

University of Massachusetts Boston

ScholarWorks at UMass Boston

Graduate Doctoral Dissertations

Doctoral Dissertations and Masters Theses

12-1-2012

The Associations of the Level of School Wellness Policy Implementation and School Nurse Activities to Weight Status of School Children in Massachusetts

Mary Jane F. O'Brien

University of Massachusetts Boston

Follow this and additional works at: https://scholarworks.umb.edu/doctoral_dissertations



Part of the [Nursing Commons](#)

Recommended Citation

O'Brien, Mary Jane F., "The Associations of the Level of School Wellness Policy Implementation and School Nurse Activities to Weight Status of School Children in Massachusetts" (2012). *Graduate Doctoral Dissertations*. 92.

https://scholarworks.umb.edu/doctoral_dissertations/92

This Open Access Dissertation is brought to you for free and open access by the Doctoral Dissertations and Masters Theses at ScholarWorks at UMass Boston. It has been accepted for inclusion in Graduate Doctoral Dissertations by an authorized administrator of ScholarWorks at UMass Boston. For more information, please contact scholarworks@umb.edu.

THE ASSOCIATIONS OF THE LEVEL OF SCHOOL WELLNESS POLICY
IMPLEMENTATION AND SCHOOL NURSE ACTIVITIES TO WEIGHT STATUS
OF SCHOOL CHILDREN IN MASSACHUSETTS

A Dissertation Presented

by

MARY JANE F. O'BRIEN

Submitted to the Offices of Graduate Studies,
University of Massachusetts Boston,
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

December 2012

College of Nursing and Health Science

© 2012 by Mary Jane F. O'Brien
All right reserved

THE ASSOCIATION BETWEEN THE LEVEL OF SCHOOL WELLNESS POLICY
IMPLEMENTATION, SCHOOL NURSE ACTIVITIES, AND WEIGHT STATUS OF
SCHOOL CHILDREN IN MASSACHUSETTS

A Dissertation Presented

by

MARY JANE F. O'BRIEN

Approved as to style and content by:

Laura Hayman, PhD, RN, FAAN, FAHA
Chairperson of Committee

Jacqueline Fawcett, PhD, RN, FAAN, Professor
Member and Chair, Department of Nursing

Ling Shi, PhD, Assistant Professor
Member

Jean Wiecha, PhD, Associate Professor
Member

Laura Hayman, PhD, RN, FAAN, FAHA
PhD Program Director

Jacqueline Fawcett, PhD, RN, FAAN
Chairperson of Nursing Department

ABSTRACT

THE ASSOCIATIONS OF THE LEVEL OF SCHOOL WELLNESS POLICY IMPLEMENTATION AND SCHOOL NURSE ACTIVITIES TO WEIGHT STATUS OF SCHOOL CHILDREN IN MASSACHUSETTS

December 2012

Mary Jane F. O'Brien, B.S., Boston University
M.S., Boston University
Ph.D., University of Massachusetts Boston

Directed by Professor Laura L. Hayman PhD, RN, FAAN, FAHA
Chairperson of Committee, PhD Program Director

The increase in prevalence of childhood obesity has prompted child health authorities to propose mandates focusing on population health efforts that may be implemented in public schools. In 2010, the federal government passed the Healthy, Hunger-Free Kids Act, reinforcing the 2004 regulations to guide school districts in development and implementation of school wellness policies.

The purpose of this secondary data analysis was an examination of the association between implementation of the school wellness policy and school nurse activities to the absolute change in percent of students with body mass index in the obese weight category

between the school years 2005-2006 and 2008-2009. The methodological approach used correlational and ordinary least squares regression analyses. The Conceptual Model of Nursing and Health Policy guided this study. The data sources were the Massachusetts Departments of Public Health and Elementary and Secondary Education.

Results indicated that school nurse activities were significantly associated with the absolute change in percent of students with body mass index in the obese weight category between the 2005-2006 and 2008-2009 school years. After adjusting for demographic variables, for every point increase in school nurse activities there was 0.16% ($p < .05$) absolute change in percent obese, indicating a reduction in the percent of students in the obese weight category. The upper fourth quartile school nurse activities was associated with a nearly 3% ($p < .05$) absolute change in percent of students with body mass index in the obese weight category when compared to the first quartile.

The level of implementation of the school wellness policy was not significantly associated with the absolute change in percent of students in the obese weight category during the study years. School nurse ratio and promotional climate for implementation of the school wellness policy were not significantly associated with change in the level of implementation of the school wellness policy or school nurse activities.

Childhood obesity is a public health problem that requires a multifactorial approach in treatment. The implications for research are to define, identify and investigate school nurse practices that may be associated with school policy implementation and reduction in childhood obesity.

ACKNOWLEDGEMENTS

Thank you to my committee which was a constant source of inspiration: my chairperson, Dr. Laura L. Hayman, was an unceasing voice of encouragement and motivation throughout the journey; Dr. Jacqueline Fawcett closed each detailed critique with the incentive, “Onward!”; Dr. Ling Shi patiently and methodically guided my analysis of the data; and Dr. Jean Wiecha was unbiased in monitoring my examination of school policy. Many faculty members have helped me along the way, and I particularly thank Dr. Jane Clouterbuck and Dr. Jerry Cromwell. I also acknowledge the Department of Public Health School Health Unit, and specifically its director, Anne Sheetz.

I am grateful for the loving support of my husband, who knows that without his endless help I would not have undertaken nor completed this endeavor; my son, who, in his unique way, has modeled for me the meaning of perseverance in the face of overwhelming challenges; my mother, whose passion conveyed the importance of women’s education; my father who taught me the love of learning for learning’s sake; my siblings and my aunt who have been a constant source of solace; my in-laws, many friends and colleagues who are ever supportive. When I’ve needed it, there has been a place to relax at Reynolds’, a ready “ear” from Lynne, a call from Terri, a card from Margie, dinner with Deb and Trish, or an email from Joe-Ann pushing me to take the next step and pulling me with her to finish the task. There are too many to name, but my network of support allowed me to succeed, and I bid each of them a heartfelt thank you.

This work is dedicated to school nurses who model efficiency with limited resources, steadfastly working within a hidden source of healthcare to improve children's health. Onward!

TABLE OF CONTENTS

ABSTRACT	v
ACKNOWLEDGMENTS	vii
CHAPTER	Page
1. INTRODUCTION	1
Study Aims and Hypotheses	7
Conceptual Model	10
2. REVIEW OF THE LITERATURE	15
Introduction	15
Childhood Obesity	16
Body Mass Index	19
School Health Services	21
School Nurse Activities	25
School Wellness Policy.....	29
School Promotional Climate for Implementation for the SWP	38
Summary	39
3. METHODS	42
Data Sources	42
Sample.....	43
Instrumentation	45
Methods of Measurement of Major Study Variables.....	48
Statistical Analysis	60
Institutional Review Board	66
4. RESULTS	67
Descriptive Analysis	67
Correlation Matrix	70
Regression Models.....	73
Summary of Findings.....	82
5. DISCUSSION	85
Aim 1	87
Aim 2	93
Aim 3	93
Conclusion	94
Limitations	96
Implications	99

APPENDIX

A. ESSENTIAL SCHOOL HEALTH SERVICES ANNUAL QUESTIONNAIRE	101
B. INSTITUTIONAL REVIEW BOARD APPROVAL	105
REFERENCE LIST	106

LIST OF FIGURES

Figure	Page
1. Conceptual Model of Nursing and Health Policy - Level 2	14
2. Essential School Health Services Annual Questionnaire	101

LIST OF TABLES

Table	Page
1. Comparison of ESHS school districts and MA public schools by race and ethnicity 2008-2009	43
2. Characteristics of ESHS School Districts and Massachusetts state public schools by language and income 2008-2009	44
3. Study variables definitions and characteristics	45
4. Components of the school nurse activities variable.....	52
5. Components of the level of implementation variable	55
6. Components of the school district promotional climate for implementation of SWP variable	57
7. Descriptive statistics for major study variables	69
8. Intercorrelation among study variables	71
9. Stepwise regression models: absolute change in percent obese between 2005 and 2008 on continuous level of implementation.....	74
10. Stepwise regression models: absolute change in percent obese between 2005 and 2008 on categorical variable of level of implementation	75
11. Stepwise regression models: absolute change in percent obese between 2005 and 2008 on continuous school nurse activities	77
12. Stepwise regression models: absolute change in percent obese between 2005 and 2008 on categorical variables of school nurse activities	79
13. Stepwise regression models: level of implementation on climate and school nurse ratio 2008-2009	80
14. Stepwise regression models: school nurse activities on school nurse ratio and promotional climate for implementation of the School Wellness Policy.....	81

CHAPTER 1

INTRODUCTION

Nearly one third of children and youth in the United States (US) are categorized as overweight or obese (Ogdon, Carrol, & Flegal, 2008; Wallinga, 2010), with rates approaching 50% among publicly insured ethnic minority children who live in low socioeconomic environments (Bethell, Simpson, Stumbo, Carle, & Gombojav, 2010; Foster, Sherman, Borradaile, Grundy, Vander Veur, Nachmani, et al., 2008; Kaufman, Hirst, Linder, Baranowski, Cooper, Foster, et al., 2009). Obesity in childhood is associated with increased risk of obesity in adulthood and accompanying cardiovascular disease, type 2 diabetes, orthopedic conditions, sleep issues, and other social, psychological, and physical problems (Deitz, 1998; Fitzgibbon, Hayman & Haire-Joshu, 2008; Robert Wood Johnson Foundation [RWJF], 2009). Childhood obesity is a major public health problem because of its chronicity, economic effect on society, and its costly yet frequently ineffective treatment (Tschannen-Moran, Lewis, & Farrell, 2003; Wallinga, 2010).

The increase in the prevalence of childhood obesity has led child health authorities to pursue policy interventions that will mitigate and prevent the problem

(Barlow & the Expert Committee of the American Academy of Pediatrics [AAP], 2007; Centers for Disease Control and Prevention [CDC], 2008; Institute of Medicine [IOM], 2004). Researchers in the treatment of childhood obesity reported improved outcomes when management was multifactorial (Fitzgibbon, 2008); thus, policy makers are concomitantly enacting strategies to deal with the underlying environmental, agricultural, and inequality issues, as minority and low-socioeconomic-status groups have disproportionately higher rates of obesity at all ages (Bethell, 2010; Kimbro & Rigby, 2010; Singh, Siahpush, & Kogan, 2010a; Wallinga, 2010; Wang & Beydoun, 2007). Many health and policy experts have proposed mandates to address the problem by focusing on preventive and population health efforts that may be implemented in public schools (Barlow, 2007; Brownell, Schwartz, Puhl, Henderson, & Harris, 2009; Fitzgibbon, 2008; Foster, 2009; Frieden, Dietz, & Collins, 2010; Kumanyika, Obarzanek, Stettler, Bell, Field, Fortmann, et al., 2008; Story, Nannery, & Schwartz, 2009).

In 2004, the federal government attempted to deal with childhood obesity through school interventions with the enactment of section 204 of the reauthorization of the Richard B. Russell National School Lunch Act (NSLA) and the Child Nutrition Act of 1966. Section 204 of the NSLA authorized an unfunded mandate that required every school district receiving funds from the NSLA for meal programs to develop and implement a school wellness policy (SWP) that promoted school environments fostering healthy eating and lifestyle behaviors by the 2006-2007 school year (US Public Law 108-265, Child Nutrition and WIC Reauthorization Act of 2004). The guidelines for implementation of the SWP encouraged school districts to increase students' access to

healthier food choices, provide a school environment that supported the SWP, promote school activities that advance the healthy lifestyle of students, and identify a SWP coordinator.

In December 2010, the federal government replaced the NSLA and passed The Healthy, Hunger-Free Kids Act (HHFKA) in an attempt to deal with the twin problems of childhood obesity and poverty. As part of the process of implementation of the HHFKA by the 2012-2013 school year, new regulations must be written to guide school districts in the development of SWPs. Until the new mandates are written and disseminated for public comment, the required SWPs continue to be guided by the previous legislation (US Public Law 111-296, HHFKA of 2010).

A coordinator for the implementation of the SWP is mandated by both the 2004 and the 2010 legislations (US Public Law 108-265, 2004; US Public Law 111-296, 2010). The coordinator may be employed at the district or school level, or that role may be incorporated into an existing role, including that of the school nurse (Probart, McDonnell, Jomaa, & Fekete, 2010).

Every school district in the nation has been required by 2004 NSLA legislation to develop and implement SWPs; however, researchers reported that there were different levels of implementation across states and within school districts, likely the result of lack of funding and coordination (Li & Hooker, 2010; Probart, 2010). In a recent RWJF study (2010a), one of the most comprehensive studies of health-related school policies and practices in the US to date, many schools and/or districts had variation in levels of

implementation of the SWP, had not established plans for evaluating the implementation of the SWP, nor did they have an ongoing health or wellness advisory council to assist the SWP coordinator with implementation of the SWP, all required in the 2004 NSLA (US Public Law 108-265, 2004).

The RWJF report additionally suggested that the performance of the coordinator in execution of the SWP may be affected when it was an additional responsibility of an existing role, for example the school nurse, rather than a specific position, influencing the level of implementation of the policy (RWJF, 2010a). Other school level factors such as teachers' beliefs and attitudes, administrators' support, and characteristics of school climate influence the implementation of school policies (Beets, Flay, Vuchinich, Acock, Li, & Allred, 2008).

In an effort to manage childhood obesity, the CDC (2007) had recommended that measurement of each student's body mass index (BMI) be conducted yearly in schools to provide screening to individuals and surveillance of childhood obesity within the US population, and further recommended that each school have a coordinator, similar to the SWP coordinator, for oversight of its comprehensive school health program (CSHP) promoting child wellness. The US Preventive Services Task Force of the Department of Health and Human Services' Agency for Healthcare Research and Quality (2010) recommended screening for obesity in children and adolescents and referring children with BMI in the overweight and obese categories for treatment to improve their weight status. Dietz, Story, and Leviton (2009) observed that much may be learned from school

programs that address childhood obesity in which the school nurse was involved in BMI screening and referrals.

School nurses are in the forefront to address this health issue through their role in prevention and systems level interventions by promoting the SWP, screening the BMI of students, and providing surveillance of the prevalence of childhood overweight and obesity. In 2002, the National Association of School Nurses (NASN) defined the complex role of the school nurse within the context of the community as one that enhances the student's well-being and successful learning; the definition also included a component of leadership in establishing and evaluating school health policies (NASN, 2002). The development and evaluation of SWPs as components of the school nurse role are described in the 2008 position statement issued by the American Academy of Pediatrics (AAP) on the role of the school nurse (AAP, 2008). School nurses are uniquely positioned to develop, implement and evaluate SWPs, and often the role of the wellness policy coordinator falls to the school nurse.

In Massachusetts (MA), school nurses were mandated by the Department of Public Health (DPH) to screen the BMI of students in grades 1, 4, 7, and 10 and refer those students who measure outside the healthy weight category to their primary care providers (PCPs) in 2009-2010. In addition, MA school nurse leaders from many of the school districts that participated in the Essential School Health Services (ESHS) program of the MA DPH, had submitted these annual BMI reports since the 2005-2006 school year, one year before the federal requirement of the SWP. ESHS grant funding

requirements include submission of these yearly surveys as well as other criteria such as the school district nurse leader position, monthly health office data reports, and school nurse practices such as coordination of the comprehensive school health program, health screenings, and BMI, diabetes and asthma surveillance.

The ESHS school district nurse leaders have also submitted, since the 2006-2007 school year, a survey entitled the Healthy Weight Survey (Figure 2, Appendix A), adapted from the CDC (2007) School Health Index and the George Washington University Center for the Health and Health Care in Schools (2007). The survey included items that examine: the district level of progress in implementing the SWP including school protocols for the type of food sold or served on school grounds, physical education and health education, time spent in physical activity, and measurement of BMI with referral of high-risk students; the promotional climate for implementation of the SWP including recognition of the problem of childhood obesity and the support of the school district, school staff and parents in implementation of the policy; and the school nurse's activities that support implementation of the SWP through educational programs and counseling of students and families, and collaborative efforts with the school health team. These reports suggested that there was considerable variation in implementation of the SWP within the state (MA DPH, 2009b).

Studies have been conducted to examine the use of school-based interventions to address childhood obesity with mixed outcomes (Foster, 2008; Gittelsohn & Kumar, 2007), but there was little research examining the level of the SWP implementation and

its association to the proportion of students with BMI in the obese weight category. Recent studies suggested that aspects of the SWP were associated with decreased BMIs in the overweight category (Sanchez-Vaznaugh, Sanchez, Baek, & Crawford, 2010; Foster, 2008), and that implementation of the SWP may play a role in reducing the prevalence of childhood overweight and obesity (Justus, Ryan, Rockenbach, Katterapalli, & Card-Higginson, 2007; Probart, 2010). However, primarily because of the variation in implementation of the SWP (RWJF, 2010a), and the challenges of conducting research in the school setting (Cowell, 2011), little research has been conducted examining levels of SWP implementation and its association with childhood obesity, thus limiting the understanding of the effects of the policy. To date, there has been little examination of school nurse activities and their relation to the proportion of students in the obese weight category.

Study Aims and Hypotheses

The major purpose of this study, a secondary data analysis, was to examine the association between the level of school wellness policy implementation, school nurse activities, and the absolute change in percent of ESHS students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years. The promotional climate for school wellness policy implementation and school nurse ratio were examined as components of the level of implementation of the school wellness policy and school nurse activities. The specific aims and corresponding hypotheses are listed below.

Aim 1

To examine the associations of the Essential School Health Services school district level of implementation of the school wellness policy and school nurse activities to the absolute change in percent of students with body mass index in the obese weight category between the 2005-2006 and 2008-2009 school years.

Hypothesis 1a. In Essential School Health Services school districts, higher levels of implementation of the school wellness policy will be associated with a higher absolute change in the percent of students with body mass index in the obese weight category between the 2005-2006 and 2008-2009 school years, controlling for the independent variables of the baseline percent of Essential School Health Services district students with body mass index in the obese weight category in the 2005-2006 school year, income, race, and geographic location.

Hypothesis 1b. In Essential School Health Services school districts, increased school nurse activities will be associated with a higher absolute change in the percent of students with body mass index in the obese weight category between the 2005-2006 and 2008-2009 school years, controlling for the independent variables of the baseline percent of Essential School Health Services district students with body mass index in the obese weight category in the 2005-2006 school year, income, race, and geographic location.

Aim 2

To examine the relations of nurse ratio and the promotional climate for implementation of the school wellness policy to the level of implementation of the school wellness policy in the Essential School Health Services school districts in the 2008-2009 school year.

Hypothesis 2a. Controlling for the independent variables of promotional climate for implementation of the school wellness policy, geographic location, race, and income, lower school nurse ratio will be associated with higher levels of implementation of the school wellness policy in Essential School Health Services school districts in the 2008-2009 school year.

Hypothesis 2b. Controlling for the independent variables of school nurse ratio, geographic location, race, and income, increased promotional climate for implementation of the school wellness policy will be associated with higher levels of implementation of the school wellness policy in Essential School Health Services school districts in the 2008-2009 school year.

Aim 3

To examine the relations of the school district promotional climate for implementation of the school wellness policy and school nurse ratio to the school nurse activities in the Essential School Health Services school districts in the 2008-2009 school year.

Hypothesis 3a. Controlling for the independent variables of promotional climate for implementation of the school wellness policy, geographic location, race, and income, lower school nurse ratio will be associated with increased school nurse activities in Essential School Health Services school districts in the 2008-2009 school year.

Hypothesis 3b. Controlling for the independent variables of school nurse ratio, geographic location, race, and income, increased promotional climate for implementation of the school wellness policy will be associated with increased school nurse activities in Essential School Health Services school districts in the 2008-2009 school year.

Conceptual Model

This study was guided by the Conceptual Model of Nursing and Health Policy (CMNHP) (Russell & Fawcett, 2005). Two of the ten philosophic assumptions of the CMNHP most important for this study were: 1) health policies of greatest interest to nurses “are those that influence... nursing practice” and promote positive benefits for the public; and 2) nurses participate in “the formulation, implementation, and evaluation of” these policies (Russell & Fawcett, 2005, p. 320). The CMNHP was designed to guide nurse researchers in health policy analysis, evaluation, and discipline-specific research by addressing the policy components of health care services, personnel, and expenditures at various nursing and policy foci levels. The four interacting, non-hierarchical levels of focus range from individual nursing practice through world health administrative practices, depending on the source of the policy, which includes public, professional, and

organizational spheres; the unit of analysis; and the research question. In the same way, the levels of outcomes vary, and focus on quality, cost, and access.

As illustrated in Figure 1, the health policy in this study was the HHFKA of 2010, US Public Law 111-296, which had its foundation in the reauthorization of the NSLA of 2004, Public Law 108-265. This federal law mandated implementation of the SWP in each of the nation's school districts to address children's health and reduce childhood obesity. Fawcett and Russell (2001) posited that health is the functional state of the nursing practice delivery system and, from the perspective of the community, the effectiveness and efficiency of the practice delivery system is evaluated in terms of population health - the proportion of the population with a specific problem that has benefitted from nursing care.

Level II of the CMNHP addresses the effectiveness of nursing practice processes and the effectiveness and efficiency of healthcare delivery subsystems on outcomes (Fawcett & Russell, 2001; Russell & Fawcett, 2005). In this study, use of the CMNHP allowed the examination of the intersection of policy and nursing. The conceptual-theoretical-empirical (CTE) structure guided this examination of the associations of the level of implementation of the SWP and school nurse activities to the absolute change in the percent of ESHS students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years in the MA ESHS school districts. These data were available from the MA DPH in the ESHS Healthy Weight Survey and annual survey.

Documentation of the MA ESHS nursing services and the school health services delivery system were represented by data available on request from the MA DPH ESHS Healthy Weight Survey, describing the level of implementation of the SWP, the school nurse activities, and the school district promotional climate for implementation of the SWP. The school nurse ratio was represented by empirics available from the MA DPH for the number of FTE school nurses for each ESHS school district, and online from MA Department of Elementary and Secondary Education (DESE) school district profiles for number of district schools. Demographic characteristics of race and income were also available from the MA DESE website. Geographic location designation was available from DESE and the MA Secretary of State website.

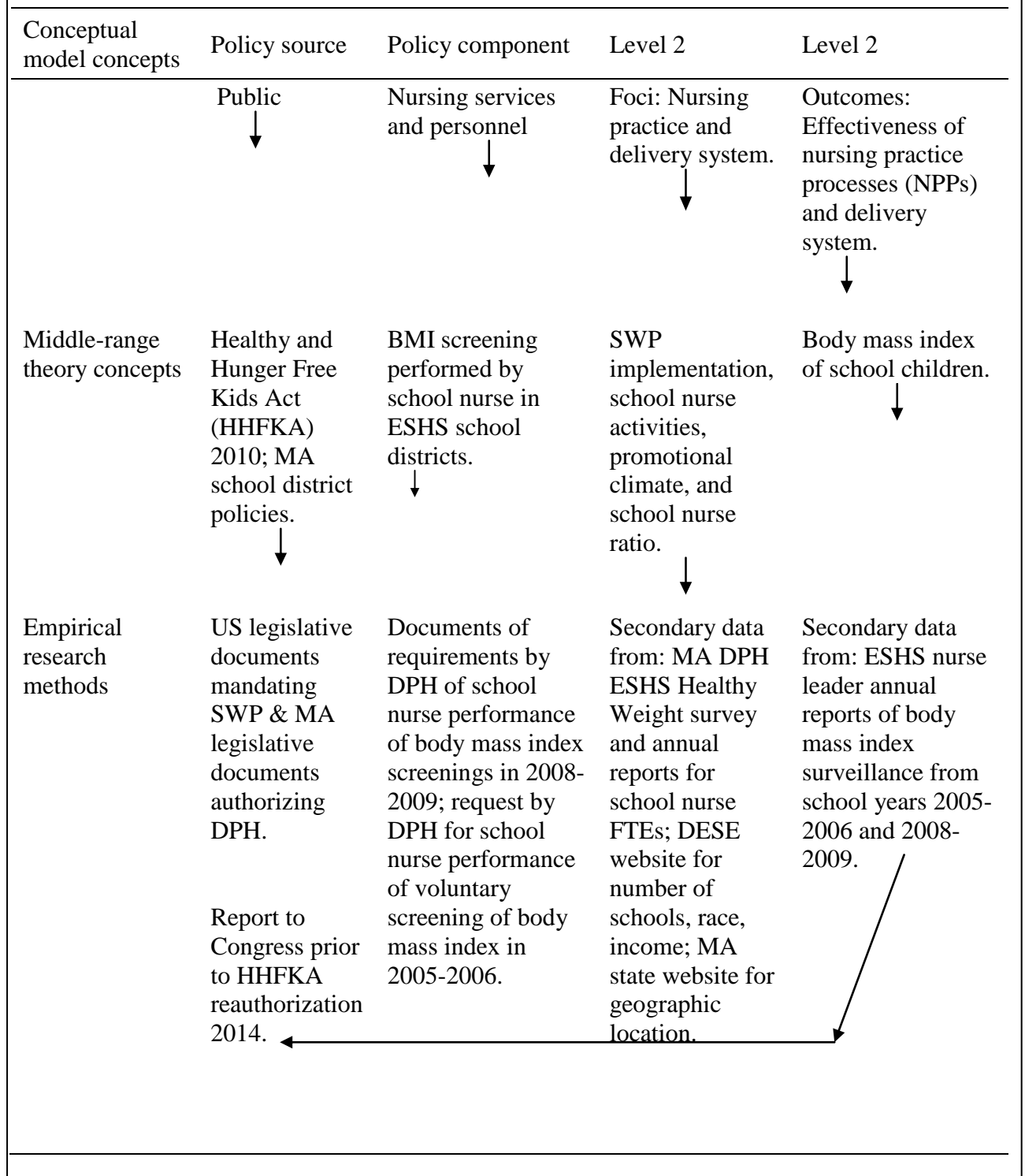
The policy component is the school nursing practice delivery system at the school district level and the school nurse's performance of the body mass index screening is the theoretical component. Public documents available from the MA DPH provided data for the requirement of performance of BMI screening by school nurses in 2008-2009 as well as the request by DPH for school nurse performance of voluntary screening of body mass index in 2005-2006. Public record of the legislated HHFKA of 2010 provided the empiric for the requirement of a SWP in every school district. The CMNHP guides studies of the impact of health policies on nursing and on the public, as well as the impact of effective nursing on the reauthorization of existing policies and formulation of new policies (Fawcett & Russell, 2001), important components of this study.

Figure Caption

Figure 1

Conceptual Model of Nursing and Health Policy - Level 2 (Russell & Fawcett, 2005): The conceptual – theoretical – empirical structure for describing the effectiveness of the level of implementation of the SWP and school nurse activities on the weight status of Massachusetts school children. CMNHP guidelines for the evaluation of the effectiveness of the policy and the analysis of the school program components adapted from Fawcett & Russell, 2001. CMNHP guidelines for nursing discipline-specific research adapted from Russell & Fawcett, 2005.

Figure 1. Conceptual Model of Nursing and Health Policy - Level 2 (Russell & Fawcett, 2005).



CHAPTER 2

REVIEW OF THE LITERATURE

Introduction

This study was designed to examine the association between the level of SWP implementation, school nurse activities and the absolute change in percent of ESHS students with BMI in the obese weight category between 2005-2008 school years. The literature search was conducted electronically using EBSCO in Medline and the Cumulative Index of Nursing and Allied Health Literature (CINAHL). Search terms included the variables singularly and in groupings: SWP and BMI; SWP and childhood obesity; SWP and school health services; SWP and school nurse; SWP and school based interventions; SWP and coordinated school health programs; SWP and school environment; SWP and implementation; BMI and school health services; BMI and school-based interventions; BMI and coordinated school health programs; BMI and school environment; childhood obesity and BMI; childhood obesity and school health services; childhood obesity and school nurse; childhood obesity and coordinated school health programs; childhood obesity and school-based interventions; and childhood obesity and school environment.

The literature search was conducted within the time frame 2000-2012 because there were limited references regarding school policy and its effect on childhood obesity prior to 2000, likely due to the fact that the mandate requiring the SWP was not enacted until 2006. For instance, a search of EBSCO on Medline of the search terms childhood obesity and school health services for the ten year time of 1990-1999 resulted in three documents. The identical search in the time frame of 2000-2012 resulted in 128 scholarly references.

There was little research that examined the federally-mandated SWP level of implementation and school nurse activities and their association with the obese weight status of students, and this study was intended to investigate those relations within the MA ESHS school districts. In addition, this study initiated an examination of the level of implementation of the SWP and school nurse activities and their relation to the school district promotional climate for implementation of the SWP and the school nurse ratio, all of which were areas of study that had limited investigation.

Childhood Obesity

The Centers for Disease Control and Prevention (2011) defined childhood overweight and obesity as weight greater than what is generally considered healthy for a given height. The terms also identified ranges of weight that have been shown to increase the likelihood of certain diseases and other health problems (CDC, 2011).

The prevalence of childhood overweight and obesity has nearly quadrupled in the 8-12 and 13-19 year old age groups and nearly tripled in the 2-5 year old group between 1966-2006 (Chriqui, Schneider, Chaloupka, Ide, & Pugach, 2009; Story, 2009). Nearly one-third of US and youth children are overweight or obese (RWJF, 2009), with poor and minority children having higher rates, and publicly insured ethnic minority children living in low socioeconomic environments have rates that approach 50% (Bethell, 2010; Chang, Gertel-Rosenberg, Drayton, Schmidt, & Anglet, 2010; Foster, 2008; Kaufman, 2009). Childhood obesity is a public health problem because of the multiple contributory causes including environmental, behavioral and genetic influences and paucity of evidence-based interventions that address all facets of the problem sources, the economic effects, the chronicity of the condition, and the co-morbid issues associated with it (RWJF, 2009). The younger the child is when assessed as obese, the greater the severity and likelihood of obesity and its long-term complications in adulthood (Must, Jacques, Dallal, Bajema, & Dietz, 1992).

Effective treatment of childhood obesity requires partnerships between parents, schools, government at all local, state and federal levels, philanthropists, and industry, and calls for changes in nutrition, environment, and physical activities as well as early intervention and prevention as important strategies (IOM, 2005; Miller & Taliento, 2009; Nader, O'Brien, Houts, Bradley, Belsky, Crosnow, et al., 2006). Public health framing of the problem and preventive, population-based federal policies that target multilevel environmental modifications are necessary tools to mitigate the problem (Fitzgibbon,

2008; Hayman, Williams, Daniels, Steinberger, Paridon, Dennison, et al, 2004; Story, 2008). This requires identification of the problem of childhood obesity and provision of support for school based interventions by parents, school staff and administrators; parental recognition of the problem is crucial because parents are partners in the treatment of childhood obesity (Story, 2009; Zenzen & Kridli, 2009).

Several studies have shown modest decrease in childhood overweight in schools that have the support of parents, staff and administrators in implementing components of the SWP (Foster, 2008; Sanchez-Vaznaugh, 2010). These studies had led some authorities to recommend that the SWP should continue and even strengthen its mandates for school-based interventions, recognizing that the majority of obesity prevention and control strategies were implemented in non-health settings where parental and institutional support were encouraged (Ashe, Bennett, Economos, Goodman, Schilling, Quintiliani, et al., 2009; Brownell, Kersh, Ludwig, Post, Puhl, Schwartz, et al., 2010; Dentzer, 2010; Kumanyika, 2008; Sanchez-Vaznaugh, 2010). Competitive federal grants have been made available through the Carol M. White Physical Education Program (PEP) to promote aspects of the SWP, specifically physical activity, and to encourage BMI measurement (Li & Hooker, 2010; U.S. Department of Education, 2011), but little financial support of other aspects of the SWP is available.

Investigation of effective prevention and treatment of childhood obesity is critical to reverse this health problem. Preliminary study of the implementation of the SWP as one area of a many-faceted approach to mitigate childhood obesity had shown promise.

However, more evidence of the level of implementation of the SWP and school nurse activities and their associations with the obese weight status of students is needed; this evidence may be used in the promulgation of new regulations for the 2012-2013 school year, and is required before funding the 2014 reauthorization of the Healthy, Hunger-Free Kids Act (US Public Law 111-296, 2010).

Experts have suggested that school policies aimed at reducing overweight and obesity should measure their effectiveness on students' BMI (Jaime & Lock, 2009). This study was designed to examine the associations of levels of SWP implementation and school nurse activities to the absolute change in percent of ESHS students with BMI in the obese weight category between 2005-2006 and 2008-2009 school years.

Body Mass Index

Body mass index (BMI), a measure of weight in relation to height (CDC, 2011), is the most widely accepted method used to measure and determine weight status. BMI is used to screen for overweight and obesity in children and adolescents because it correlates with body fatness, but it is not a direct measure of adiposity and thus is not a diagnostic measure (CDC, 2011). For children ages 2-19 years, the BMI value is plotted on the CDC age and gender specific growth charts to determine the corresponding BMI percentile. The CDC defines children's BMIs in categories for children of the same age and sex with the 0-5th percentile categorized as underweight, the 5th to 85th percentile as healthy weight; at the 85th percentile but below 95th as overweight; and BMI at or above the 95th percentile as obese. (CDC, 2011).

Child health experts have not always agreed on the definition, measurement, and interventions to treat childhood obesity (Himes, 2009). In 2004, the IOM recommended annual school screening of BMI, and in 2005, requested that the federal government provide guidelines for BMI measurement in schools in order to accurately address the rising rates of childhood obesity. The CDC responded with a report, *Body Mass Index Measurement for Schools* (Nihiser, Lee, Wechsler, McKenna, Odom, Reinhold, et al., 2007), to provide screening and surveillance direction. In 2010, the US Preventive Services Task Force (USPSTF) provided further guidance by recommending annual BMI screening of children (2010), citing that accurate measurement to assess overweight and obesity rates through surveillance and individual screening is necessary to define the extent of the problem (Illuzzi & Cinelli, 2000; USPSTF, 2010).

Health service programs in schools typically use the BMI measurement in two ways: for BMI surveillance, anonymously identifying population trends by the percent of the students in the four weight categories; and BMI screening, identifying individual students' weight category for risk-status for overweight or underweight. Results of all school screenings are usually sent to parents; however, there was much variability regarding referrals to primary care providers of overweight and obese students from school health programs, although it was recommended in the SWP. This variation in the processes of provision of health services in schools was a possible reason for irregularities in SWP implementation. There is growing recognition that health care at school can significantly impact children's health (Lear, Barnwell, & Behrens, 2008) and

standardization of the implementation of the SWP was suggested as an important feature of school based interventions (CDC, 2009). This study was limited to the ESHS population because the provision of health services was uniform in its delivery in order to meet the requirements of ESHS grant funding.

School Health Services

School based health care has been recognized by the Institute of Medicine (IOM, 2005) as a means of addressing current health issues of children; to date, however, school health remains a complex yet unseen source of healthcare that has not been described in patterns of health care utilization (Lear, 2007; RWJF, 2010c; Schainker, O'Brien, Fox, & Bauchner, 2005). School health has little evidence based practice research published in scholarly journals that can be used to guide main-streamed healthcare providers and organizations in recognizing the functions of health care delivery at school because of its lack of standardized structure and processes (Lear, 2007; Maughan, 2009).

The health services delivered in schools are typically of 2 distinct models: school health services managed by school nurses and school based health centers (SBHCs) managed primarily by outside agencies. School nurse managed health services are in the public health domain and provide care that includes population health issues of surveillance and screening as well as direct care to students and staff. SBHCs provide primary care within the school setting to enrolled students. It is estimated that 61,000 school nurses and 1,900 school-based health centers provide health services in about

95,000 public schools serving more than 50 million students in the US. (Lear, 2007; Maughan, 2009; RWJF, 2010c; Schainker, 2005).

SBHCs are typically sponsored by community hospitals, public health departments, community health centers, and academic medical centers. They have increased in number from fewer than 100 in the late 1980s to more than 1900, provide primary care to approximately 2% of public school children, and are reimbursed for services to individual students through third-party billing (Lear, 2007). SBHCs have been suggested as a vehicle to overcome challenges to health care access for underserved children and adolescents and are the model of care best understood by the health care field because of their main stream health care institution sponsorship (Lear, 2007).

School nurse-managed health service models are present in 98% of US public schools and school nurses have assumed responsibility for most school health functions relating to physical and mental health issues (Lear, 2007). In addition to population health care, school nurses: manage students' chronic health conditions; respond to life-threatening allergy, asthma, diabetes, neurological and other health conditions events; alert public health departments when epidemics strike; respond to students' physical and mental health concerns; connect students with specialty services such as substance abuse treatment, mental and behavioral health services, and reproductive health services; refer students' families to care providers and insurance programs; screen for conditions that impair learning, such as poor vision and hearing; educate children about healthy lifestyles; ensure immunization and compliance; develop health plans for students with

disabilities and chronic conditions; prepare for school-wide and community emergencies; administer medication; and provide first aid (RWJF, 2010c).

School nurses are important members of the public health team that provides health care to children, partnering with community agencies and a wide range of providers to support physical and mental wellbeing of students. It has been reported that children have better health promoting behaviors when there is a school nurse (Salmon, Moulton, Omer, Chace, Klassen, Talebian, et al., 2004), and growing evidence supports that school based health services may have a beneficial effect on students': access to care; reduced likelihood of receiving care in an emergency room; and increased likelihood of seeking mental health services (RWJF, 2010c).

Within the school-nurse managed model, however, there are multiple variations in staffing nationally (RWJF, 2010c) including public health vs. school district employed nurses, the use of unlicensed assistive personnel (UAPs), and nurse-to-student ratios ranging from 1:298 (Vermont) to 1: 5,822 (Utah); MA ranks 6th with 1:524 nurse to student ratio (Maughan, 2009). The National Association of School Nurses (NASN) recommends a ratio of one school nurse to every 750 general education students; when students require daily professional nursing services, the recommended ratio drops to 1:225; and when the school nurse provides care to students with special health care needs, the recommended ratio drops to 1:125 (NASN, 2010b).

On average, each school nurse in the US is responsible for 1151 students in 2.2 schools (Bergren, 2009); this student population is a mix of regular education students

and students with special health care needs who require daily nursing care. Although there have been difficulties in establishing an exact measure of children with special health care needs, the US Federal Interagency Forum on Child and Family Statistics (2009) has reported that 14% of US children have these needs. Bethell and colleagues (2008) have estimated the prevalence of children with special healthcare needs to be in the range of 12.5-20%; Van Cleave, Gortmaker and Perrin (2010) reported 26.6%; and in MA ESHS schools, 20-30% of school children are reported to have special health care needs (MA DPH, 2009).

The CDC (2009) has recommended its coordinated school health program as one model for school health services and suggested that standardization of the implementation of the SWP is important to allow comparisons of intervention outcomes. Kruger, Toker, Radjenovik, Comeaux, and Macha (2009), however, reported that school nurses who were responsible for both the CDC coordinated school health program (CSHP) while providing health care to students with special health care needs were less likely to perform the eight components of the CSHP; their recommendation was to lower the student to school nurse ratio. RWJF researchers suggested that the performance of the coordinator in execution of the SWP may be affected when it is an additional responsibility of an existing role rather than a specific position (RWJF, 2010a). When the school nurse has the added responsibility of the SWP, other factors defining the school nurse's work load must be taken into account, including provision of direct care for

students with special health care needs and the number of enrolled students to school nurse ratio.

The variety of models and staffing patterns in providing healthcare to students leads to inconsistent state policies and uneven school district compliance regarding school-based healthcare and health policy implementation (RWJF, 2010c; Salmon, 2004). Lack of standardization also thwarts research efforts to link school nurse practice with students' health and educational outcomes.

In ESHS school districts, for the years of this study, consistency in measuring and reporting was supported through grant funding from the MA DPH to provide education and other resources to school nurses, including funds to increase numbers of school district health services staff. School nurses were employed, at least in a part-time capacity, in 100% of ESHS schools. The ESHS school nurse was responsible for the CDC CSHP, may also be accountable for implementation of the SWP, and may likely be providing care to ESHS students with special health care needs. This may lead to fragmentation in ESHS school district achievement of the SWP.

School Nurse Activities

The National Association of School Nurses (NASN) defined seven components of the school nurse role: leadership in establishing and evaluating school health policies; health promotion; provision of direct emergency, acute and chronic physical and emotional care for staff and students; promotion of a healthy environment; surveillance

and screening; disaster preparedness; and community liaison (NASN, 2002). NASN encouraged school nurses to lead or be involved in the development of the SWP by collaborating with school and community members including parents, students, representatives of the school food authority, the school board, school administrators, dietitians, parks and recreation leaders, pediatricians, local food vendors, and the public (NASN, 2010a). The SWP as an intervention to establish healthy school nutrition environments, reduce childhood obesity, and prevent diet-related chronic diseases (HHFKA, 2010) may be advanced through the expertise of a school nurse who has knowledge about the needs of the student population and the resources necessary for promotion of wellness within the school district, and who practices in the context of school, family, and community (NASN, 2010a).

NASN (2010a) provided a guideline for the role of the school nurse in advancing the wellness policy within the school or school district. It encourages the school nurse to:

- Identify incidence of diet-related chronic disease and indications for prevention and treatment;
- Lead or actively participate in the development of the school wellness policy;
- Provide school administrators with advice on the necessity of good nutrition for learning, and the need for healthy, nutritious food and beverage choices available in school cafeterias, vending machines, school stores, snack bars, and any area in school where food is sold;

- Provide health/nutrition education for students, staff, parents and community including management of school-based educational programs;
- Liaison between school and community to provide health education for promotion of healthy lifestyles;
- Advocate for school and community facilities for physical activities for all;
- Provide health referrals to students with BMI outside of the healthy weight category;
- Provide follow up on student health referrals for BMI outside of the healthy weight category.

The MA DPH ESHS identified that the school nurse promoted physical activity and healthy eating to students and their families through the following methods: the distribution of educational materials, provision of individual advice, conduction of small group discussions, and the management of presentations about healthy lifestyles (MA DPH, 2009b). In addition, ESHS school nurses collaborated with school staff to promote physical activity and healthy eating through policy development, curriculum development, unit/lesson planning, special events/planning, and in-service training (MA DPH, 2009b). The ESHS school nurse measured the BMI of students and referred all students whose BMI falls outside of the healthy weight category to the student's PCP, followed up on student referrals to the PCP, and provided surveillance data of percent of students in the four CDC weight categories to the DPH ESHS.

There have been school-based interventional studies for the treatment of childhood obesity with mixed outcomes (Cole, Waldrop, D'Auria, & Garner, 2006), but

there is little literature about school nurse activities that promoted reduction in the obese weight category of students. One interventional study in Finland showed modest (5%) but statistically significant weight loss 6 months after a 9-week group healthy lifestyles program for students and parents as compared to two (autumn and spring term) sessions of individual counseling led by the school nurse (Kalavainen, Korppi, & Nuutinen, 2007). Weepie and McCarthy (2002) implemented and studied an intervention of a school nurse led healthy lifestyle educational program, and although their intervention did not assist weight loss in obese students, they suggested that school nurses promote, advocate and implement health education programs in school.

Clark (2004) advocated for school nurses to use their scarce time to educate students in healthy lifestyles rather than screening students for obesity. However, King, Meadows, Engleke, & Swanson (2006) argued that screening was an important role for school nurses. In Neymark and Wagner's study (2006), Danish school nurses suggested health discussions with school children were an opportunity to promote healthy lifestyles and these nurses also pointed out that there were barriers in collaboration in school settings. Moyers, Bugle, & Jackson (2005) studied school nurse perceptions of childhood obesity and found that although school nurses were aware of the risks of childhood obesity and knowledgeable of the interventions, they were reluctant to take on the role of counseling students who were obese. The school nurses who were studied cited lack of parental support and low self-confidence in their provision of the necessary counseling. These studies illustrate that although school nurses have the capability to deliver

preventive and interventional care to obese students (Gellar, Druker, Osganian, Gapinski, LaPelle, & Pbert, 2012), there are many differences in the school nurses' opportunities to promote interventions and lack of evidence to guide school nurse in their activities to reduce childhood obesity (Borup & Holstein, 2010).

These school nurse activities to reduce the prevalence of childhood obesity may also include the role of the SWP coordinator. This added responsibility may lead to fragmentation of implementation of the SWP (RWJF, 2010a) because of the number of students with special health care needs and the number of schools the nurse staffs. Support of the parents, staff, and administrators of the SWP coordinator is necessary in the provision of a school milieu that allows changes in the foods served, student physical activities, and health education encouraged by this federal law.

School Wellness Policy

Sociological context

According to the US Department of Health and Human Services, National Institutes of Health (NIH, 2010), combined overweight and obesity rates have increased four-fold among children in the past 40 years, and 17 percent of children and adolescents have BMI in the obese category. Cardiovascular and endocrine diseases associated with obesity, including high blood pressure and type-2 diabetes, are increasingly being diagnosed during childhood (NIH, 2010). Child health experts called for structured, policy-based interventions to address childhood obesity, but little research was available

to policymakers providing evidence of the best practices for treating this condition or reversing the trend that threatened the health of US children, a shared societal value (Wallace and Wolf, 1999). In 2004, the addition of Section 204, the SWP, to the reauthorization of the NSLA provided a possible solution to this societal problem.

Historical context

In 1946, the NSLA was passed to improve the health and well-being of the nation's youth, and in its 1966 reauthorization, the Child Nutrition Act was added to the NSLA, establishing the School Breakfast Program (US Department of Agriculture, 2011). At that time, the societal issues of poverty and hunger were addressed through the Act, which was portrayed as a "measure of national security, to safeguard the health and well-being of the Nation's children and to encourage the domestic consumption of nutritious agricultural commodities and other food" (US Public Law 108-265, 2008, Section 2, p.2). In 2004, the NSLA was amended to establish a SWP by the start of the 2006-2007 school year. This amendment required schools to set goals for nutritional standards of foods available in schools, nutrition education, physical activity, and other school-based activities designed to promote student wellness (US Public Law 108-265, 2008). This was to be guided by a variety of stakeholders including members of the school board, school administrators, representatives of the school food authority, parents, students, and members of the public (US Public Law 108-265, 2008). In December of 2010, the NSLA was replaced with the HHFKA.

Political context

The NSLA was originally presented as a breach in guarding the health of children, and through this political frame, the legislation was propelled through congress and into law (US Public Law 108-265, 2008). The Act was reauthorized every 5 years to solve the societal issues of poverty and hunger, but prior to the legislated SWP in 2004, some school districts began to voluntarily regulate the school nutrition environment in an attempt to reduce the prevalence of childhood overweight and obesity (Gordon, Cohen, Crepinsek, Fox, Hall, & Zeidman, 2009). In 2004, policymakers seized a window of opportunity to incrementally legislate an additional section, Section 204, to the existing public law, the NSLA of 1946 and the Child Nutrition Act (the school breakfast program) of 1966 (US Public Law 108-265, 2008). Section 204 required those school districts that participate in federally reimbursed school meal programs to establish a SWP to address the problem of childhood obesity within the context of the school environment. (US Public Law 108-265, 2008; IOM, 2005).

In December, 2010, with the active support of some voters and the First Lady, Michelle Obama, Congress passed the HHFKA of 2010 (RWJF, 2010a; The White House, 2010), reissuing the mandate that each educational agency receiving funds from the HHFKA or from the Child Nutrition Act of 1966 establish a SWP.

Economic context

In 2008, \$147 billion was estimated to be spent on obesity in the US, a cost that doubled between the years 1998 to 2008 (Finkelstein, Trogon, Cohen, & Dietz, 2009). The predicted substantial increases in cardiovascular disease and other health problems related to childhood obesity will be costly to treat, subsequently, in 2010 the NIH launched two major research efforts, totaling \$72.5 million, to examine ways to curtail the national childhood obesity epidemic. One study, funded for \$32 million, will examine community and school efforts to reduce childhood obesity rates, evaluating existing programs to determine which of them or their components are the most promising approaches for improving children's obesity-related health behaviors and weight (NIH, 2010).

Requirements of the School Wellness Policy

The basic requirements of the SWP in the 2004 legislation were for school districts to develop nutritional standards for all foods sold or served in its schools that meet the most recent Dietary Guidelines for Americans, written jointly every five years by the U.S. Department of Health and Human Services (HHS) and the U.S. Department of Agriculture (USDA) (HHS USDA, 2011); institute goals for nutrition education and physical activity; and assign a coordinator to oversee that the policy requirements are met (US Public Law 108-265, 2008). There was a requirement for school districts to evaluate their progress in achieving the SWP; however there was no standardization of

measurement of the educational and activity goals and there were no requirements for BMI screening, BMI surveillance, or physical education (RWJF, 2009; US Public Law 108-265, 2008).

The regulations of the HHFKA (US Public Law 111-296, 2010) will include: goals for promoting student wellness and reducing childhood obesity through school nutrition, health education, and physical activity; guidelines for foods available in schools; inclusion of parents, students, school personnel, and the public to participate in the development, implementation and review of the SWP; and transparency of the SWP as demonstrated by the school district making available the content and implementation of the SWP, a report of the extent to which the SWP compares to model SWPs, and a description of the progress made in attainment of the goals of the SWP. As in the 2004 NSLA, the school district must designate one or more school officials to coordinate and ensure that the school complies with the SWP, using the guidelines promulgated by the Secretary of Agriculture (Public Law 111-296, 2010).

In January, 2012, the new nutritional standards for all foods sold or served in its schools were released, with a compliance date of July, 2012. These standards required districts to increase the availability of fruits, vegetables, whole grains, and fat-free and low-fat fluid milk in school meals; reduce the levels of sodium, saturated fat and trans-fat in meals; and meet the nutrition needs of school children within their calorie requirements (USDA, 2012).

In addition to writing the regulations, the Secretary of the USDA, the Secretary of HHS and the CDC are to provide technical assistance and information to assist school districts in establishing SWPs (Public Law 111-296, 2010). The technical assistance is to be consistent with the specific needs of the school district and includes: training to school districts on designing, implementing, and evaluating the SWP to surmount barriers to achievement of it; model SPW and best practices; and technical assistance to promote healthy school nutrition environments (US Public Law 111-296, 2010).

The USDA Secretary will report to Congress no later than January 1, 2014, on the implementation and effectiveness of the SWPs, and how the local SWPs compare to the model (US Public Law 111-296, 2010). This report will include an analysis of the strength and weaknesses of the SWPs, an assessment of the impact of SWPs in meeting the goals of legislation and requires rigorous study of the complexities of implementation of the SWP in a wide variety of schools and educational settings. Funding for the HHFKA of 2010 was supported in the 2012 budget; however, regulations for fiscal year 2012 required states to support the unfunded mandate (Federal Register, 2011; US Public Law 111-296, 2010; Federal Register, 2011).

Implementation of the school wellness policy

Implementation of policy is the execution of programs and processes intended to achieve the goal of the enacted law (Longest, 2006). In the 2004 NSLA, there are 96 points recommended as areas of concentration by school districts that promote activities to achieve implementation of the SWPs. These areas include improvements in the

nutritional quality of foods available in school, class time spent in physical education, and availability of physical activities promoting healthy lifestyles of students (US Public Law 108-265, 2008). These activities, when developed and executed in the school district, are factors determining of the level of SWP implementation.

The wellness policy, as legislated by both the 2004 reauthorization of the NSLA and the 2010 HHFKA, is unfunded, and only 2% of US school districts have identified funding sources for its mandated implementation and evaluation (Gordon, 2009; RWJF, 2009). Consequently, there is variation in the programs and processes and different levels of implementation across the US and within states (Probart, 2010; RWJF, 2009).

In 2009, RWJF assessed the local implementation of the SWP, reporting that the 2004 NSLA had indeed raised the significance of school health programs, but that implementation of the SWP is feasible only when there is accountability, state support, and funding (RWJF, 2009). State support through standardization of health and physical education requirements and additional funding will provide the means needed to make nutrition and physical activity a priority and allow reporting of progress in achievement by school districts that is meaningful (RWJF, 2009). The HHFKA of 2010 will attempt to address some of these limitations by providing guidelines for implementation of SWPs, and requiring a report of progress to Congress in 2014, prior to reauthorization (US Public Law 111-296, 2010).

Schools as a part of the solution

In a recent study, it was reported that one of the next steps that RWJF will take in measuring the progress of the implementation of the SWP will be to examine the effect of district policy on secondary students' self-reports of BMI (Chriqui, Schneider, Chaloupka, Gourdet, Bruursema, Ide, et al., 2010). Schools are a logical venue to implement a policy addressing childhood obesity because the school environment plays a role in shaping children's general health and health behaviors (IOM, 2007) and school-based interventions can be disseminated as efficient, low-cost, population-based approaches designed to address health issues (Finklestein, 2008; Mauriello, Driskell, Sherman, Johnson, Prochaska & Prochaska, 2006). In addition, at least ninety-five percent of school age children in the US attend school (US Department of Commerce, Census Bureau, 2010). For these reasons, health experts and researchers identify schools as a most important starting place to implement strategies to address and prevent the problem of childhood obesity (Della Torre, Akre, & Suris, 2010; Brownell, 2009; IOM, 2007; Li & Hooker, 2010), and point out that some of the earliest policy successes addressing childhood obesity have occurred in schools (Brownell, 2010).

From the school perspective, childhood obesity is a risk factor for less than optimal academic performance, school engagement and attendance (Bethell, 2010; Vinciullo & Bradley, 2009). Physical fitness in students has been associated with improved scores in academic achievement testing in one state (Chomitz, Slining, McGowan, Mitchell, Dawson, & Hacker, 2009). These studies provide increased

significance of the problem of childhood obesity to school officials and political stakeholders. Currently, there is increased support for political action to address childhood obesity (Della Torre, 2010; Frieden, 2010), and a recent survey found that 8 out of 10 voters described childhood obesity as a serious issue with more than 50% supporting a comprehensive program to combat it (Evans, Finkelstein, Kamerow, & Renaud, 2005; RWJF, 2010a).

Limitations of the legislation

Critics of the 2004 legislation affirmed that the language of the mandate needed to be stronger with consequences for non-implementation in order to adequately address the increasing rate of childhood obesity (Fitzgibbon, 2008; Probart, 2010; RWJF, 2009; Story, 2009). The experts' recommendations for the 2010 Act were: nutritional standards for competitive foods; increased time allowed for physical activity; established guidelines for physical education, health education and health promotion activities; standardized measurements of progress and reporting accountability; leadership by a designated wellness coordinator with authority to enforce the mandate within the school district; and a system of rewards and consequences (National Alliance for Nutrition and Activity, 2007; Probart, 2010; RWJF, 2009).

All of the regulations of the HHFKA have yet to be determined; however, the language of the Act required assessment of each district level of implementation and a comparison of the district implementation to the proposed model, thus implying standardized measurement. The study to be conducted by the Secretary of the USDA in

its report to Congress on the effectiveness of SWPs by January 1, 2014 also would require clear and objective measurement of progress in reaching the twin goals of healthier children and reduced childhood obesity (US Public Law 111-296, 2010).

Research that offers evidence of best practice is needed to support the implementation of the policy, because the ultimate goal of the SWP is to structure the school environment to promote healthy behaviors through the alignment of public health concerns, evidence and policy (Story, 2008; Brownell, 2009). In the interest of addressing childhood obesity and as part of the next reauthorization in 2014, legislators could call for studies of the strategies used by school districts that successfully established a SWP or identify evidence-based practices that address the problem of childhood obesity (RWJF, 2009), but with little evidence of its effectiveness, Congress may not include funding for implementation of the SWP in the 2014 reauthorization. The variety of structures and processes of school health services delivery models limits the standardization required to conduct generalizable research in schools and school districts. Standardized measurement of the objective goals of the 2010 legislation, although complex, is the next incremental step in the legislative process in order to provide proof of effectiveness of the SWP.

School Promotional Climate for Implementation for the SWP

Treatment of childhood obesity requires a multifactorial approach (Fitzgibbon, 2008), and recognition of the problem is an important first step in treatment and prevention. The legislation mandates SWP implementation as a requirement to meal

reimbursement funding, and this brings the problem of childhood obesity to the attention of the school community. However, the school community must acknowledge this health issue in order to devote the resources to fully address it, and the support from school staff and parents in the efforts to address childhood obesity is essential to combating the problem (Story, 2009; Zenzen & Kridli, 2009).

For the purposes of this study, the milieu in the ESHS school district environment to support the processes of implementation of the SWP was narrowly defined as: (1) recognition by the school district of the problem of childhood obesity; (2) the efforts of the school district to improve the quality of food offered in the schools; (3) the support of staff in efforts of the school district to improve the quality of foods offered in schools; (4) and the support of parents in efforts of the school district to improve the quality of foods offered in schools. The reimbursement funding contingent on changes in foods served and sold in schools has been well-publicized and the changes in the school food environment are easily recognized by staff and students.

Summary

The results of this review of the literature revealed that childhood obesity is a national epidemic and that multifaceted prevention and treatment had been suggested to reverse the growing prevalence of the problem. One approach was a school-based environmental improvement and physical activity program promoted through the SWP and mandated in the 2010 HHFKA. The CDC recommended a coordinated school health plan that provides oversight of the SWP interventions of improving the nutritional

environment, the health curriculum and time spent in physical activity. In addition, the CDC recommended school-based screening and surveillance of students' BMI. School nurses have conducted this screening and surveillance and been recognized by the AAP (2008) as plausible coordinators of the SWP.

Researchers have suggested that schools are an ideal setting for a policy-based model to address childhood obesity where low-cost but effective interventions can be disseminated, and schools can be effective partners in keeping children healthy by providing a food and activity environment that is guided by evidence based policy and aligned with national goals (Foster, 2008; Story, 2009). Although schools have been identified as a setting to address the issue and the federally mandated SWP has been cited as the mechanism for change in the school food and physical activity environments (Brownell, 2009; Foster, 2008; Story, 2009), there was little evidence of the effect of the SWP on students' obese weight status, the extent to which the SWP has been implemented or about the factors that influence implementation (Story, Kaphingst, Robinson-O'Brien, & Glanz, 2008). Story and colleagues (2008) reported that there were few data on the cause-and-effect of school environmental factors on a child's eating, or the influence of any policy to improve the food environment; they also cited the lack of validated and reliable environmental measures that can be used by researchers. These issues explained the absence of evidence in support of the SWP as a means of addressing the problem of childhood obesity.

Schools are important venues for the research of interventions because they play key roles in the food environment of children (Chriqui, 2009; Foster, 2008), in that children eat one to three meals, spend almost one half of their waking hours, socialize, play, learn, and are physically active in school (Story, 2008). It may be beneficial for schools to study and implement SWPs because in this era of “academic accountability” (Rosas, Case, & Tholstrup, 2009, p. 109), students in states where such policies were implemented had lower rates of absenteeism (Geier, Foster, Womble, McLaughlin, Borradaile, & Nachmani, 2007).

CHAPTER 3

METHODS

Data Sources

This study used existing data from the MA DPH ESHS program (2009b), which were provided in EXCEL format and included three datasets organized by school district. Two datasets were results from the 2008-2009 school-year self-administered school nurse leaders' surveys, including items on the district promotion of the SWP, factors that influence SWP implementation, school nurse practices, and number of full-time equivalent (FTE) school nurses employed in the district (MA DPH, 2009a); the third dataset was the students' BMI measurements from both 2005-2006 and 2008-2009 school-years (MA DPH, 2009b). Data providing the number of students enrolled in district schools, percent of students in white and non-white race categories, and percent of district students with low income were available online from the MA Department of Elementary and Secondary Education (DESE) at <http://profiles.doe.mass.edu>. The geographic location, urban, was available from the MA Secretary of State website at <http://www.sec.state.ma.us/cis/cisctlist/ctlistalph.htm>.

Sample

There are 361 school districts in MA; for the years reported in this study, approximately 70-103 school districts or 19-28.5% of the MA school districts, participated in the MA DPH ESHS competitive grant program (MA DPH ESHS, 2009), and of these, the sample for this study included 62 school districts (N = 62). This sample comprised approximately 16.62% of the 361 Massachusetts school districts and 60.19% of the ESHS school districts. The requirements of the ESHS competitive grant were stringent, and for this reason school districts biannually chose to participate or opt out of the funding process depending on their ability to meet the grant criteria; this led to variation in participating ESHS school districts.

<i>Table 1. Comparison of ESHS school districts and MA public schools by race and ethnicity 2008-2009 (MA DPH, 2009a; MA DESE, 2009).</i>		
	ESHS Schools	State public schools
Race/ ethnicity	Number/Percent	Number/Percent
African American	58,701/12.3	78,631/8.2
Asian	31,498/6.6	48,904/5.1
Hispanic	104,039/21.8	137,124/14.3
Native American	1432/0.3	2876/0.3
White	270, 597/56.7	670,278/69.9
Hawaiian /Pacific Islander	477/0.1	959/0.1
Multi-race, non-Hispanic	10,499/2.2	19,178/2.0
Total pop.	477,243/100.0	958,910/100.0

Characteristics of race, language, and income for the ESHS school district population as compared with the state public schools for the school year 2008-2009 are described in Tables 1 and 2 (MA DPH, 2009a; MA DESE, 2009). The ESHS population included 477,000 students or 49.77% of MA students and represented higher percentages of ethnic minority and low income students as compared to the statewide public school population. More than half (270,456 or 52%) of ESHS students attended city-district schools; in MA, 50 of the 361 school districts are located in cities, and 32-33 of these city-school districts, or 64-66% of MA cities, participated in the ESHS grant program. This may account for the higher representation of ethnic minority and low-income students in ESHS school districts.

<i>Table 2. Characteristics of ESHS School Districts and Massachusetts state public schools by language and income 2008-2009 (MA DESE, 2009).</i>		
	ESHHS Schools	State public schools
Characteristic	Number/Percent	Number/Percent
First Language Not English	110,354/23.1	147,672/15.4
Limited English Proficient	46,780/9.8	56,576/5.9
Low Income	201,591/42.2	294,385/30.7

Instrumentation

The unit of analysis for this study was the ESHS school district and this research is generalizable only to the MA ESHS school districts. The variables were examined in aggregate for the 62 ESHS school districts for school year 2008-2009, and the BMI percent from 2005-2006 was also examined in aggregate. The main school district variables studied were the absolute change in the percent of ESHS students with BMI in the obese weight category in 2008-2009, level of implementation of the SWP, school nurse activities, school nurse ratio, district promotional climate for implementation of the SWP, the 2005-2006 percent of students with BMI in the obese weight category (baseline), income, race, and geographic location. The variables were defined and operationalized as described in the following section and in Table 3.

<i>Table 3. Study variables definitions and characteristics.</i>		
Variable name	Variable definition	Variable characteristics
Chng_p_o_05	The absolute change in percent of ESHS district students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years derived from percent obese in 2005-2006 minus percent obese 2008-2009.	Dependent ratio
P_o_05	The percent of ESHS district students with BMI in the obese weight category 2005-2006.	Independent ratio

SNA_08	<p>School nurse activities; a summed scale of 13 items ordinally scored from 1 to 4, in the Healthy Weight Survey 2008-2009. The items represented school nurse practices that promoted students' healthy lifestyles. The possible survey responses were: fully in place (scored as 4), partially in place (scored as 3), under development (scored as 2), or not in place (scored as 1). The summed score of 13-52 created the school nurse activities scale. The school nurse activities variable was used in two ways: it was a continuous independent variable when its influence on the absolute change in percent of ESHS students with BMI in the obese weight category between 2005 and 2008 was examined; and viewed as a continuous dependent variable when examined as an outcome of the association between climate and school nurse ratio on school nurse activities.</p>	<p>Independent/ dependent continuous scale 13-52 (see Table 4)</p>
LOI_08	<p>The level of implementation of the SWP; a summed scale of 19 items, ordinally scored from 1 to 4, in the Healthy Weight Survey 2008-2009. The items represented activities to achieve implementation of the SWP. The possible survey responses were: fully in place (scored as 4), partially in place (scored as 3), under development (scored as 2), or not in place (scored as 1). The summed score of 19-76 created the level of implementation of the SWP scale. The level of implementation variable was used in two ways: it was an independent variable when its influence on the absolute change in percent of ESHS students with BMI in the obese weight category was examined; and viewed as a continuous dependent variable when examined as an outcome of the association between climate and school nurse ratio on SWP implementation.</p>	<p>Independent/ dependent continuous scale 19-76 (see Table 5)</p>

Climate_08	Promotional climate of the ESHS school district for implementation of the SWP; a summed scale of 4 items ordinally scored from 1 to 5, in the Healthy Weight Survey 2008-2009. The items represented the recognition of the problem of childhood obesity by the school district, and school district, school staff and parental support for changes in school nutrition, environment, and physical activities. The summed score of 4-20 created the promotional climate scale.	Independent ordinal scale 4 to 20 (see Table 6)
SNratio_08	The ratio of the number of school district students to the number of full-time equivalent school nurses in 2008-2009.	Independent ratio
Lowinc_08	Percent of school district students who met the criteria to be eligible for free or reduced fee school meals in 2008-2009. This variable was used as an indicator of income because the requirement for eligibility is one of the following: a family income of 1.3 to 1.8 times the federal poverty line; Transitional Aid to Families benefits; or food stamps.	Independent ratio
NWrace_08	Percent of non-white race students in the school district in 2008-2009. Race was defined by MA DESE as the percent of student population in seven categories: African American or Black, Asian, Hispanic or Latino, Multi-race/Non-Hispanic, Native American, Native Hawaiian or Other Pacific Islander, or White. In this study, minority was the percent of non-white student population in the district.	Independent ratio
Urban_08	The school district geographic location of urban or non-urban setting as designated by the Massachusetts state government in 2008-2009.	Independent categorical dummy

Methods of Measurement of Major Study Variables

Measurement of absolute change in percent of ESHS district students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years

The dependent variable in aim 1 of this study was the absolute change in percent of ESHS students with BMI in the obese weight category between the 2005 and 2008 school years, *chnng_p_o_05*. It was defined as the total percent of ESHS students with BMI in the CDC (2010) obese weight category in the school year 2005-2006, the variable *p_o_05*, minus the total percent of students with BMI in the CDC obese weight category in the school year 2008-2009, the variable *p_o_08*, and measured as a ratio variable.

Following the CDC guidelines (2011), the BMI value was calculated by plotting the child's height and weight on the CDC age and gender specific growth charts to determine the corresponding BMI percentile. A child's BMI greater than 95th percentile for children of the same age and sex was classified as being in the obese weight category (CDC, 2010). The ESHS school nurses have been trained in BMI measurement technique since 2003 (MA DPH, 2003), and training was a requirement for ESHS school nurses during the specific years of this study. BMI of students in grades 1, 4, 7, and 10 were measured yearly, and the results reported to the MA DPH ESHS by grade and gender in each of the 4 CDC weight categories: underweight, normal weight, overweight, and obese (CDC, 2010).

The percent of ESHS students in the obese weight category in both the 2005-2006 and 2008-2009 school years was examined first by individual school district and then by ESHS aggregate, before the calculation of the absolute change in percent of ESHS students with BMI in the obese weight category in 2008-2009 was calculated. It was hypothesized that the 2005-2006 school year would have a higher percent of ESHS students with BMI in the obese weight category than in the 2008-2009 school year, and that the difference in percent between the two years, the absolute change in percent of students with BMI in the obese weight category, would be a positive number.

Measurement of percent of ESHS school district students with BMI in the obese weight category in the 2005-2006 school year

This independent variable, *p_o_05* was a ratio variable defined as the percent of ESHS students with BMI in the obese weight category in the 2005-2006 school year. The federally-mandated SWP was not a requirement for school districts until the 2006-2007 school year; controlling for this independent variable allowed a more accurate view of the association between the ESHS school district level of implementation of the SWP, school nurse activities, and the absolute change in percent of ESHS students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years. Use of this variable allowed comparison to other school districts of the absolute change in percent of ESHS students with BMI in the obese weight category in the study years.

Measurement of school nurse activities

The activities of the school nurse in promoting healthy behaviors have been well described (RWJF, 2010c). The federal government suggested processes to implement the SWP that may be performed by the school nurse to promote the healthy weight status of students and prevent obesity including: distribution of educational materials, individual student advice, small group discussions, presentations, and collaborations with other staff in developing policy, curriculum, lesson plans, special events and in-service trainings. The hypothesis that school nurse activities may be related to absolute change in percent of ESHS students with BMI in the obese weight category between 2005-2006 and 2008-2009 school years was based on the mixed outcomes from studies of school nurses promoting healthy lifestyles and obesity reduction (Clark, 2004; Kalavainen, 2007; King, 2006; Moyers, 2005; Neymark & Wagner, 2006; Weepie & McCarthy, 2002).

Thirteen of the 36 ESHS Healthy Weight survey items (36%) reflected the school nurse activities (Table 4). These activities were scored as: fully in place (scored as 4), partially in place (scored as 3), under development (scored as 2), or not in place (scored as 1). When combined, the responses from the 2008-2009 school year created a scale ranging from 13-52, with higher numbers representing higher levels of nurse activity. This scale measured the school nurse activities supportive of healthy lifestyles of students and families. The variable, SNA_08, was used as a continuous independent variable when its relation to the absolute change in percent of ESHS students with BMI in the

obese weight category between the 2005-2006 and 2008-2009 school years was examined.

The school nurse activities variable was divided into categories for several analytic models. It was split at the median and used to view the relation between the higher level and lower level of school nurse activities as they were associated with the absolute change in percent of ESHS students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years. Similarly, school nurse activities variable values were divided into tertiles and quartiles and used to view the their relation to the absolute change in percent of ESHS students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years.

The school nurse activities variable was also used as a continuous dependent variable when it was identified as a function of the ESHS 2008-2009 promotional climate for the implementation of the SWP and school nurse ratio. This allowed a closer examination of the school nurse activities variable as it was influenced by the school district, staff and parental support for implementation of the SWP and by school nurse staffing ratios.

Table 4. Components of the school nurse activities variable.

Question from Healthy Weight Surver 2008-2009	Measurement
1. Do school nurses promote physical activity (PA) to students and their families through: Educational materials?	1-4
2. Do school nurses promote PA to students and their families through: Individual advice?	1-4
3. Do school nurses promote PA to students and their families through: Small group discussions?	1-4
4. Do school nurses promote PA to students and their families through: Presentations?	1-4
5. Do school nurses promote healthy eating to students and their families through the distribution of educational materials?	1-4
6. Do school nurses actively promote healthy eating to students and their families through individual advice?	1-4
7. Do school nurses actively promote healthy eating to students and their families through small group discussion?	1-4
8. Do school nurses actively promote healthy eating to students and their families through presentations?	1-4
9. Do school nurses collaborate with other school staff to promote PA and healthy eating through policy development?	1-4
10. Do school nurses collaborate with school staff to promote PA and healthy eating through curriculum development?	1-4
11. Do school nurses collaborate with other school staff to promote PA and healthy eating through unit/lesson planning?	1-4
12. Do school nurses collaborate with school staff to promote PA and healthy eating through special events/planning?	1-4
13. Do school nurses collaborate with other school staff to promote PA and healthy eating through inservice training?	1-4
Sum of scored items is the scale measuring continuous variable <i>SNA_08</i>	13-52

Measurement of the level of implementation of the SWP

Implementation of public policy was defined as the conduction of the programs and processes embedded in the enacted law which were intended to achieve a goal (Longest, 2006, p. 269-270). The level of implementation of the SWP referred to the progress each school district was making to meet the requirements of legislation.

In MA ESHS schools, self-administered Healthy Weight surveys of school district nurse leaders have been collected since the 2006 school year to determine the level of implementation of the SWP by the DPH ESHS. Nineteen of the 36 items, or 53% of the ESHS Healthy Weight survey, reflect the 96 points designated in the 2004 reauthorization of the NSLA as suggested areas of concentration by school districts to promote programs and processes to achieve implementation of their SWPs. Each of the item responses of the school nurse leaders indicated the stage of development of the programs and processes put into practice by the school district with the intent of meeting the requirements of the SWP implementation (Table 5).

The nurse leader's responses to items depicting activities that support improvements in the nutritional quality of foods available through multiple venues in school, class time spent in physical education (PE), and the protocols for screening and reporting of BMIs and for referring students at risk for overweight and obesity were elicited in this survey. The development of these programs and processes, and the progression in their execution in the school district, were the factors determining the level of SWP implementation.

The independent variable of SWP level of implementation, LOI_08 was measured on a continuous scale from 1-4 by scoring the 19 survey responses in 2008-2009 school year ordinally as: fully in place (scored as 4), partially in place (scored as 3), under development (scored as 2), or not in place (scored as 1), permitting a full range of evaluation of the progress in program development (Table 5). The level of implementation was viewed as a continuous independent variable when its influence on the absolute change in percent of ESHS students with BMI in the obese weight category between 2005-2008 school years was examined.

The level of implementation variable was divided into categories for several analytic models. It was divided at the median and used to view the relation between the higher level and lower level of implementation and the absolute change in percent obese between the 2005-2006 and 2008-2009 school years. Similarly, level of implementation variable values were divided into tertiles and quartiles and used to view the absolute change in percent of ESHS students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years.

The level of implementation of the SWP was also examined as a continuous dependent variable when it was identified as a function of the ESHS 2008-2009 promotional climate for the implementation of the SWP and school nurse ratio. This allowed a closer examination of the level of implementation of the SWP variable as it was influenced by the support of the implementation of the SWP of the school district, staff and parents and by school nurse staffing ratios.

Table 5. Components of the level of implementation variable.

Question from Healthy Weight Surver 2008-2009	Measurement
1. Are students provided with at least 20 minutes of recess daily?	1-4
2. Do teachers or recess monitors encourage students to be active?	1-4
3. Do all who teach physical education use a sequential PE curriculum consistent with state or national standards for PE?	1-4
4. Do all students in each grade receive PE for at least 150 minutes per week throughout the school year?	1-4
5. Is PE spread over at least 3 days per week but preferably over 5 days?	1-4
6. Does the school district promote walking/biking to school?	1-4
7. Do school menus include a variety of foods?	1-4
8. Does the school food service offer low-fat and skim milk every day?	1-4
9. Do school meals or al carte offerings every day include at least one appealing, low-fat item from each of the following food groups: fruits, vegetables, grains, and dairy products?	1-4
10. Do students have at least 10 minutes to eat breakfast and at least 20 minutes to eat lunch, counting from the time they are seated?	1-4
11. Is access to vending machines restricted in your school district?	1-4
12. As a food source site outside of the cafeteria, do vending machines offer appealing, low-fat fruits, vegetables, grains, or dairy products?	1-4
13. As a food source site outside of the cafeteria, do parties offer appealing low-fat fruits, vegetables, grains, or dairy products?	1-4
14. As a food source site outside of the cafeteria, do school-sponsored after school programs offer appealing, low-fat fruits, vegetables, grains, or dairy products?	1-4
15. As a food source site outside of the cafeteria, do other sites offer appealing, low-fat fruits, vegetables, grains, or dairy products?	1-4

16. As a food source site outside of the cafeteria, do other sites offer appealing, low-fat fruits, vegetables, grains, or dairy products?	1-4
17. Is there a system in place to measure student BMIs?	1-4
18. Are BMIs reported to the student's family?	1-4
19. Are BMIs reported to the student's physician?	1-4
20. Do you have a written protocol for management of students identified a risk for overweight or obese?	1-4
Sum of scored items is the scale measuring the continuous variable <i>LOI_08</i>	19-76

Measurement of promotional climate for implementation of the SWP

Effective treatment of childhood obesity requires partnerships between parents and schools to support the activities addressing the problem; calls for changes in school nutrition, environment, and physical activities; and promotes early intervention and prevention (Fitzgibbon, 2008; IOM, 2005; Miller & Taliento, 2009; Nader, O'Brien, Houts, Bradley, Belsky, Crosnow, et al., 2006; Story, 2008). Recognition of the problem of childhood obesity and the support of parents and staff in promoting school based activities to address solutions are a crucial first step (Story, 2009; Zenzen & Kridli, 2009); this recognition of the problem and support for changes in school nutrition, environment, and physical activities was the narrow definition of the climate for implementation of the SWP.

The independent variable of the school districts climate for implementation of the SWP, *climate_08*, was calculated using the nurse leaders' four responses in 2008-2009 to the Healthy Weight survey items including: recognition of obesity as a problem; efforts of the school district to improve the quality of food offered in the schools; the support of staff in efforts of the school district to improve the quality of foods offered in schools; and the support of parents in efforts of the school district to improve the quality of foods offered in schools (Table 6). These responses were measured on an ordinal scale of 1-5, and when combined, created a continuous interval scale of 4-20, depicting the school district climate for implementation.

<i>Table 6. Components of the school district promotional climate for implementation of SWP variable.</i>	
Question from Healthy Weight Surver 2008-2009	Measurement
1. Is obesity a concern in your school community?	1-5
2. Are efforts being made in your school to improve the nutritional quality of meals and snacks available to students?	1-5
3. Does school staff support efforts to improve nutritional quality of meals and snacks, for example, reduce fat and/or caloric content or replace sugared drinks with water or 100% juice?	1-5
4. Do parents support efforts to improve nutritional quality of meals and snacks, for example, reduce fat and/or caloric content or replace sugared drinks with water or 100% juice?	1-5
Sum of scored items is the scale measuring continuous variable <i>climate_08</i> .	4-20

Measurement of school nurse ratio

In this study, the independent variable of school nurse ratio, *SNratio_08*, was defined as the school district number of enrolled students, available from the DESE website, per school district nurse FTEs in the 2008-2009 school year, available from MA DPH ESHS (2009a). Its association with the level of implementation of the SWP and school nurse activities was examined.

Measurement of demographics

Each school district socioeconomic demographic variables of race, income, and geographic location were examined in this study as independent variables. These were available from the MA DESE (2009). Minority and low-socioeconomic-status groups have disproportionately higher rates of obesity at all ages (Bethell, 2010; Kimbro & Rigby, 2010; Singh, Siahpush, & Kogan, 2010a; Wallinga, 2010; Wang & Beydoun, 2007), and for this reason, the independent variables of *NWrace_08* and *lowinc_08* were examined in this study.

Race, Race was defined By MA DESE (2009) in seven categories. The categories were: African American or Black (a person having origins in any of the black racial groups of Africa), Asian (a person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent), Hispanic or Latino (a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race), Multi-race/Non-Hispanic (a person selecting more than one racial

category and non-Hispanic), Native American (a person having origins in any of the original peoples of North and South America [including Central America], and who maintains tribal affiliation or community attachment), Native Hawaiian or Other Pacific Islander (a person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands), or White (a person having origins in any of the original peoples of Europe, the Middle East, or North Africa). For the purposes of this study, the variable *NWrace_08* will be used as an independent ratio variable of percent of ESHS district students who are non-white, or the percent of minority race.

Income. Low income status was defined by the DESE (2009) as the percent of students who are eligible free or reduced price meals by meeting the criteria of receiving: Transitional Aid to Families benefits; food stamps; or family income measures. Requirements for free or reduced fee lunch were defined in the School Lunch Act (US Public Law 108-265, 2004) and were determined by multiplying the Federal income poverty guidelines by 1.30 for free lunch status and 1.85 for reduced fee lunch status (USDA, 2010). These income criteria have remained unchanged since 2005 and students of families that have incomes below the guidelines were eligible for free or reduced fee meals. For the purposes of this study, the independent variable *lowinc_08* was used as an independent ratio variable of percent of ESHS district students who are eligible for free or reduced fee meals in the 2008-2009 school year.

Geographic location. Geographic location of the school district was an independent variable that identified the district location as urban or not urban. The location of the school district may influence the ability of the school district to meet the requirements of the mandate; the suburban and rural school districts may not have the personnel employed to carry out the implementation of the SWP, and urban school districts may have variation in implementation across the school district. In addition, urban geographic locations in this sample have higher concentrations of poor and people of ethnic minorities. The independent geographic location variable, urban_08, was measured as a dummy variable of urban/non-urban location of the school district in the 2008-2009 school year. The geographic location, urban, is available from the MA Secretary of State website at <http://www.sec.state.ma.us/cis/cisctlist/cistlisyalph.html>.

Statistical Analysis

The main purpose of this study as listed in Aim 1 was to examine the association between the ESHS school district level of implementation of the school wellness policy, school nurse activities and the absolute change in percent of students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years. Hypothesis 1a for this aim was in ESHS school districts, higher levels of implementation of the school wellness policy were associated with a higher absolute change in the percent of students with BMI in the obese weight category between the 2005 and 2008 school years, while controlling for the independent variables of the baseline percent of ESHS district

students with BMI in the obese weight category in the 2005-2006 school year, income, race, and geographic location.

The categorical variable urban_08 was examined by frequency and percent. Measures of central tendency, including means and medians, and measures of variability, including ranges and standard deviations, were used to describe each of the continuous variables of absolute change in percent of ESHS students with BMI in the obese weight category between the 2005-2008 school years, the baseline percent of students with BMI in the obese weight category in the 2005-2006 school year, level of implementation of the SWP, school nurse activities, school nurse ratio, race, and income. A correlation matrix was created to examine the strength of the relations between the study variables and identify the direction of those relations.

The correlational matrix and literature review guided a simple linear regression model created to examine and describe the relation between the baseline percent of ESHS students with BMI in the obese weight category in the 2005-2006 school year and absolute change in percent of ESHS students with BMI in the obese weight category between the 2005-2008 school years. Multivariate analysis using ordinary least squares (OLS) regression was used to assess the absolute change in percent of district students with BMI in the obese weight category between the 2005- 2008 school years as a function of the baseline percent of ESHS students with BMI in the obese weight category in the 2005-2006 school year, while controlling for the demographic variables of income, race and geographic location in the equation.

The independent variable of interest, level of implementation of the SWP was added to the model equation to examine the association between continuous level of implementation variable and the absolute change in percent of ESHS students with BMI in the obese weight category between the 2005-2008 school years while controlling for the baseline percent of ESHS students with BMI in the obese weight category in the 2005-2006 school year, income, race and geographic location. Hypothesis 1a was tested using the regression equation:

$$Y [\text{absolutechange (\% obese 2005 - \% obese 2008)}] = a + b [\% \text{ obese 2005}] + c [\% \text{ poverty}] + d [\% \text{ minority}] + e [\text{urban}] + f [\text{level of implementation}] + \text{error term.}$$

The level of implementation variable values were then cut into categories by median, tertiles, and quartiles, allowing further examination in model equations of the variable and its association with the absolute change in percent of ESHS students with BMI in the obese weight category between the 2005-2008 school years while controlling for the baseline percent of ESHS students with BMI in the obese weight category in the 2005-2006 school year, income, race and geographic location. The same model equation was used with the substitution of categorical variable for level of implementation rather than the continuous variable.

Hypothesis 1b for Aim 1 was: in ESHS school districts, higher levels of school nurse activities were associated with a higher absolute change in the percent of students with BMI in the obese weight category between the 2005 and 2008 school years, while controlling for the independent variables of the baseline percent of ESHS district students

with BMI in the obese weight category in the 2005-2006 school year, income, race, and geographic location. The descriptive, correlational and simple linear regression model remained as stated in hypothesis 1a.

Multivariate analysis using OLS was used to examine the association between school nurse activities and the absolute change in percent of ESHS students with BMI in the obese weight category between the 2005-2008 school years while controlling for the baseline percent of ESHS district students with BMI in the obese weight category in the 2005-2006 school year, income, race, and geographic location in the model equation. The second hypothesis of Aim 1 was tested using the regression equation:

$$Y [\text{absolutechange (\% obese 2005 - \% obese 2008)}] = a + b [\% \text{ obese 2005}] + c [\% \text{ poverty}] + d [\% \text{ minority}] + e [\text{urban}] + f [\text{school nurse activities}] + \text{error term.}$$

The school nurse activities variable values were then categorized by median, tertiles, and quartiles, allowing further examination in model equations of the variable and its association with the absolute change in percent of ESHS students with BMI in the obese weight category between the 2005-2008 school years while controlling for the baseline percent of ESHS students with BMI in the obese weight category in the 2005-2006 school year, income, race and geographic location. The same model equation was used with the substitution of categorical variable for school nurse activities rather than the continuous variable.

Aim 2 was to examine the relation between nurse ratio, the promotional climate for implementation of the SWP and the level of implementation of the SWP in ESHS school districts in the 2008-2009 school year. Hypothesis 2a was: controlling for the independent variables of promotional climate for implementation of the SWP, geographic location, race, and income, lower school nurse ratio was associated with higher levels of implementation of the school wellness policy in ESHS school districts in the 2008-2009 school year. The correlational matrix and literature review guided the simple linear regression model that examined the relation between the school nurse ratio and level of implementation of the SWP.

Hypothesis 2b for aim 2 was: controlling for the independent variables of school nurse ratio, geographic location, race, and income, increased promotional climate for implementation of the SWP was associated with higher levels of implementation of the SWP in ESHS school districts in the 2008-2009 school year. The correlational matrix and literature review guided the simple linear regression model that examined the relation between the promotional climate for implementation of the SWP and level of implementation of the SWP.

Multivariate OLS analysis was used to examine the level of implementation of the SWP on school nurse ratio and promotional climate for implementation of the SWP while controlling for geographic location, race, and income in the model equation. In the final OLS multivariate model equation, the level of implementation of the SWP on school nurse ratio and promotional climate for implementation was examined while controlling

geographic location, race, and income. The equation for the regression model used to test these hypotheses was:

$$Y \text{ [level of implementation]} = a + b \text{ [school nurse ratio]} + c \text{ [promotional climate for implementation of the SWP]} + d \text{ [urban]} + e \text{ [minority]} + f \text{ [poverty]} + g \text{ [climate]} + \text{error term.}$$

Aim 3 was to examine the relation between the school district promotional climate for implementation of the SWP, the school nurse ratio, and the school nurse activities in the ESHS school districts in the 2008-2009 school year. Hypothesis 3a was: controlling for the independent variables of promotional climate for implementation of the SWP, geographic location, race, and income, lower school nurse ratio was associated with higher levels of school nurse activities in ESHS school districts in the 2008-2009 school year. The correlational matrix and literature review guided the simple linear regression model that examined the relation between the school nurse ratio and school nurse activities.

In hypothesis 3b, controlling for the independent variables of school nurse ratio, geographic location, race, and income, increased promotional climate for implementation of the SWP was associated with higher levels of school nurse activities in ESHS school districts in the 2008-2009 school year. The correlational matrix and literature review guided the simple linear regression model that examined the relation between the promotional climate for implementation of the SWP and school nurse activities.

Multivariate OLS analysis was used to examine the school nurse activities on school nurse ratio and promotional climate for implementation of the SWP while controlling for geographic location, race, and income in the model equation. In the final OLS multivariate model equation for hypotheses 3a and 3b, the school nurse activities on school nurse ratio and promotional climate for implementation of the SWP were examined while controlling for geographic location, race and income. The equation to test aim 3 hypotheses was: Y [school nurse activities] = a + b [climate] + c [school nurse ratio] + d [urban] + e [minority] + f [poverty] + g [school nurse ratio] + error term.

The unit of analysis is the ESHS school district and this research is generalizable only to the MA ESHS school districts. STATA version 12 was used to analyze the data, and $p < .05$ was considered statistically significant in the analyses indicating confidence levels of 95%. All regression models were checked for multicollinearity using the Variance Inflation Factor (VIF), and heteroskedasticity, using the Breusch-Pagan / Cook-Weisberg test. The OLS regression models have the underlying assumption that the outcome or dependent variable Y is a linear function of the changes in X , the independent variables.

Institutional Review Board

The Institutional Review Board of the University of Massachusetts, Boston approved this study in November, 2011 as exempt (see appendix B). This study used secondary data and the anonymity of the school districts remained intact. The investigator submitted the required Collaborative Institutional Training Initiative certification.

CHAPTER 4

RESULTS

The results of the study are presented in this chapter. Three aims were specified and six hypotheses were tested in order to examine the association between the level of implementation of the SWP, school nurse activities and the absolute change in percent of ESHS students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years. Level of implementation of the SWP and school nurse activities were identified as functions of the school district promotional climate for implementation of the SWP and school nurse ratio. The chapter begins with descriptive analysis and the presentation of characteristics of the 62 school districts followed by correlational analysis and then the presentation of the results of the regression analyses of the specific study aims.

Descriptive Analysis

The characteristics of the sample 62 school districts are described in Table 7. In 2005-2006, the average rate of obesity was 17.7% ($SD = 7.5\%$), and in the 2008-2009 school year this rate decreased to 16.5% ($SD = 5.6\%$). The average absolute change in

percent of ESHS students with BMI in the obese weight category between the 2005-2008 school years was 1.2% (SD 6.6%) and this variable had a wide range of -13.9% to 35%.

The mean value of the level of implementation of the SWP was 54.6 (SD = 6.0) with a range of 41-70. The average school nurse activities variable was 39.90 (SD = 6.9) and had a range of 24-52. The school nurse ratio in 2008-2009 had a wide range of 152-638 students per 1 FTE school nurse indicating wide variation in school district staffing of school nurses. The mean school nurse ratio was 422 (SD = 94). Promotional climate for implementation of the SWP in 2008-2009 did not have a wide range, with a mean of 16 and SD of 3 out of a possible score of 20; most school districts scored this variable highly. The race of students in the selected school districts in 2008-2009 had wide variation; the average percent of minority or non-white race students was 25.5% with a SD of 22.7%. Similarly, there was wide variation in 2008-2009 in the income levels of the school districts as indicated by the percent of students receiving free or reduced-fee meals, an indicator of poverty; on average 27.5% of students received free or reduced fee meals with a SD of 22.2%. There were 29 urban and 33 non-urban districts.

Table 7. Descriptive statistics for major study variables.

Variable	m ± SD	Range (minimum / maximum)	n/%
Percent obese 2008-2009	16.51 ± 5.63	05.24 / 33.26	
Baseline percent obese 2005-2006	17.71 ± 7.55	02.36 / 53.49	
Absolute change in percent obese between 2005 and 2008	1.20 ± 6.61	-13.92 / 35.06	
Level of implementation continuous scale 19-76	54.64 ± 6.03	41 / 70	
Level of school nurse activities continuous scale 13-52	39.90 ± 6.90	24 / 52	
Promotional climate continuous scale 4-20	16.02 ± 3.06	6 / 20	
Income - percent free reduced fee meals	27.49 ± 2.22	02.80 / 87.10	
Race - percent non-white race	25.46 ± 22.68	03.00 / 93.70	
School nurse ratio - district students per one full time school nurse	421.93 ± 94.11	152.50 / 637.86	
Geographic location of city school districts			29 / 46.77
Non-urban school districts			33 / 53.23

Correlation Matrix

Measures of relations among the variables were examined using Pearson's correlation; the correlation matrix is shown in Table 8. As expected, the baseline percent of students with BMI in the obese category in 2005-2006 was significantly correlated with the absolute change in percent of obese in between the 2005-2006 and 2008-2009 school years ($r = 0.69$, $p < .01$). School nurse ratio was correlated with the absolute change ($r = 0.13$, N.S.). The other major study variables were not significantly correlated with the absolute change in percent obese between the 2005-2006 and 2008-2009 school years and had r-values of less than .10.

The baseline percent of ESHS students with BMI in the obese weight category in the 2005-2006 school year was correlated with district income ($r = .46$, $p < .01$) such that school district percent of students receiving free or reduced-fee meals were significantly and positively related to percent of students in the obese weight category. The baseline percent of ESHS students with BMI in the obese weight category in the 2005-2006 school year was correlated with district race ($r = .38$, $p < .01$) such that school districts percent of non-white students was significantly and positively related to percent of students in the obese weight category. The baseline percent of ESHS students with BMI in the obese weight category in the 2005-2006 school year was correlated with district geographic location ($r = .30$, $p < .02$) such that school districts geographically located in urban settings were significantly and positively related to percent of students in the obese weight category.

Table 8. Intercorrelation among study variables: absolute change in percent obese between 2005 and 2008 school years.

	Absolute change in percent obese 2005 -2008	Baseline percent obese 2005-2006	Level of implementation	School nurse activities	Income, percent students of low income	Race, percent students of non-white	Geographic location, urban	Promotional climate for implementation	School nurse ratio
Variable Name	1	2	3	4	5	6	7	8	9
1 Absolute change in percent obese 2005 -2008	-								
2 Baseline percent obese 2005 -2006	.69*	-							
3 Level of implementation	.05	-.07	-						
4 School nurse activities	.01	-.13	.42*	-					
5 Income, percent students of low income	-.08	.46*	.04	.06	*				
6 Race, percent students of non-white race	<.01	.38*	-.17	-.07	.66*	-			
7 Geographic location, urban	<.01	.30*	.09	.12	.60*	.55*	-		
8 Promotional climate for implementation	-.07	.03	.16	.20	.24	.12	.13	-	
9 School nurse ratio	.13	.03	-.10	-.21	-.07	.08	-.09	.06	-

Note: * indicates $p < .05$

The level of implementation of the SWP in 2008-2009 was correlated with school nurse activities ($r = 0.42, p < .01$) such that levels of implementation were significantly and positively related to school nurse activities. The level of implementation of the SWP in school year 2008-2009 was correlated to the school district race ($r = -0.17, N.S.$) such that school district level of implementation of the SWP was negatively related to school district percent of non-white students, but not significantly. Level of implementation of the SWP was correlated with promotional climate for implementation of the SWP in 2008-2009 ($r = 0.16, N.S.$) such that the level of implementation of the SWP was positively related to the climate for implementation of the SWP, but not significantly.

School nurse activities were correlated with the promotional climate for implementation of the SWP in 2008-2009 ($r = .20, N.S.$) such that school nurse activities were positively related to climate for implementation, but not significantly. The school nurse ratio was correlated with school district school nurse activities in 2008-2009 ($r = -.21, N.S.$) and although the relation was insignificant, it was such that school nurse ratio had a positive relation to school nurse activities.

The 2008-2009 triad of school district income, race, and geographic location were all correlated ($r = 0.30$ to $0.66, p < 0.01$), such that school district percent of students receiving free or reduced-fee meals were positively and significantly related to school district percent of non-white race, and those in urban geographic locations. Promotional climate for implementation of the SWP was correlated with school district income ($r = .24, N.S.$), such that climate was positively related to the school district percent of

students receiving free or reduced-fee meals in 2008-2009, but not significantly. The climate for implementation of the SWP in 2008-2009 was correlated to the school district race ($r = 0.12$, N.S.) and geographic location ($r = 0.13$, N.S.) such that promotional climate was positively related to the school district percent of non-white students and urban geographic location, but not significantly.

Regression Models

Aim 1

The first aim of this study was to examine the association between the ESHS school district level of implementation of the school wellness policy, school nurse activities and the absolute change in percent of students with BMI in the obese weight category between the 2005-2008 school years.

Aim 1 Hypothesis 1a. In ESHS school districts, higher levels of implementation of the SWP were associated with a higher absolute change in the percent of students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years, while controlling for the independent variables of the baseline percent of ESHS district students with BMI in the obese weight category in the 2005-2006 school year, income, race, and geographic location. Results for the stepwise regression are shown in Table 9.

In every model the baseline 2005-2006 percent obese was significantly positively associated with absolute change in percent of ESHS students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years, after adjusting for

the school districts demographic variables. These findings indicated that higher rates of baseline obesity were associated with a larger decrease in obesity in 2008-2009. Income was significantly negatively associated with absolute change in percent of ESHS students with BMI in the obese weight category, indicating that poorer school districts had less reduction in the obesity rate.

Table 9. Stepwise regression models: absolute change in percent obese between 2005 and 2008 on continuous level of implementation.

Variable	Model 1	Model 2	Model 3
Baseline 2005 obese percent	.6050*	.8070*	.8176
Income		-.0015*	-.0016*
Race		-.0001	.0001
Geographical location/urban		.4794	.0943
Level of implement.			.1610
Adjusted R ²	.4692	.6578	.6728

Note: * indicates $p < 0.05$

Model 1: absolute change in percent obese between 2005-2006 and 2008-2009 on percent obesity in 2005.

Model 2: absolute change in percent obese between 2005-2006 and 2008-2009 on percent obesity in 2005, income, race, and urban 2008-2009.

Model 3: absolute change in percent obese between 2005-2006 and 2008-2009 on percent obesity in 2005, and income, race, urban, and level of implementation 2008-2009.

Table 10. Stepwise regression models: absolute change in percent obese between 2005 and 2008 on categorical variable of level of implementation.

Variable	Model 1	Model 2	Model 3
Baseline 2005 obese percent	.8202*	.7978*	.8196*
Income	-.0016*	-.0015*	-.0015*
Race	<.0001	<.0001	<-.0001
Geographical location/urban	.2094	.2228	.2035
LOI median 2	1.2813	-	-
LOI tertile 2		2.2264	-
LOI tertile 3		2.0433	-
LOI quartile 2			1.0335
LOI quartile 3			1.9466
LOI quartile 4			1.8369
Adjusted R ²	.6609	.6699	.6527

Note: * indicates $p < 0.05$

Model 1: absolute change in percent obese between 2005-2006 and 2008-2009 on percent obesity in 2005, income, race, urban, and categorical median level of implementation.

Model 2: absolute change in percent obese between 2005-2006 and 2008-2009 on percent obesity in 2005, income, race, urban, and categorical tertiles level of implementation 2008-2009.

Model 3: absolute change in percent obese between 2005-2006 and 2008-2009 on percent obesity in 2005, and income, race, urban, and categorical quartiles of level of implementation 2008-2009.

For models 2-3 in Table 9, the adjusted R² indicated that the model explained approximately 67% of the variation in the dependent variable; and as shown in model 3, Table 9, the level of implementation of the SWP was not significantly associated with absolute change in percent of ESHS students with BMI in the obese weight category after adjusting for baseline obesity rate and demographic variables.

In addition to examining level of implementation as a linear function of the absolute change in obesity rate, the level of implementation was examined as a categorical variable by median, tertile, and quartile categories while controlling for the independent variables of the baseline percent of ESHS district students with BMI in the obese weight category in the 2005-2006 school year, income, race, and geographic location. The results are reported in Table 10.

The upper level of implementation was positively associated with reduction in obesity rate, although not significantly, when using the median as a cut point. Similarly, when tertile and quartile measures of level of implementation were used, the higher levels of implementation as compared to lower levels were positively associated with absolute change in obesity rate. These associations, however, were not statistically significant. Overall, the results revealed that after adjusting for demographic and baseline percent of ESHS students with BMI in the obese weight category variables, level of implementation was not statistically significantly associated with the absolute change in percent of ESHS students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years. Therefore, Aim 1, hypothesis 1a was not supported.

Aim 1 Hypothesis 1b. In ESHS school districts, increased school nurse activities were associated with a higher absolute change in the percent of students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years, while controlling for the independent variables of the baseline percent of ESHS district students with BMI in the obese weight category in the 2005-2006 school year, income, race, and geographic location. Model 3 in Table 11 was expected to explain about 68% of the variation in the dependent variable.

School nurse activities were positively associated with absolute change in obesity rate after adjusting for 2005-2006 percent of ESHS students with BMI in the obese

<i>Table 11. Stepwise regression models: absolute change in percent obese between 2005 and 2008 on continuous school nurse activities.</i>			
	Model 1	Model 2	Model 3
SN activities	.0001	.0010	.0016*
Baseline 2005 obese percent		.6163*	.8332*
Income			-.0016*
Race			<-.0001
Adjusted R ²	.0165	.4710	.6797
Note: * indicates $p < .05$			
Model 1: absolute change in percent obese between 2005-2006 and 2008-2009 on school nurse activities 2008-2009.			
Model 2: absolute change in percent obese between 2005-2006 and 2008-2009 on school nurse activities 2008-2009, and 2005 obese percentage.			
Model 3: absolute change in percent obese between 2005-2006 and 2008-2009 on 2008-2009 school nurse activities, 2005 obese percentage, and income, race, urban 2005 - 2008.			

weight category and demographic variables. The model suggested with every one point increase in SN activities, there was a 0.16% decrease in obesity rate ($p < 0.04$). Poverty was significantly negatively associated with absolute change in percent of ESHS students with BMI in the obese weight category, indicating that poorer school districts had less reduction in the obesity rate.

School nurse activities were then examined by median, tertile and quartile while controlling for the independent variables of the baseline percent of ESHS district students with BMI in the obese weight category in the 2005-2006 school year, income, race, and geographic location. Results are reported in Table 12.

When using the median as cut point, the upper level of school nurse activities was positively associated with greater change in obesity rate, as compared to the lower level of SN activities, although the difference was not statistically significant. When examining SN activities by tertiles and quartiles, the highest levels of school nurse activities, the third tertile and the fourth quartile, were significantly associated with greater absolute change in percent of ESHS students with BMI in the obesity weight category ($p < 0.04$). Overall, the results showed that school nurse activities significantly increased the absolute change in percent of ESHS students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years when adjusting for school district demographics and baseline obesity rate. Therefore, Aim 1, hypothesis 1b was supported.

Table 12. Stepwise regression models: absolute change in percent obese between 2005 and 2008 on categorical variables of school nurse activities.

Variable	Model 1	Model 2	Model 3
Baseline			
2005 obese percent	.8253*	.8287*	.8431*
Income	-.0016*	-.0017*	-.0017*
Race	<.0001	<-.0001	.0001
Geographical location/urban	.2176	.4434	.4100
SNA median 2	1.5090	-	-
SNA tertile 2		-.4861	-
SNA tertile 3		2.6828*	-
SNA quartile 2			-1.1737
SNA quartile 3			.3779
SNA quartile 4			2.7184*
Adjusted R ²	.6651	.6865	.6863

Note: * indicates $p < 0.05$

Model 1: absolute change in percent obese between 2005-2006 and 2008-2009 (abs change) on 2005 obese %, and income, race, urban, and median school nurse activities (SNA) 2008-2009.

Model 2: abs change on 2005 obese %, and income, race, urban, and categorical tertiles of SNA 2008-2009.

Model 3: abs change on 2005 obese % obese and income, race, urban, and categorical quartiles of SNA 2008-2009.

Aim 2

To examine the level of implementation of the SWP in the 2008-2009 school year and its relation to the ESHS school district nurse ratio and the promotional climate for implementation of the SWP. Hypothesis 2a was: controlling for promotional climate for implementation of the SWP, geographic location, race, and income, lower school nurse

ratio was associated with higher levels of implementation of the SWP in ESHS school districts in the 2008-2009 school year. Hypothesis 2b was: controlling for school nurse ratio, geographic location, race and income, increased promotional climate for implementation of the SWP was associated with higher levels of implementation of the SWP in ESHS school districts in the 2008-2009 school year. Results for the stepwise regression models for these hypotheses are displayed in Table 13.

The amount of variance explained by the variables promotional climate for implementation of the SWP, school nurse ratio, geographic location, race and income was modest with an adjusted R² of 0.12. After adjusting for demographic variables,

<i>Table 13. Stepwise regression models: level of implementation on climate and school nurse ratio 2008-2009.</i>				
Variable	Model 1	Model 2	Model 3	
Climate	.2906		.2998	
SN ratio		-.0022	-.0031	
Geo. Location/urban	2.3101	2.2543	2.2289	
Race	-.1080*	-.1080*	-.1043	
Income	.0443	.0540	.0416	
Adjusted R ²	.1188	-.0022	.1211	
Note: * indicates $p < .05$				
Model 1: Level of implementation (LOI) on climate, urban, race and income 2008-2009.				
Model 2: LOI on school nurse ratio, urban, race and income 2008-2009.				
Model 3: LOI on climate, SN ratio, urban, race and income 2008-2009.				

promotional climate for implementation of the SWP and school nurse ratio were positively associated with an increase in the level of implementation, although the associations were not statistically significant. The selected variables did not sufficiently explain the variation in level of implementation of the SWP; therefore Aim 2, hypotheses 2a and 2b were not supported.

Table 14. Stepwise regression models: school nurse activities on school nurse ratio and promotional climate for implementation of the SWP.

Variable	Model 1	Model 2	Model 3
SN ratio	-.0126		-.0140
Climate		.4268	.4679
Geo. Location/urban	2.3168	2.6419	2.2772
Race	-.0628	-.0735	-.0570
Income	.0260	.0188	.0068
Adjusted R ²	.0121	.0827	.0383

Note: * indicates $p < .05$

Model 1: Level of implementation (LOI) on climate, urban, race and income 2008-2009.

Model 2: LOI on school nurse ratio, urban, race and income 2008-2009.

Model 3: LOI on climate, SN ratio, urban, race and income 2008-2009.

Aim 3

To examine school nurse activities and the relation between the ESHS school district promotional climate for implementation of the SWP, the school nurse ratio, and school nurse activities in the 2008-2009 school year. Hypothesis 3a was: controlling for

promotional climate for implementation of the SWP, geographic location, race, and income, lower school nurse ratio was associated with higher levels of school nurse activities in ESHS school districts in the 2008-2009 school year. Hypothesis 3b was: controlling for school nurse ratio, geographic location, race, and income, promotional climate for implementation of the SWP was associated with higher levels of school nurse activities in ESHS school districts in the 2008-2009 school year. Results of the stepwise regression models are presented in Table 14.

Results showed that after adjusting for demographic variables, higher promotional climate and lower school nurse ratio were associated with an increase in school nurse activities, although the associations were not statistically significant. The amount of variance explained by the variables promotional climate for implementation of the SWP, school nurse ratio, geographic location, race and income was modest with an adjusted R² of 0.04, indicating that the selected variables did not adequately explain the variation in school nurse activities, and Aim 3 hypotheses 3a and 3b were not supported.

Summary of Findings

Aim 1 hypothesis 1a in this study was in ESHS school districts, higher levels of implementation of the school wellness policy were associated with a higher absolute change in the percent of students with BMI in the obese weight category between the 2005-2006 and the 2008-2009 school years, while controlling for the independent variables of the baseline percent of ESHS district students with BMI in the obese weight

category in the 2005-2006 school year, income, race, and geographic location. No statistically significant associations were found, and hypothesis 1a was not supported.

Aim 1 hypothesis 1b in this study was in ESHS school districts, higher levels of school nurse activities were associated with a higher absolute change in the percent of students with BMI in the obese weight category between the 2005-2006 and the 2008-2009 school years, while controlling for the independent variables of the baseline percent of ESHS district students with BMI in the obese weight category in the 2005-2006 school year, income, race, and geographic location. The level of school nurse activities was found to be significantly and positively associated with the absolute change in percent of ESHS students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years. The results indicated that after controlling for demographic variables, for every point increase in school nurse activities there was a 0.16% decrease in obesity rate ($p < 0.05$). The highest level of school nurse activities, in the fourth quartile, was associated with a nearly 3% absolute change in percent of students with BMI in the obese weight category when compared to the first quartile. Hypothesis 1b was supported.

Aim 2 hypothesis 2a was controlling for the independent variables of promotional climate for implementation of the school wellness policy, geographic location, race, and income, lower school nurse ratio was associated with higher levels of implementation of the school wellness policy in ESHS school districts in the 2008-2009 school year. No statistically significant association was found between the school nurse ratio and the level of implementation of the SWP, and the hypothesis was not supported.

Aim 2 hypothesis 2b was controlling for the independent variables of school nurse ratio, geographic location, race, and income, higher level of promotional climate for implementation of the school wellness policy was associated with higher levels of implementation of the school wellness policy in ESHS school districts in the 2008-2009 school year. No statistically significant association was found and the hypothesis was not supported.

Aim 3 hypothesis 3a was controlling for the independent variables of promotional climate for implementation of the SWP, geographic location, race, and income, lower school nurse ratio was associated with higher levels of school nurse activities in ESHS school districts in the 2008-2009 school year. Although the direction of the association was as expected, there was no statistically significant association found between lower school nurse ratio and school nurse activities, and this hypothesis was not supported. In Aim3, hypothesis 3b, controlling for the independent variables of school nurse ratio, geographic location, race, and income, increased promotional climate for implementation of the school wellness policy was associated with higher levels of school nurse activities in ESHS school districts in the 2008-2009 school year. There was no statistically significant association found and this hypothesis was not supported.

CHAPTER 5

DISCUSSION

Nearly one third of children and youth in the US is categorized as overweight or obese (Ogdon, 2008; Wallinga, 2010), with rates approaching 50% among publicly insured ethnic minority children who live in low socioeconomic environments (Bethell, 2010; Foster, 2008; Kaufman, 2009). The increase in the prevalence of childhood obesity has led child health authorities to pursue policy interventions that will mitigate and prevent the problem (Barlow 2007; CDC, 2008; IOM, 2004); policy makers are concomitantly enacting strategies to deal with the underlying environmental, agricultural, and inequality issues, as minority and low socioeconomic groups have disproportionately higher rates of obesity at all ages (Bethell, 2010; Kimbro & Rigby, 2010; Singh, 2010a; Wallinga, 2010; Wang & Beydoun, 2007).

Many health and policy experts have proposed mandates that focus on population health and to be implemented in public schools (Barlow, 2007; Brownell, 2009; Fitzgibbon, 2008; Foster, 2009; Frieden, 2010; Kumanyika, 2008; Story, 2009). In 2010, the federal government reauthorized the unfunded mandate that required every school district receiving funds for school meal programs to continue its development and

implementation of a SWP (US Public Law 111-296, 2010). Researchers reported that there were different levels of implementation of the SWP across states and within school districts, likely the result of lack of funding and coordination (Li & Hooker, 2010; Probart, 2010; RWJF, 2010a).

School nurses are in the forefront to address this health issue through their roles in prevention and systems level interventions by promoting the SWP and healthy lifestyles of students. The development and evaluation of SWPs as components of the school nurse role were described by NASN (2011) and by the AAP (2008). In MA, yearly surveys of ESHS school nurse leaders indicate that there is variation in implementation of the SWP within the state (MA DPH, 2009b).

This study was conducted to examine the association between the level of implementation of the SWP and school nurse activities that support students' healthy lifestyles to the absolute change in percent of MA ESHS students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years. The associations of the promotional climate for SWP implementation and school nurse ratio to the level of implementation and school nurse activities were also examined and this is the first known study to examine these relations. The Conceptual Model for Nursing and Health Policy (CMNHP) was a useful guide for this study assisting in the exploration, clarification and descriptions of the intersection of nursing, health policy, and the outcomes of the ESHS school children.

Aim 1

Hypothesis 1a

The results of the first hypothesis testing did not support the association of the level of implementation of the SWP to the absolute change in the percent of ESHS students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years. The reason for this may be a lagged response to the implementation of the policy, the rising rates of childhood obesity, or the combination of both. A significant finding for this hypothesis would have required the association of the level of implementation of the SWP to a reduction in ESHS obese students' BMI measurements as well as a decrease in the occurrence of new cases of obesity among ESHS students.

The level of implementation of the SWP is composed of many factors. The scale created to measure the level of implementation was based on the nurse leaders' responses to 19 (53%) of the 36 Healthy Weight Survey items devised from the legislation mandating the SWP. This method of measurement may have contributed to the lack of significant absolute change in the percent of ESHS students with BMI in the obese weight category (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). The logical link between the measurement of the level of implementation of the policy and the absolute change in BMI may be flawed because the outcome may not be responsive to the policy as measured. The items measuring implementation of the SWP may not be specific enough to determine those aspects of the policy that have a direct influence on the absolute change in BMI.

Those specific aspects of the policy that contribute to the absolute change in BMI may not have been reliably measured by Healthy Weight Survey. Further testing of the reliability of the scale used to measure level of implementation is warranted. Survey responses are subjective, and thus multiple survey items to measure the same aspects of implementation may increase the reliability of the survey instrument.

In this study, the measurement of the concept of implementation of the SWP, by creating a scale from the survey responses, may not have construct validity (Houser, 2008) particularly if the survey items or responses do not accurately reflect the school district level of implementation of the SWP. In addition, one survey was submitted for each school district; there are multiple schools in a school district and implementation levels may not be similar at all district schools.

There was no significant association between the level of implementation of the SWP and the absolute change in percent of students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years evident in those regression models that focused on school districts with the highest 25% of level of implementation, indicating high dose or high intensity of implementation, as measured, was not associated with the absolute change. The examination of the highest level of implementation allowed the risk of inflation in the reporting of the level of implementation of the SWP because it is a requirement of the school district by the federal government for funding to be dismissed.

The lack of significant association between the level of implementation and the absolute change in percent obese may also be due to fragmentation of the role of the coordinator of the SWP. Experts have reported that fragmentation of coordination may lead to poor outcomes (Li & Hooker, 2010; Probart, 2010). Further study about the coordination and implementation of the SWP and its role in reducing childhood obesity is warranted by these findings. The school nurse as the coordinator of the SWP must also be investigated as well as the accompanying issues of school nurse ratios, and the school nurse's responsibility for the care of the district percent of students with special health care needs, and number of school buildings. A descriptive quantitative study of these issues might be a next step in the process of exploration of the implementation of the SWP.

A qualitative study examining the role of the school nurse as wellness coordinator may clarify the nurse's perceived capacity to effectively accomplish implementation of the SWP. Direct observation of the school nurse activities in promoting the SWP in addition to the nurse's subjective responses could be examined in light of prior survey findings in an attempt to increase the quality of the data collected and clarify the activities that promote implementation of the policy.

The requirements of the SWP were for school districts to develop nutritional standards for all foods sold or served in its schools that meet the most recent Dietary Guidelines for Americans; institute goals for nutrition education and physical activity; assign a coordinator to oversee that the policy requirements were met; and evaluate the

district progress in achieving the SWP (US Public Law 108-265, 2008). There were, however, no guidelines or standardization in the measurement of the progress made in attainment of these goals (RWJF, 2009; US Public Law 108-265, 2008). The HHFKA legislation requires standards for foods sold and served in schools, and the establishment of goals for nutrition education and physical activity by the 2012-2013 school year; this legislation may assist in resolving measurement problems and advance study into the drivers of the level of implementation of the SWP through access to meaningful data.

Hypothesis 1b

The results of the second hypothesis testing, that increased school nurse activities were significantly associated with the absolute change in percent of ESHS students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years, are of high importance to stakeholders in school health because of the relation between school nurse practices and policy implications in the reduction of childhood obesity rates. The highest levels of school nurse activities, those in the fourth quartile, were associated with a nearly 3% increase in the absolute change in percent of students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years as compared to the first quartile. Prior to this study there had been limited research with significant findings that associate school nurse activities to a reduction in childhood obesity.

The nursing practice processes and school based healthcare delivery systems that were involved in these highest levels of activities must be identified and defined in order to further investigate their effectiveness in promotion of healthy weight of students. A

first step would be examination of the scale created to measure school nurse activities. The scale was based on the nurse leaders' responses to 13 (36%) of the 36 Healthy Weight survey items devised from the legislation mandating the SWP and may not be reliable nor valid. This method of measurement may have contributed to the significance in the absolute change in the percent of ESHS students with BMI in the obese weight category (Podsakoff, 2003). Further investigation may be to survey school nurses in those ESHS districts with the highest levels of school nurse activities to provide descriptions of the characteristics of those activities and how they were executed.

Qualitative research methods that avoid the biases created through the predefined options on the Healthy Weight Survey may provide suggestions that identify interventions useful in future studies of school nurse activities promoting health policies and reduction of obesity in school children. In addition, a qualitative data collection method, such as recorded focus group discussions, may be beneficial. These may assist in identifying themes that inform investigators how to best implement school nurse activities and may be useful in giving school nurses the opportunity to provide input into the development of other practices designed to meet the health care needs of obese children in the school setting (Gellar, 2012). The relation between lower school nurse ratios on increased school nurse activities approached significance and this requires further investigation, as this finding suggested that school health delivery models providing increased school nurse staff may support those nursing activities that promote the healthy weight status of students.

The significant correlation between school nurse activities and level of implementation of the SWP suggested, too, that increased school nurse activities promoted higher levels of implementation of the SWP and this may prove beneficial if indeed there was a lagged response to the SWP implementation. However, there may be no logical link between the implementation of the SWP and those school nurse activities that promote reduction in BMI prevalence. The nurse activities that supported the absolute change in BMI may be independent of the policy and possibly the result of measurement of students' BMI accompanied by additional school nurse support for those students with BMI in the obese category. This school-based BMI screening activity along with follow-up for those students measuring outside the normal weight category was legislated to begin in MA schools districts in 2010 (MA DPH 2009c), but has been performed in ESHS school districts since 2006-2007.

Overall, the hypothesis testing for Aim 1 found that school district income overshadowed the other demographic variables of race and geographic location as an overwhelming predictor of obesity. Prior research suggested that ethnic minorities were disproportionately represented in childhood obesity rates (Bethell, 2010; Kimbro & Rigby, 2010; Singh, 2010a; Wallinga, 2010). In this study, the variables of income and race may have been confounded, representing a threat to internal validity and suggesting the need for further investigation.

Aim 2

The results of the hypotheses testing of the level of implementation as a function of the school district promotional climate for implementation of the SWP and school nurse ratio were not significant. As previously discussed, the method of measurement of level of implementation may threaten the validity of the results, and this measurement error may apply to the scale created from the nurse leaders' responses regarding the district promotional climate for implementation of the SWP as well. A more in-depth assessment of the components that advanced this climate and the effect of these components on the level of implementation may reveal what drives the implementation of the SWP. The notion that the promotional climate and nurse ratio are the likely variables of interest in the level of implementation may be faulty; other key fiscal, environmental and staffing components must be explored to devise a more specific measurement of the climate promoting the implementation of the SWP.

Aim 3

The results of the hypotheses tested for Aim 3, school nurse activities as functions of school nurse ratio and climate for implementation of the SWP, were not significant. Again, measurement issues of the promotional climate may lack validity and reliability. The use of the variables school nurse ratio and promotional climate of implementation of the SWP to explain the variability in school nurse activities may be defective. As previously discussed, the marginally significant finding of the association between school

nurse ratio and school nurse activity warranted further investigation with possible policy implications for secure staffing models.

Conclusion

This study was an examination the association of the level of implementation of the SWP, school nurse activities, school nurse ratio, and promotional climate for the implementation of the SWP, to the absolute percent change in percent of ESHS students with BMI in the obese weight category between 2005 and 2008 school years, guided by the Conceptual Model of Nursing and Health Policy (CMNHP). The significant result, that increased school nurse activities are associated with an increase in the absolute change in percent of ESHS students with BMI in the obese weight category between the 2005 and 2008 school years, is a useful beginning in the investigation of the intersection of nursing and policy at the school health delivery service level.

Two of the CMNHP assumptions, that nurses are most interested in policies that “influence ... nursing practice” that promotes positive benefits for the public, and that nurses participate in “the formulation, implementation, and evaluation of” these policies (Russell & Fawcett, 2005, p. 320) were also underlying assumptions of this study. The CMNHP guided this research by addressing the SWP components of health care services and personnel, with the foci of school nursing practice and school health delivery system, in the public health domain. Fawcett and Russell (2001) posited that health is the functional state of the nursing practice delivery system and, from the perspective of the community, the effectiveness and efficiency of the practice delivery system is evaluated

in terms of population health - the proportion of the population with a specific problem that has benefitted from nursing care. In this study, use of the CMNHP allowed the examination of the intersection of policy and nursing and the significant association between school nurse activities and the absolute change in percent of ESHS students with BMI in the obese weight category between 2005-2006 and 2008-2009 school years. The CMNHP was assistive in the description and exploration of the interface of nursing, policy and child health outcomes, and may provide the science needed to change the SWP to include a strong school nursing presence in the report to Congress prior to the reauthorization of HHFKA in 2014.

This study may increase the awareness of policymakers and stakeholders to the importance of school nurse research in promoting child health. The over-arching research priority of the National Association of School Nurses (NASN) is to improve the reliability, quality, and accessibility of school health data to promote research in child health and school nursing (NASN, 2011). This study may add to the call for access to the necessary data for the advancement in school health research.

Further research is needed to more succinctly define school nurse activities and delineate data that are required to test hypotheses examining school nurse activities and their support of school policies that contribute to the wellness of children. Future studies of school nursing should focus on measurement of school nurse activities and, specifically, the examination and establishment of the psychometric properties of this survey.

Limitations

The use of secondary data raises concerns about the integrity and adequate reporting of the data (Singleton & Straits, 1999). As with any quantitative study using data initially intended for a different purpose, there is a threat of internal validity because of the lack of knowledge of the specific data collection procedure (Burns & Grove, 2007).

The sample size was small (N=62) thus limiting the power to obtain significant results for the association between the level of implementation of the SWP and the absolute change in percent of ESHS students with BMI in the obese weight category. Although the sample size was small and the results generalizable only to MA ESHS school districts, the study yielded a significant finding in the association between school nurse activities and a reduction in childhood obesity and illustrated the need for further investigation.

The variables used in the regression models for aims 2 and 3 had findings with small adjusted R² values indicating that the regression models did not explain the variation of the level of implementation of the SWP and school nurse activities well. There may be variables that are more critical indicators to explain the variation, but these may not be available in the existing data. The implications are to define the variables that will more fully explain the level of implementation of the SWP and school nurse activities.

There were concerns about the data which were collected as requirements of ESHS grant funding. The reports and surveys, prepared by school nurse leaders, might be biased in favor of school nurse activities, or, in terms of implementation of the SWP, biased in favor of the school district employing the school nurse leader. The school district nurse leaders' responses indicate the stage of development of the programs and processes put into practice by the school district with the intent of meeting the mandated requirements of the SWP implementation, and thus these responses may favor of the level of implementation.

The reliability and validity of the survey instrument have not been evaluated, and although adapted from the CDC School Health Index and George Washington University Center for Health and Healthcare in Schools, the instrument has not been tested for its consistency and appropriateness. The reliability, or consistent measurement, of the middle-range theory concepts presented in this study is questionable because the efficiency, feasibility, comprehensiveness, linearity, simplicity, speededness, and responsiveness of the instrument have not been assessed (Fawcett & Garity, 2009, p. 177). The validity, or the evaluation of the adequacy of the instrument in its measurement of the constitutive definition of a concept in the middle-range theory, is also in question (Fawcett & Garity, 2009, p. 179). This requires future evaluation of the survey which may include qualitative research of its appropriateness and quantitative study of the tool as a consistent measure of the concepts; the estimation of the psychometric properties of the survey is a first step.

To the investigator's knowledge, this was the first research study to use the instrument and subsequently there was concern about three important study variables that were based on self-report survey items: level of implementation of the SWP, school nurse activities, and school district promotional climate for implementation. Two of these variables were included in the main purpose of the study, Aim 1, and lack of validity in measurement of all these variables limits the findings of this study. Further, the questions on the survey were not linked conceptually with the problem of obesity but to the policy implementation, thus limiting associations between the policy and the outcome of reduction in obesity rates. There was also limited instruction and guidance to the school nurse leader regarding definitions of the survey items or responses. The definitions of what constitutes the responses of "partial", or "under development" of the implementation of the policy are lacking, and this requires further clarification.

The use of a pre/post study with a result that indicates a change without the use of a comparison group brings with it potentially confounded results. The absolute change in the percent of students with BMI in the obese weight category between the 2005-2006 and 2008-2009 school years may not be due to the implementation of the SWP or school nurse activities and may have been brought about by socioeconomic or other events that happened during that time period.

Implications

This study has implications for school nurses, researchers and school districts. The school nurse activities that are significantly associated with a reduction in obesity rates for students in the ESHS school districts must be clarified for future studies. Although the activities of the school nurse in promoting healthy behaviors have been well described (RWJF, 2010c), the school nurse activities in promoting the SWP have not been clearly defined or measured in any previous studies. This warrants future qualitative and quantitative school nurse research studies and requires participation of school nurses across the nation.

NASN (2011) described the role of the school nurse in SWP implementation, but recognized the problem of lack of definition of school nurse activities; currently, two of five NASN research priorities deal with improving the quality of school nursing data and isolating critical indicators sensitive to the effects of school nursing interventions. This completed study points out concerns with the lack of reliable and accessible data, and may inform stakeholders of the need to make quality data available to school nurse researchers.

Further study into school health delivery models and the staffing of school nurses is needed. The relation between school nurse ratios, multiple school sites of healthcare delivery, and percent of students with special health care needs on school nursing practice and school health delivery systems must be clarified in order to more robustly examine the effectiveness of school nursing activities on students health and educational

outcomes. Researchers must publicly request and receive data that are reliable in order to carry out this research.

School districts are constrained by lack of economic and human resources. This study may be the impetus to begin looking at the school nurse activities and health delivery system in schools as a support to students that is too valuable to eliminate. School nurses who understand the school cultural and policy environments are assets that can be expected to positively affect student outcomes.

APPENDIX A

FIGURE 2. MASSACHUSETTS ESSENTIAL SCHOOL HEALTH SERVICES ANNUAL QUESTIONNAIRE

Massachusetts Department of Public Health Essential School Health Services Healthy Weight Questionnaire*

School District _____

Using a scale of 1 – 5, 1=Yes, a lot, and 5=No, not much, please answer the following questions by marking the number that reflects your response.

-
1. Is obesity a concern in your school community?
1 2 3 4 5
 2. Are efforts being made in your school to improve the nutritional quality of meals and snacks available to students?
1 2 3 4 5
 3. Do school staff support efforts to improve nutritional quality of meals and snacks, for example, reduce fat and/or caloric content or replace sugared drinks with water or 100% juice?
1 2 3 4 5
 4. Do parents support efforts to improve nutritional quality of meals and snacks, for example, reduce fat and/or caloric content or replace sugared drinks with water or 100% juice?
1 2 3 4 5

Please check the appropriate response for each of the following items.

	Fully in place	Partially in place	Under development	Not in place
5. Are students provided with at least 20 minutes of recess during each school day?				
5a. Do teachers or recess monitors encourage students to be active?				
6. Do all who teach physical education use a sequential PE curriculum that is consistent with state or national standards for PE?				
7. Do all students in each grade receive PE for at least 150 minutes per week throughout the school year?				
7a. Is PE spread over at least three days per week but preferably over five days?				
8. Does the school district promote walking/biking to school?				
9. Do school menus include a variety of foods? (<i>variety defined as a) choice of 2 entrees for lunch, b) 2 choices of fruit or 100% fruit juice daily, c) 2 choices of vegetables daily, d) 5 foods containing whole grains offered weekly</i>)				
10. Does the school food service offer low-fat and skim milk every day?				
11. Do school meals or al carte offerings every day include at least one appealing, low-fat item from each of the following food groups: fruits, vegetables, grains, and dairy products?				

	Fully in place	Partially in place	Under development	Not in place
12. Do students have at least 10 minutes to eat breakfast and at least 20 minutes to eat lunch, counting from the time they are seated?				
13. Is access to vending machines restricted in your school district?				
14. Do sites outside the cafeteria offer appealing, low-fat fruits, vegetables, grains, or dairy products?				
15a. Vending machines?				
15b. Parties?				
15c. School-sponsored after-school programs?				
15. Do school nurses promote physical activity to students and their families through the following methods?				
16a. Distribution of educational materials?				
16b. Individual advice				
16c. Small group discussions				
16d. Presentations				
16. Do school nurses actively promote healthy eating to students and their families through the following methods?				
17a. Distribution of educational materials				
17b. Individual advice				
17c. Small group discussions				

	Fully in place	Partially in place	Under development	Not in place
17d. Presentations				
18. Do school nurses collaborate with other school staff to promote physical activity and healthy eating through the following methods?				
18a. Policy development				
18b. Curriculum development				
18c. Unit/lesson planning				
18d. Special events/planning				
18e. Inservice training				
19. Is there a system in place to measure student BMIs?				
19a. Are BMIs reported to the student's family?				
19b. Are BMIs reported to the student's physician?				
20. Do you have a written protocol for management of students identified at risk for overweight or overweight?				

Thank you for taking the time to complete this survey!

* Adapted from the *Nutrition, Physical Exercise, and Obesity: What's Happening in Your School? Survey* from the Center for Health and Health Care in Schools and the School Health Index, Centers for Disease Control and Prevention.

APPENDIX B

IRB+
INSTITUTIONAL REVIEW BOARD
OFFICE OF RESEARCH AND SPONSORED PROGRAMS
UNIVERSITY OF MASSACHUSETTS BOSTON

November 18, 2011

Mary Jane O'Brien

RE: Your application dated 11/8/2011 regarding study number 2011187: The association between school wellness policy implementation, school nurse activities and weight status of school children in Massachusetts

Dear Ms. O'Brien:

The application has been reviewed by a member of the IRB. They have determined that the research activities described in this proposal do not meet the definition of human subject research for the following reasons:

There will be no intervention of interaction with a living person that would not be occurring or would be occurring in some other fashion, but for this research.

There will be no identifiable private data/information obtained for this research in a form associable with the individual from whom the human material was obtained. Associable means that the identity of the subject is or may readily be associated with information through direct or indirect identifiers, e.g. codes.

This determination was based on the DHHS/OHRP Human Subject Regulations Decision Charts. Additional review by the IRB is not needed. You will not be required to submit annual progress reports; however, you may not make changes to this research activity without first discussing them with the IRB to determine such changes are consistent with this determination. 101(B) (4) data/specimens that already exists.

You are free to conduct your study without further reporting to University of Massachusetts Boston IRB.

Please submit a final report to IRB upon the completion of your study.

Thank you for keeping the board informed of your activities.

Sincerely,

Kristen Kenney, BFA
IRB Administrator

REFERENCE LIST

- American Academy of Pediatrics (2008). Position statement on the role of the school nurse. Retrieved from:
<http://aappolicy.aappublications.org/cgi/reprint/pediatrics;121/5/1052.pdf>
- Ashe, M., Bennett, G., Economos, C., Goodman, E., Schilling, J., Quintiliani, L., Rosenbaum, S., Vincent, J., & Must, A. (2009). Assessing coordination of legal-based efforts across jurisdictions and sectors for obesity prevention and control. *Journal of Law, Medicine and Ethics*, 37, 45-54.
- Barlow, S. E., & the Expert Committee. (2007). Expert Committee recommendations regarding the prevention, assessment and treatment of child and adolescent overweight and obesity: Summary report. *Pediatrics*, 120, s164-s192. Retrieved from: http://www.pediatrics.org/cgi/content/full/120/Supplement_4/S164
- Beets, M. W., Flay, B. R., Vuchinich, S., Acock, A. C., Li, K., & Allred, C. (2008). School climate and teachers' beliefs and attitudes associated with implementation of the positive action program: A diffusion of innovation model. *Prevention Science*, 9, 264-275.
- Bergren, M. D. (2009). National Association of School Nurses testimony at the Robert Wood Johnson Foundation Initiative on the Future of Nursing at the Institute of Medicine Future of Nursing, December 3, 2009. Retrieved from:
http://www.nasn.org/portals/0/legislation/2009_12_03_Testimony_Future_of_Nursing.pdf
- Bethell, C. D., Read, D., Blumberg, S. J., & Newacheck, P. W. (2008). What is the prevalence of children with special health care needs? Toward and understanding of variations in findings and methods across three national surveys. *Maternal Child Health Journal*, 12, 1-14.
- Bethell, C., Simpson, L., Stumbo, S., Carle, A. C., & Gombojav, N. (2010). National, state, and local disparities in childhood obesity. Personal responsibility and obesity: A constructive approach to a controversial issue. *Health Affairs*, 29, 347-356.
- Borup, I. K. & Holstein, B. E. (2010). Overweight children's response to an annual health dialogue with the school nurse. *International Journal of Nursing Practice*, 16, 359-365.

- Brownell, K. D., Kersh, R., Ludwig, D. S., Post, R. C., Puhl, R. M., Schwartz, M., & Willett, W. C. (2010). Personal responsibility and obesity: A constructive approach to a controversial issue. *Health Affairs, 29*, 379-387.
- Brownell, K. D., Schwartz, M. D., Puhl, R. M., Henderson, K. E., & Harris, J. L. (2009). The need for bold action to prevent childhood obesity. *Journal of Adolescent Health, 45*, S8-S17.
- Burns, N., & Grove, S. K. (2007). *Understanding nursing research – building an evidence-based practice (4th ed.)*. St. Louis: Saunders Elsevier.
- Center for Health and Healthcare in Schools. (2007). *Nutrition, Physical Exercise, and Obesity: What's Happening in Your School? 2005/2006 Survey Results*. Retrieved from: <http://www.healthinschools.org/Publications-and-Resources/Polls-and-Surveys/Web-Based-Surveys/Nutrition-Physical-Exercise-and-Obesity-2005-2006-Survey-Results.aspx>
- Centers for Disease Control and Prevention. (2009). *Body mass index measurement in schools*. Retrieved from: <http://www.cdc.gov/Features/ChildBMI/>
- Centers for Disease Control and Prevention. (2008). *Childhood overweight and obesity*. Retrieved from: <http://www.cdc.gov/nccdphp/dnpa/obesity/childhood/index.htm>
- Centers for Disease Control and Prevention. (2007). *Healthy youth! Coordinated school health programs*. Retrieved from: <http://www.cdc.gov/HealthyYouth/CSHP/>
- Centers for Disease Control and Prevention. (2011). *Healthy weight: About BMI for children and teens*. Retrieved from: http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html
- Chang, D.I., Gertel-Rosenberg, A., Drayton, V. L., Schmidt, S., & Anglet, G. B. (2010). A statewide strategy to battle child obesity in Delaware. *Health Affairs, 29*, 481-490.
- Chomitz, V. R., Slining, M. M., McGowan, R. J., Mitchell, S. E., Dawson, G. F., & Hacker, K. A. (2009). Is there relationship between physical fitness and academic achievement? Positive results from public school children in the northeastern United States. *Journal of School Health, 39*, 30-37.

- Chriqui, J. F., Schneider, L., Chaloupka, F. J., Ide, K., & Pugach, O. (2009). Local wellness policies: Assessing school district strategies for improving children's health. School years 2006-07 and 2007-08. Chicago, IL: Bridging the Gap Program, Health Policy Center, Institute for Health Research and Policy, University of Illinois: Chicago. Retrieved from: <http://www.rwjf.org/files/research/20090728bridgingthegapexecsum.pdf>
- Chriqui, J. F., Schneider, L., Chaloupka, F. J., Gourdet, C., Bruursema, A., Ide, K., & Pugach, O. (2010). *School District Wellness Policies: Evaluating Progress and Potential for Improving Children's Health Three Years after the Federal Mandate. School Years 2006-07, 2007-08 and 2008-09. Volume. 2.* Chicago, IL: Bridging the Gap Program, Health Policy Center, Institute for Health Research and Policy, University of Illinois: Chicago. Retrieved from: <http://www.rwjf.org/files/research/2010schooldistrictwellnesspolicies.pdf>
- Clark, A. (2004). The role of the school nurse in tackling childhood obesity. *Nursing Times*, 100, 28-29.
- Cole, K., Waldrop, J., D'Auria, J., & Garner, H. (2006). An integrative research review: Effective school-based childhood overweight interventions. *Journal for Specialists in Pediatric Nursing*, 11, 166-177.
- Cowell, Julia. (2011). Childhood obesity research: Directions for school health researchers and school nurses. *The Journal of School Nursing* 27, 7-12.
- Della Torre, S. B., Akre, C., & Suris, J. (2010). Obesity prevention opinions of school stakeholders: A qualitative study. *Journal of School Health*, 80, 233-239.
- Dentzer, S. (2010). The child abuse we inflict through childhood obesity. *Health Affairs*, 29, 342.
- Dietz, W. H. (1998). Health consequences of obesity in youth: Childhood predictors of adult disease. *Pediatrics*, 101, 518-525.
- Dietz, W. H., Story, M. T., & Leviton, L. C. (2009). Issues and Implications of screening, surveillance, and reporting children's BMI. *Pediatrics*, 124, S98-S101.
- Evans, W. D., Finkelstein, E. A., Kamerow, D. B., & Renaud, J. M. (2005). Public perceptions of childhood obesity. *American Journal of Preventive Medicine*, 28, 26-32.

- Fawcett, J., & Garity, J. (2009). *Evaluating research for evidence-based nursing practice*. Philadelphia: F. A. Davis Company.
- Fawcett, J., & Russell, G. E. (2001). A conceptual model for nursing and health policy. *Policy, Politics, & Nursing Practice*, 2, 108-116.
- Federal Register. (2011). Rules and regulations, June 29, 2011, Department of Agriculture Food and Nutrition Service, 76, Retrieved March 26, 2012 from: <http://www.gpo.gov/fdsys/pkg/FR-2011-06-29/pdf/2011-16282.pdf>
- Finkelstein, D.M., Hill, E. L., Whitaker, R. C. (2008). School environments and policies in US public schools. *Pediatrics*, 122, e251-e259.
- Finkelstein, E. A., Trogon, J. G., Cohen, J. W., & Dietz, W. (2009). Annual medical spending attributable to obesity: payer and service-specific estimates. *Health Affairs*, 28, w822-w831.
- Fitzgibbon, M. L., Hayman, L. L., and Haire-Joshu, D. (2008). Childhood obesity: A Policy Statement of the Society of Behavioral Medicine, July 2008. Retrieved from: http://www.sbm.org/policy/childhood_obesity.asp
- Foster, G. D., Sherman, S., Borradaile, K. E., Grundy, K. M., Vander Veur, S. S., Nachmani, J., Karpyn, A., Kumanyika, S., & Shults, J. (2008). A policy-based school intervention to prevent overweight and obesity. *Pediatrics*, 121, e794-e802.
- Frieden, T. R., Dietz, W., & Collins, J. (2010). Reducing childhood obesity through policy change: Acting now to prevent obesity. *Health Affairs*, 29, 357-363.
- Gellar, L., Druker, S., Osganian, S. K., Gapinski, M. A., LaPelle, N., & Pbert, L. (2012). Exploratory research to design a school nurse-delivered intervention to treat adolescent overweight and obesity. *Journal of Nutrition Education and Behavior*, 44, 46-54.
- Geier, A. B., Foster, G. B., Womble, L. G., McLaughlin, J., Borradaile, K. E., Nachmani, J., Sherman, S., Kumanyika, S., & Shults, J. (2007). The relationship between relative weight and school attendance among elementary schoolchildren. *Obesity*, 15, 2157-2161.
- Gittelsohn, J., & Kumar, M. B. (2007). Preventing childhood obesity and diabetes: Is it time to move out of the school? *Pediatric Diabetes*, 8, 55-69.

- Gordon, A. R., Cohen, T., Crepinsek, M. K., Fox, M. K., Hall, J., & Zeidman, E. (2009). The third nutrition dietary assessment study: Background and study design. *Journal of the American Dietetic Association, 109*, S20-S30.
- Hayman, L. L., Williams, C. L., Daniels, S. R., Steinberger, J., Paridon, S., Dennison, B. A., & McCrindle, B. W. (2004). Cardiovascular health promotion in the schools: A statement for health and education professionals and child health advocates from the committee on atherosclerosis, hypertension, and obesity in youth of the council on cardiovascular disease in the young. American Heart Association. *Circulation, 110*, 2266-2275.
- Himes, J. H. (2009). Challenges of accurately measuring and using BMI and other indicators of obesity in children. *Pediatrics, 124*, S3-S22.
- Houser, J. (2008). *Nursing research*. Sudbury, MA: Jones and Bartlett.
- Illuzzi, S. & Cinelli, B. (2000). A coordinated school health program approach to adolescent obesity. *Journal of School Nursing, 16*, 12-19.
- Institute of Medicine. (2005). *Preventing childhood obesity: Health in the balance*. Washington, DC: National Academies Press.
- Institute of Medicine. (2004). Childhood obesity in the United States: Facts and figures. Retrieved from:
<http://www.iom.edu/Object.File/Master/22/606/FINALfactsandfigures2.pdf>
- Institute of Medicine. (2007). Nutrition standards for foods in schools: Leading the way toward healthier youth. Washington, DC: National Academies Press. Retrieved from:
<http://www.iom.edu/en/Reports/2007/Nutrition-Standards-for-Foods-in-Schools-Leading-the-Way-toward-Healthier-Youth.aspx>
- Jaime, P. C., & Lock, K. (2009). Do school based food and nutrition policies improve diet and reduce obesity? *Preventive Medicine, 48*, 45-53.
- Justus, M. B., Ryan, K. W., Rockenbach, J., Katterapalli, C., & Card-Higginson, P. (2007). Lessons learned while implementing a legislated school policy: Body mass index assessments among Arkansas's public school students. *Journal of School Health, 77*, 706-713.

- Kalavainen, M. P., Korppi, M. O., & Nuutinen O. M. (2007). Clinical efficacy of group-based treatment for childhood obesity compared with routinely given individual counseling. *International Journal of Obesity*, *31*, 1500-8.
- Kaufman, F. R., Hirst, K., Linder, B., Baranowski, T., Cooper, D. M., Foster, G.D., ... Treviño, R.P. (2009). Risk factors for type 2 diabetes in a sixth-grade multiracial cohort: the HEALTHY study. *Diabetes Care*, *32*, 953–955.
- Kimbrow, R. T., & Rigby, E. (2010). Federal food policy and childhood obesity: A solution or part of the problem? *Health Affairs*, *29*, 411-418.
- King, C. A., Meadows, B. B., Engleke, M. K., & Swanson, M. (2006). Prevalence of elevated body mass index and blood pressure in a rural school-aged population: Implications for school nurses. *Journal of School Health*, *76*, 145–149.
- Kruger, B.J., Toker, K. H., Radjenovic, D., Comeaux, J. M., & Macha, K. (2009). School nursing for children with special care needs: Does number of schools make a difference? *Journal of School Health*, *79*, 337-346.
- Kumanyika, S. K., Obarzanek, E., Stettler, N., Bell, R., Field, A. E., Fortmann, S. P., ... Hong, Y. (2008). Population-based prevention of obesity: The need for comprehensive promotion of healthful eating, physical activity, and energy balance. A scientific statement from the American Heart Association Council on Epidemiology and Prevention, Interdisciplinary Committee for Prevention (Formerly the Expert Panel on Population and Prevention Science). *Circulation*, *118*, 428-464.
- Lear, J. G., Barnwell, E. A., Behrens, D. (2008). Health-care reform and school-based health care. *Public Health Report*, *123*, 704-8.
- Lear, J. G. (2007). Health at School: A hidden health care system emerges from the shadows. *Health Affairs*, *26*, 409-419.
- Li, J., & Hooker, N. H. (2010). Childhood obesity and schools: Evidence from the National Survey of Children's Health. *Journal of School Health*, *80*, 96-103.
- Longest, B. B. (2006). *Health policymaking in the United States (4th ed.)*. Chicago: Health Administration Press.

- Massachusetts Department of Elementary and Secondary Education. (2011). *School district profiles*. Retrieved from:
<http://profiles.doe.mass.edu/profiles/student.aspx?orgcode=00000000&orgtypecode=0&&fycode=2009>
- Massachusetts Department of Public Health School Health Unit. (2003). Children weighing in for better health: Body mass index (BMI). *News in School Health, Spring*, 8-9.
- Massachusetts Department of Public Health School Health Unit. (2009a). Essential school health services program data reports 2006-2009. Retrieved from:
http://www.mass.gov/?pageID=eohhs2terminal&L=7&L0=Home&L1=Provider&L2=Guidelines+and+Resources&L3=Guidelines+for+Services+%26+Planning&L4=School+Health&L5=School+Health+Services&L6=Essential+School+Health+Services&sid=Eeohhs2&b=terminalcontent&f=dph_com_health_school_p_eshs_reports&csid=Eeohhs2
- Massachusetts Department of Public Health School Health Unit. (2009b). Annual survey of ESHS nurse leaders 2006-2009. Available by request from MA DPH.
- Massachusetts Department of Public Health School Health Unit. (2009c). BMI screening guidelines for schools. Retrieved from:
<http://www.mass.gov/eohhs/docs/dph/com-health/school/bmi-screening-guidelines-for-schools.pdf>
- Massachusetts Secretary of State. (2011). Massachusetts cities and towns incorporation and settlement dates. Available at:
<http://www.sec.state.ma.us/cis/cisctlist/ctlistalph.htm>.
- Maughan, E. (2009). Part I – Factors associated with school nurse ratios: An analysis of state data. *Journal of School Nursing*, 25, 214-221.
- Mauriello, L. M., Driskell, M. M. H., Sherman, K. J., Johnson, S. S., Prochaska, J. M., & Prochaska, J. O. (2006). Acceptability of a school-based intervention for the prevention of adolescent obesity. *Journal of School Nursing*, 22, 269-77.
- Miller, M., & Taliento, L. (2009). Battling childhood obesity in the US: An interview with Robert Wood Johnson's CEO. *The McKinsey Quarterly*. Retrieved from:
https://www.mckinseyquarterly.com/ghost.aspx?ID=/Food_Agriculture/Battling_childhood_obesity_in_the_US_An_interview_with_Robert_Wood_Johnson_CEO_2316

- Moyers, P., Bugle, L., & Jackson, E. (2005). Perceptions of school nurses regarding obesity in school age children. *Journal of School Nursing, 21*, 86–93.
- Must, A., Jacques, P. F., Dallal, G. E., Bajema, C. J., & Dietz, W. H. (1992). Long-term morbidity and mortality of overweight adolescents. A follow-up of the Harvard Growth Study of 1922 to 1935. *New England Journal of Medicine, 327*, 1350-1355.
- Nader, P. R., O'Brien, M., Houts, R., Bradley, R., Belsky, J., Crosnow, R., ... Susman, E. J. (2006). Identifying risk for obesity in early childhood. *Pediatrics, 118*, e594-e601.
- National Alliance for Nutrition and Activity. (2009). Child nutrition reauthorization recommendations. Retrieved from:
http://cspinet.org/new/pdf/cnr_recommendations_2009.pdf
- National Association of School Nurses. (2010a). School wellness policies. Retrieved from: <http://www.nasn.org/PolicyAdvocacy/SchoolWellnessPolicies>
- National Association of School Nurses. (2010b). Caseload assignments. Retrieved from: <http://www.nasn.org/Default.aspx?tabid=468>
- National Association of School Nurses. (2002). Issue brief: Role of the school nurse. Retrieved from: <http://www.nasn.org/Default.aspx?tabid=279>
- Neymark, K. & Wagner, L. (2006). The acuity of school nurses on their ability to improve eating habits in 11–16 year old students in Denmark. An interview study inspired by the Health Belief Model. *Vard I Norden, 26*, 19–23.
- Nihiser, A. J., Lee, S. M., Wechsler, H., McKenna, M., Odom, E., Reinhold, C., ... Grummer-Strawn, L. (2007). Body mass index measurement in schools. *Journal of School Health, 77*, 651-671.
- Ogden, C. L., Carroll, M. D., & Flegal, K. M. (2008). High body mass index for age among US children and adolescents, 2003–2006. *Journal of the American Medical Association, 299*, 2401–2405.
- Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of applied Psychology, 88*, 879-903.

- Probart, C., McDonnell, E. T., Jomaa, L., & Fekete, V. (2010). Lessons from Pennsylvania's mixed response to federal school wellness law. *Health Affairs*, 29, 447-453.
- Rosas, S., Case, J., & Tholstrup, L. (2009). A retrospective examination of the relationship between implementation quality of the coordinated school health program and school-level academic indicators over time. *Journal of School Health*, 79, 108-115.
- Robert Wood Johnson Foundation. (2009). Local school wellness policies: How are schools implementing the Congressional mandate? *Research brief*, June. Retrieved from: <http://www.rwjf.org/files/research/20090708localwellness.pdf>
- Robert Wood Johnson Foundation. (2010a). School policies and practices to improve health and prevent obesity: National elementary school survey results. *Bridging the gap*. Retrieved from: <http://www.rwjf.org/childhoodobesity/product.jsp?id=46348>
- Robert Wood Johnson Foundation. (2010b). F as in Fat 2010: How obesity threatens America's future. Retrieved from: <http://www.rwjf.org/files/research/20100629fasinfatmainreport.pdf>
- Robert Wood Johnson Foundation. (2010c). Unlocking the potential of school nursing: Keeping children healthy, in school, and ready to learn. *Charting Nursing's Future*, August. Retrieved from: <http://www.rwjf.org/files/research/cnf14.pdf>
- Russell, G. E., & Fawcett, J. (2005). The conceptual model for nursing and health policy revisited. *Policy, Politics & Nursing Practice*, 6, 319-326.
- Salmon, D.A., Moulton, L.H., Omer, S.B., Chace, L.M., Klassen, A., Talebian, P. & Halsey, N.A. (2004). Knowledge, attitudes and beliefs of school nurses and personnel and associations with non-medical immunization exemptions. *Pediatrics*, 113:e552-559.
- Sanchez-Vaznaugh, E. V., Sanchez, B. N., Baek, J., & Crawford, P. B. (2010). 'Competitive' food and beverage policies: Are they influencing childhood overweight trends? *Health Affairs*, 29, 436-446.

- Schainker, E., O'Brien, M. J., Fox, D., & Bauchner, H. (2005). School nursing services: Use in an urban public school system. *Archives of Pediatric and Adolescent Medicine*, *159*, 83-87.
- Singh, G. K., Siahpush, M., & Kogan, M.D. (2010a). Rising social inequalities in U.S. childhood obesity, 2003-2007. *Annals of Epidemiology*, *20*, 40-52.
- Singh, G. K., Siahpush, M., & Kogan, M.D. (2010b). Neighborhood socioeconomic conditions, built environments, and childhood obesity. *Health Affairs*, *29*, 503-512.
- Singleton, R.A., & Straits, B.C. (1995). *Approaches to social research (3th ed.)*. New York: Oxford Press.
- Story, M., Kaphingst, K., Robinson-O'Brien, R., & Glanz, K. (2008). Creating healthy foods and eating environments: Policy and environmental approaches. *The Annual Review of Public Health*, *29*, 253-272.
- Story, M., Sallis, J. F., & Orleans, C. T. (2009). Adolescent obesity: Towards evidence-based policy and environmental solutions. *Journal of Adolescent Health*, *45*, S1-S5.
- Story, M., Nannery, M. S., & Schwartz, M. B. (2009). Schools and obesity prevention: Creating school environment and policies to promote healthy eating and physical activity. *Millbank Quarterly*, *87*, 71-100.
- The White House Office of the Press Secretary. (2010). Press Release: President Obama signs Healthy, Hunger-Free Kids Act of 2010 into law. Retrieved from: <http://www.whitehouse.gov/the-press-office/2010/12/13/president-obama-signs-healthy-hunger-free-kids-act-2010-law>
- Tschannen-Moran, B., Lewis, R., & Farrell, S. P. (2003). Childhood obesity: Policy issues in 2003. *Journal of Pediatric Nursing*, *18*, 416-420.
- United States Department of Agriculture, Food and Nutrition Service. (2011). Legislative History Related to Farm to School. Retrieved from: http://www.fns.usda.gov/cnd/F2S/pdf/F2Sleg_history.pdf
- United States Department of Agriculture, Food and Nutrition Services. (2010). Income and eligibility guidelines. Retrieved from: <http://www.fns.usda.gov/cnd/governance/notices/iegs/iegs.htm>

- United States Department of Agriculture, Food and Nutrition Services. (2012). Nutrition standards for schools meals. Retrieved from:
<http://www.fns.usda.gov/cnd/Governance/Legislation/nutritionstandards.htm>
- United States Department of Commerce, Census Bureau (2010). Historical statistics of the United States, colonial times to 1970; current population reports, series P-20, various years; and Current Population Survey (CPS), October, 1970 through 2009. Retrieved March 13, 2012 from
http://nces.ed.gov/programs/digest/d10/tables/dt10_007.asp?referrer=list
- United States Department of Education, Office of Safe and Drug Free Schools. (2011). Carol M. White Physical Education Program Information and Application Procedures for Fiscal Year 2011. Retrieved from:
<http://www2.ed.gov/programs/whitephysed/2011-215f.pdf>
- United States Department of Health and Human Services, Agency for Healthcare Research and Quality. U.S. Preventive Services Task Force. (2010). Screening for obesity in children and adolescents. Recommendation statement. Retrieved from:
<http://www.ahrq.gov/clinic/uspstfab.htm>
- United States Department of Health and Human Services, National Institutes of Health. (2010). NIH-funded studies aim to prevent, treat childhood obesity: Researchers will also evaluate strategies for children, communities, homes, and schools. Retrieved from:
<http://www.nih.gov/news/health/sep2010/nhlbi-09.htm>
- United States Department of Health and Human Services, United States Department of Agriculture. (2011). 2010 Dietary Guidelines for Americans. Retrieved from:
<http://www.hhs.gov/news/press/2011pres/01/20110131a.html>
- United States Federal Interagency Forum on Child and Family Statistics. (2009). *America's children: Key national indicators of well-being*. Washington, DC: US Government Printing Office.
- United States Office of Management and Budget. (2011). Budget of the United States Government: Fiscal Year 2012. Retrieved from:
<http://www.gpoaccess.gov/usbudget/fy12/pdf/BUDGET-2012-BUD-5.pdf>
- United States Public Law, The Healthy, Hunger-Free Kids Act of 2010, Public Law 111-296. (2010). Retrieved from:
<http://www.gpo.gov/fdsys/pkg/PLAW-111publ296/pdf/PLAW-111publ296.pdf>

- United States Public Law, Child Nutrition and WIC Reauthorization Act of 2004, public Law 108-265. (2004). Retrieved from:
<http://www.govtrack.us/congress/bill.xpd?bill=s108-2507>
- United States Public Law, Richard B. Russell National School Lunch Act, Amended Public Law 110-246. (2008). Retrieved from:
<http://www.fns.usda.gov/cnd/Governance/Legislation/NSLA-10-2008.pdf>
- Van Cleave, J., Gortmaker, S. L., Perrin, J. M. (2010). Dynamics of obesity and chronic health conditions among children and youth. *Journal of the American Medical Association*, 303, 623-630.
- Vinciullo, F. M., & Bradley, B. J. (2009). A correlational study of the relationship between a coordinated school health program and school achievement: A case for school health. *Journal of School Nursing*, 25, 453-465.
- Wallace, R.A., & Wolf, A. (1999). *Contemporary sociological theory: Expanding the Classical tradition (5th ed.)*. Upper Saddle River, NJ: Prentice-Hall, Inc.
- Wallinga, D. (2010). Agricultural policy and childhood obesity: A food systems and public health commentary. *Health Affairs*, 29, 405-410.
- Wang, L. Y., Yang, Q., Lowry, R., & Wechsler, H. (2003). Economic analysis of a school based obesity prevention program. *Obesity research*, 11, 1313-1324.
- Wang, Y., & Beydoun, M. (2007). The obesity epidemic in the United States-- Gender, age, socioeconomic, racial/ethnic, and geographic characteristics: A systematic review and meta-regression analysis. *Epidemiologic Reviews*, 29, 6-28.
- Weepie, A. K. W., & McCarthy, A. M. (2002). A healthy lifestyle program: Promoting child health in schools. *Journal of School Nursing*, 18, 322-328.
- Zenzen, W., & Kridli, S. (2009). Integrative review of school-based childhood obesity prevention programs. *Journal of Pediatric Health Care*, 23, 1-17. Retrieved from: [http://www.jpmedhc.org/article/S0891-5245\(08\)00123-5](http://www.jpmedhc.org/article/S0891-5245(08)00123-5)