 1): S24-S34.

DHHS (2004). Child Health. Rockville, MI, U.S. DHHS.

Dinour, L. M., D. Bergen, et al. (2007). "The food insecurity-obesity paradox: A review of the literature and the role food stamps may play." J Am Diet Assoc **107**(11): 1952-1961.

Economos, C. (2008). Plenary Session - Community Interventions: Shape Up Somerville. Healthy Foods, Health Moves: Delivering the Childhood Obesity Prevention Message in Schools and Communities. Chicago, IL.

Edmundson, E., G. Parcel, et al. (1996). "The effect of the child and adolescent trial for cardiovascular health upon psychosocial determinants of diet and physical activity behavior." Prev Med **25**: 442-454.

Engels, H. J., R. J. Gretebeck, et al. (2005). "Promoting healthful diets and exercise: efficacy of a 12-week after-school program in urban African Americans." J Am Diet Assoc **105**(3): 455-459.

Ervin, R. B., J. D. Wright, et al. (2004). "Dietary intake of fats and fatty acids for the United States population: 1999-2000." Adv Data(348): 1-6.

Ervin, R. B., J. D. Wright, et al. (2004). "Dietary intake of selected vitamins for the United States population: 1999-2000." Adv Data(339): 1-4.

Fanjiang, G. and R. E. Kleinman (2007). "Nutrition and performance in children." Curr Opin Clin Nutr **10**(3): 342-7.

Figlio, D. and J. Winicki (2005). "Food for thought: the effects of school accountability plans on school nutrition." Journal of Public Economics **89**(2-3): 381-394.

Finkelstein, D. M., E. L. Hill, et al. (2008). "School food environments and policies in US public schools." Pediatrics **122**(1): e251-259.

Food and Nutrition Service U.S. Department of Agriculture, Centers for Disease Control and Prevention, et al. (January 2005). FNS-374, Making it Happen! School Nutrition Success Stories. Alexandria, VA.

Fox, M. K. and N. Cole (2004). Nutrition and Health Characteristics of Low-Income Populations. Volume 3, School-Age Children, United States Department of Agriculture, Economic Research Service.

Fox, M. K., P. Crepinsek, et al. (2001). School Nutrition Dietary Assessment Study-II: Summary of Findings. Alexandria, VA, US Department of Agriculture, Food and Nutrition Service, Office of Analysis, Nutrition and Evaluation.

Fox, M. K., A. H. Dodd, et al. (2009). "Association between school food environment and practices and body mass index of US public school children." J Am Diet Assoc **109**(2 Suppl): S108-117.

Fox, M. K., A. Gordon, et al. (2009). "Availability and consumption of competitive foods in US public schools." J Am Diet Assoc **109**(2 Suppl): S57-66.

French, S., R. Jeffery, et al. (2001). "Pricing and promotion effects on low-fat vending snack purchases:The CHIPS Study." Am J Public Health **91**(1): 112-117.

French, S. A., M. Story, et al. (2002). "School food policies and practices: A state-wide survey of secondary school principals." J Am Diet Assoc **102**(12): 1785-1789.

French, S. A., M. Story, et al. (2003). "Food environment in secondary schools: A la carte, vending machines, and food policies and practices." Am J Public Health **93**(7): 1161-1167.

French, S. A., M. Story, et al. (2004). "An environmental intervention to promote lower-fat food choices in secondary schools: Outcomes of the TACOS Study." Am J Public Health **94**(9): 1507-1512.

French, S. A., M. Story, et al. (1997). "Pricing strategy to promote fruit and vegetable purchase in high school cafeterias." J Am Diet Assoc **97**(9): 1008-1010.

Friedman, R. R. (2009). School wellness policies: a policy brief, Rudd Center For Food Policy & Obesity, Yale University, New Haven, CT.

Fu, M.-L., L. Cheng, et al. (2007). "Association between unhealthful eating patterns and unfavorable overall school performance in children." J Am Diet Assoc **107**(11): 1935-1943.

Fulkerson, J. A., S. A. French, et al. (2004). "Promotions to increase lower-fat food choices among students in secondary schools: Description and outcomes of TACOS (Trying Alternative Cafeteria Options in Schools)." Public Health Nutr **7**(5): 665-674.

Gemmill, E. and N. Cotugna (2005). "Vending machine policies and practices in Delaware." The Journal of school nursing : the official publication of the National Association of School Nurses **21**(2): 94-99.

Gleason, P. M. and A. H. Dodd (2009). "School breakfast program but not school lunch program participation is associated with lower body mass index." J Am Diet Assoc **109**(2 Suppl): S118-128.

Gortmaker, S. L., L. W. Y. Cheung, et al. (1999). "Impact of a school-based interdisciplinary intervention on diet and physical activity among urban primary school children: Eat well and keep moving." Arch Pediatr Adolesc Med **153**(9): 975-983.

Greenberg, J., R. Cottrell, et al. (2001). "Baseline data on coordinated school health programs in the state of Ohio." American Journal of Health Studies **17**(1): 1-6.

Greves, H. M. and F. Rivara (2006). "Report card on school snack food policies among the United States' largest school districts in 2004-2005: Room for improvement." International Journal of Behavioral Nutrition and Physical Activity **3**(1): 1.

Harnack, L., M. P. Snyder, et al. (2000). "Availability of A La Carte Food Items in Junior and Senior High Schools: A Needs Assessment." Journal of the American Dietetic Association **100**(6): 701-703.

Harnack, L., P. Snyder, et al. (2000). "Availability of a la carte food items in junior and senior high schools: A needs assessment." J Am Diet Assoc **100**(6): 701-703.

Harrell, J. S., S. A. Gansky, et al. (1998). "School-based interventions improve heart health in children with multiple cardiovascular disease risk factors." Pediatrics **102**(2 Pt 1): 371-380.

Heaney, R. P., S. Abrams, et al. (2000). "Peak bone mass." Osteoporos Int **11**(12): 985-1009.

Institute of Medicine (2006). Dietary Reference Intakes: The Essential Guide to Nutrient Requirements Washington, D.C, National Academies Press.

Institute of Medicine (2007). Nutrition Standards for Foods in Schools: Leading the Way Toward Healthier Youth. Washington, DC, The National Academies Press.

Jago, R., J. S. Harrell, et al. (2006). "Prevalence of abnormal lipid and blood pressure values among an ethnically diverse population of eighth-grade adolescents and screening implications." Pediatrics **117**(6): 2065-2073.

James, J., P. Thomas, et al. (2004). "Preventing childhood obesity by reducing consumption of carbonated drinks: cluster randomised controlled trial." BMJ **328**(7450): 1237.

Johnson, E. J. and D. Goldstein (2003). "Medicine: do defaults save lives?" Science **302**(5649): 1338-1339.

Joint FAO/WHO expert consultation on diet, n. a. t. p. o. c. d. (2003). "Diet, nutrition, and the prevention of chronic diseases." World Health Organ Tech Rep Ser **916**: 58-63.

Kant, A. K. (2003). "Reported consumption of low-nutrient-density foods by American children and adolescents: Nutritional and health correlates, NHANES III, 1988 to 1994." Arch Pediatr Adolesc Med **157**(8): 789-796.

Kelder, S. H., C. L. Perry, et al. (1995). "Community-wide youth nutrition education: Long-term outcomes of the Minnesota Heart Health Program." Health Educ. Res. **10**(2): 119-131.

Kristal, A. R., U. Peters, et al. (2005). "Is it time to abandon the food frequency questionnaire?" Cancer Epidemiol Biomarkers Prev **14**(12): 2826-2828.

Kristal, A. R. and J. D. Potter (2006). "Not the time to abandon the food frequency questionnaire: counterpoint." Cancer Epidemiol Biomarkers Prev **15**(10): 1759-1760.

Kubik, M. Y., L. A. Lytle, et al. (2009). "Food use in middle and high school fundraising: does policy support healthful practice? Results from a survey of Minnesota school principals." J Am Diet Assoc **109**(7): 1215-1219.

Kubik, M. Y., L. A. Lytle, et al. (2003). "The association of the school food environment with dietary behaviors of young adolescents." Am J Public Health **93**(7): 1168-1173.

Larson, N. and M. Story (2010). "Are 'competitive foods' sold at school making our children fat?" Health Affairs **29**(3): 430-435.

Lingstrom, P., A. K. Holm, et al. (2003). "Dietary factors in the prevention of dental caries: A systematic review." Acta Odontol Scand **61**(6): 331-340.

Longley, C. H. and J. Sneed (2009). "Effects of federal legislation on wellness policy formation in school districts in the United States." J Am Diet Assoc **109**(1): 95-101.

Luepker, R. V., C. L. Perry, et al. (1996). "Outcomes of a field trial to improve children's dietary patterns and physical activity. The Child and Adolescent Trial for Cardiovascular Health. CATCH collaborative group." JAMA **275**(10): 768-776.

Lytle, L. A. and J. A. Fulkerson (2002). "Assessing the dietary environment: Examples from school-based nutrition interventions." Public Health Nutr **5**(6A): 893-899.

Lytle, L. A., M. Y. Kubik, et al. (2006). "Influencing healthful food choices in school and home environments: Results from the TEENS study." Prev Med **43**(1): 8-13.

Lytle, L. A., D. M. Murray, et al. (2004). "School-based approaches to affect adolescents' diets: Results from the TEENS study." Health Educ Behav **31**(2): 270-287.

Lytle, L. A., E. J. Stone, et al. (1996). "Changes in nutrient intakes of elementary school children following a school-based intervention: Results from the CATCH Study." Prev Med **25**(4): 465-477.

Manios, Y., J. Moschandreas, et al. (1999). "Evaluation of a health and nutrition education program in primary school children of crete over a three-year period." Prev Med **28**(2): 149-159.

McDonnell, E., C. Probart, et al. (2006). "School competitive food policies: Perceptions of Pennsylvania public high school foodservice directors and principals." J Am Diet Assoc **106**(2): 271-276.

McGraw, S. A., D. Sellers, et al. (2000). "Measuring implementation of school programs and policies to promote healthy eating and physical activity among youth." Preventative Medicine **31**(2): S86-S97.

Metos, J. and M. S. Nanney (2007). "The strength of school wellness policies: One state's experience." J School Health **77**(7): 367-372.

Meyer, M. K., M. T. Conklin, et al. (2001). "Barriers to healthy nutrition environments in public school middle grades." Journal of Child Nutrition and Management **25**(2): 66-71.

Michigan Action for Healthy Kids (Fall 2007). Local Wellness Policy Implementation: Strategies and Successes in Michigan, Michigan Department of Education.

Michigan Department of Education (October 2007). Local Wellness Policy Implementation Grant Data Report: Status of Local Wellness Policy Adoption and Implementation among Michigan Local Education Agencies.

Michigan Department of Education, Michigan Department of Community Health, et al. (2001). The Role of Michigan Schools in Promoting Healthy Weight.

Moag-Stahlberg, A., N. Howley, et al. (2008). "A national snapshot of local school wellness policies." J School Health **78**(10): 562-570.

Moreno, N. P., J. P. Denk, et al. (2004). "An approach to improving science knowledge about energy balance and nutrition among elementary- and middle-school students." Cell Biol Educ **3**(2): 122-130.

Moshfegh, A., J. D. Goldman, et al. (2005). What we eat in America, NHANES 2001-2002: Usual nutrient intakes from food compared to Dietary Reference Intakes U.S. Department of Agriculture, Agricultural Research Service.

Murphy, J., C. Wehler, et al. (1998). "Relationship between hunger and psychosocial functioning in low-income American children." J Am Acad Child Adolesc Psychiatry **37**(2): 163-170.

Murphy, J. M., M. E. Pagano, et al. (1998). "The relationship of school breakfast to psychosocial and academic functioning: cross-sectional and longitudinal observations in an inner-city school sample." Arch Pediat Adol Med **152**(9): 899-907.

Murray, N. G., B. J. Low, et al. (2007). "Coordinated school health programs and academic achievement: a systematic review of the literature." J Sch Health **77**(9): 589-600.

Nader, P. R., E. J. Stone, et al. (1999). "Three-year maintenance of improved diet and physical activity: The CATCH cohort." Arch Pediat Adol Med **153**(7): 695-704.

Neumark-Sztainer, D., M. Story, et al. (1999). "Factors influencing food choices of adolescents: Findings from focus-group discussions with adolescents." J Am Diet Assoc **99**(8): 929-37.

Neumark-Sztainer, D., M. Story, et al. (1996). "Correlates of inadequate fruit and vegetable consumption among adolescents." Prev Med **25**(5): 497-505.

O'Dea, J. A. (2003). "Why do kids eat healthful food? Perceived benefits of and barriers to healthful eating and physical activity among children and adolescents." J Am Diet Assoc **103**(4): 497-501.

O'Toole, T. P., S. Anderson, et al. (2007). "Nutrition services and foods and beverages available at school: Results from the school health policies and programs study 2006." J Sch Health **77**(8): 500-521.

Ogden, C. L., M. D. Carroll, et al. (2006). "Prevalence of overweight and obesity in the United States, 1999-2004." JAMA **295**(13): 1549-1555.

Ogden, C. L., K. M. Flegal, et al. (2002). "Prevalence and trends in overweight among US children and adolescents, 1999-2000." JAMA **288**(14): 1728-1732.

Osganian, S. K., M. K. Ebzery, et al. (1996). "Changes in the nutrient content of school lunches: Results from the CATCH eat smart food service intervention." Prev Med **25**(4): 400-412.

Parcel, G., B. Simons-Morton, et al. (1989). "School promotion of healthful diet and physical activity: impact on learning outcomes and self-reported behavior." Health Educ Q **16**: 181-99.

Perry, C. L., D. B. Bishop, et al. (2004). "A randomized school trial of environmental strategies to encourage fruit and vegetable consumption among children." Health Educ Behav **31**(1): 65-76.

Perry, C. L., L. A. Lytle, et al. (1998). "Effects of the Child and Adolescent Trial for Cardiovascular Health (CATCH) on fruit and vegetable intake." Journal of Nutrition Education **30**(6): 354-360.

Pliner, P. (1982). "The effects of mere exposure on liking for edible substances." Appetite **3**: 283-90.

Pollitt, E. (1997). "Iron deficiency and educational deficiency." Nutr Rev **55**(4): 133-141.

Prentice, A., I. Schoenmakers, et al. (2006). "Nutrition and bone growth and development." Proc Nutr Soc **65**(4): 348-360.

Probart, C., E. McDonnell, et al. (2008). "Statewide assessment of local wellness policies in Pennsylvania public school districts." J Am Diet Assoc **108**(9): 1497-1502.

Prochaska, J. O., C. A. Redding, et al. (2002). The transtheoretical model and stages of change. Health Behavior and Health Education. K. Glanz, B. K. Rimer and F. Lewis, Jossey-Bass: 99-120.

Rosas, S., J. Case, et al. (2009). "A retrospective examination of the relationship between implementation quality of the coordinated school health program model and school-level academic indicators over time." J Sch Health **79**(3): 108-115.

Sallis, J. F., T. L. McKenzie, et al. (2003). "Environmental interventions for eating and physical activity: A randomized controlled trial in middle schools." Am J Prev Med **24**(3): 209-217.

Sallis, J. F. and N. Owen (2002). Ecological models of health behavior. Health Behavior and Health Education: Theory, Research and Practice. K. Glanz, B. K. Rimer and F. M. Lewis. San Francisco, CA, Josssey-Bass.

School Nutrition Association (2006). A Foundation for the Future II: Analysis of Local Wellness Policies from 140 School Districts in 49 States.

Schwartz, M. B., A. E. Lund, et al. (2009). "A comprehensive coding system to measure the quality of school wellness policies." J Am Diet Assoc **109**(7): 1256-1262.

Scientific Software International (2009). HLM 6.08. Lincolnwood, IL.

Section 204 of Public Law 108-265 (June 3, 2004). Child Nutrition and WIC Reauthorization Act of 2004; www.usda.gov/tn/Healthy/108-265.

Shahid, B. (2003). "A study of school principals and the promotion of nutritional health in middle grade schools." Education **123**(3): 552-563, 569.

Simons-Morton, B. G., G. S. Parcel, et al. (1991). "Promoting physical activity and a healthful diet among children: Results of a school-based intervention study." Am J Public Health **81**(8): 986-991.

Slusser, W. M., W. G. Cumberland, et al. (2007). "A school salad bar increases frequency of fruit and vegetable consumption among children living in low-income households." Public Health Nutr **10**(12): 1490-6.

Smith, C. and S. Fila (2006). "Comparison of the Kid's Block Food Frequency Questionnaire to the 24-hour recall in urban Native American youth." American Journal of Human Biology **18**(5): 706-709.

Sorof, J. M., D. Lai, et al. (2004). "Overweight, ethnicity, and the prevalence of hypertension in school-aged children." Pediatrics **113**(3 Pt 1): 475-482.

Stevenson, J. (2006). "Dietary influences on cognitive development and behaviour in children." P Nutr Soc **65**(04): 361-365.

Story, M. (1999). "School-based approaches for preventing and treating obesity." International Journal of Obesity **23**(Suppl 2): S43-S51.

U.S. Department of Agriculture, Food and Nutrition Service, et al. (2007). *School Nutrition Dietary Assessment Study-III, Vol. II: Student Participation and Dietary Intakes,* by Anne Gordon, et al. Project Officer: Patricia McKinney. Alexandria, VA.

U.S. Department of Health and Human Services (2000). Healthy People 2010. 2nd ed. With Understanding and Improving Health and Objectives for Improving Health. 2 vols. Washington, DC, U.S. Government Printing Office.

U.S. Department of Health and Human Services and U.S. Department of Agriculture (2004). Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2005. A Report to the Secretary of Health and Human Services and the Secretary of Agriculture. [Online]. Available: http://www.health.gov/dietaryguidelines/dga2005/report/ [accessed May 30, 2009].

U.S. Government Accountability Office (2005). School Meal Programs: Competitive Foods Are Widely Available and Generate Substantial Revenues for Schools.

Wang, Y. and Q. Zhang (2006). "Are American children and adolescents of low socioeconomic status at increased risk of obesity? Changes in the association between overweight and family income between 1971 and 2002." Am J Clin Nutr **84**(4): 707-716.

Wardle, J., M.-L. Herrera, et al. (2003). "Modifying children's food preferences: the effects of exposure and reward on acceptance of an unfamiliar vegetable." European Journal of Clinical Nutrition **57**(2): 341-348.

Weaver, C. M. (2000). "The growing years and prevention of osteoporosis in later life." Proc Nutr Soc **59**(2): 303-306.

Webber, L. S., S. K. Osganian, et al. (1996). "Cardiovascular risk factors among children after a 2 1/2-year intervention-the CATCH study." Prev Med **25**(4): 432-441.

Wharton, C. M., M. Long, et al. (2008). "Changing nutrition standards in schools: the emerging impact on school revenue." J Sch Health **78**(5): 245-251.

Wiecha, J. L., D. Finkelstein, et al. (2006). "School vending machine use and fast-food restaurant use are associated with sugar-sweetened beverage intake in youth." J Am Diet Assoc **106**(10): 1624-1630.

Wildey, M. B., S. Z. Pampalone, et al. (2000). "Fat and sugar levels are high in snacks purchased from student stores in middle schools." J Am Diet Assoc **100**(3): 319-322.

Willett, W. (1998). Nutritional Epidemiology, 2nd ed. New York, NY, Oxford University Press.

Willett, W. and F. B. Hu (2006). "Not the time to abandon the food frequency questionnaire: point." Cancer Epidemiol Biomarkers Prev **15**(10): 1757-8.

Winnail, S. D. and R. T. Bartee (2002). "How can primary concerns of school district superintendents guide school health efforts?" J Sch Health **72**(10): 408-412.

Wojcicki, J. M. and M. B. Heyman (2006). "Healthier choices and increased participation in a middle school lunch program: Effects of nutrition policy changes in San Francisco." Am J Public Health **96**(9): 1542-1547.

Wright, J. D., C. Y. Wang, et al. (2003). "Dietary intake of ten key nutrients for public health, United States: 1999-2000." Adv Data(334): 1-4.