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Barriers and Facilitators Regarding Awareness, Selection, and Implementation of School-Based Interventions Addressing Physical Activity and Healthy Eating Behaviors: Perspectives of South Carolina Public School Administrators and Personnel

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Barriers and Facilitators Regarding Awareness, Selection, and Implementation of School-Based Interventions Addressing Physical Activity and Healthy Eating Behaviors: Perspectives of South Carolina Public School Administrators and Personnel

By

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A dissertation submitted to the faculty of the Medical University of South Carolina in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the College of Nursing.

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Introduction

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ABSTRACT

Purpose

This dissertation explores the perceptions and experiences of South Carolina (SC) public school administrators and personnel regarding barriers and facilitators to school-based interventions, with a focus on physical activity (PA) and healthy eating behaviors, to address childhood obesity. An integrative review was completed to identify challenges and supports to school-based weight management interventions.[1-35] Findings from the integrative review provided the framework for the dissertation study, which used a concurrent multi-methodological design to investigate the barriers and facilitators regarding awareness, selection, and implementation of school-based interventions addressing PA and healthy eating behaviors in the SC education system and to examine how the coronavirus disease 2019 (COVID-19) pandemic affected these interventions.

Problem

In SC, approximately 37% of children and adolescents are overweight or obese, and the state ranks 3rd in the nation for the number of youth ages 10-17 who are obese.[36,37] Behaviors that lead to excess weight gain include inadequate participation in PA and consumption of high-calorie, low-nutrient foods.[38] Substantial negative health outcomes are associated with obesity, including increased rates of chronic illnesses, diminished quality of life, and shorter life span.[38-42] Childhood obesity is also linked to psychological and social problems, such as anxiety, depression, and stigmatization.[38,43,44] School-based weight management interventions have successfully improved PA and eating behaviors; however, not all schools offer these types of interventions and some

interventions are not implemented to their fullest extent.[45-49] It is important to understand the factors that hinder and promote the delivery of school-based interventions.

The following research question guided the study: *What do public school administrators and personnel in South Carolina perceive and experience as barriers and facilitators regarding awareness, selection, and implementation of school-based interventions addressing physical activity and healthy eating behaviors?* The specific aims of the dissertation were:

- Aim 1: Describe actual and perceived barriers and facilitators public school administrators and personnel in South Carolina encounter regarding awareness, selection, and implementation of school-based physical activity and healthy eating interventions.
  - Aim 1a. Identify actual and perceived concerns and experiences within school settings regarding the use of weight-related terminology and any stigma that may exist.
  - Aim 1b. Assess ability to recruit and engage public school administrators and personnel in South Carolina to participate in an exploratory study on school-based interventions.
- Aim 2: Identify greatest challenges and supports, priority focal areas, and school-based interventions that have been implemented along with their outcomes.

Design

A concurrent multi-methodological study, informed by the Social Ecological Model (SEM)[50-54] and the Steps in Quality Intervention Development (6SQuID) Model,[55,56] was completed to form a comprehensive understanding of the phenomena.[57,58]

The qualitative descriptive component included one-time Key Informant Interviews (KIIs) with SC public school administrators. The quantitative descriptive component involved conducting a needs assessment survey of SC public school personnel.

Findings

KII participants ($N = 28$) reported that negative beliefs, comments, and bullying behaviors were more prevalent toward students perceived as being overweight. School administrators also indicated that school-based interventions addressing PA and healthy eating behaviors were present in schools. Participants identified insufficient time as the main barrier and adequate support as the primary facilitator to school-based interventions. These factors inhibited or enhanced intervention implementation, based on the extent to which they were present. Survey respondents ($N = 1311$) reported the foremost barriers as insufficient time for PA ($n = 514$, 39.2%) and limited access to healthy foods for healthy eating behaviors ($n = 271$, 20.7%). The key facilitators were adequate support from school-level administrators for PA ($n = 264$, 20.1%) and adequate support from cafeteria staff for healthy eating behaviors ($n = 234$, 17.8%). Both interview and survey participants described the COVID-19 pandemic as causing changes in school-based interventions addressing PA and healthy eating behaviors and in academic delivery impacting PA and healthy eating behaviors. Responses revealed that schools' abilities to address PA and healthy eating behaviors were negatively affected by COVID-19, and the pandemic was predicted to disrupt future school-based interventions related to PA and healthy eating behaviors.

Conclusions

Information from this dissertation provides the foundation for future studies on mitigating barriers and maximizing facilitators to school-based interventions addressing PA and healthy eating behaviors, with the ultimate goal of decreasing rates of childhood obesity. Additionally, findings may help school systems to adapt school-based interventions to changes from the COVID-19 pandemic so that students can still receive and benefit from content on healthy lifestyle practices.[59,60] A promising opportunity for interprofessional collaboration exists for health care and education professionals to work together on school-based interventions that address students' health and academic needs.

Keywords: *childhood obesity, school-based interventions, physical activity, healthy eating behaviors, barriers, facilitators, COVID-19 pandemic, multi-methods*

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INTRODUCTION

Overview of Dissertation

Childhood obesity is a serious health condition associated with negative physical, psychological, and social effects.[1-3] Childhood is a formative period during which children establish health habits; lifestyle changes in this age group are easier compared to adulthood.[4,5] Behaviors that lead to excess weight gain include inadequate participation in physical activity (PA) and consumption of high-calorie, low-nutrient foods.[1] School-based interventions can improve behaviors that contribute to childhood obesity, notably PA and dietary intake, because children spend approximately 6 hours each weekday attending school.[6-11] Despite this evidence, not all schools have these types of interventions in place.[10] In addition, some schools that have tried to implement interventions have faced challenges that are important to understand. This dissertation investigated the barriers and facilitators regarding awareness, selection, and implementation of school-based interventions addressing PA and healthy eating behaviors among South Carolina (SC) public school administrators and personnel. Research on this topic is needed in SC because nearly 37% of children and adolescents are overweight or obese, and the state ranks 3rd in the nation for the number of youth ages 10-17 who are obese.[12,13]

The overall objective of this study was to understand the barriers and facilitators to school-based weight management interventions from the perspectives of public school administrators and personnel in SC to guide future Intervention Mapping (IM). The following research question guided the study: *What do public school administrators and personnel in South Carolina perceive and experience as barriers and facilitators*

regarding awareness, selection, and implementation of school-based interventions addressing physical activity and healthy eating behaviors? The specific aims of the dissertation were:

- Aim 1: Describe actual and perceived barriers and facilitators public school administrators and personnel in South Carolina encounter regarding awareness, selection, and implementation of school-based physical activity and healthy eating interventions.
  - Aim 1a. Identify actual and perceived concerns and experiences within school settings regarding the use of weight-related terminology and any stigma that may exist.
  - Aim 1b. Assess ability to recruit and engage public school administrators and personnel in South Carolina to participate in an exploratory study on school-based interventions.
- Aim 2: Identify greatest challenges and supports, priority focal areas, and school-based interventions that have been implemented along with their outcomes.

The results of this study expand knowledge on barriers and facilitators to school-based interventions to inform future studies that mitigate challenges and maximize supports. These efforts may enhance successful development, adaptation, and implementation of school-based interventions to promote PA and healthy eating behaviors. The long-term goal of this research trajectory is to reduce rates of childhood obesity by influencing school system-wide PA and dietary policies that promote health.

Background and Problem Statement

The World Health Organization (WHO) identifies childhood obesity as one of the 21st century's most serious public health challenges.[2] In the United States, the prevalence of childhood obesity is 19.3%, affecting approximately 14.4 million children and adolescents.[14,15] Behaviors that lead to excess weight gain include inadequate participation in PA and consumption of high-calorie, low-nutrient foods.[1] Youth who are obese face numerous physical health risks associated with the cardiovascular, pulmonary, and endocrine systems, such as hypertension, asthma, and diabetes.[1,3] Childhood obesity is also linked to psychological and social problems, including anxiety, depression, and stigmatization.[1-3] Another important consideration is that children who are obese are likely to have more pronounced rates of obesity and comorbid disease risk factors as adults.[1]

Childhood obesity is also a severe problem in SC because nearly 37% of youth are overweight or obese, and SC has an overall health ranking of 42 out of 50 states.[12,16] Health disparities in SC that contribute to obesity include the state's rurality, educational challenges, diminished access to and affordability of health care, and health communication difficulties related to geographic locations and income.[17] The affordability and income barriers are pronounced because 22.6% of children in SC live in poverty, and poverty is associated with early childhood obesity.[16] Childhood obesity is especially concerning because it contributes to health problems in adulthood and because SC is located in the stroke belt, with high rates of cardiovascular disease and diabetes.[16,18] Addressing and accounting for these issues in research may decrease childhood obesity and reduce life-threatening chronic illnesses.

Currently, childhood obesity is often treated in clinical settings. Numerous challenges exist with this treatment approach, including time and resource constraints, inability to attend appointments, and misunderstandings of medical orders.[19-22] A promising weight management approach is school-based interventions because typically over 95% of youth attend school for approximately 6 hours each weekday, making these accessible and convenient locations for health interventions.[6-11,23] School-based interventions targeting PA and healthy eating patterns have successfully improved behaviors associated with the development of childhood obesity because schools can take more preventative actions compared to clinical settings.[6-11,23] These types of interventions also help promote equity because potentially all students can have access, regardless of their demographic and socioeconomic backgrounds.

Another important consideration is the effect of the coronavirus disease 2019 (COVID-19) on school-based interventions. In January 2020, the United States identified its first confirmed case of COVID-19.[24] By March 2020, all 50 states had reported COVID-19 cases, and the disease had reached pandemic status.[25] In response, schools across the nation transitioned to remote learning to slow the spread of the virus and to protect students and other school members. This unprecedented move interrupted academic education as well as school-based health interventions, and little is known on how these interventions have been affected by COVID-19.[26] This information is especially important as school closures from COVID-19 have been associated with weight gain due to disruptions in students' daily routines.[27,28] As the pandemic continues and schools adjust to required restrictions, there is a need to understand how school-based

interventions addressing PA and healthy eating behaviors have been affected from the perspectives of SC public school administrators and other school personnel.

Gaps in Knowledge

Recent studies explored the barriers and facilitators to implementing school-based interventions in primary and elementary schools from the perspectives of students, family members, school personnel, and community stakeholders.[5,8,29-63] However, there is a notable gap in the literature on system-wide barriers and facilitators regarding awareness, selection, and implementation of school-based interventions addressing PA and healthy eating behaviors from the perspectives of school administrators and the needs of school personnel at all academic levels, including elementary, middle, and high schools. This research is important because school administrators decide whether and which PA or healthy eating interventions can be offered, and school personnel are involved at various stages, from initial planning to content delivery.[64] Furthermore, the educational system in SC warrants attention because the state ranks 3rd in the nation for the number of youth ages 10-17 who are obese.[13] Lack of knowledge about barriers and facilitators limits implementation of school-based interventions that might improve health practices and reduce health risks. Finally, there is no synthesized understanding of the interventions that SC schools have or have not initiated to address obesity-related behaviors and reasons behind these decisions. To improve the knowledge of these interventional activities and decisions, understanding the characteristics of settings, involved individuals, and leadership practices in SC schools is imperative. Also, knowledge of the implementation processes and their outcomes among SC schools that have adopted interventions is essential.

Design and Method

An integrative review of the barriers and facilitators to school-based interventions addressing PA and nutritional intake in primary and elementary schools provided a framework for designing the dissertation study.[63] The study used a concurrent multi-methodological approach, guided by the Social Ecological Model (SEM)[65-69] and the first two steps of the Steps in Quality Intervention Development (6SQuID) Model.[70,71] The qualitative descriptive component involved semistructured, individual Key Informant Interviews (KIIs) with SC public school administrators from all academic levels. Thematic analysis of interview transcripts was conducted to discover patterns within the data.[38,43,63,72,73] The quantitative descriptive element included the conduct of a needs assessment survey of SC public school personnel. Univariate and bivariate descriptive statistical analyses were performed using IBM SPSS Statistics 27.[34,59,63,74-76]

Key Concepts/Terms and Definitions

Two key concepts are defined for this dissertation: childhood obesity and school-based interventions. Childhood obesity is defined based on the WHO's growth reference charts for 5-19 year olds. Children are considered overweight when their body mass index (BMI)-for-age is greater than one standard deviation above the WHO Growth Reference median and obese when their BMI-for-age is greater than two standard deviations above the WHO Growth Reference median.[3] School-based interventions are services offered to students at school locations around regularly scheduled school hours.[77-79] These services can occur before, during, or after school and involve programs addressing PA and healthy eating behaviors.

Theoretical Frameworks

Examining barriers and facilitators through multilevel approaches accounts for factors beyond the individual person. The SEM (Figure 1)[65-69] and 6SQuID Model (Figure 2)[70,71] guided this research.

The SEM addressed the interrelations of the social, cultural, and physical environments; human health; and health behaviors. Core components of this model included intrapersonal, interpersonal, institutional, community, and social/policy levels.[65-69] Intrapersonal factors involved the attitudes, beliefs, knowledge, and behaviors of school administrators and personnel regarding school-based PA and healthy eating interventions. Interpersonal components explored the relationships school administrators and personnel had with students, students' families, and other school officials, and how these personal connections acted as barriers and facilitators to school-based interventions. The institutional level referred to the organizational characteristics existing within school systems, such as physical settings, PA and food options, and access to health promoting resources. Community considerations included school-level relationships in terms of partnerships, involvement of stakeholders, opportunities for physical activity, and access to healthy foods that can impede and promote school-based interventions. Social/policy elements encompassed the broad societal aspects that helped create an environment in which healthy PA and eating behaviors were inhibited or fostered, with a focus on government mandates, policies, and programs regulating PA and nutrition in school settings. Collecting and analyzing data along with interpreting findings in the context of the SEM allowed for knowledge synthesis about barriers and facilitators in school settings, thus providing a framework for future Intervention Mapping (IM) informed by

school-based findings.[65-69] IM is a rigorous and elaborate approach for developing and adapting theory- and evidence-based interventions.[70,71,80,81] IM involves six systematic steps, beginning with understanding various aspects of a health problem and ending with planning evaluations to assess the implementation of an intervention.[70,71,80,81]

The 6SQuID Model focused on the process of quality intervention development through six steps: defining and understanding the problem and its causes; identifying modifiable causal or contextual factors; determining a change mechanism; clarifying how the change mechanism will be delivered; testing and adapting the change mechanism; and collecting evidence of effectiveness.[70,71] This study incorporated the first two steps of the 6SQuID Model. Questions on the interview guide and the needs assessment survey were developed based on these two steps, and data were analyzed to clarify the problems stakeholders perceived and experienced, as well as the problems' causes. This method defined and characterized the barriers and facilitators regarding awareness, selection, and implementation of school-based interventions targeting PA and healthy eating behaviors.[70,71] To determine factors that shaped the problem and had the greatest potential for change, data was examined to describe challenges and supports, identify priority focal areas, and itemize school-based interventions that have been implemented along with their outcomes.[70,71]

Figure 1. Modified Social Ecological Model (SEM)[65-69]

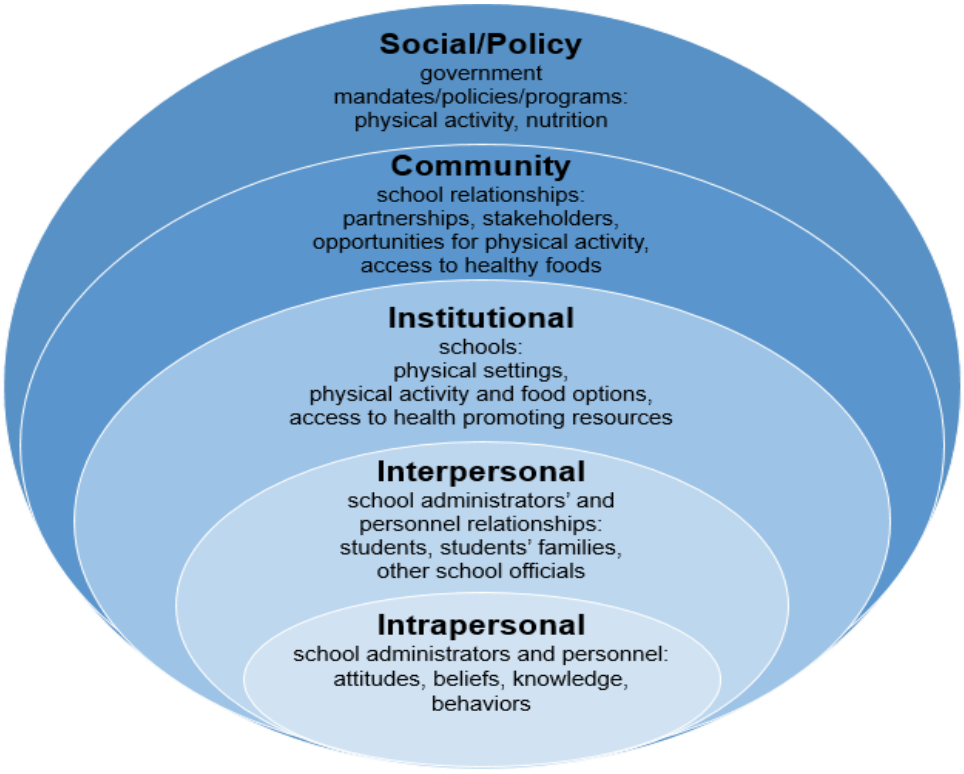
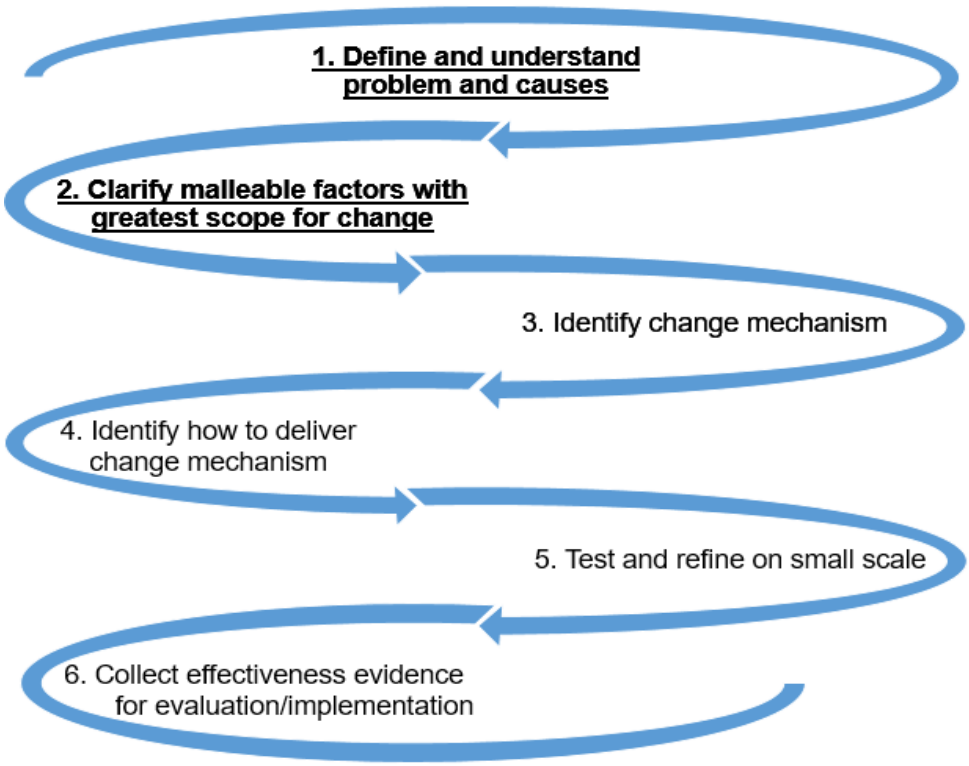


Figure 2. Modified Steps in Quality Intervention Development (6SQuID) Model[70,71]



Description of Dissertation Manuscripts

The first manuscript is a comprehensive integrative review of the barriers and facilitators to school-based interventions addressing PA and nutritional intake in primary and elementary schools.[63] The review was guided by Whittemore and Knafl's methodological framework and the SEM.[65-69,82] A total of 34 studies met inclusion criteria, which involved reporting on school-based interventions targeting health behaviors related to PA and/or nutrition and discussion of barriers and/or facilitators to school-based interventions. Studies were reviewed, analyzed, and evaluated for quality using the Mixed Methods Appraisal Tool.[83]

The second manuscript is the qualitative descriptive component of the study exploring the perspectives of SC public school administrators on school-based interventions addressing PA and healthy eating behaviors.[84] School administrators were defined as people currently serving in leadership roles in schools, such as principals and assistant principals. The interview guide was developed based on the integrative review,[63] the SEM,[65-69] and the first two steps of the 6SQuID model,[70,71] and asked questions about demographic information, schools' roles in students' weight-related health and concerns or experiences with weight-related terminology use or stigma, and experiences with school-based interventions addressing PA and/or healthy eating behaviors with associated barriers and facilitators. Thematic analysis of interview transcripts was conducted to discover patterns within the data.[38,43,63,72,73]

The third manuscript is the quantitative descriptive portion of the study examining the viewpoints of SC public school personnel on barriers and facilitators to PA and healthy eating behaviors in schools.[85] To be eligible for the study, school personnel had

to be employed in certified or licensed roles within schools during the 2019-2020 academic year. A needs assessment survey, informed by the integrative review,[63] the SEM,[65-69] and the first two steps of the 6SQuID model,[70,71] was conducted statewide. Survey questions asked about demographic information and barriers and facilitators to PA and healthy eating behaviors in schools. Univariate and bivariate descriptive statistical analyses were performed using IBM SPSS Statistics 27.[74-76]

The fourth manuscript is the qualitative and quantitative strands of the concurrent multi-methodological study of the impacts of the COVID-19 pandemic on school-based interventions addressing PA and healthy eating behaviors.[86] As part of the larger study examining barriers and facilitators to school-based interventions among public school officials in SC, data were collected on COVID-19's effects on these interventions in the context of remote learning environments. This study incorporated two independent components: qualitative descriptive semistructured interviews conducted with school administrators and a quantitative descriptive needs assessment survey distributed to school personnel. COVID-19 specific responses from the interview transcripts underwent thematic analysis to discover patterns within the data.[38,43,63,72,73] Pandemic-related questions from the needs assessment survey were analyzed using descriptive statistics of multiple choice questions and thematic analysis of write-in responses.[87,88] Statistical analyses were performed using IBM SPSS Statistics 27.[74-76]

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MANUSCRIPT 1: Barriers and Facilitators to School-Based Interventions Targeting Physical Activity and Nutritional Intake Behaviors to Address Childhood Obesity: An Integrative Review

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Abstract

Background: The World Health Organization identifies childhood obesity as one of the 21st century's most serious public health challenges. Behaviors that lead to excess weight gain include inadequate participation in physical activity (PA) and consumption of high-calorie, low-nutrient foods. Some school-based weight management interventions have improved PA and nutritional intake behaviors; however, there is insufficient evidence on common barriers and facilitators to providing these interventions. This integrative review critically appraised the literature by using the Social Ecological Model (SEM) to investigate and synthesize the barriers and facilitators to obesity-targeted interventions in primary and elementary schools.

Methods: The review was guided by Whittemore and Knafl's methodological framework. The electronic databases of EBSCOhost, PubMed, and Scopus, along with reference lists of applicable studies, were searched for appropriate publications from January 2009 – February 2021. Studies were reviewed, analyzed, and evaluated for quality using the Mixed Methods Appraisal Tool.

Results: Thirty-four studies met inclusion criteria. Barriers and facilitators to school-based interventions were analyzed at each level of the SEM. Main barriers involved teachers' lack of time and insufficient resources. Leading facilitators included adequate training and support for school officials.

Conclusions: Understanding barriers and facilitators to primary and elementary school-based interventions addressing PA and nutritional intake behaviors is critical for intervention design, development, and delivery. Although studies have described existing barriers and facilitators, more research is warranted on strategies to mitigate challenges and maximize supports. Results from this review can inform future studies addressing barriers and facilitators to advance school-based weight management interventions.
Keywords: *childhood obesity, nutritional intake, physical activity, school-based interventions, barriers, facilitators*

Introduction

The World Health Organization (WHO) identifies childhood obesity as one of the 21st century's most serious public health challenges.[1] Globally, approximately 340 million children and adolescents are considered overweight or obese.[2] Based on the WHO's growth reference charts for 5-19 year olds, children are considered overweight when their body mass index (BMI)-for-age is greater than one standard deviation above the WHO Growth Reference median and obese when their BMI-for-age is greater than two standard deviations above the WHO Growth Reference median.[2] Behaviors that lead to excess weight gain include inadequate participation in physical activity (PA) and consumption of high-calorie, low-nutrient foods.[3] Substantial negative health outcomes are associated with obesity, including increased rates of chronic illnesses, diminished quality of life, and shorter life span.[3-7] Society also bears a tremendous economic burden associated with childhood obesity through direct and indirect costs.[8,9] In the United States alone, health care expenditures related to childhood obesity are an estimated $14 billion per year.[10,11] The personal, societal, and financial costs associated with this condition emphasize the need for evidence-based practices to prevent and reduce childhood obesity.

Currently, childhood obesity is often treated in clinical settings. Numerous challenges exist with this treatment approach, including time and resource constraints, inability to attend appointments, and misunderstandings of medical orders.[6,12,13] Another important consideration is that children do not have complete control over their health behaviors. Caregivers make decisions regarding children's participation in physical activities and their dietary intake.[3] However, school-based weight management interventions have improved students' PA and eating behaviors associated with

obesity.[14-17] These interventions encourage participants to adopt active roles in maintaining their health. Schools have ready access to children and serve as excellent venues for teaching the importance of healthy lifestyles while encouraging daily PA and nutritious eating habits. In the United States, children typically spend approximately 6 hours per weekday attending school and eat one or two of their daily meals at school, making it a convenient and conducive environment for health interventions.[14-18]

Childhood is a formative period during which children establish health habits; lifestyle changes in this age group are easier compared to adulthood.[19] School-based interventions delivered in primary and elementary schools can contribute to lasting PA and dietary patterns that promote well-being. To better understand the context of public health initiatives in school settings, this integrative review assessed the challenges and supports to primary and elementary school-based interventions targeting PA and nutritional intake behaviors. The purpose of the review was to investigate and synthesize the barriers and facilitators to obesity-targeted interventions in schools through critical appraisal of the literature.

Theoretical Framework

The Social Ecological Model (SEM) was used as the theoretical framework to explore and interpret barriers and facilitators to school-based weight management interventions.[20-24] Examining these elements through multilevel approaches accounts for factors beyond the individual person. The SEM addresses how personal traits, relationships, organizations, community networks, and policies and laws influence health behaviors.[20-24] The SEM involves the following levels: intrapersonal, interpersonal,

institutional, community, and social/policy.[20-24] Table 1 displays the SEM levels with descriptions and barrier and facilitator conceptualizations for analysis in this review.

Methods

Design

Whittemore and Knafl's five-stage methodological framework guided the integrative review to synthesize current knowledge and evaluate the applicability of research findings to inform school health initiatives. The five stages included problem identification, literature search, data evaluation, data analysis, and presentation.[25] The goal was to identify studies published between January 2009 – February 2021 that described barriers and facilitators to primary and elementary school-based interventions targeting PA and/or nutritional intake behaviors to address childhood obesity.

Search Strategy

A medical reference librarian assisted with the development of the search strategy. The electronic databases of EBSCOhost, PubMed, and Scopus were searched for appropriate publications. All 56 databases within EBSCOhost were included, such as Cumulative Index of Nursing and Allied Health Literature (CINAHL) Complete, MEDLINE, and Psychology Information (PsycINFO). Search terms and keywords, like "child," "obesity," "health behavior," "school-base," "barrier," "facilitator," "intervention," "outcome," "physical active," "nutrition," "elementary school," and "primary school," along with Boolean, truncation, and wildcard operators, were used in searches. Supplementary Table 1 displays the detailed search strategy. Hand searches were also completed as reference lists from review articles were evaluated.[26] All searches were originally conducted in September 2019 and updated in February 2021.

Inclusion and Exclusion Criteria

Publications were included if they (1) were scholarly, peer reviewed, primary research studies; (2) were set in elementary or primary schools; (3) reported on school-based interventions targeting health behaviors related to PA and/or nutritional intake; and (4) discussed barriers and/or facilitators to school-based interventions. Studies were excluded if they (1) were not in English, (2) were review articles, or (3) were published prior to 2009 to allow for critical appraisal of most current research findings.

Search Outcome

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement and flow diagram directed the process for screening and selection of relevant studies (Figure 1).[27,28] The initial search strategy in September 2019 yielded a total of 395 citations. The updated search strategy in February 2021 resulted in an additional 80 citations. In total, 34 studies were included in the final synthesis.[29-62] The authors of this review acknowledge that two studies[32,53] have commentaries and correspondences published regarding concerns with statistical analyses and interpretation of results.[63-67] Because this review was focused on barriers and facilitators to school-based interventions and not directed at study results, these two articles were included in this review.[32,53]

Quality Appraisal, Data Extraction, and Synthesis

Studies were evaluated for methodological quality using the Mixed Methods Appraisal Tool (MMAT) (Supplementary Table 2).[68] The MMAT has been tested for reliability and validity and poses 7 questions based on study type: qualitative, quantitative randomized controlled trials, quantitative non-randomized, quantitative descriptive, and

mixed methods. Assessment replies include “Yes”, “No”, and “Can’t tell”. While users are discouraged from calculating overall rating scores, more “Yes” responses indicate that more criteria have been met.[68] Data from the studies were extracted and synthesized into an evidence table that summarized important characteristics, including authors, year, country, and number of MMAT “Yes” responses; study purpose; study elements of design, setting, and school-based intervention; main results; SEM levels addressed; and barriers and facilitators to school-based intervention (Table 2).

Results

All studies ($N = 34$) addressed barriers and/or facilitators to school-based interventions related to childhood obesity from the perspectives of different school stakeholders, including students, families, administrators, teachers, staff, and community members.[29-62] Since the studies focused on primary and elementary school-based interventions, they all advocated increasing PA and/or improving nutritional intake (Table 2). All studies discussed how barriers and/or facilitators affected interventions and how identified concepts hindered or supported intervention efforts. There was a mixture of methodological designs among the studies: quantitative randomized controlled trials ($n = 14$),[30,35-37,39,45,46,48,49,52,53,58,60,62] quantitative non-randomized ($n = 12$),[29,31-33,40,41,44,47,50,54,56,61] qualitative ($n = 4$),[38,42,43,55] mixed methods ($n = 2$),[51,57] and quantitative descriptive ($n = 2$)[34,59] (Supplementary Table 2, Table 2). Studies were conducted in the United States ($n = 19$),[29,30,32,35-37,39,42,44,45,49,50,53-56,59,60,62] England ($n = 3$),[38,41,52] China ($n = 2$),[46,47] Italy ($n = 2$),[33,51] Netherlands ($n = 2$),[57,61] Australia ($n = 1$),[31] Canada ($n = 1$),[40] Iceland ($n = 1$),[48] Ireland ($n = 1$),[43] Malaysia ($n = 1$),[34] and Turkey ($n = 1$)[58] (Table 2).

The majority of studies (n = 26) involved all SEM levels (Table 2).[29-32,34-41,43-46,49,50,53-57,60-62]

School-Based Interventions

School-based interventions predominantly focused on PA and/or nutritional intake practices. In 29 studies, the interventions had both PA and dietary components.[29-36,38,40-46,50-62] These interventions included lessons on healthy PA and meal choices; participation in structured movements, such as games at recess or dance breaks during classes; and cooking and eating high nutritional quality foods. Three studies reported on interventions involving only PA behaviors by integrating PA into academic lessons, increasing activity at recess, and delivering active video games.[39,47,48] Two studies examined specific nutritional interventions, such as school gardens, healthy cooking classes, and installation of water stations.[37,49]

Intrapersonal Level

Student factors such as attitudes, beliefs, knowledge, and behaviors are incorporated in the intrapersonal level of the SEM.[20-24] All studies acknowledged the importance of considering students' personal characteristics to improve PA and dietary intake practices through school-based interventions.[29-62]

Barriers. The inability to change knowledge and habits regarding PA and healthy eating patterns had negative effects on interventions. Despite receiving hands-on lessons about healthy activities and dietary intake, some students were not making sustained adjustments in their lifestyle choices at intervention follow-up.[43,46,55] In two studies, intervention participation did not increase the amount of time students were physically active and did not improve the nutritional quality of consumed foods.[43,55] Lack of

attention, engagement, and motivation; behavioral and learning issues resulting in disciplinary actions; and students being removed from school-based health interventions for tutoring interfered with intervention delivery.[29,46,56,62] In two studies, students' misbehavior during interventional activities presented challenges and required decisions about removing students from interventions.[29,56] The authors of another study cited students being taken out of the school-based intervention for tutoring as a study limitation.[62] These situations served as distractions and decreased the amount of time some students were able to partake in interventions.[29,56,62]

Facilitators. Student engagement, motivation, and cooperation in interventional actions were beneficial to interventions.[29-42,44-48,50,51,53,54,58-61] Students' acceptance of interventions was related to content and enhanced participation was reported in interventions that students found enjoyable and flexible.[29,30,34,35,38,39,41,46,47,50,52,60,61] Two studies highlighted the leadership roles students assumed regarding school-based interventions.[31,42] In one of these studies, students were recruited as health leaders by school officials.[42] The student health leaders participated in the design and delivery of several school-based activities, including a jump rope contest with fruit snacks and a school assembly where the leaders dressed up as healthy foods while a magician performed with raw vegetables that students could eat. Students felt empowered to improve their own well-being and to promote the health of their peers, which fostered acceptance of the school-based health intervention. Student health leaders reported that the student-led health process had positive impacts on students' PA and dietary intake behaviors as a result of the intervention.[42] In four studies, the school-based intervention included a school garden component.[37,38,53,60] Students planted and grew fruits and

vegetables that they were able to eat at school and take home to share with their families. This level of involvement helped students have increased ownership of their health behaviors and dietary choices.[37,38,53,60]

Interpersonal Level

The main interpersonal influences examined by the studies were students' relationships with others, with a focus on the engagement of school faculty and staff, other students, and family members in interventions.[20-24] All studies included school personnel and classmates because interventions were delivered in school settings with numerous barriers and facilitators affecting participation.[29-62] In addition, 29 studies discussed parental involvement, either by intentionally including them in interventions (n = 19) or by having them offer support and encouragement to their children (n = 10).[29,30,32-38,40-46,49-51,53-62]

Barriers. School personnel most frequently reported concerns of time constraints (n = 8),[34,38,43,52,53,59-61] curriculum intrusions (n = 7),[30,35,43,44,48,52,59] and staffing issues (n = 5)[30,31,38,41,52] as barriers to delivering school-based interventions targeting PA and/or nutritional intake. School administrators, faculty, and staff indicated that competing priorities related to academic achievement, multiple role responsibilities, principal turnover, lack of qualified people to provide interventions, and excessive paperwork inhibited school-based interventions.[30,31,34,38,43,48,52,55,59] Teachers also indicated that insufficient training and technical support, along with interventions not being incorporated into annual lesson plans, led to negative attitudes, lack of involvement and buy-in, and feelings of discomfort when delivering interventions.[30,34,37,38,41,43,44,48,52-54,58,60,61]

Parents' perceptions of stigma and social ramifications associated with obesity negatively impacted school-based efforts. In some instances, parents became upset that their children's weight status was addressed at school. One intervention included only children who were obese, and parents received letters about their child's eligibility.[55] Parental resistance resulted in interventions not being supported or endorsed by school administrators and lack of parental involvement in healthy lifestyle action plans.[34,38,55] Other factors that reduced parental participation included challenges of changing familial norms and attitudes, limited availability, and reluctance to commit to interventions and provide data.[33,37,43,47,50-54,58,60,61]

Facilitators. School officials highlighted the importance of having adequate training, support, resources, technical assistance, teamwork, and staff members to facilitate the success of school-based interventions. Interventions that allowed for flexible delivery methods, were easy to deliver and enjoyable, and did not have negative effects on instructional time and learning outcomes were considered favorable and were more likely to be utilized.[29-32,34-41,43-52,54-62] Education sessions on childhood obesity and staff health screenings helped school personnel prioritize health and understand their role in assisting students to learn, establish, and practice healthy PA and eating behaviors. This accountability and communication led to more meaningful interventions with increased engagement.[30,32-34,38,41,43,48,59]

Advocating for students also played a major role in promoting interventions. Four studies emphasized the importance of students feeling supported by trusted adults, such as teachers and parents, in intervention participation. These relationships increased students' accountability and intervention involvement.[29,33,46,51] Encouragement from

teachers, parents, and health authorities came in various forms and included teachers providing content related to PA and diet, parents taking active roles in intervention activities alongside their children, and school nurses tailoring interventions based on student population needs.[33,35,37-39,44,46,49,51,52,55,57,60,61,62] These efforts helped students to understand the importance of healthy lifestyle behaviors to make sustained changes. Parental involvement and communication from schools were especially important in intervention lessons extending beyond school days.[33,35,38,46,50,51,53,57,60-62]

Institutional Level

The institutional settings for all studies were primary and elementary schools.[29-62] Factors such as facilities, resources, funding, and school practices affected school-based interventions.[20-24] Facilities referred to physical structures in the schools to deliver interventions. Resources included PA equipment and availability of healthy foods. Funding considerations involved intervention costs and monetary support. School practices were actions allowed by schools related to PA and food options.

Barriers. Lack of quality facilities and equipment, inadequate financial resources and funding, and scheduling conflicts were identified as institutional barriers to interventions.[29-32,34,38,43,48,52,54,59,60] Limited infrastructure decreased delivery of interventions to their full potential and resulted in frustration for those involved. Classroom considerations, such as the sedentary nature of school days, the inability to use gymnasiums and cooking areas, and not having fitness equipment, created challenges to intervention participation.[32,34,38,39,43,48,52,54] Obstacles like these potentially impacted intervention fidelity.[30,32,34,36,41,44,48,52,60] One study reported on a school practice that allowed teachers to give candy as rewards for student achievement and good behavior.[56]

This type of reward system can negatively impact interventions by nullifying progress students make in choosing healthy foods.[4,56]

Facilitators. Monetary assistance and sufficient funding, low-cost and free materials, and adequate facilities and equipment aided school-based interventions.[30,31,34-38,44,47,49,50,52-54,57,60-62] Appropriate support minimized strain on school budgets, which encouraged participation in healthy PA and eating interventions. School settings generated positive reinforcement of students' efforts by promoting healthy lifestyle practices and incorporating activities into familiar school environments and routines. Interventions that did not negatively compete with academic missions and allowed for resources to be used across curricula were well-positioned within schools.[33-35,37,41,47,49,50,52-54,59-61] Three studies detailed intervention guidelines schools enacted to reinforce PA and healthy eating content to change obesity-related behaviors. These guidelines involved activity breaks between academic lessons, disciplinary actions that did not remove opportunities for PA, non-food rewards and healthy food options for student achievements and during classroom celebrations, and increased access to healthy foods and beverages at school.[35,57,61]

Community Level

Most studies (n = 30) addressed the community level of the SEM because the school-based interventions involved community partnerships and stakeholder input.[20-24,29-41,43-47,49-57,60-62] While the interventions were delivered in schools, community members provided assistance, and participants were able to use interventions in conjunction with outdoor spaces and community resources.

Barriers. Main barriers included lack of community support and engagement, insufficient communication among stakeholders, and volunteer personnel turnover.[34,35,40,43] In one study, participants reported that limited community involvement inhibited the intervention due to inadequate buy-in.[34] The authors of another study identified ineffectual communication with community members as a hindrance to the school-based intervention.[43] These factors increased the burden on schools and made it difficult to translate interventions beyond school settings.

Facilitators. The central facilitator to school-based interventions was external community members providing resources and training and leading intervention lessons and activities.[29-32,35-37,39,40,43-47,49-53,56,57,60-62] These community members included representatives from public health, professional, and non-profit organizations; personnel from universities; health care providers; and employees from local grocery stores and restaurants. This involvement supported efforts and helped relieve school members from adding intervention delivery as a professional responsibility. Community members' work was supplemented by the creation of committees and advisory boards that encouraged teamwork among stakeholders.[37,44,51,53,61,62] One study that included a school garden as part of the intervention highlighted the importance of strong relationships among school nutrition directors, regional produce distributors, and farmers for intervention success.[53]

Social/Policy Level

The social/policy level of the SEM addressed how schools were influenced by government mandates, policies, and programs that affected PA and nutrition.[20-24] While the social/policy level was evident in a majority of studies, only fifteen studies discussed social/policy issues as barriers or facilitators.[30-32,35,37,38,43,44,46,49,50,53,57,60,61]

Barriers. In one study, safety concerns about roads near the school and lack of a formal food service program affected the school-based intervention.[43] A portion of the intervention involved students walking and riding bicycles, but these actions were not fully performed due to dangerous conditions. In addition, the school could not store fresh produce because there was no food service program or food storage area.[43] Inadequate and unsafe travel routes and nutritional policies in the school setting would require government decisions and funding for improvements.

Facilitators. Integration of healthy PA and nutrition policies in schools that aligned with government initiatives enhanced interventions. These types of involvement helped to ensure that interventions were meeting established health standards and were promoting students' well-being.[31,32,35,37,38,43,46,49,50,53,57,60,61] Authorities supported intervention efforts by helping with recruitment, assisting with intervention delivery, and providing monetary incentives.[30,44,46,49,57] These measures encouraged and reinforced participation.

Discussion

This integrative review synthesized the literature on barriers and facilitators to primary and elementary school-based interventions targeting PA and nutritional intake behaviors to address childhood obesity. All studies ($N = 34$) discussed the severity of childhood obesity to emphasize the need for interventions focused on changing weight-related actions.[29-62] The SEM provided a theoretical framework for understanding the multilevel factors affecting school-based interventions.[20-24] Twenty-six studies addressed all levels of the SEM, which demonstrated the importance of considering issues beyond the individual student to encourage healthy lifestyles (Table 2).[29-32,34-41,43-46,49,50,53-57,60-62]

This review expanded on results from other literature reviews while also offering unique perspectives. In accordance with a systematic review and meta-analysis,[69] students' motivation to participate and enjoyment of intervention activities served as barriers or facilitators, depending on the level of motivation and enjoyment. Students need to be invested in interventions in order to promote success and positive outcomes. Three other reviews reported parental involvement as an essential component of school-based interventions that may improve children's health.[70-72] This information is consistent with the barriers and facilitators identified at the interpersonal level of this review. Parents make decisions regarding their children, so by participating in interventions targeting PA and nutritional intake patterns, parents can help their children make lasting behavior changes.

An interesting finding of this review that was reinforced by other reviews was the instrumental roles school personnel play in delivering school-based interventions.[69,70,72] This review increases the understanding of these roles by providing in-depth descriptions of the barriers and facilitators these school members encounter in terms of interventions. This information can guide future research on how to overcome challenges and enhance supports. Additionally, the current review examined community and social/policy factors that hinder or help interventions addressing PA and nutritional intake. These factors are important considerations that should be accounted for in the design and delivery of school-based interventions.

Barriers

The most commonly reported barriers involved teachers' lack of time and insufficient resources related to interventions.[29-31,34,38,43,48,52-55,59-61] In 25 studies, teachers

were directly involved in providing school-based interventions.[29-32,34-39,41-45,48,49,51-54,56,57,60,61] Teachers already face challenges of meeting increased curricular requirements with no extra time built into academic calendars. The addition of health interventions without support from external sources can serve as stressors and lead to non-compliance. Important considerations when designing school-based interventions include giving careful thought as to what can be expected from educators who are already overwhelmed with instructional content and how interventions can be delivered with minimal demands on educational time. Promising opportunities involve incorporating interventions into academic curricula and offering interventions during recess and lunch periods.

Inadequate resources made it difficult to deliver interventions when funding, necessary equipment, and facilities were unavailable.[29-32,34,38,43,48,52,54,59,60] School administrators often work with constricted budgets. These funds are typically allocated to scholastic areas first, with little to no money remaining for interventions concerning PA and nutritional intake.[73] A key implication is that school-based interventions that are free or have few associated costs have a greater chance of being enacted.

Facilitators

The main facilitators to school-based interventions addressing PA and nutritional intake behaviors included adequate training and support for school officials.[29-32,34-41,43-62] School faculty and staff who receive instructions and detailed lesson plans about interventions are more likely to understand their responsibilities and benefits to students, which leads to increased adherence and engagement. Training sessions that provide information on the importance of addressing PA and nutritional intake and have thorough

directions on how to deliver interventions should be presented before school-based interventions are offered.

Adequate support referred to external personnel who assisted with school-based interventions.[29-32,34-41,43-62] These helpers were community members who provided intervention resources, trained school officials, and led students in activities on appropriate PA and dietary habits. This component relieves workload burdens on school members and also allows stakeholders to be involved with students' health. School-based interventions with community participation foster a collaborative environment with improved PA and nutritional intake outcomes.

SEM and Knowledge Gaps

The SEM allowed for a robust understanding and interpretation of the barriers and facilitators to school-based health interventions addressing childhood obesity behaviors.[20-24] More positive outcomes were observed when facilitators outweighed barriers.[29-31,33,35-42,44-48,50-52,54-56,60-62] Understanding these challenges and supports in the context of the SEM can improve intervention delivery.

This review revealed knowledge gaps in the literature because more research is warranted on how to mitigate barriers and maximize facilitators. Further exploration into intrapersonal and social/policy level elements is especially important because these areas were the least detailed in the studies and greatly contribute to school-based intervention efforts.[29-62] In addition, it would be important to examine peer relationships more closely and their influence on interventions. Future studies can focus on mutual themes in terms of barriers and facilitators to have the largest impact on the most common factors.

Reducing burdens and encouraging enablers can lead to improved delivery of school-based interventions to promote health.[74]

Methodological Strengths and Limitations

There are several strengths of this integrative review. First, a medical reference librarian aided with the development of the search strategy. Second, the use of Whittemore and Knafl's methodological framework guided knowledge synthesis while the SEM helped to organize research findings and interpret their meanings in a logical sequence.[20-25] Third, there was a variety of study designs and settings that provided diverse and in-depth results.[29-62] Finally, in the fourteen studies with randomized designs, the randomization took place at the school level, which helped reduce contamination of results.[30,35-37,39,45,46,48,49,52,53,58,60,62]

One of the limitations of this review is that only articles written in English were included. All studies involved self-reported measures for data collection, which could have resulted in response bias and telescoping.[29-62] In addition, 25 studies specifically discussed issues with participant retention and missing data, which could have altered research findings and interpretations of results.[29,30,32,33,35,37,39-42,44-48,50-54,57-59,61,62]

Conclusions

The increasing prevalence of childhood obesity and the evidence showing that school-based weight management interventions can improve PA and nutritional intake behaviors demonstrate the importance of this field of inquiry. Understanding the barriers and facilitators to primary and elementary school-based interventions targeting PA and dietary patterns are critical in the design, development, and delivery of interventions. Although studies have described existing barriers and facilitators, gaps exist on strategies

to mitigate challenges and maximize supports. Results from this review can inform future studies addressing barriers and facilitators to advance school-based health interventions.

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Supplementary Material

Supplementary Table 1

Supplementary Table 2

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Table 1. Social Ecological Model (SEM) Levels, Level Descriptions, and Barrier and Facilitator Conceptualizations[20-24]		
SEM Levels	**Level Descriptions**	**Barrier and Facilitator Conceptualizations**
Intrapersonal	Biological and personal characteristics that impact childhood obesity	Students' characteristics: attitudes, beliefs, knowledge, behaviors
Interpersonal	Relationships with others that affect risk of childhood obesity	Students' relationships: school personnel, other students, family members
Institutional	Social establishments with organizational characteristics and operational rules and regulations related to childhood obesity	Primary/elementary schools: physical settings, food options, access to health promoting resources
Community	Groups of people within defined boundaries who share common values and concerns for members' well-being in terms of childhood obesity	Primary/elementary schools and community connections: partnerships, stakeholders, community resources
Social/Policy	Government/society factors that shape atmospheres that influence childhood obesity	Government mandates/policies/programs: physical activity, nutrition

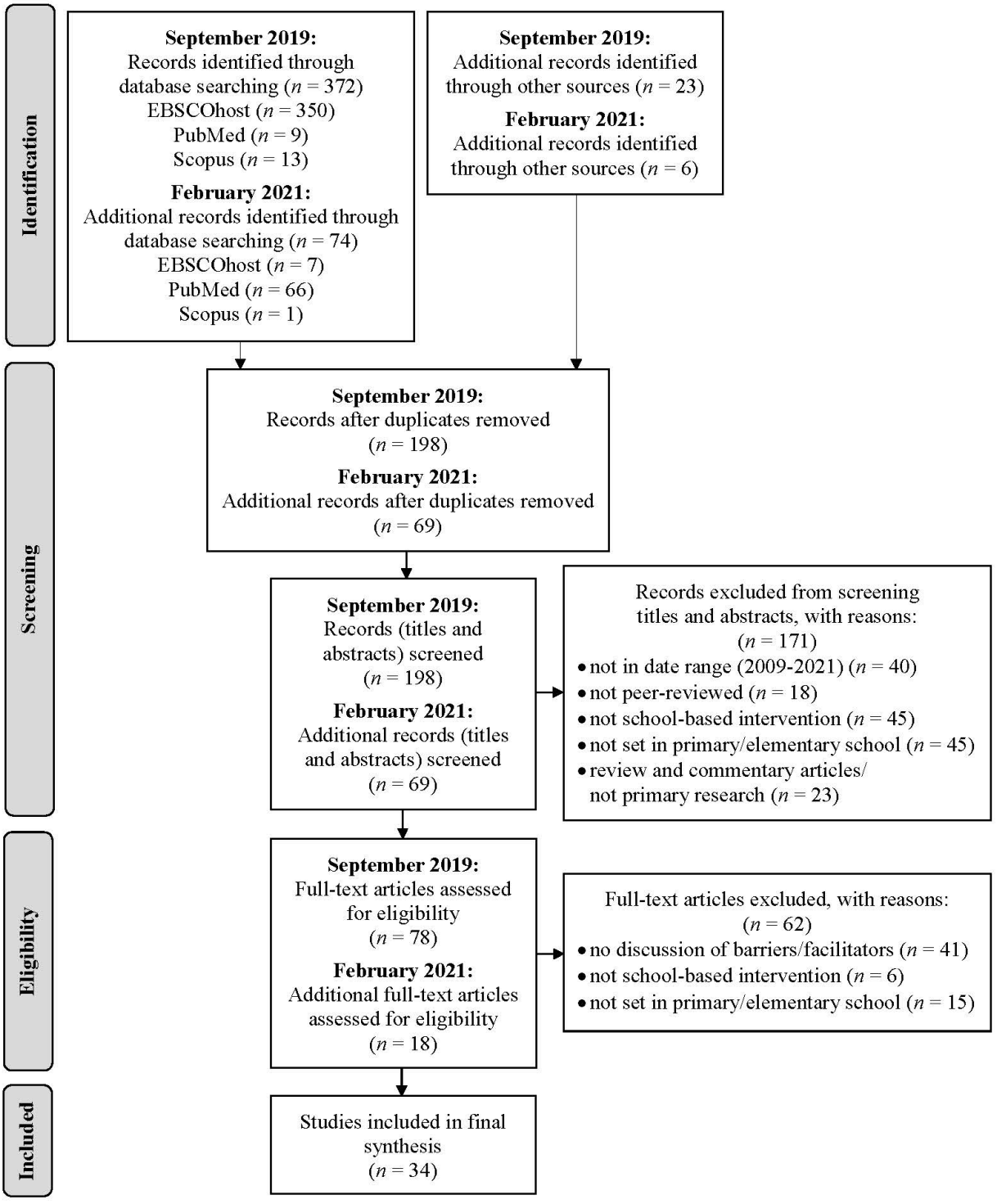

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram.[27,28]

Table 2. Evidence Table: Summary of Characteristics of Included Studies[29-62]					
Authors, Year, Country, MMAT "Yes" Responses	**Study Purpose**	**Study Elements: Design, Setting, School-Based Intervention**	**Main Results**	**SEM Levels Addressed**	**Barriers and Facilitators to School-Based Intervention**
Alaimo et al., 2015,[29] United States, MMAT: 6/7	Report nutrition outcomes and intervention implementation from Project FIT	Quantitative non-randomized 6 elementary schools Project FIT	Small but beneficial effects on consumption of fruits, vegetables, and whole grain bread in ethnically diverse low-income elementary school children	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: student behavior issues, lack of infrastructure Facilitators: intervention flexibility, training, non-food rewards, community support
Belansky et al., 2013,[30] United States, MMAT: 4/7	Implement environment and policy changes related to nutrition and physical activity using an adapted version of Intervention Mapping (AIM)	Quantitative randomized controlled trial 10 elementary schools Adapted Intervention Mapping (AIM) and School Health Index (SHI)	AIM schools: average of 4.4 effective changes, 90% in place one year later SHI schools: average of 0.6 effective changes, 66% in place one year later Implementation steps distinguished AIM from SHI	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: limited time and resources, lack of buy-in, principal turnover, competing priorities, multiple responsibilities Facilitators: accountability, resources and staff, principal involvement, community support, communication, impact feedback

Table 2. Evidence Table: Summary of Characteristics of Included Studies[29-62] *continued*					
Authors, Year, Country, MMAT "Yes" Responses	**Study Purpose**	**Study Elements: Design, Setting, School-Based Intervention**	**Main Results**	**SEM Levels Addressed**	**Barriers and Facilitators to School-Based Intervention**
Bravo et al., 2020,[31] Australia, MMAT: 4/7	Examine Live Life Well @ School (LLW@S) monitoring data to provide insights into adoption and changes in school environments	Quantitative non-randomized 2126 primary schools Live Life Well @ School (LLW@S)	Reach to schools: 82.7% Adoption of desirable practices: 72.9%	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: lack of support, communication difficulties, inadequate training budget, lack of transport and distance Facilitators: student leadership, educator involvement, free materials, funding, community support, aligned with mandatory government requirements
Burke et al.,* 2014,[32] United States, MMAT: 5/7 *published concerns regarding statistical analyses and interpretation of results	Measure effectiveness of HealthMPowers in improving school environment, student knowledge, behavior, cardiovascular fitness levels, and body mass index	Quantitative non-randomized 40 elementary schools HealthMPowers	Improved school practices Improved knowledge and self-reported behaviors Increased performance on Progressive Aerobic Capacity Endurance Run tests Decreased body mass index-for-age z-scores	Intrapersonal Interpersonal Institutional Community Social/Policy	Barrier: budget limitations for equipment Facilitators: training, technical assistance, staff health screenings, resources, incorporation of government health standards

Table 2. Evidence Table: Summary of Characteristics of Included Studies[29-62] *continued*					
Authors, Year, Country, MMAT "Yes" Responses	**Study Purpose**	**Study Elements: Design, Setting, School-Based Intervention**	**Main Results**	**SEM Levels Addressed**	**Barriers and Facilitators to School-Based Intervention**
Centis et al., 2012,[33] Italy, MMAT: 7/7	Test effectiveness of intervention on changing students' habits and making families aware of importance of healthy choices	Quantitative non-randomized 7 primary schools Physical activity and nutrition components	Mean standard deviation score body mass index decreased in intervention group and increased in control group Outdoor activities increased in intervention group	Intrapersonal Interpersonal Institutional Community	Barrier: family involvement time consuming and difficult to obtain Facilitators: support of students by trusted adults, teacher and family involvement, school settings generated positive reinforcement
Chan et al., 2018,[34] Malaysia, MMAT: 7/7	Assess awareness of policies on obesity prevention for school children among school administrators, implementation status, and factors influencing implementation	Quantitative descriptive 447 primary schools Policies on students involved in sports, weight management, food and drinks sold at school, and health promotion	90% of administrators aware of policies 50%-70% of schools fully implemented policies Policy implementation comparable in all schools Barriers and facilitators reported (see last column)	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: lack of equipment, insufficient training, limited time, too much paperwork, no effect on noncompliance, lack of parent and community support Facilitators: knowledge, school member cooperation, priority of health, school responsibility, funding

Table 2. Evidence Table: Summary of Characteristics of Included Studies[29-62] *continued*					
Authors, Year, Country, MMAT "Yes" Responses	**Study Purpose**	**Study Elements: Design, Setting, School-Based Intervention**	**Main Results**	**SEM Levels Addressed**	**Barriers and Facilitators to School-Based Intervention**
Crespo et al., 2012,[35] United States, MMAT: 4/7	Evaluate impact of Aventuras para Niños to promote healthy eating and physical activity and prevent excess weight gain among Latino children	Quantitative randomized controlled trial 13 elementary schools Aventuras para Niños with promotoras (community health advisors)	No significant intervention effects on students' body mass index z-scores Family intervention changed several obesity-related student behaviors that were mediated by changes in parenting variables	Intrapersonal Interpersonal Institutional Community	Barriers: concerns about curriculum intrusions Facilitators: training, dedicated principals, academic content incorporated into intervention, parent involvement, resources, healthy school practices, community support
Cunningham-Sabo et al., 2016,[36] United States, MMAT: 2/7	Describe study protocol for Fuel for Fun: Cooking with Kids Plus Parents and Play (FFF)	Quantitative randomized controlled trial 8 elementary schools Fuel for Fun: Cooking with Kids Plus Parents and Play (FFF)	Not reported	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: none reported in detail Facilitators: training, portion of intervention offered during recess and did not interfere with academic curriculum, resources, community support

Table 2. Evidence Table: Summary of Characteristics of Included Studies[29-62] *continued*					
Authors, Year, Country, MMAT "Yes" Responses	**Study Purpose**	**Study Elements: Design, Setting, School-Based Intervention**	**Main Results**	**SEM Levels Addressed**	**Barriers and Facilitators to School-Based Intervention**
Davis et al., 2021,[37] United States, MMAT: 5/7	Evaluate effects of Texas Sprouts on dietary intake, obesity outcomes, and blood pressure	Quantitative randomized controlled trial 16 elementary schools Texas Sprouts	Intervention resulted in increased vegetable intake No effects of intervention on fruit intake, sugar sweetened beverages, any of obesity measures, or blood pressure	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: training issues, lack of parent support due to transportation and time issues Facilitators: training, incentives for parent involvement, intervention part of academic content, resources, funding, community support, government required nutrition education
Day et al., 2019,[38] England, MMAT: 7/7	Explore perspectives of school stakeholders about factors facilitating and hindering implementation and sustainability of healthy eating and physical activity interventions	Qualitative 14 primary schools PhunkyFoods (PF) Program and Food Dudes (FD) Program (main focus), additional healthy eating and physical activity interventions	All schools delivering range of healthy lifestyle interventions Barriers and facilitators reported (see last column)	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: time constraints, lack of training and technical support, ineffective leadership, lack of parent and staff participation, inadequate resources and funding Facilitators: contextual appropriateness and adaptability, student and teacher engagement, effective leadership, training and technical support, interventions part of academic content, resources, whole school approach, parent and community support

Table 2. Evidence Table: Summary of Characteristics of Included Studies[29-62] *continued*					
Authors, Year, Country, MMAT "Yes" Responses	**Study Purpose**	**Study Elements: Design, Setting, School-Based Intervention**	**Main Results**	**SEM Levels Addressed**	**Barriers and Facilitators to School-Based Intervention**
Donnelly et al., 2009,[39] United States, MMAT: 6/7	Promote physical activity and diminish increases in overweight and obesity through Physical Activity Across the Curriculum (PAAC)	Quantitative randomized controlled trial 24 elementary schools Physical Activity Across the Curriculum (PAAC)	Schools with ≥ 75 minutes of PAAC per week showed significantly less increase in body mass index at 3 years PAAC schools had significantly greater changes in daily physical activity and academic achievement scores	Intrapersonal Interpersonal Institutional Community Social/Policy	Barrier: sedentary nature of school day Facilitators: students and school personnel enjoyed intervention, training, intervention flexibility, intervention positively influenced academic achievement and did not interfere with academic instruction, teachers modeling physical activity, no extra preparation time, low burden and minimal cost, community support
Fung et al., 2012,[40] Canada, MMAT: 7/7	Examine changes in diet, physical activity, and weight status among students in Alberta Project Promoting active Living and healthy Eating (APPLE) Schools	Quantitative non-randomized 160 elementary schools Alberta Project Promoting active Living and healthy Eating (APPLE) Schools	Students attending APPLE Schools were eating more fruits and vegetables, consuming fewer calories, more physically active, and less likely to be obese	Intrapersonal Interpersonal Institutional Community Social/Policy	Barrier: lack of stakeholder engagement Facilitators: training, principal support, community support

Table 2. Evidence Table: Summary of Characteristics of Included Studies[29-62] *continued*					
Authors, Year, Country, MMAT "Yes" Responses	**Study Purpose**	**Study Elements: Design, Setting, School-Based Intervention**	**Main Results**	**SEM Levels Addressed**	**Barriers and Facilitators to School-Based Intervention**
Gorely et al., 2009,[41] England, MMAT: 7/7	Evaluate effect of GreatFun2Run on physical activity, fruit and vegetable consumption, body composition, knowledge, and psychological variables	Quantitative non-randomized 8 primary schools GreatFun2Run	Total time in moderate-to-vigorous physical activity, time in moderate-to-vigorous bouts, and daily steps per day increased in intervention group No differences in fruit and vegetable intake	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: no specialist physical education teachers, lack of training Facilitators: intervention flexibility, strong head-teacher/principal support, cross-curricular nature of resources, whole school initiative
Gutuskey et al., 2016,[42] United States, MMAT: 7/7	Examine students' perceptions of participating in student-led school health improvement team	Qualitative 1 elementary school Student-led school health improvement team	Student-led health reform process improved students' leadership skills and health behaviors	Intrapersonal Interpersonal Institutional	Barrier: sustainability concerns Facilitators: youth-led health reform process, student leaders, student empowerment

Table 2. Evidence Table: Summary of Characteristics of Included Studies[29-62] *continued*					
Authors, Year, Country, MMAT "Yes" Responses	**Study Purpose**	**Study Elements: Design, Setting, School-Based Intervention**	**Main Results**	**SEM Levels Addressed**	**Barriers and Facilitators to School-Based Intervention**
Hayes et al., 2019,[43] Ireland, MMAT: 7/7	Explore and categorize factors that enhance or hinder implementation and transferability of multi-component dietary and physical activity school-based interventions	Qualitative 6 primary schools Food Dudes (FD) Program, Green Schools Travel (GST)	Good working relationships with government and schools critical for interventions Organization and leadership abilities of coordinators essential Participation incentives motivate students Understanding students' lives important contextual factor Importance of adaptation to enhance intervention sustainability Barriers and facilitators reported (see last column)	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: difficult to change students' personal and family habits, parent issues, time constraints, insufficient communication, record keeping, curricular commitments, lack of funding, difficult to measure implementation, lack of canteens in schools, road and transport infrastructure safety concerns, lack of set intervention protocols Facilitators: effective leadership, school staff as role models, intervention simplicity, training, funding, health policies, community and government support

Table 2. Evidence Table: Summary of Characteristics of Included Studies[29-62] *continued*					
Authors, Year, Country, MMAT "Yes" Responses	**Study Purpose**	**Study Elements: Design, Setting, School-Based Intervention**	**Main Results**	**SEM Levels Addressed**	**Barriers and Facilitators to School-Based Intervention**
Hoelscher et al., 2010,[44] United States, MMAT: 7/7	Compare impact of Coordinated Approach To Child Health BasicPlus (CATCH BP) and Coordinated Approach to Child Health BasicPlus and Community (CATCH BPC) on prevalence of overweight and obesity	Quantitative non-randomized 30 elementary schools Coordinated Approach To Child Health BasicPlus (CATCH BP) and Coordinated Approach to Child Health BasicPlus and Community (CATCH BPC)	Percent of students classified as overweight/obese decreased by 1.3 points in BP schools compared to decrease of 8.3 points in BPC schools More positive results found among dietary and activity behaviors for students in CATCH BPC schools More physical activity and healthy eating programs implemented in CATCH BPC schools	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: delayed training, lack of intervention incorporation into annual teacher lesson plans Facilitators: training, intervention instructions, teacher awareness and accountability for teaching curriculum, principal support, resources, community support, monetary awards for intervention delivery

Table 2. Evidence Table: Summary of Characteristics of Included Studies[29-62] *continued*					
Authors, Year, Country, MMAT "Yes" Responses	**Study Purpose**	**Study Elements: Design, Setting, School-Based Intervention**	**Main Results**	**SEM Levels Addressed**	**Barriers and Facilitators to School-Based Intervention**
Koch et al., 2019,[45] United States, MMAT: 3/7	Conduct outcome evaluation of the Food, Health, & Choices (FHC) intervention	Quantitative randomized controlled trial 20 elementary schools Food, Health, & Choices (FHC)	No obesity changes Negative curriculum intervention change in physical activity Positive wellness intervention change in unhealthy food consumption	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: none reported in detail Facilitators: principal support, stipend for classroom teachers to attend training, substituted for current curriculum, community support
Li et al., 2019,[46] China, MMAT: 5/7	Evaluate clinical- and cost-effectiveness of Chinese Primary School Children Physical Activity and Dietary Behaviour Changes Intervention (CHIRPY DRAGON)	Quantitative randomized controlled trial 40 primary schools Chinese Primary School Children Physical Activity and Dietary Behaviour Changes Intervention (CHIRPY DRAGON)	High adherence rates Mean difference in body mass index z-scores was -0.13 Beneficial intervention effects observed on food consumption, screen-based sedentary behavior, and physical activity Intervention was cost effective	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: boys not taking health behavior challenges seriously, boys less attentive Facilitators: intervention handbook for teachers and principals, training, respect for schools and teachers, community support, local education and health authority support

Table 2. Evidence Table: Summary of Characteristics of Included Studies[29-62] *continued*					
Authors, Year, Country, MMAT "Yes" Responses	**Study Purpose**	**Study Elements: Design, Setting, School-Based Intervention**	**Main Results**	**SEM Levels Addressed**	**Barriers and Facilitators to School-Based Intervention**
Liang et al., 2020,[47] China, MMAT: 5/7	Determine effects of school-based active video game (AVG) intervention on sedentary time, physical activity, body composition, and psychosocial factors	Quantitative non-randomized 1 primary school Active video game (AVG)	No group differences in sedentary time Intervention group increased total physical activity No differences in body composition and psychosocial variables Treatment effects on body mass index z-scores among boys	Intrapersonal Interpersonal Institutional Community	Barriers: teachers not involved in intervention delivery, no family involvement Facilitators: students selected playing partners, after-school intervention did not interfere with academic curriculum, resources, community support
Magnusson et al., 2011,[48] Iceland, MMAT: 4/7	Assess extent physical activity during and after school hours changed among students who received progressive school-based intervention	Quantitative randomized controlled trial 6 elementary schools Multi-component physical activity and healthy diet intervention	Intervention group more physically active after one year No difference in physical activity between groups after two years Barriers and facilitators reported (see last column)	Intrapersonal Interpersonal Institutional	Barriers: teacher resistance, competing curriculum demands, tightly booked gymnasium Facilitators: training, positive attitudes of principals and teachers, intervention integrated into academic curriculum, teaching materials, resources, community support

Table 2. Evidence Table: Summary of Characteristics of Included Studies[29-62] *continued*					
Authors, Year, Country, MMAT "Yes" Responses	**Study Purpose**	**Study Elements: Design, Setting, School-Based Intervention**	**Main Results**	**SEM Levels Addressed**	**Barriers and Facilitators to School-Based Intervention**
Moreno et al., 2020,[49] United States, MMAT: 3/7	Examine how increased access to safe and appealing drinking water at school, coupled with robust education and promotion activities, impacts food and beverage intake and obesity	Quantitative randomized controlled trial 26 elementary schools Water First	Not reported	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: students could fill up on water Facilitators: intervention promotion, classroom lessons, parent engagement, resources, community support, monetary and non-food incentives for participation, intervention supported government water policy
Narayanan et al., 2019,[50] United States, MMAT: 4/7	Address five elements of RE-AIM (reach, efficacy, adoption, implementation, maintenance) framework to evaluate Team Kid POWER!'s (KiPOW!'s) effect to improve implementation of federal and local school policies	Quantitative non-randomized 5 elementary schools Team Kid POWER! (KiPOW!): Full and Lite versions	Modest reduction in body mass index percentile in Full Systolic blood pressure improved in Full more than in Lite Diastolic blood pressure improved in Full and Lite Annual renewal of volunteer commitment sustainable	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: limited family involvement, variations in resources Facilitators: minimal demand on academic time, low intervention cost, school health policies, sustainable volunteer energy, community support, intervention followed government recommendations

Table 2. Evidence Table: Summary of Characteristics of Included Studies[29-62] *continued*					
Authors, Year, Country, MMAT "Yes" Responses	**Study Purpose**	**Study Elements: Design, Setting, School-Based Intervention**	**Main Results**	**SEM Levels Addressed**	**Barriers and Facilitators to School-Based Intervention**
Piana et al., 2017,[51] Italy, MMAT: 5/7	Describe school-based education intervention to promote healthy lifestyles and evaluate components which contribute most to beneficial effects	Mixed methods 5 primary schools Book titled: Little Bear Gigetto and Snake Jones Exploring Healthy Habits	Increase in students' adherence to Mediterranean Diet, healthy habit changes, greater parental awareness of health responsibilities, and new school-family alliance	Intrapersonal Interpersonal Institutional Community	Barrier: limited involvement of some parents and families Facilitators: training, teacher support, parent participation, incentives for participation, community support
Sahota et al., 2019,[52] England, MMAT: 5/7	Evaluate feasibility and acceptability of PhunkyFoods (PF) Program	Quantitative randomized controlled trial 8 primary schools PhunkyFoods (PF) program	Increased knowledge of healthy lifestyle behaviors, healthier eating, and liking of fruits and vegetables in intervention group Year 4 intervention group had higher healthy balanced diet knowledge scores Delivery of intervention feasible and acceptable	Intrapersonal Interpersonal Institutional Community	Barriers: time constraints, additional responsibilities, limited resources and staff, inadequate facilities, lack of training, teacher preference for another health intervention, lack of parent engagement Facilitators: training, intervention flexibility, intervention embedded into academic curriculum, cross-curricular resources, parent support and interactive home activities, community support

Table 2. Evidence Table: Summary of Characteristics of Included Studies[29-62] *continued*					
Authors, Year, Country, MMAT "Yes" Responses	**Study Purpose**	**Study Elements: Design, Setting, School-Based Intervention**	**Main Results**	**SEM Levels Addressed**	**Barriers and Facilitators to School-Based Intervention**
Scherr et al.,* 2017,[53] United States, MMAT: 4/7 *published concerns regarding statistical analyses and interpretation of results	Investigate effectiveness of Shaping Healthy Choices Program (SHCP) to improve students' dietary behaviors and prevent childhood obesity	Quantitative randomized controlled trial 4 elementary schools Shaping Healthy Choices Program (SHCP)	Improvements in nutrition knowledge and total vegetable identification in intervention group Greater improvements in body mass index percentiles, body mass index z-scores, and waist-to-height ratios in intervention group	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: time constraints, lack of administrator support, difficult to get parent data Facilitators: student engagement, communication, low intervention cost, vegetables from school gardens shared with families, community support, stipend to purchase produce
Schetzina et al., 2009,[54] United States, MMAT: 4/7	Assess effectiveness, acceptability, and feasibility of Winning with Wellness in improving student nutrition and physical activity and in reducing prevalence of overweight and obesity	Quantitative non-randomized 1 elementary school Winning with Wellness	Improvements in nutrition offerings and increased physical activity Program acceptable and implemented utilizing existing and new resources and sustainable through continued practice and expansion to other schools	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: teachers uncomfortable leading class exercises, equipment issues, difficulty in recruiting parents Facilitators: training, administration involvement, intervention did not negatively compete with academic mission, resources

Table 2. Evidence Table: Summary of Characteristics of Included Studies[29-62] *continued*					
Authors, Year, Country, MMAT "Yes" Responses	**Study Purpose**	**Study Elements: Design, Setting, School-Based Intervention**	**Main Results**	**SEM Levels Addressed**	**Barriers and Facilitators to School-Based Intervention**
Schroeder & Smaldone, 2017,[55] United States, MMAT: 7/7	Explore school nurses' perceived barriers and facilitators to Healthy Options and Physical Activity Program (HOP) implementation	Qualitative 19 elementary schools Healthy Options and Physical Activity Program (HOP)	Barriers and facilitators reported (see last column)	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: heavy nurse workload, parental and administrative gatekeeping, concerns about obesity stigma, obesogenic environments Facilitators: teamwork with parents and school staff, autonomy to tailor intervention, teacher support, training, resources
Stines et al., 2011,[56] United States, MMAT: 2/7	Describe organization and structure of Jumpin' Jaguar	Quantitative non-randomized 1 elementary school Jumpin' Jaguar	Not reported	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: student social and discipline issues, school practice allowing candy rewards Facilitators: administrator and teacher support, after-school intervention did not interfere with academic curriculum, intervention promotion, family engagement, resources, community support, incentives for participation, government agency support

Table 2. Evidence Table: Summary of Characteristics of Included Studies[29-62] *continued*					
Authors, Year, Country, MMAT "Yes" Responses	**Study Purpose**	**Study Elements: Design, Setting, School-Based Intervention**	**Main Results**	**SEM Levels Addressed**	**Barriers and Facilitators to School-Based Intervention**
Takens et al., 2020,[57] Netherlands, MMAT: 4/7	Describe study design to evaluate effects of Jump-in on students' dietary behavior, behavior determinants, and intervention implementation process	Mixed methods 10 primary schools Jump-in	Not reported	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: none reported in detail Facilitators: staff, intervention flexibility, training, parent involvement, resources, community support, intervention embedded in government program
Toruner & Savaser, 2010,[58] Turkey, MMAT: 3/7	Evaluate effectiveness of school-based weight management intervention	Quantitative randomized controlled trial 2 elementary schools Physical activity and nutrition components	Lower body mass index measurements for intervention group Higher posttest scores for intervention group Higher overall average posttest scores for intervention group	Intrapersonal Interpersonal Institutional	Barriers: lack of training, lack of parent participation Facilitator: community support

Table 2. Evidence Table: Summary of Characteristics of Included Studies[29-62] *continued*					
Authors, Year, Country, MMAT "Yes" Responses	**Study Purpose**	**Study Elements: Design, Setting, School-Based Intervention**	**Main Results**	**SEM Levels Addressed**	**Barriers and Facilitators to School-Based Intervention**
Turner et al., 2013,[59] United States, MMAT: 6/7	Examine school administrators' attitudes regarding childhood obesity and relevant behaviors	Quantitative descriptive 3746 elementary schools Interventions varied by school	90% agreed schools play role in addressing childhood obesity, physical education improves academic outcomes, and they were interested in improving practices 33% agreed parents interested in improving nutrition and physical activity	Intrapersonal Interpersonal Institutional Social/Policy	Barriers: time constraints, scheduling conflicts, competition from other school priorities, lack of staff, financial constraints and inadequate resources Facilitators: administrator support, training, school members concerned about health
van den Berg et al., 2020,[60] United States, MMAT: 2/7	Assess individual and combined effects of Learn!Grow!Eat! Go! (LGEG) and Walk Across Texas (WAT!) on students' eating and physical activity behaviors and obesity status	Quantitative randomized controlled trial 28 elementary schools Learn!Grow!Eat! Go! (TGEG) and Walk Across Texas (WAT!)	LGEG schools increased nutrition knowledge and vegetable preference WAT! schools increased time parents and children were active together LGEG and WAT! schools decreased body mass index percentiles	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: challenging to implement two interventions, time constraints, curriculum concerns, lack of parent participation, lack of resources Facilitators: training, intervention programming, experiential learning, parent involvement, resources, community support, government mandated school health program

Table 2. Evidence Table: Summary of Characteristics of Included Studies[29-62] *continued*					
Authors, Year, Country, MMAT "Yes" Responses	**Study Purpose**	**Study Elements: Design, Setting, School-Based Intervention**	**Main Results**	**SEM Levels Addressed**	**Barriers and Facilitators to School-Based Intervention**
Verjans-Janssen et al., 2020,[61] Netherlands, MMAT: 6/7	Evaluate effectiveness of KEIGAAF (Dutch acronym for Chances in Eindhoven for a family-based approach by Fontys) on body mass index z-scores and energy balance-related behaviors	Quantitative non-randomized 11 primary schools KEIGAAF (Dutch acronym for Chances in Eindhoven for a family-based approach by Fontys)	Body mass index z-scores decreased in intervention group Intervention prevented age-related decline in moderate-to-vigorous physical activity Negative intervention effects on sugar-sweetened beverages and water consumption at school Comprehensive physical activity schools showed more favorable effects on body mass index z-scores, sedentary behavior, and moderate-to-vigorous physical activity	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: time constraints, parent and staff resistance Facilitators: intervention flexibility, school health practices, community support, government nutrition recommendations

Table 2. Evidence Table: Summary of Characteristics of Included Studies[29-62] *continued*					
Authors, Year, Country, MMAT "Yes" Responses	**Study Purpose**	**Study Elements: Design, Setting, School-Based Intervention**	**Main Results**	**SEM Levels Addressed**	**Barriers and Facilitators to School-Based Intervention**
Wright et al., 2013,[62] United States, MMAT: 4/7	Evaluate impact of Kids N Fitness (KNF) on activity behaviors and body mass index	Quantitative randomized controlled trial 5 elementary schools Kids N Fitness (KNF)	Boys in intervention group had decreased television viewing Girls in intervention group had increased daily physical activity and physical education class attendance and decreased body mass index z-scores	Intrapersonal Interpersonal Institutional Community Social/Policy	Barriers: students removed from intervention to attend tutoring Facilitators: training, low cost of intervention, teacher support, after-school intervention did not interfere with academic curriculum, community support

Supplementary Table 1. Detailed Search Strategy (All Database Searches Used Same Search Strategy)				
Search	**Database**	**Fields**	**Query**	**Records Found**
#1	EBSCOhost (all 56 databases)	All fields	(child* OR pediatric* OR kid*) AND (obese OR obesity OR overweight OR fat) AND (health* behavior* OR health* lifestyle* OR health* practice*) AND (school-base* OR school base*) AND (barrier* OR facilitator* OR intervention* OR strateg* OR treatment* OR program* OR best practice*) AND (evaluation* OR outcome* OR outcome* measure* OR outcome* assessment*) AND (nutrition* OR diet*) AND (activ* OR physical active* OR exercise*) AND (primary school* OR elementary school* OR primary education* OR elementary education* OR grade school*)	September 2019: 350 February 2021: 7
#2	PubMed	All fields	(child* OR pediatric* OR kid*) AND (obese OR obesity OR overweight OR fat) AND (health* behavior* OR health* lifestyle* OR health* practice*) AND (school-base* OR school base*) AND (barrier* OR facilitator* OR intervention* OR strateg* OR treatment* OR program* OR best practice*) AND (evaluation* OR outcome* OR outcome* measure* OR outcome* assessment*) AND (nutrition* OR diet*) AND (activ* OR physical active* OR exercise*) AND (primary school* OR elementary school* OR primary education* OR elementary education* OR grade school*) Medical Subject Headings (MeSH): child; obesity; overweight; pediatric obesity; health behavior; schools; outcome assessment, health care; diet; exercise	September 2019: 9 February 2021: 66
#3	Scopus	All fields	(child* OR pediatric* OR kid*) AND (obese OR obesity OR overweight OR fat) AND (health* behavior* OR health* lifestyle* OR health* practice*) AND (school-base* OR school base*) AND (barrier* OR facilitator* OR intervention* OR strateg* OR treatment* OR program* OR best practice*) AND (evaluation* OR outcome* OR outcome* measure* OR outcome* assessment*) AND (nutrition* OR diet*) AND (activ* OR physical active* OR exercise*) AND (primary school* OR elementary school* OR primary education* OR elementary education* OR grade school*)	September 2019: 13 February 2021: 1

Supplementary Table 2. Mixed Methods Appraisal Tool (MMAT) for Methodological Quality of Studies[68]							
Qualitative							
Authors, Year	Are there clear research questions?	Do the collected data address the research question?	Is the qualitative approach appropriate to answer the research question?	Are the qualitative data collection methods adequate to address the research question?	Are the findings adequately derived from the data?	Is the interpretation of results sufficiently substantiated by data?	Is there coherence between qualitative data sources, collection, analysis, and interpretation?
Day et al., 2019[38]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gutuskey et al., 2016[42]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hayes et al., 2019[43]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Schroeder & Smaldone, 2017[55]	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Supplementary Table 2. Mixed Methods Appraisal Tool (MMAT) for Methodological Quality of Studies[68] *continued*							
Quantitative randomized controlled trials							
Authors, Year	Are there clear research questions?	Do the collected data address the research question?	Is randomization appropriately performed?	Are the groups comparable at baseline?	Are there complete outcome data?	Are outcome assessors blinded to the intervention provided?	Did the participants adhere to the assigned intervention?
Belansky et al., 2013[30]	Yes	Yes	Yes	Yes	No	Can't tell	No
Crespo et al., 2012[35]	Yes	Yes	Can't tell	Yes	No	Yes	No
Cunningham-Sabo et al., 2016[36]	Yes	Yes	Can't tell	Can't tell	Can't tell	No	Can't tell
Davis et al., 2021[37]	Yes	Yes	Yes	Yes	Yes	No	No
Donnelly et al., 2009[39]	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
Koch et al., 2019[45]	Yes	Yes	Can't tell	Yes	No	Can't tell	No
Li et al., 2019[46]	Yes	Yes	Yes	Yes	No	Yes	No
Magnusson et al., 2011[48]	Yes	Yes	Can't tell	Can't tell	Yes	Can't tell	Yes
Moreno et al., 2020[49]	Yes	Yes	Yes	Can't tell	Can't tell	Can't tell	Can't tell
Sahota et al., 2019[52]	Yes	Yes	Yes	No	Yes	Yes	No
Scherr et al., 2017[54]	Yes	Yes	Yes	No	No	Yes	No
Toruner & Savaser, 2010[58]	Yes	Yes	Can't tell	Yes	No	Can't tell	No

Supplementary Table 2. Mixed Methods Appraisal Tool (MMAT) for Methodological Quality of Studies[68] *continued*							
Quantitative randomized controlled trials *continued*							
Authors, Year	Are there clear research questions?	Do the collected data address the research question?	Is randomization appropriately performed?	Are the groups comparable at baseline?	Are there complete outcome data?	Are outcome assessors blinded to the intervention provided?	Did the participants adhere to the assigned intervention?
van den Berg et al., 2020[60]	Yes	Yes	Can't tell	No	Can't tell	Can't tell	No
Wright et al., 2013[62]	Yes	Yes	Can't tell	Yes	Yes	Can't tell	No

Supplementary Table 2. Mixed Methods Appraisal Tool (MMAT) for Methodological Quality of Studies[68] *continued*							
Quantitative non-randomized							
Authors, Year	Are there clear research questions?	Do the collected data address the research question?	Are the participants representative of the target population?	Are measurements appropriate regarding both the outcome and intervention (or exposure)?	Are there complete outcome data?	Are the confounders accounted for in the design and analysis?	During the study period, is the intervention administered (or exposure occurred) as intended?
Alaimo et al., 2015[29]	Yes	Yes	Yes	Yes	No	Yes	Yes
Bravo et al., 2020[31]	Yes	Yes	Yes	Can't tell	Yes	Can't tell	No
Burke et al., 2014[32]	Yes	Yes	Yes	Yes	No	Yes	Can't tell
Centis et al., 2012[33]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fung et al., 2012[40]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gorely et al., 2009[41]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hoelscher et al., 2010[44]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Liang et al., 2020[47]	Yes	Yes	No	Yes	Can't tell	Yes	Yes
Narayanan et al., 2019[50]	Yes	Yes	Can't tell	Yes	Can't tell	Yes	No
Schetzina et al., 2009[54]	Yes	Yes	Can't tell	Yes	Yes	Can't tell	No
Stines et al., 2011[56]	Yes	Yes	Can't tell	Can't tell	No	Can't tell	Can't tell

Supplementary Table 2. Mixed Methods Appraisal Tool (MMAT) for Methodological Quality of Studies[68] *continued*							
Quantitative non-randomized *continued*							
Authors, Year	Are there clear research questions?	Do the collected data address the research question?	Are the participants representative of the target population?	Are measurements appropriate regarding both the outcome and intervention (or exposure)?	Are there complete outcome data?	Are the confounders accounted for in the design and analysis?	During the study period, is the intervention administered (or exposure occurred) as intended?
Verjans-Janssen et al., 2020[61]	Yes	Yes	Yes	Yes	Yes	Yes	No

Supplementary Table 2. Mixed Methods Appraisal Tool (MMAT) for Methodological Quality of Studies[68] *continued*							
Quantitative descriptive							
Authors, Year	Are there clear research questions?	Do the collected data address the research question?	Is the sampling strategy relevant to address the research question?	Is the sample representative of the target population?	Are the measurements appropriate?	Is the risk of nonresponse bias low?	Is the statistical analysis appropriate to answer the research question?
Chan et al., 2018[34]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Turner et al., 2013[59]	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes

Supplementary Table 2. Mixed Methods Appraisal Tool (MMAT) for Methodological Quality of Studies[68] *continued*							
Mixed methods							
Authors, Year	Are there clear research questions?	Do the collected data address the research question?	Is there an adequate rationale for using a mixed methods design to address the research question?	Are the different components of the study effectively integrated to answer the research question?	Are the outputs of the integration of qualitative and quantitative components adequately interpreted?	Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?	Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?
Piana et al., 2017[51]	Yes	Yes	No	Yes	Yes	Yes	Can't tell
Takens et al., 2020[57]	Yes	Yes	Yes	Yes	Can't tell	Can't tell	Can't tell

MANUSCRIPT 2: Perspectives of South Carolina Public School Administrators on School-Based Weight-Management Interventions: A Qualitative Descriptive Study

This manuscript is prepared for submission to the *Journal of School Health*.

Camp-Spivey LJ, Newman SD, Stevens RN, Nichols M. Perspectives of South Carolina Public School Administrators on School-Based Weight-Management Interventions: A Qualitative Descriptive Study. 2021.

ABSTRACT

BACKGROUND: School-based interventions targeting physical activity (PA) and healthy eating patterns have successfully improved unhealthy behaviors associated with excess weight in school-age children. The purpose of this study was to investigate South Carolina (SC) public school administrators' perceptions of barriers and facilitators to awareness, selection, and implementation of school-based PA and healthy eating interventions.

METHODS: This qualitative descriptive study, guided by the Social Ecological Model and the Steps in Quality Intervention Development Model, involved semistructured interviews with SC public school administrators from all academic levels ($N = 28$). Data were analyzed using thematic analysis.

RESULTS: Four themes were identified from the interviews: weight-related terminology use or stigma, experiences with school-based interventions addressing PA and healthy eating behaviors, barriers to school-based interventions addressing PA and healthy eating behaviors, and facilitators to school-based interventions addressing PA and healthy eating behaviors.

CONCLUSIONS: Schools are well-positioned to provide interventions to improve PA and eating patterns associated with childhood obesity. School administrators, while knowledgeable and experienced with weight-related issues and school-based

interventions, encounter barriers and facilitators that impact intervention offerings and delivery. Understanding these challenges and supports is important in the development, adaptation, and successful implementation of school-based interventions addressing PA and healthy eating behaviors.

Keywords: *childhood obesity, barriers, facilitators, nutrition, physical activity, school-based interventions*

BACKGROUND

Childhood obesity is a serious public health concern. In the United States, the prevalence of childhood obesity is 19.3%, affecting approximately 14.4 million children and adolescents.[1,2] Inadequate physical activity (PA) and unhealthy dietary behaviors are key contributors to excess weight in children and adolescents.[3] This excess weight leads to serious health risks associated with the cardiovascular, pulmonary, and endocrine systems, such as hypertension, asthma, and diabetes.[3,4] Childhood obesity is also linked to psychological and social problems, including anxiety, depression, and stigmatization.[3-5] Another important consideration is that children who are obese are likely to have more pronounced rates of obesity and comorbid disease risk factors as adults.[3]

A school-based weight management approach is one potential prevention and treatment strategy. Because children typically spend approximately 6 hours per weekday attending school, this setting can help students learn and develop healthy PA and eating practices.[6,7] School-based interventions targeting PA and healthy eating patterns have successfully improved PA and dietary behaviors associated with childhood obesity.[8-13] Despite this evidence, not all schools implement these interventions.[14] In addition, some schools that have tried to implement such interventions have faced challenges that are important to understand.

Recent studies explored the barriers and facilitators to implementing school-based interventions in primary and elementary schools from the perspectives of students, family members, school personnel, and community stakeholders.[15-48] However, there is a notable gap in the literature on system-wide barriers and facilitators regarding school-based interventions addressing PA and healthy eating behaviors from the perspectives of public

school administrators at all academic levels. School administrators decide whether and which PA or healthy eating interventions can be offered, so their insight is vital in identifying challenges and supports.[49] Lack of knowledge about barriers and facilitators limits implementation of school-based interventions that might improve health practices and lower health risks.

To advance the knowledge of barriers and facilitators, the purpose of this study was to investigate South Carolina (SC) public school administrators' perceptions of barriers and facilitators to awareness, selection, and implementation of school-based PA and healthy eating interventions. SC is of particular interest because nearly 37% of youth are overweight or obese, and the state ranks 3rd in the nation for the number of people ages 10-17 who are obese.[50,51] Findings can guide the development and adaptation of interventions into school schedules after minimizing barriers and maximizing facilitators. Addressing and accounting for these issues may decrease childhood obesity and reduce life-threatening chronic diseases.

METHODS

Design

This qualitative descriptive study explored SC public school administrators' perceptions of and experiences with school-based interventions addressing PA and healthy eating behaviors. This approach allowed for a comprehensive and straightforward understanding of participants' perceptions and experiences.[52,53] The Social Ecological Model (SEM)[54-58] and the Steps in Quality Intervention Development (6SQuID) Model[59,60] guided this research. The SEM addressed the interrelations of the social, cultural, and physical environments; human health; and health behaviors. Core

components of this model included intrapersonal, interpersonal, institutional, community, and social/policy levels (Figure 1).[54-58] The 6SQuID Model focused on the process of quality intervention design through six steps. This study incorporated the first two steps of the 6SQuID Model to define and understand the barriers and facilitators to school-based interventions that school administrators perceive and experience, as well as identify factors that shape the problem and have the greatest potential for change (Figure 2).[59,60] Collecting and analyzing data along with interpreting findings in the context of the SEM and the 6SQuID Model allowed for knowledge synthesis about barriers and facilitators in school settings, thus providing a framework for future Intervention Mapping (IM) informed by school-based findings.[61,62]

Participants

Participants were public school administrators in elementary and secondary schools in SC. For this study, school administrators were defined as people currently serving in leadership roles in schools, such as principals and assistant principals. A purposive sampling plan with snowballing was used for recruitment to ensure all academic levels were represented.[41,63]

The principal investigator (PI) created an electronic mail (e-mail) database using publicly available professional e-mail addresses for recruitment. Several school districts also required separate research approval processes. Potential participants received study information and invitations to partake in study interviews via e-mail from the PI or from their school districts. Contacted individuals were also able to forward e-mail messages about the study to other school administrators. The objective for participant recruitment was data saturation, with a goal of 25-30 Key Informant Interviews (KIIs).[24,41,64]

Instruments

A semistructured interview guide was developed based on a literature review,[15-48] the SEM,[54-58] and the first two steps of the 6SQuID Model.[59,60] Questions about the following subject areas were included: (1) demographic information, (2) schools' roles in students' weight-related health and concerns or experiences with weight-related terminology use or stigma, and (3) experiences with school-based interventions addressing PA and/or healthy eating behaviors with associated barriers and facilitators. Probing questions were used to elicit additional information and clarification of participants' responses.

Procedure

Following informed consent, individual, in-depth telephone and videoconference KIIs were conducted from July to August 2020. KIIs were audio recorded and securely sent to a speech-to-text company for verbatim transcription. The PI confirmed the accuracy of all transcripts by comparing them to audio recordings and removed personally identifying information.

Data Analysis

Thematic analysis of interview transcripts was conducted to discover patterns within the data.[24,29,64,65] A codebook with a priori codes was developed based on a literature review,[15-48] the SEM,[54-58] and the first two steps of the 6SQuID Model.[59,60] Emergent codes were added following Level 1 and Level 2 coding. The PI (LJCS) and the senior researcher (MN) coded each transcript independently and met 13 times between August 2020 to January 2021 to review transcripts, resolve discrepancies, and reach confirmation and consensus. Through consensus, the researchers identified

common themes from the data. Information related to barriers and facilitators to school-based interventions was analyzed and interpreted in the context of the SEM.[54-58]

RESULTS

Participant Characteristics

Twenty-eight school administrators participated in KIIs. Eleven (39.3%) participants were principals, 16 (57.1%) were assistant principals, and 1 (3.6%) was an assistant director. Experience time as a school administrator ranged from 2 months to 40 years. Participants were from all academic levels: elementary (n = 13, 46.4%), middle (n = 5, 17.9%), high (n = 8, 28.6%), prekindergarten-12th grade (n = 1, 3.6%), and 6th grade-12th grade (n = 1, 3.6%). Participants were from schools located in all regions of SC: Upstate (n = 7, 25.0%), Midlands (n = 9, 32.1%), Pee Dee (n = 6, 21.4%), and Lowcountry (n = 6, 21.4%). Ten (35.7%) participants were employed in rural school districts, while 18 (64.3%) worked in urban school districts.

Overview of Themes

Four themes were identified from the interviews (N = 28): weight-related terminology use or stigma, experiences with school-based interventions addressing PA and healthy eating behaviors, barriers to school-based interventions addressing PA and healthy eating behaviors, and facilitators to school-based interventions addressing PA and healthy eating behaviors. Each theme, with supporting information, is shown in Figure 3. Exemplary statements for each theme are presented in Table 1.

Theme 1: Weight-Related Terminology Use or Stigma (Table 1)

Negative beliefs, comments, and bullying behaviors are more prevalent toward students perceived as being overweight. Most participants (n = 26) expressed concerns or

issues regarding the use of weight-related terminology or stigma in their schools. Negative beliefs, comments, and bullying behaviors concerning weight were directed more toward students perceived as being overweight versus those seen as normal weight or underweight, despite students' actual weight status. These beliefs, comments, and bullying behaviors were not only directed at students' outward appearances, but also their physical activity abilities and food consumption patterns. Participants acknowledged the negative impact that weight-related issues had on students that often manifested as decreased participation in school activities, such as reduced engagement in physical education classes and not eating at school in front of others. Compared to male students, female students were more adversely affected as a result of societal messages on ideal body type.

Several administrators discussed how they addressed negative comments, beliefs, and bullying by promoting acceptance of students' differences and by enforcing strict policies against negative comments and bullying. Students were encouraged to avoid using weight-related terminology and to focus on having healthy lifestyles instead of on weight status. Participants who described more engaged policies reported decreased weight-related issues in their schools, such as negative comments and bullying.

Derogatory weight-related comments more prominent during middle and high school years. Among academic levels, the majority of school administrators from middle and high school grades (n = 13) reported that negative comments toward students perceived as being overweight were more prominent in these age groups. Although elementary school students expressed awareness of weight status, derogatory statements about weight were more common during the middle school period. Participants employed

in middle school settings reported that students would often make remarks about weight while making fun of other students or while upset with other students. Participants indicated that these remarks contributed to middle school students having body image issues. As students aged and moved into high school, weight-related comments were still present, but there was a shift in the perceived intent of comments. Several participants discussed how weight-related communication was used in a more joking manner in high school among male students and acknowledged these comments were still hurtful even when said with playful intent.

Theme 2: Experiences with School-Based Interventions Addressing PA and Healthy Eating Behaviors (Table 1)

Schools play positive roles in students' weight-related health. All participants (*N* = 28) believed schools played important roles in students' weight-related health through education, resources, and interventions on PA and eating behaviors to promote healthy lifestyles. Participants felt that these efforts had positive effects on students' PA and healthy eating behaviors.

School-based interventions addressing PA and healthy eating behaviors present in schools. All participants (*N* = 28) had knowledge and experience with school-based interventions addressing PA and healthy eating behaviors. Interventions involved those developed by schools, external people and entities, and government and education agencies (Table 2). School developed interventions included activity breaks during classroom instruction, school gardens, water filling stations, and school-sponsored events, such as walks and runs with healthy snacks. Examples of externally supported interventions were health partnerships with Young Men's Christian Associations

(YMCAs) and universities, family involvement with interventional activities, Girls on the Run, and Fuel Up to Play 60. Interventions from government and education agencies encompassed the National School Lunch and Breakfast Programs, grant programs for fruits and vegetables at school, and mandated physical education and health requirements as part of the academic curriculum. Interventions were implemented at multiple levels, ranging from school-wide to small groups to individuals.

Theme 3: Barriers to School-Based Interventions Addressing PA and Healthy Eating Behaviors (Table 1)

Intrapersonal factors. Participants reported how their abilities, behaviors, and beliefs served as barriers to school-based interventions due to their limited input regarding interventions, and their views of academics. Despite awareness of school-based interventions, several participants discussed restrictions they faced in making choices regarding interventions. This lack of decision making authority resulted in some school administrators being unable to implement certain interventions. Additionally, participants felt that academics were the primary focus of school activities due to how schools were evaluated. Administrators believed that core content subject areas were given precedence over health interventions.

Interpersonal factors. Interpersonal factors focused on the relationships school administrators had with school members, including students, teachers, and families, along with characteristics of these school members. Participants reported that the motivation, choices, and actions of some school members created challenges for school-based interventions because health behaviors were not seen as a priority. Some students would not participate in physical activities and would eat unhealthy food items, such as potato

chips and candy. These behaviors led to lack of support and buy-in for school-based interventions. Many teachers had curricular concerns related to time allotted to school-based interventions. If time was limited or students were not progressing as expected, participants indicated that health interventions would be removed from the curriculum to prioritize core content subject areas. Socioeconomic factors of students and their families contributed to difficulties in implementing school-based interventions. Lower levels of familial education and income, problems with employment, life stressors, and lack of time all served as barriers to encouraging PA and healthy eating behaviors because these students and families were focused on meeting basic needs.

Institutional factors. Several participants discussed school elements and practices as barriers to school-based interventions. Inadequate resources were cited as reasons why interventions were not implemented at all or to their full potential. Several schools did not have outdoor recreational areas, large indoor spaces, or equipment needed for physical activities. Unhealthy foods were often available for purchase, through vending machines and fundraisers, and participants found this to be counterproductive to interventions promoting healthy eating behaviors. Furthermore, punishments in the form of taking away students' recess time or having students walk laps and rewards involving celebrating students' successes with candy presented challenges to school-based interventions by creating negative perceptions of PA in students' minds and reinforcing unhealthy PA and eating habits.

Community factors. Participants at schools without established community partnerships identified this as a major barrier to school-based interventions. Lack of external support severely limited schools' implementation abilities because they did not

have the aid of outside resources or assistance with intervention delivery. Community access issues, such as limited spaces for physical activities and food unavailability and insecurity, inhibited the ability of interventions to have effects on students beyond school settings.

Social/Policy factors. School administrators identified inadequate and unclear PA and healthy eating policies in schools and competing requirements from government and education agencies related to academics as primary barriers to school-based interventions. Participants expressed concerns with the types of activities that met school requirements for PA and confusion about how foods were determined to be healthy before being served in schools. Participants also discussed academic expectations from government and education agencies as being more important than school-based health interventions, resulting in academics receiving more attention.

Theme 4: Facilitators to School-Based Interventions Addressing PA and Healthy Eating Behaviors (Table 1)

Intrapersonal factors. Participants discussed their own motivation, beliefs, and actions and their autonomy to make decisions as main facilitators to implementing school-based interventions. These administrators had the freedom to select PA and healthy eating interventions appropriate for their schools and needs of their students. Overall, participants expressed a desire to improve student health through interventions, offered interventions, valued PA and healthy eating, and viewed schools as appropriate locations for intervention delivery.

Interpersonal factors. Participants indicated that students, teachers, and families who were motivated to partake in school-based interventions and made healthy choices

through their actions served as supports. These supports enhanced communication about school-based interventions and created trusting relationships. Teamwork and flexibility were especially important among school personnel for successful intervention implementation. Opportunities for interprofessional collaboration were also present as teachers, school nurses, and food service providers were able to work together to deliver interventions. Additionally, champions for school-based interventions, such as teachers and school nurses, were vital to promoting and engaging school members in interventions. Participants reported that school personnel were most receptive to interventions that did not have negative effects on learning.

Institutional factors. Key school features that acted as facilitators to school-based interventions were adequate resources, variety, innovation, cross-curricular nature of interventions, and clear school guidelines on PA and healthy eating. Participants discussed the importance of schools having appropriate space, facilities, equipment, and materials to deliver interventions. Offering interventions that had options and were creative in design helped maintain interest. Participants were most enthusiastic about school-based interventions that were interwoven into academic content. Examples included students being physically active while reading and growing fruits and vegetables as part of science and social studies lessons. Several participants discussed information in their school handbooks that related to PA and healthy eating, such as PA breaks during the school day and not allowing desserts at school for celebrations. These directives allowed school members to understand expectations and helped with intervention delivery.

Community factors. Participants reported community involvement as an asset to school-based interventions. These partnerships were built on strong relationships between schools and communities with a focus on student health. Community members and organizations provided resources and led interventions, such as parents teaching PA classes at school, Master Gardeners' Clubs helping with school gardens, and a university sponsored children's wellness center offering an initiative that provided strategies and incentives for schools to implement interventions involving PA and nutrition. Participants acknowledged the value of community support and the importance of providing school personnel with assistance in implementing school-based interventions.

Social/Policy factors. Administrators discussed how having established school health policies and support from government and education agencies were facilitators to school-based interventions. Government and education mandates regarding physical education and school meal programs helped with school-based interventions by requiring schools to follow PA and nutrition standards. However, many participants expressed room for improvement in these areas.

DISCUSSION

Results from this study aided in understanding SC public school administrators' experiences with weight-related issues and school-based interventions addressing PA and healthy eating behaviors. It is important to consider the perspectives of school administrators when designing, adapting, and implementing school-based weight management interventions because of their insights into school environments and populations. Within their leadership positions, administrators also have the ability to influence change and provide access to intervention resources and systems. This

influence can be used to address weight-related terminology in schools and mitigate barriers and support facilitators to school-based interventions.

Regarding weight-related terminology use and stigma, participants reported that negative beliefs, comments, and bullying behaviors were most often directed toward students who were seen as being overweight during the middle and high school years. These findings are aligned with the United States Department of Education's National Center for Education Statistics that show bullying is most prevalent during middle school.[66] Beyond policies to curtail bullying, there is an opportunity to educate students on the detrimental effects derogatory remarks can have on the physical and emotional well-being of others and to shift focus to leading healthy lifestyles instead of on weight. This type of body positive messaging may help students accept themselves and others.

A key finding from this study was that participants viewed schools as having roles in students' weight-related health and that schools positively influenced PA and healthy eating behaviors. This information is encouraging because this mindset is one of the first steps necessary to successfully introduce and maintain school-based weight-management interventions. Participants were also knowledgeable and experienced regarding school-based interventions addressing PA and healthy eating behaviors that could be implemented in entire schools, among small groups, and with individual students. This foundation can be built upon to enhance the impact of interventions.

Many barriers and facilitators to school-based interventions identified by study participants were aligned with findings from previous studies.[15-48] However, participants shared unique viewpoints that are valuable to minimize barriers and maximize facilitators. Two of the overriding barriers were the focus on academic content in schools

and school personnel not having time to take away from core subject areas to deliver health interventions. To overcome this, several participants discussed how interventions were imbedded into the academic curriculum so that students were learning and participating in physical activities and healthy eating behaviors as part of lessons. This approach to learning is a prime example of how health content can be incorporated into the school day.

Several important factors that served as either barriers or facilitators to school-based interventions addressing PA and healthy eating behaviors were the viewpoints school members had about school-based interventions, school resources, and community involvement. Having the support of school personnel, students, and families is vital to successful school-based interventions and may require educating and encouraging those resistant to interventions. Champions who are enthusiastic about school-based interventions can promote intervention implementation and enhance participation. Space and equipment at schools hindered or helped interventions, especially those focused on PA. Schools with limited space and equipment can explore interventions that use existing school layouts to encourage PA by placing signs around the school that instruct students to perform certain movements, such as jumping jacks and squats. Community partnerships also contributed to school-based interventions by providing assistance so that schools were not solely responsible for delivering interventions. For schools without community partnerships, establishing these connections is a worthy opportunity that may result in improvements in health.

A final implication from the study was the necessity of having clear policies regarding PA and nutrition in school settings for healthy behaviors to be practiced.

Following established health standards and mandates from government and education agencies as well as developing specific policies appropriate for individual schools encourages the success of school-based interventions addressing PA and healthy eating behaviors. These policies may include prohibiting physical activities and unhealthy foods as punishments or rewards, requiring students to participate in physical activities to the best of their abilities, and restricting types of outside foods that can be brought to or sold at school.

Strengths and Limitations

Strengths of this study included reaching data saturation with 28 KIIs and that participants from all academic levels were involved in the study. The use of the SEM[54-58] and 6SQuID Model[59,60] provided strong theoretical underpinnings for instrument development and data collection and analysis. Trustworthiness for qualitative research was achieved by meeting criteria for credibility, transferability, dependability, and confirmability.[67,68]

There are limitations to the study. First, since all of the participants were public school administrators in SC and a majority (n = 18, 64.3%) worked in urban school districts, findings may differ in other geographic locations. Second, although the recruitment approach was thorough and detailed, not all school administrators had publicly available contact information and not all school districts with separate research approval processes approved the study. Furthermore, it is unknown if school administrators interested in school-based weight management interventions may have been more inclined to participate in the study.

Conclusion

Childhood obesity contributes to negative physical and psychosocial health outcomes, including cardiovascular disease and depression.[3-5] Schools are well-positioned to provide interventions that have the potential to improve PA and dietary behaviors associated with the development of childhood obesity.[7-13] School administrators, while knowledgeable and experienced with weight-related issues and school-based interventions, encounter barriers and facilitators that impact the types of school-based interventions that are offered and the extent they are able to be delivered. Understanding these challenges and supports is important in the development, adaptation, and successful implementation of school-based interventions addressing PA and healthy eating behaviors. Further research in this area is warranted to investigate the effects mitigating barriers and maximizing facilitators have on the success of school-based interventions.

IMPLICATIONS FOR SCHOOL HEALTH

This study highlights the importance of considering school members, environments, and policies when implementing school-based interventions addressing PA and healthy eating behaviors. Perceived and experienced barriers and facilitators directly influence if school-based interventions are delivered and the extent. School administrators could benefit from the following suggestions to decrease challenges and increase supports:

- School administrators should have decision making authority within their schools to select school-based interventions that are appropriate for their students, faculty, and staff. This autonomy is important because administrators are aware of the needs of

their school members and their schools' characteristics, which influences acceptance of interventions and accounts for scheduling and resource considerations.

- School administrators need access to training and materials related to school-based interventions that can be integrated with little to no disruption to the traditional school day. One helpful resource is CDC Healthy Schools from the Centers for Disease Control and Prevention.[7] This program provides a plethora of information, including data to support the relationship between healthy behaviors and academic achievement, professional development offerings on the subject of school health, and guided examples of how to incorporate PA and nutrition into academic curricula.
- School administrators should establish and foster community partnerships related to school-based interventions addressing PA and healthy eating behaviors. Collaborations with external entities, such as recreational centers, businesses, and faith-based organizations, can help provide personnel and resources in delivering interventions that do not place unmanageable strains on schools. These partnerships can also include students' families to help extend interventional effects beyond school settings.
- School administrators can establish a culture of health within their schools by developing and following evidence-based PA and healthy eating policies. These policies should be clearly described in school handbooks that are available to all school members. While there may be initial resistance to changes in PA expectations and foods allowed at school, consistently enforcing guidelines will lead to habit formation.

Human Subjects Approval Statement

The Institutional Review Board at the Medical University of South Carolina (MUSC) approved this study.

Conflict of Interest Statement

All authors of this article declare they have no conflicts of interest.

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Figure 1. Modified Social Ecological Model (SEM)[54-58]

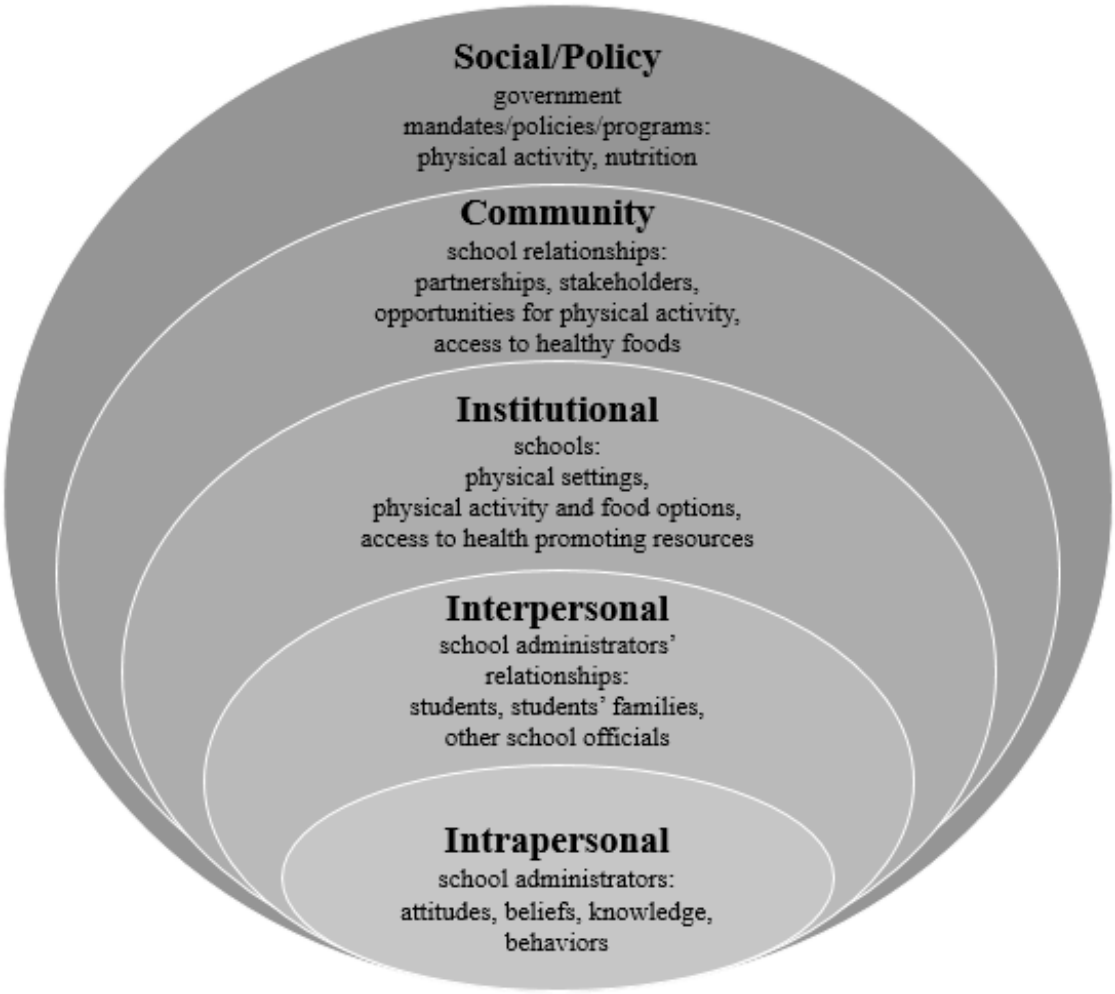

Figure 2. Modified Steps in Quality Intervention Development (6SQuID) Model[59,60]

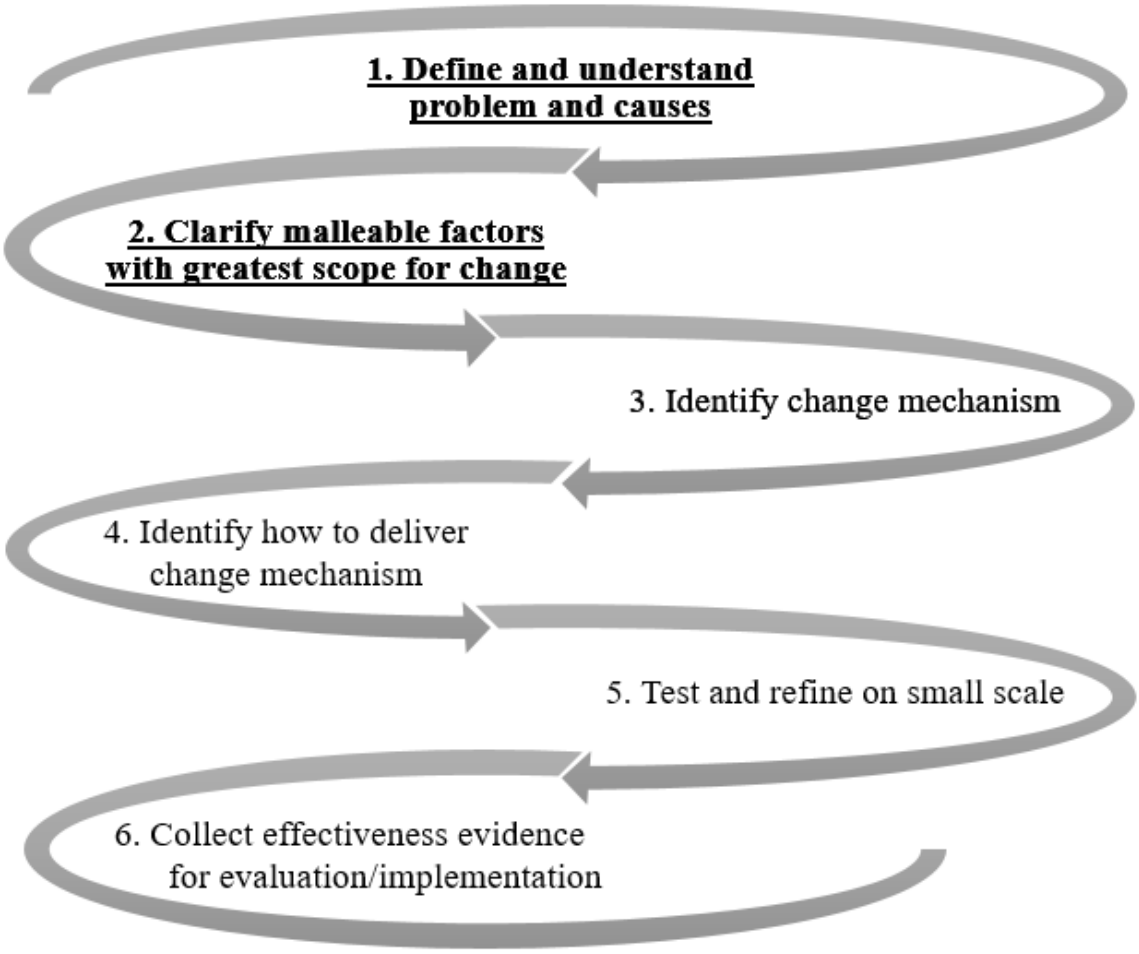

Figure 3. Themes with Supporting Information from Interviews (*N* = 28)

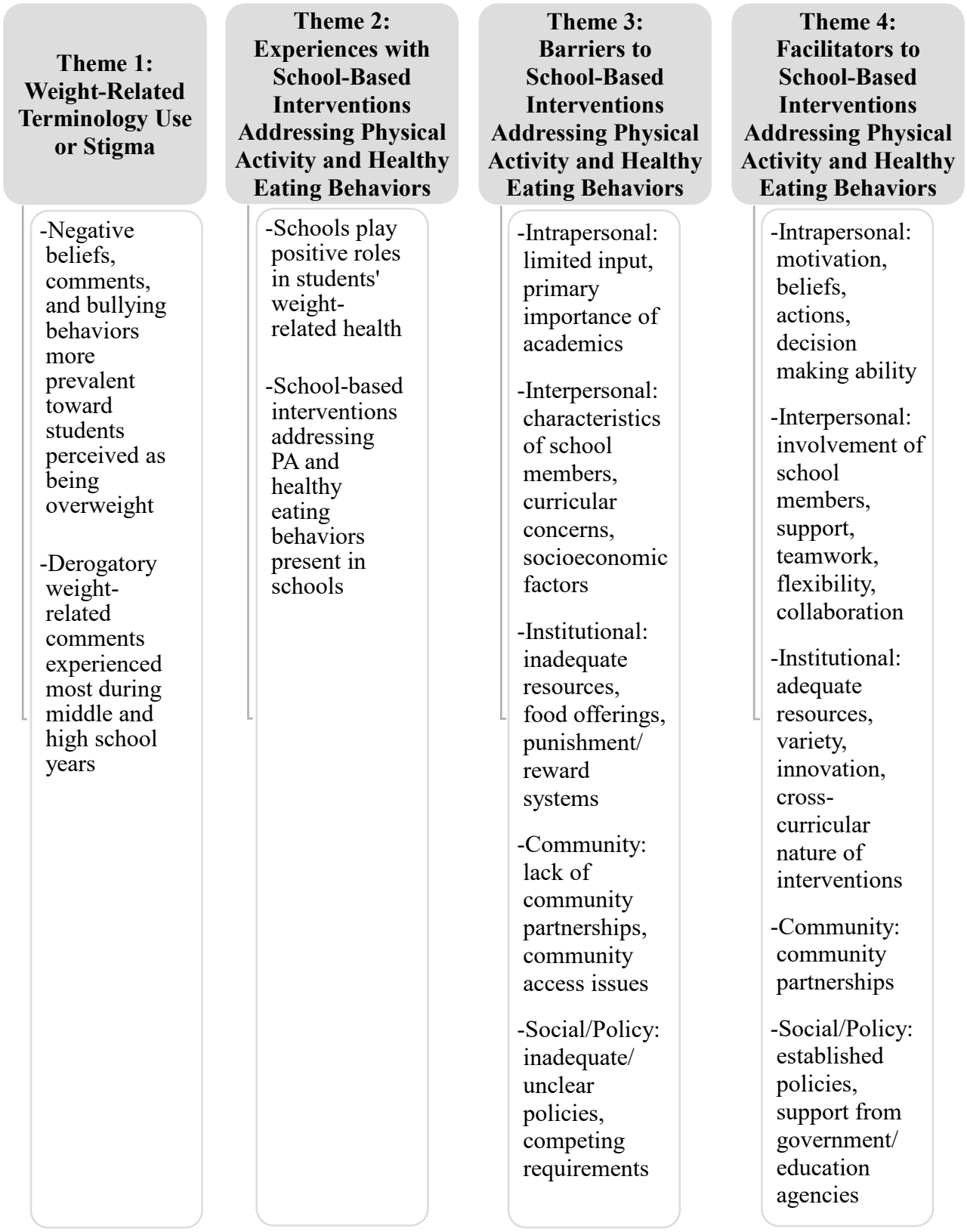

Table 1. Exemplary Statements by Theme from Interviews with School Administrators (*N* = 28)

Theme	Exemplary Statements
1. Weight-Related Terminology Use or Stigma	"Kids flat out calling other kids fat, calling kids chunky, or they'll talk about specific body parts of kids, like 'your fat stomach.' Those are usually the things that we see, 'such and such is fat,' but it's not uncommon to hear somebody is fat. That's common." (Participant 3: elementary school administrator from Midlands region and urban school district) "Some of the examples are stating, 'You move a little slower down the court. Maybe you should lose some weight.' Another example is, 'You're breathing heavy. Are you overweight? Are you obese?' Another example, 'Look how much she's eating at lunch. That explains a lot.' And that's more of the middle school setting of the comments that are being made." (Participant 22: 6th grade-12th grade administrator from Lowcountry region and urban school district) "And I see that a lot, use of sarcasm, 'Oh, gosh, I bet that guy would eat three hamburgers.' And they mean it kind of in a joking or satirical way, but they take it as, 'Oh, he thinks I'm fat. He thinks I'm obese.' So, that happens a lot." (Participant 6: high school administrator from Upstate region and urban school district)

Table 1. Continued

Theme	Exemplary Statements
2. Experiences with School-Based Interventions Addressing Physical Activity and Healthy Eating Behaviors	"We do make a concerted effort to inform our kids and to try to teach them healthy eating, and also, the importance of physical activity. In our classrooms, when we're instructing, and we do teach health, we can put an emphasis on healthy eating and exercise. In our cafeteria, our managers at our food service program make a concerted effort to provide healthy meals. We do a lot of that also in our physical education program as well. So there is an emphasis on it." (Participant 11: elementary school administrator from Pee Dee region and urban school district) "So, things that we do in the classroom here, like brain breaks and movement breaks, the walking program, our afterschool programs with physical activity and mentorship. Those things really tend to say, 'Hey, I can live a healthy lifestyle by one, eating right, two, exercising and being active, and three, limiting the bad things that happen or could happen to my body if I don't take care of myself.'" (Participant 8: elementary school administrator from Upstate region and rural school district) "We feed them two meals a day, breakfast and lunch, and so by providing them with healthy food options. We do the Fresh Fruit and Vegetable Program. That's a grant that we have received from DHEC and the governor's office and a couple of other places. Through that program, at the beginning of the year, we offer one fresh fruit or vegetable a week. Then, as production ramps up, we're able to offer it three days a week to every single classroom. It's an exposure to lots of different foods that they may normally not have exposure to, things like massive Chinese persimmons or sugar snap peas or grape and cherry tomatoes. That goes on for most of the school year." (Participant 18: elementary school administrator from Pee Dee region and urban school district) "It definitely does state in our school handbook to refrain from giving sweets as a reward. What we kind of did as administrators to curb that was we bought a treasure chest just full of little junky tchotchkes that kids love. So if they do something great, let them go to the treasure chest. Don't give them a lollipop or a Snickers bar. Let them choose a little prize instead." (Participant 12: elementary school administrator from Pee Dee region and rural school district)

Table 1. Continued

Theme	Exemplary Statements
3. Barriers to School-Based Interventions Addressing Physical Activity and Healthy Eating Behaviors	"I'm going to say, as an educator, to advocate for teachers, sometimes there's not enough time in the day. Sometimes, based upon mandated testing, mandated expectations for content with regards to standards and instruction, maybe there's not enough value in physical education for what has to be shared. You can't run every day, but sometimes you have health standards as well to cover, but there's just not enough time." (Participant 27: middle school administrator from Midlands region and rural school district) "We are at a point where we are getting pretty full here in our building. We're not at capacity, but we're very, very close. I guess a barrier would be that we could utilize a larger playground area. For the more traditional kind of playground recess play, we definitely could use more space." (Participant 13: elementary school administrator from Lowcountry region and urban school district) "We do offer food that can be purchased on a monthly basis that's brought in from outside, and that is not necessarily the healthiest food. It's food that the kids will eat, so it's pizza, there's a barbecue day, and there was a Subway sandwich day." (Participant 17: prekindergarten-12th grade administrator from Lowcountry region and urban school district)

Table 1. Continued

Theme	Exemplary Statements
4. Facilitators to School-Based Interventions Addressing Physical Activity And Healthy Eating Behaviors	"Even the students who might be overweight and obese, I saw most, if not all, of the physical education teachers being able to motivate the students. Let's say they had, and it was pretty standard, they would do a track unit, they would have to run a mile. Well, you might have a kid who it's going to be pretty tough for him to run at all, even 100 yards. Well, they had to walk a mile. I found most physical education educators were able to motivate those kind of students, because as I said, they just seemed to like PE." (Participant 26: high school administrator from Lowcountry region and urban school district) "The school nurse wrote a grant, and it was about health. All around the school she posted signs: do 10 squats here; if you walk this far, it's this much; and then you're going to have a wall chair. But it was all over the school so that if the teachers wanted to walk, they could see the distance. They had it all mapped out. They had the different types of strength conditioning along the way for the kids. It was phenomenal. The school nurse took that, and she ran with it, and she did an excellent job. I've never seen anything like it anywhere else I've ever been." (Participant 28: high school administrator from Midlands region and urban school district) "If we think about physical interventions, we're not in just one building, so students definitely have to walk and get to the further end of the campus sometimes for going to classes, but because we are more spaced out, it allows more space for us to do different activities. Also, just thinking about the setup, we have our students on the same hall for seventh grade and eighth grade. And so if there was an intervention that needed to be done in a hallway where it's visible to other students, I don't think it would be something that is an opportunity for students to feel picked on or anything like that." (Participant 19: middle school administrator from Pee Dee region and urban school district) "Definitely with the cafeteria, the types of foods that are served in the cafeteria, and making sure they follow dietary guidelines, as far as health and nutrition goes, of what should be served to the students. I know that they do follow those because of our course our state guidelines. They do typically give the students fruits, vegetables, meat, et cetera...the different portions in food items that they're supposed to have." (Participant 23: middle school administrator from Lowcountry region and urban school district)

Table 2. School-Based Interventions Identified from Interviews with School Administrators (*N* = 28)

Developed by Schools	Developed by External People/Entities	Developed by Government/Education Agencies
• Active learning strategies involving physical activity (examples – action based learning labs with treadmills and stair step machines, alternative seating, foot pedals, tableau) • Afterschool programs and extracurricular activities involving physical activity (examples – karate, lacrosse, tennis, yoga) • Athletic programs involving physical activity • Body mass index measurements • Class breaks involving physical activity (examples – brain breaks, activity breaks, movement breaks) • Clubs focused on physical activity and healthy eating • Courtyard time for physical activity • Faculty and staff role modeling healthy behaviors • Field day • Food service workers promoting healthy eating behaviors (examples – nutrition posters, cooking healthy meals with students) • Health and wellness assemblies/fairs/festivals	• 5210 Healthy Children encouraging physical activity and healthy eating behaviors • Boys & Girls Clubs encouraging physical activity and healthy eating behaviors • Businesses supporting healthy eating behaviors (examples – plant stores, restaurants) • Clemson University Cooperative Extension supporting and providing resources for physical activity and healthy eating behaviors • Community partners providing health screenings and programs on physical activities and healthy eating (examples – hospitals, recreational centers) • Faith-based organizations leading physical activities • Fuel Up to Play 60 encouraging physical activity and healthy eating behaviors • Girls on the Run encouraging physical activity • Healthy Schools Initiative focused on improving health of students	• Farm-to-School Program for healthy eating • FitnessGram Progressive Aerobic Cardiovascular Endurance Run Test for physical activity • Fresh Fruit and Vegetable Program for healthy eating • Grants to support physical activity and healthy eating • Guidelines for healthy foods allowed in vending machines • Healthy food recommendations from school district health officials • Mandated courses on physical education and health • National School Breakfast and Lunch Programs for healthy eating • National Walk to School Day for physical activity • President's Challenge Fitness Test for physical activity

Table 2. Continued

Developed by Schools	Developed by External People/Entities	Developed by Government/Education Agencies
• Health and wellness committees • Healthy foods provided to students • Healthy snacks sold at school and physical activities offered at school by Parent-Teacher-Student Organizations • Incentive events for good grades, behavior, and special occasions involving physical activity • Information about physical activity and healthy foods communicated to students and families (examples – newsletters, pamphlets, websites) • Interprofessional collaborations (example – cafeteria manager and PE teacher working together on physical activity and healthy eating initiatives) • Intramural sports involving physical activity • Limits on types of unhealthy foods that can be sold at school for fundraisers • Mentorship programs focused on physical activity and nutrition with school personnel and students • Mobile kitchen with teacher guided healthy cooking lessons • No food from restaurants allowed • No taking away recess as punishment	• High school, college, and professional athletes promoting healthy habits as guest speakers • Keeping Kids Fit to encourage physical activity and healthy eating behaviors • Master Gardener's Clubs assisting with school gardens • Medical University of South Carolina Boeing Center for Children's Wellness School-Based Wellness Initiative focused on physical activity and healthy eating behaviors • Parents teaching fitness classes to students • Playworks through AmeriCorps to encourage physical activity • Project FIT to encourage physical activity and healthy eating behaviors • South Carolina Department of Health and Environmental Control presenting healthy eating information • University of South Carolina study on physical activity habits of students and school personnel	

Table 2. Continued

Developed by Schools	Developed by External People/Entities	Developed by Government/Education Agencies
• No unhealthy foods as classroom rewards or for celebrations • Nutrition education programs (examples – culinary arts, food and nutrition) • Outside areas for physical activity (examples – fields, playgrounds, trails) • Physical activity and healthy eating topics integrated into academic curriculum (examples – math and science lessons, writing prompts) • Recess and extended recess • Related arts classes involving physical activity (examples – creative movement, dance, music, Spanish) • School counselors teaching health lessons involving physical activity and healthy eating • School gardens • School layout conducive to physical activity • School nurses promoting healthy behaviors (examples – teaching physical activities, lessons on healthy foods) • School personnel applying for grants to support school-based interventions	• Walks/runs through professional organizations (examples – American Heart Association, March of Dimes, United Way) • Young Men's Christian Associations (YMCAs) providing physical activity and healthy cooking opportunities for students and families	

Table 2. Continued

Developed by Schools	Developed by External People/Entities	Developed by Government/Education Agencies
• Students attending multiple PE classes weekly • Technology guided physical activity (examples – GoNoodle, YouTube videos) • Water being available to students (examples – water bottle filling stations, water jugs in cafeterias)		

MANUSCRIPT 3: A Survey of South Carolina Public School Personnel Perspectives on Barriers and Facilitators to Physical Activity and Healthy Eating Behaviors in Schools

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ABSTRACT

BACKGROUND: Nearly 37% of youth in South Carolina (SC) are overweight or obese. Two modifiable behaviors contributing to obesity are physical activity (PA) and dietary habits. School-based interventions have successfully improved these behaviors. The purpose of this study was to identify SC public school personnel perspectives on the most common barriers and facilitators to PA and healthy eating in schools.

METHODS: A needs assessment survey was conducted with school personnel statewide. Univariate and bivariate descriptive statistical analyses were performed using IBM SPSS Statistics 27.

RESULTS*:* Participants (N = 1311) indicated insufficient time for PA (n = 514, 39.2%) and limited access to healthy foods for healthy eating (n = 271, 20.7%) as main barriers. The primary facilitators were support from administrators for PA (n = 264, 20.1%) and support from cafeteria staff for healthy eating (n = 234, 17.8%). Further analyses explored how factors compared based on roles, academic levels, and district classifications.

CONCLUSIONS: Results suggest that overarching barriers and facilitators to school-based interventions addressing childhood obesity exist, so common strategies to mitigate challenges and maximize supports can be used in schools. Future studies are needed to examine how decreasing barriers and enhancing facilitators affect the implementation and

outcomes of school-based interventions.

Keywords: *childhood obesity, barriers, facilitators, nutrition, physical activity, school-based interventions*

BACKGROUND

Approximately 14.4 million children and adolescents are overweight or obese in the United States.[1] Childhood obesity contributes to numerous physical and psychological health issues, such as asthma and depression.[2-4] Two modifiable behaviors contributing to obesity are physical activity (PA) and dietary patterns.[2] Examining methods to establish healthy PA and eating practices during childhood are important for addressing childhood obesity because lifestyle habits are easier to cultivate in this age group compared to adulthood.[5] Research has shown that children who are obese are likely to have obesity and increased disease risk factors into adulthood, so focusing on these issues in childhood can potentially improve children's lifelong health outcomes.[2]

Childhood obesity is a severe problem in South Carolina (SC). Nearly 37% of youth are overweight or obese, and SC has an overall health ranking of 42 out of 50 states.[6,7] Health disparities in SC that contribute to obesity include the state's rurality, educational challenges, diminished access to and affordability of health care, and health communication difficulties related to geographic locations and income.[8] The affordability and income barriers are pronounced because 22.6% of children in SC live in poverty, and poverty is associated with early childhood obesity.[7,9] Childhood obesity is especially concerning because it contributes to health problems in adulthood and because SC is located in the stroke belt, with high rates of cardiovascular disease and diabetes.[7,10] Addressing and accounting for these issues in school-based interventions may decrease childhood obesity and reduce life-threatening chronic illnesses.

School-based interventions have led to positive changes in PA and healthy eating behaviors related to childhood obesity.[11-16] These types of interventions also help promote

equity because potentially all students can have access, regardless of their demographic and socioeconomic backgrounds. However, not all schools deliver these types of interventions, and some schools have encountered challenges.[17] These barriers and facilitators to implementing school-based interventions, and the needs of those involved, have not been adequately characterized from the viewpoints of public school personnel at all academic levels.

Recent studies examined elements affecting the implementation of school-based interventions addressing PA and healthy eating behaviors in primary and elementary schools.[18-51] Information is warranted on the barriers and facilitators to these interventions from the perspectives of school personnel at secondary schools as well. This information is important because school personnel are often involved at various interventional stages, from initial planning to content delivery.[52] Furthermore, the educational system in SC warrants attention because the state ranks 3rd in the nation for the number of youth ages 10-17 who are obese, thus underscoring the need for identifying challenges that may impede progress in addressing this important health issue.[53] Lack of knowledge about barriers and facilitators limits implementation of school-based interventions that might improve health practices and reduce health risks in terms of childhood obesity. Therefore, the purpose of this study was to identify SC public school personnel perspectives on the most common barriers and facilitators to PA and healthy eating behaviors in schools.

METHODS

Design

This quantitative descriptive cross-sectional study investigated the barriers and facilitators to PA and healthy eating behaviors in schools from the perspectives of SC

public school personnel. The Social Ecological Model (SEM) guided the examination of barriers and facilitators through multilevel approaches and factors beyond the individual person.[54-58] These factors included relationships school personnel had with other school members, such as students, administrators, and staff, school elements related to health behaviors, and the influence of external community and social/policy aspects. The first two steps of the Steps in Quality Intervention Development (6SQuID) Model aided with exploring underlying problems and causes as well as changeable features.[59,60] Table 1 displays how the SEM[54-58] and the first two steps of the 6SQuID Model[59,60] were used to inform survey design and data analysis.

Participants

Study participants were school personnel employed in public elementary and secondary schools in SC. To be eligible for the study, school personnel had to be working in certified or licensed roles within schools during the 2019-2020 academic year. Examples of school personnel included teachers and school nurses. A consecutive sampling strategy was used to reach a goal of participation from all academic levels and a 10% survey response rate.[61]

Recruitment materials were distributed through electronic messages: (1) from the Principal Investigator (PI) to professional electronic mail (e-mail) addresses, (2) from school districts with separate research approval processes, and (3) from a professional state organization. Potential participants received study information and the link to the needs assessment survey in the Research Electronic Data Capture (REDCap) system.[62,63]

Instruments

A needs assessment survey was developed by the PI with input from the study team based on a literature review,[18-51] the SEM,[54-58] and the first two steps of the 6SQuID Model.[59,60] Two members of the study team had previous experience in the public education system in SC, one as a former school administrator and one as a former school nurse. They provided valuable insights into both the design of the study and the survey.

There were 17 questions on the survey that addressed: (1) demographic information about educational backgrounds, (2) barriers to PA and healthy eating behaviors in schools, and (3) facilitators to PA and healthy eating behaviors in schools. Questions were multiple choice with write-in response options. Participants were instructed to select all that apply or one response, depending on the nature of the question. Prior to distribution, the survey was informally pre-tested among educators not eligible to participate in the study.

Procedure

Eligible school personnel responded to questions on the needs assessment survey through REDCap.[62,63] After receiving study details, providing informed consent, and answering self-screening questions, participants proceeded to topic-specific survey questions. Data were collected from July 2020 – October 2020.

Data Analysis

Needs assessment survey responses were analyzed using univariate and bivariate descriptive statistics. Statistical analyses were performed using IBM SPSS Statistics 27.[64-67] Univariate descriptive statistics were reported for participants' demographic information (Table 2) and to identify the overall barriers and facilitators to PA and

healthy eating behaviors in schools.[23,48,64,65] Bivariate descriptive statistical analyses were performed to further explore how barriers and facilitators compared by participants' roles in schools, academic levels, and school district classifications.[23,48,64,65] This information was used to create tables to display these relationships (Tables 3-5). The most common barriers and facilitators to PA and healthy eating behaviors in schools were defined based on the 6SQuID Model[59,60] and interpreted in the context of the SEM.[54-58]

RESULTS

Participant Characteristics

Overall, 1451 participants answered demographic questions on the survey. Of these, 1311 participants responded to topic-specific survey questions, and thus were included in the final sample. There were no differences between participants in the final sample who answered all survey questions and those who did not answer all survey questions. Table 2 presents the participants' demographic characteristics. Information from the South Carolina Department of Education was used for categorizing academic levels, school district regions, and school district classifications.[68,69] Academic levels were defined as: elementary – prekindergarten-5th grade, middle – 6th grade-8th grade, and high – 9th grade-12th grade.

Overall Barriers and Facilitators to PA and Healthy Eating Behaviors in Schools

For the entire sample of participants (N = 1311), the main barriers included insufficient time for PA (n = 514, 39.2%) and limited access to healthy foods for healthy eating (n = 271, 20.7%). The primary facilitators were adequate support from school-level administrators for PA (n = 264, 20.1%) and adequate support from cafeteria staff for healthy eating (n = 234, 17.8%).

Barriers and Facilitators to PA and Healthy Eating Behaviors in Schools by Participants' Roles in Schools

Table 3 displays the relationships between primary barriers and facilitators based on participants' roles in schools. Insufficient time was identified as a primary barrier to PA in schools among all school roles. For main barriers to healthy eating in schools, inadequate parent/family support, inadequate student cooperation, and limited healthy food access were shared responses among differing roles.

In terms of facilitators to PA, adequate school-level administrator support and adequate student cooperation were the most common responses across school roles. Main supports for healthy eating in schools were adequate cafeteria staff support, adequate parent/family support, and adequate teacher support.

Barriers and Facilitators to PA and Healthy Eating Behaviors in Schools by Academic Levels

Table 4 illustrates how barriers and facilitators manifested themselves among various academic levels. Across the grade levels, foremost challenges to PA in schools were inadequate student cooperation and insufficient time. Main barriers to healthy eating included inadequate parent/family support and inadequate student cooperation.

The primary facilitator to PA in schools among the academic levels was adequate school-level administrator support. For healthy eating, the main facilitator was adequate cafeteria staff support.

Barriers and Facilitators to PA and Healthy Eating Behaviors in Schools by School District Classifications

Table 5 shows barriers and facilitators to PA and healthy eating behaviors based on rural or urban school district classifications. The primary barrier to PA in schools for both rural and urban school districts was insufficient time. For healthy eating, inadequate parent/family support was reported as the main challenge for rural school districts while limited healthy food access was reported for urban school districts.

When exploring facilitators, adequate school-level administrator support was key for PA in schools in both rural and urban school districts. Adequate cafeteria staff support was the primary facilitator for healthy eating in rural and urban school districts.

DISCUSSION

Findings from this study improved understanding of barriers and facilitators to PA and healthy eating behaviors in schools from the perspectives of SC public school personnel. This information can inform effective implementation of school-based interventions addressing childhood obesity and can identify priority target areas for intervention refinement. Results pertaining to overall barriers and facilitators aligned with findings from previous research which recognized lack of time and insufficient resources as main barriers and adequate support systems as overriding facilitators.[18-51] An unexpected outcome from this study was that despite differences in school roles, academic levels, and school district classifications, participants reported common barriers and facilitators. These data are encouraging because findings pave the way for universal approaches for overcoming challenges and amplifying supports.

The predominant barrier to PA related to school roles, academic levels, and school district classifications was insufficient time, an interpersonal factor from the SEM influenced by institutional and social/policy levels.[54-58] School personnel have to adhere to structured school days that follow educational guidelines and to meet mandatory requirements, which can result in little to no time remaining for school-based interventions specifically targeting PA. One strategy to overcome this challenge is to infuse PA into academic instruction. The Centers for Disease Control and Prevention (CDC) has resources on classroom PA that guide educators on incorporating PA into lessons in logical ways.[70] This approach allows for interventions to be tailored based on space availability and students' physical abilities. Examples of implementation include kinesthetic spelling (students move into different positions while spelling and pronouncing words) during language arts classes, silent signs (students use body movements without speaking to indicate where countries are on a map) during social studies lessons, and vote with your feet (students move to marks that correlate with their answers) as they work through math content.[71] Encouraging movement during class can improve cognition and help students to meet PA recommendations that are associated with healthier body compositions with lower body fat.[72]

For healthy eating, common challenges emerged among school roles, academic levels, and school district classifications as well. These barriers involved the interpersonal, institutional, community, and social/policy elements from the SEM and were inadequate parent/family support, inadequate student cooperation, and limited access to healthy foods.[54-58] Students need to understand the importance of healthy dietary patterns that adhere to calorie and nutrient needs that can help prevent or manage

obesity.[73] Having buy-in in terms of practicing appropriate nutritional habits, both at school and at home, is essential because if students do not follow healthy eating behaviors away from school, it can be difficult to encourage these behaviors while at school. Healthy eating interventions that involve students' parents and family members, such as offering healthy cooking classes at school or distributing information from school containing healthy recipes, can bridge this gap to create partnerships between home and school. Limited access to healthy foods is also a multifaceted issue that can be affected by an array of factors, from food being unavailable depending on location and socioeconomic status impacting the ability to purchase healthy foods. To encourage school-based healthy eating interventions, there are several avenues schools can explore, such as restricting unhealthy foods being consumed at school from vending machines and during classroom celebrations. Another option is school gardens that not only provide healthy food choices, but can also involve students in the planting and harvesting process. An extra advantage is that these gardens can be incorporated into academic instruction involving science and social studies. If funding is a concern, there are farm-to-school grant programs to support school gardens.[74] An additional way to increase the availability of healthy foods at schools, mainly fruits and vegetables, is the Fresh Fruit and Vegetable Program that is offered through the United States Department of Agriculture Food and Nutrition Service (USDA FNS).[75] Qualifying schools receive a variety of free fresh produce for students to eat as school snacks.

Across school roles, academic levels, and school district classifications, the primary facilitator to PA at school, representing the interpersonal level of the SEM, was support from school-level administrators.[54-58] School administrators ultimately decide

whether and which PA interventions can be offered, so it is important for these leaders to be approving of interventions.[52] This support can come in various forms, such as allowing structured interventions to be implemented, allotting time in the schedule for extra recess, and purchasing equipment for PA. Informing school administrators about the health benefits of school-based interventions to improve childhood obesity and how these types of interventions can enhance learning are helpful talking points when approaching administrators about interventions.[70,76]

In terms of healthy eating, adequate support from cafeteria staff, an interpersonal factor of the SEM, was reported as a main facilitator among participants from differing school roles, academic levels, and school district classifications.[54-58] Cafeteria staff members are responsible for preparing school meals and are influential in fostering healthy food choices that relate to the development of childhood obesity. These professionals can provide balanced nutritional selections through food offerings that follow federal guidelines for breakfasts and lunches served at schools.[77] Cafeteria workers can also promote healthy diets through the use of visual aids, such as posters, that are designed to encourage students to try new and nutritious foods and that display what healthy plates look like by using the five food groups. These resources are free to schools participating in the National School Lunch or Breakfast Program through Team Nutrition.[78] Materials come in a variety of grade levels and can also be integrated into educational subjects, if desired.

Another noteworthy finding of this study was that the most variations in barrier and facilitator responses were observed among school roles and academic levels. Explanations for this may relate to the capacity in which school personnel work with

students, differences in students' developmental stages, and changes in support based on school settings.[79] For example, elementary schools often have recess and playground equipment that encourage students to engage in PA, whereas high schools typically do not. Secondary schools may also allow students more freedom in food selections, which can lead to unhealthier choices. It is important for school personnel to be aware of these considerations because school-based interventions need to be adapted and tailored based on students' personal characteristics and available school resources. CDC Healthy Schools is a helpful program with strategies on school PA and nutrition that can be used by school officials working with students from various grade levels.[80]

Strengths and Limitations

Strengths. This study included a diverse sample population, with school personnel employed in various roles in school settings, from all academic levels, and from both rural and urban school district classifications. The use of the SEM[54-58] and the 6SQuID Model[59,60] provided sound theoretical foundations for data collection, analysis, and interpretation. The electronic survey delivery method reduced study burden because participants were able to respond to the survey at their convenience and did not have to send any printed survey materials to the PI.

Limitations. Study participants were exclusive to public school personnel working in SC, so this could affect the generalizability of findings to other state, national, and international locations.[61] The survey involved self-reported information, there was missing data, and although an exact survey response rate was not able to be calculated due to how participants were contacted by school districts with separate research approval processes, the 10% survey response rate goal was not met based on the number

of participants contacted directly by the PI. These factors could have contributed to potential biases.[61] Additionally, not all school personnel were contacted for study participation due to issues with locating professional e-mail addresses and two school districts did not approve the study.

Conclusion

Schools are convenient locations to deliver interventions to address childhood obesity. Understanding the barriers and facilitators to PA and healthy eating behaviors in school environments are important so that these factors can be accounted for in intervention development, adaptation, and implementation. The results of this study suggest that overarching barriers and facilitators are present, so strategies to mitigate challenges and maximize supports can be shared among schools, regardless of academic levels and locations. Additionally, other areas with similar demographics or rates of childhood obesity could apply findings to school-based weight management interventions. These joint efforts can further propel the success of interventions to increase PA and healthy dietary choices to ultimately reduce rates of childhood obesity. Future studies are needed to examine how decreasing barriers and enhancing facilitators impact the implementation and outcomes of school-based interventions.

IMPLICATIONS FOR SCHOOL HEALTH

The findings from this study may assist school personnel to overcome barriers and capitalize on facilitators to deliver school-based interventions addressing PA and healthy eating behaviors. The authors propose several implications below:

- Schools may benefit from incorporating PA and healthy eating lessons into academic curricula. This approach decreases time strains on school personnel and does not detract from educational content.
- School personnel can use existing resources to implement school-based interventions that are evidence-based and can be tailored to specific student and school needs. Such resources include classroom PA strategies from the CDC, National Network of Public Health Institutes, and Health Resources in Action;[71] funding and materials to promote healthy eating from the USDA FNS;[74,75,78] and comprehensive plans to address both PA and healthy eating behaviors in schools from the CDC.[80]
- School-level administrator and cafeteria staff support for school-based interventions addressing PA and healthy eating behaviors may enhance intervention acceptance and delivery. This support can be demonstrated by allowing school-based interventions, promoting healthy lifestyle choices, and creating a culture of health at schools.

Human Subjects Approval Statement

The Institutional Review Board at the Medical University of South Carolina (MUSC) approved this study.

Conflict of Interest Statement

All authors of this article declare they have no conflicts of interest.

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Table 1. Social Ecological Model (SEM)[54-58] and the Steps in Quality Intervention Development (6SQuID) Model[59,60]: Applications to Survey Design and Data Analysis

Theoretical Model	Elements	Survey Design and Data Analysis
SEM[54-58]		
Intrapersonal	school personnel: attitudes, beliefs, knowledge, behaviors	demographics, main barriers and facilitators based on participants (examples: personal views, opinions)
Interpersonal	school personnel relationships: students, students' families, other school officials	main barriers and facilitators involving students, students' families, administrators, cafeteria staff, instructional support staff, teachers, and school nurses (examples: time, training)
Institutional	schools: physical settings, physical activity and food options, access to health promoting resources	main barriers and facilitators involving school elements (examples: facilities, funding, resources)
Community	school relationships: partnerships, stakeholders, opportunities for physical activity, access to healthy foods	main barriers and facilitators involving community resources (examples: physical activity, healthy foods)
Social/Policy	government mandates/policies/programs: physical activity, nutrition	main barriers and facilitators involving mandates/policies/programs (examples: physical activity, nutrition)
6SQuID Model (first two steps)[59,60]		
Step 1	define and understand problem and causes	main barriers and facilitators identified by all participants
Step 2	clarify malleable factors with greatest scope for change	main barriers and facilitators identified based on school roles, academic levels, and school district classifications

Table 2. Demographic Characteristics of Survey Participants (*N* = 1311)

	n	%
School personnel role		
Curriculum coordinator	3	0.2%
Instructional coach/specialist	30	2.3%
Interventionist	27	2.1%
Media specialist/school librarian	26	2.0%
School counselor	3	0.2%
School nurse	49	3.7%
Speech language pathologist/speech therapist	10	0.8%
Teacher:	1163	88.7%
academic (*n* = 755, 64.9%)		
career and technology education (*n* = 2, 0.2%)		
English language learners/ English for speakers of other languages (*n* = 24, 2.1%)		
fine/related arts (*n* = 90, 7.7%)		
gifted and talented (*n* = 21, 1.8%)		
physical education (*n* = 40, 3.4%)		
special area/elective (*n* = 94, 8.1%)		
special education/resource (*n* = 137, 11.8%)		

Table 2. Continued

	n	%
Years of experience as school personnel		
0-5	272	20.7%
6-10	259	19.8%
11-15	225	17.2%
16-20	217	16.6%
21-25	151	11.5%
26-30	99	7.6%
31+	88	6.7%
Academic level[a]		
Elementary	625	47.7%
Middle	359	27.4%
High	389	29.7%
South Carolina school district region[a]		
Upstate	229	17.5%
Midlands	437	33.3%
Pee Dee	221	16.9%
Lowcountry	424	32.3%
South Carolina school district classification[a]		
Rural	378	28.8%
Urban	935	71.3%

[a]Participants were able to select multiple responses if they worked with multiple academic levels or were employed in multiple school districts.

Table 3. Barriers and Facilitators to Physical Activity (PA) and Healthy Eating Behaviors in Schools by Roles in Schools [*n* (%)]

Barriers	Curriculum coordinator *n* = 3	Instructional coach/ specialist *n* = 30	Interventionist *n* = 27	Media specialist/ librarian *n* = 26	School counselor *n* = 3	School nurse *n* = 49	Speech language pathologist/ speech therapist *n* = 10	Teacher *n* = 1163
Main Barriers to PA (*n* = 1309)								
inadequate age-appropriate PA policies	1 (33.3)				1 (33.3)			
inadequate parent/family support	1 (33.3)							
insufficient funds					1 (33.3)			
insufficient time	1 (33.3)	17 (56.7)	12 (44.4)	10 (38.5)	1 (33.3)	16 (32.7)	6 (60.0)	451 (38.8)
Main Barriers to Healthy Eating (*n* = 1309)								
inadequate age-appropriate nutrition training	1 (33.3)							
inadequate district-level administrator support							2 (20.0)	
inadequate parent/family support	1 (33.3)		7 (25.9)	6 (23.1)	1 (33.3)	11 (22.4)		
inadequate student cooperation					1 (33.3)			244 (21.0)
inadequate teacher support					1 (33.3)			
insufficient funds	1 (33.3)							
limited healthy food access		10 (33.3)				11 (22.4)	2 (20.0)	

Non-majority response areas are shaded.

Table 3. Continued

Facilitators	Curriculum coordinator *n* = 3	Instructional coach/ specialist *n* = 30	Interventionist *n* = 27	Media specialist/ librarian *n* = 26	School counselor *n* = 3	School nurse *n* = 49	Speech language pathologist/ speech therapist *n* = 10	Teacher *n* = 1163
Main Facilitators to PA (*n* = 1213)								
adequate district-level administrator support	1 (33.3)							
adequate school-level administrator support				7 (26.9)		7 (14.3)		242 (20.8)
adequate student cooperation		5 (16.7)	4 (14.8)		2 (66.7)		3 (30.0)	
adequate teacher support	1 (33.3)					7 (14.3)		
sufficient PA opportunities			4 (14.8)					
sufficient resources	1 (33.3)							
sufficient time			4 (14.8)					
Main Facilitators to Healthy Eating (*n* = 1211)								
adequate cafeteria staff support	1 (33.3)	5 (16.7)					2 (20.0)	214 (18.4)
adequate district-level administrator support	1 (33.3)							
adequate parent/family support					1 (33.3)	8 (16.3)		
adequate school-level administrator support				5 (19.2)				
adequate teacher support	1 (33.3)				1 (33.3)		2 (20.0)	
sufficient healthy food access			7 (25.9)					

Non-majority response areas are shaded.

Table 4. Barriers and Facilitators to Physical Activity (PA) and Healthy Eating Behaviors in Schools by Academic Levels [*n* (%)]

Barriers	Elementary *n* = 625	Middle *n* = 359	High *n* = 389
Main Barriers to PA (*n* = 1310)			
inadequate student cooperation			88 (22.6)
insufficient time	319 (51.0)	132 (36.8)	
Main Barriers to Healthy Eating (*n* = 1309)			
inadequate parent/family support	148 (23.7)		
inadequate student cooperation		89 (24.8)	100 (25.7)
Facilitators	**Elementary** ***n* = 625**	**Middle** ***n* = 359**	**High** ***n* = 389**
Main Facilitators to PA (*n* = 1213)			
adequate school-level administrator support	132 (21.1)	73 (20.3)	69 (17.7)
Main Facilitators to Healthy Eating (*n* = 1211)			
adequate cafeteria staff support	115 (18.4)	67 (18.7)	62 (15.9)

Non-majority response areas are shaded.

Table 5. Barriers and Facilitators to Physical Activity (PA) and Healthy Eating Behaviors in Schools by School District Classifications [*n* (%)]

Barriers	Rural *n* = 378	Urban *n* = 935
Main Barriers to PA (*n* = 1310)		
insufficient time	133 (35.2)	381 (40.7)
Main Barriers to Healthy Eating (*n* = 1309)		
inadequate parent/family support	90 (23.8)	
limited healthy food access		206 (22.0)
Facilitators	**Rural** ***n* = 378**	**Urban** ***n* = 935**
Main Facilitators to PA (*n* = 1213)		
adequate school-level administrator support	68 (18.0)	196 (21.0)
Main Facilitators to Healthy Eating (*n* = 1211)		
adequate cafeteria staff support	85 (22.5)	149 (15.9)

Non-majority response areas are shaded.

MANUSCRIPT 4: "We've had to build the plane as we flew it.": Impacts of the COVID-19 Pandemic on School-Based Weight Management Interventions

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Abstract

Background: In response to the coronavirus disease 2019 (COVID-19) pandemic, schools in the United States transitioned to remote learning to slow the spread of the virus and to protect students and other school members. This unprecedented move interrupted academic education as well as school-based health interventions addressing physical activity (PA) and healthy eating behaviors to help combat childhood obesity. Little is known on how these interventions were affected by COVID-19.

Methods: This concurrent multi-methodological study incorporated two independent components: qualitative descriptive semistructured interviews with school administrators and quantitative descriptive cross-sectional needs assessment survey of school personnel.

Results: Three themes emerged from interviews with school administrators (N = 28): changes in school-based interventions addressing PA and healthy eating behaviors, changes in academic delivery impacting PA and healthy eating behaviors, and needs of school administrators. From the survey (N = 1311), 635 (48.4%) participants indicated that schools' abilities to address PA and healthy eating behaviors were negatively impacted by COVID-19. The majority (n = 876, 66.8%) of participants strongly agreed or agreed that the pandemic would affect future school-based interventions related to PA and healthy eating behaviors.

Conclusions: While schools are prime locations for delivering school-based weight management interventions related to childhood obesity, participants reported the pandemic had overall negative impacts on interventions addressing PA and healthy eating behaviors. Understanding these impacts is essential in adapting school-based interventions based on changes from COVID-19 so students may receive health information and access health promotion interventions in remote learning environments and during social distancing.

Keywords: *COVID-19, pandemic, childhood obesity, dietary intake, physical activity, school-based interventions*

Introduction

In January 2020, the United States (US) identified its first confirmed case of the coronavirus disease 2019 (COVID-19).[1] By March 2020, all 50 states had reported COVID-19 cases, and the disease had reached pandemic status.[2] In response, elementary and secondary schools across the nation transitioned to remote learning to slow the spread of the virus and to protect students and other school members. Remote learning strategies involved synchronous and asynchronous virtual lessons as well as packets containing printed schoolwork for students to complete at home.[3]

This unprecedented move interrupted academic education as well as school-based health initiatives.[4] Of particular interest is how the pandemic impacted school-based interventions addressing physical activity (PA) and healthy eating behaviors. Many of these interventions are in place to help combat childhood obesity, which affects approximately 14.4 million US children and adolescents.[5] School-based interventions have shown success in improving PA and dietary behaviors,[6-11] but little is known on how these interventions have been affected by COVID-19. This information is especially important as school closures from COVID-19 have been associated with weight gain due to disruptions in students' daily routines.[12,13] One study predicts that these closures could potentially lead to 1.2 million new cases of childhood obesity.[13,14]

As the pandemic continues and schools adjust to required restrictions, there is a need to understand how school-based interventions addressing PA and healthy eating behaviors are impacted from the perspectives of school administrators and other school personnel. As part of a larger study examining barriers and facilitators to school-based interventions among public school officials in South Carolina (SC), data were collected

on COVID-19's effects on these interventions in the context of remote learning environments. These findings may help school systems to adapt school-based interventions so that students can still receive and benefit from content on healthy lifestyle practices, with the ultimate goal of decreasing rates of childhood obesity.

Methods

Design

A concurrent multi-methodological design explored the pandemic's effects on school-based interventions addressing PA and healthy eating behaviors.[15-17] Both qualitative and quantitative components were completed independently using two different sample populations to form a more comprehensive understanding of the phenomena.[15-17] The qualitative descriptive component included one-time Key Informant Interviews (KIIs) with SC public school administrators.[17-21] The quantitative descriptive cross-sectional component involved conducting a needs assessment survey of SC public school personnel. The Institutional Review Board at the Medical University of South Carolina approved this study.

Participants

Study participants were school administrators and school personnel from public schools in SC. School administrators were individuals currently working in school leadership roles, such as principals and assistant principals. School personnel were people employed in certified or licensed positions in schools, including teachers and school nurses. The qualitative descriptive element used a purposive sampling plan with snowballing,[15,22] while the quantitative descriptive portion utilized a consecutive

sampling approach.[15] The overall goal for both sampling strategies was participant representation from all academic levels, including elementary, middle, and high schools.

For recruitment, the Principal Investigator (PI) developed an electronic mail (e-mail) database using publicly available professional e-mail addresses for school administrators and school personnel. Several school districts required separate research approval processes. Potential participants received e-mails from either the PI or their school districts containing study information regarding interviews or the needs assessment survey. A professional state organization also distributed research materials to its members. For the qualitative descriptive component, the objective for recruitment was data saturation, with a targeted goal of 25-30 KIIs.[18,22,23] For the quantitative descriptive component, the objective for recruitment was a 10% survey response rate.[15]

Data Collection

The semistructured interview guide for the KIIs and the needs assessment survey were developed based on a literature review[22-55] and two theoretical models: the Social Ecological Model[56-60] and the Steps in Quality Intervention Development (6SQuID) Model.[61,62] These models were utilized for the larger study examining barriers and facilitators to school-based interventions among public school officials in SC, but were not incorporated into the COVID-19 aspects of the study. COVID-19 questions from the interview guide focused on how the pandemic affected school-based interventions addressing PA and healthy eating behaviors and potential lasting effects of the pandemic on these interventions. COVID-19 questions from the needs assessment survey inquired about the impact of COVID-19 on schools' abilities to address PA and healthy eating behaviors and how the pandemic would affect future school-based interventions.

Following informed consent, the PI conducted individual, in-depth telephone and videoconference KIIs that were audio recorded and transcribed verbatim. The PI verified accuracy of transcripts by comparing them to audio recordings and deleted identifying information. Participants accessed the survey electronically through the Research Electronic Data Capture (REDCap) system.[63,64] Survey questions were multiple choice with the option of write-in responses.

Data Analysis

Interview transcripts underwent thematic analysis to discover patterns within the data.[18,23,37,65] After transcripts were Level 1 coded, a codebook with a priori and emergent codes was used for Level 2 coding. The PI (LJCS) and the senior researcher (MN) coded each transcript independently and met 13 times to review transcripts, resolve discrepancies, and reach confirmation and consensus. This process allowed the researchers to determine overriding themes from interview data.

Needs assessment survey responses were analyzed using descriptive statistics of multiple choice questions and thematic analysis of write-in responses.[66-68] Statistical analyses were performed using IBM SPSS Statistics 27.[69] Frequency counts and percentages were calculated to explore how COVID-19 impacted schools' abilities to address PA and healthy eating behaviors and effects on future school-based interventions addressing PA and healthy eating behaviors.[29,52,66,67] Thematic analysis of write-in responses identified commonalities in what these impacts entailed and provided details on how COVID-19 would affect future school-based interventions.[68]

Results

Demographics of Participants

Twenty-eight SC public school administrators participated in KIIs. For the needs assessment survey, 1311 SC public school personnel were included in the final sample. There were no differences between survey participants in the final sample with complete data and those with missing data. Tables 1 and 2 display demographic characteristics of interview and survey participants, respectively. Information from the South Carolina Department of Education was used for categorizing academic levels, school district regions, and school district classifications.[70,71] Academic levels were defined as: elementary – prekindergarten-5th grade, middle – 6th grade-8th grade, and high – 9th grade-12th grade.

Qualitative Results

Three COVID-19 specific themes emerged from school administrator interviews (N = 28): changes in school-based interventions addressing PA and healthy eating behaviors, changes in academic delivery impacting PA and healthy eating behaviors, and needs of school administrators. Each theme with supporting information is shown in Figure 1. Exemplary statements for each theme are presented in Table 3.

Theme 1. Changes in school-based interventions addressing PA and healthy eating behaviors (Table 3). When schools closed in response to the pandemic, there was a rapid transition to remote learning and extracurricular activities, including athletics and clubs, stopped. Participants discussed how academic content areas, such as math, reading, and science, took precedence over school-based interventions addressing PA and healthy eating behaviors. The closures also created stress for students, students' families, and

school personnel. Participants did not want to increase this stress, which resulted in many school-based interventions directed at PA and healthy eating behaviors not being offered at all, being limited in their delivery, or becoming optional for students.

Although the primary focus was on academic content, participants reported sincere efforts to continue some interventions, even with restrictions. One notable example was the school meal programs where students and their families could receive meals from schools while school buildings were closed. While participants questioned the health of some food items and acknowledged distribution issues, they stated that overall meals were of high nutritional quality, and the programs helped students to have access to healthy foods. Several participants indicated that the physical education (PE) teachers at their schools took initiative to develop virtual PA lessons that were then shared with PE classes and in some cases entire schools and school districts. Other strategies to promote PA involved choice boards for students to select their activities and virtual field days where students could post videos of themselves engaging in PA.

Theme 2. Changes in academic delivery impacting PA and healthy eating behaviors (Table 3). All participants discussed how changes in academic delivery in response to COVID-19 affected students' PA and healthy eating behaviors, both negatively and positively. Remote learning and not being able to physically see students limited participants' abilities to monitor students' actions related to health behaviors. Many participants voiced concerns about students not being active and eating unhealthy foods while away from school. Students receiving virtual education lessons were spending the majority of their days in front of electronic devices, and options for PA were restricted due to organized sports being cancelled, recreational areas being closed, and

students not being allowed to go outside due to fear of COVID-19. Additionally, participants were worried about student eating habits because, despite the meal programs established during school closures, students may not have had ready access to healthy meals as they traditionally did in school settings.

Despite remote learning challenges, participants indicated that attempts were made to still promote healthy lifestyles. Technology was a valuable tool to send content to students regarding PA and healthy eating behaviors. Google Classroom lessons, e-mail messages, and social media posts encouraged PA and healthy eating while learning from home. Providing students with this information was important to participants so that students were aware of their schools' concerns for their wellbeing.

Theme 3. Needs of school administrators (Table 3). There was unanimity among participants regarding needs to deliver school-based interventions addressing PA and healthy eating behaviors during the pandemic. One of the main requests involved examples of how to implement school-based interventions given changes from COVID-19. Participants reported that having guiding materials would help them tailor interventions to their schools' specific requirements of offering safe in-person activities as well as remote learning activities. Support from the South Carolina Department of Education and school districts was identified as a key factor necessary for continuing school-based interventions. These support measures included dependable education plans that were not constantly changing and having adequate school personnel to help implement interventions. Participants discussed how these elements were helpful during traditional school years, but were especially critical during the pandemic when interventions addressing PA and healthy eating behaviors were not viewed as high

priorities compared to academic learning. Participants were also vocal about the need for resources related to school-based interventions to adjust to changes in school operations due to COVID-19. These resources included space to allow for social distancing and non-shared individual equipment for students when they are physically able to return to schools.

Quantitative Results

Survey participants were asked to categorize and explain the impact COVID-19 had on their schools' abilities to address PA and healthy eating behaviors and if they thought the pandemic would affect future school-based interventions related to PA and healthy eating behaviors. Results are presented in Table 4.

Impact of COVID-19 pandemic on schools' abilities to address PA and healthy eating behaviors. When asked about the impact of COVID-19 on schools' abilities to address PA and healthy eating behaviors, 635 (48.4%) participants indicated a negative impact, while 44 (3.4%) participants indicated a positive impact. The predominant reason given by participants for negative responses was students not physically being in schools (n = 370), thus school personnel were not able to monitor students' PA and eating habits or deliver school-based interventions to their full extent. Other common responses included students having limited to no PA at home (n = 68), students having limited or lack of access to resources for PA and healthy eating behaviors (n = 61), students spending the majority of their time on electronic devices (n = 44) and indoors (n = 42), students engaging in unhealthy eating habits while out of school (n = 34), and social distancing measures restricting students' abilities to get together with others (n = 32). For those who selected positive impact, the leading support involved the meal programs

being offered by schools (n = 34). Participants reported that these meals provided students with healthy food and beverage options, such as fruits, vegetables, and milk.

COVID-19 pandemic will affect future school-based interventions related to PA and healthy eating behaviors. A majority of participants (n = 876, 66.8%) strongly agreed or agreed that COVID-19 would affect future school-based interventions related to PA and healthy eating behaviors. In write-in responses to the previous question on COVID-19's impact, numerous participants identified negative effects they were aware of for the 2020-2021 school year. These effects included PE classes being delivered in small classrooms; limited opportunities for physical movement during the school day due to social distancing, inadequate space, and inability to share equipment; and students eating pre-packaged meals with less nutritious foods in classrooms.

Discussion

Results from this study provided insights into how COVID-19 has affected school-based interventions addressing PA and healthy eating behaviors. Information from those working directly in school settings enhanced understanding of the pandemic's impacts on school personnel, students, and educational operations. Findings can help school officials to adapt school-based interventions to changes caused by COVID-19 so students can still benefit from health initiatives aimed at reducing rates of childhood obesity. It is noteworthy that participants reported consistent responses in terms of the pandemic's effects on school-based interventions, regardless of role, years of experience, academic level, and school district region and classification. There was a universality of both the challenges schools faced and the initiatives schools took to address these challenges. As one participant noted, "Nobody ever told us this was coming, and to this

extent. So, it will be a challenging, frustrating, daunting time, but I think we'll come out of the end and be like, 'Guys, we changed the face of the world as we know it.'" (Participant 20: middle school administrator from Pee Dee region and urban school district)

In both the qualitative and quantitative components of this study, participants identified remote learning and students not being in school buildings as barriers to implementing school-based interventions due to a focus on academic content and lack of monitoring and accountability. While schools move to re-opening phases, there are continued concerns about how COVID-19 restrictions will affect physical movements and healthy eating. There is an opportunity for innovative solutions regarding delivery of school-based interventions as part of the academic curriculum required for students, with PA and nutrition content being incorporated into education lessons. For example, students could plan a healthy meal, learn about the nutrients in the foods, calculate how many calories would be consumed, and determine the amount and types of PA needed to burn the consumed calories. Assignments such as these incorporate reading, math, and science skills and allow for monitoring of completed work.

Both school administrators and personnel indicated that students had increased use of electronic devices during the pandemic. While excessive screen time is not recommended,[72] technology can be used for school-based intervention delivery, particularly PA interventions. Synchronous sessions and pre-recorded videos involving physical movements can be presented to students, and students can track their PA. To encourage participation, schools can recognize or reward student involvement. These

options can also be used for remote learning lessons in schools that are re-opened, but have limited space for students to be physically active while at school.

Another important consideration is the continuation of healthy food offerings through school meal programs. During initial school closures, participants reported the benefits of the school meal programs; however, participants indicated that food choices would change from fresh options to pre-packaged meals served in classrooms in the 2020-2021 school year as schools re-open. School administrators and personnel should advocate for students to still receive healthy meals, despite the eating locations. School officials can collaborate with food service workers to identify the best solutions for their schools.

Furthermore, it is essential that school members have resources to encourage school-based interventions addressing PA and healthy eating behaviors. One helpful endeavor would be the creation of a virtual space where school administrators and personnel across each state or nationally could describe successful strategies for implementing interventions in schools. This type of knowledge sharing could assist those encountering difficulties to benefit from examples from other schools and would still enable them to adapt interventions to meet their local needs. Support systems such as these are imperative during the pandemic as changes occur rapidly, and time is of the essence.

A final implication of this study is that while academic lessons are important, health behaviors, especially during a pandemic, should continue to be encouraged and promoted. Educating school officials regarding the importance of PA and healthy eating behaviors to facilitate student weight management, which can further serve as a

protective factor against COVID-19, is a priority.[13] To help with this, schools can capitalize on existing resources, such as school nurses, to design instructional programs that could be shared with their schools. This awareness may help encourage implementation of school-based interventions during the pandemic.

Strengths and Limitations

This study is one of the first to examine the pandemic's impact on school-based interventions addressing PA and healthy eating behaviors in SC schools. The study had a diverse sample population, with school administrators and personnel from various educational backgrounds, academic settings, and experience levels. The qualitative and quantitative aspects allowed for a multifaceted understanding of how COVID-19 has affected school-based health initiatives related to childhood obesity. Also, the qualitative portion met the goal of data saturation with 28 KIIs.

All study participants were part of the educational system in SC, self-reported measures were used for data collection, there was missing data from the survey, and the goal of a 10% survey response rate was not met. These factors limit the generalizability of findings and contribute to potential biases. Additionally, e-mail addresses were not available for everyone who met inclusion criteria, and not all school districts with separate research approval processes approved the study.

Conclusions

The COVID-19 pandemic affected all aspects of school life, from content delivery to extracurricular activities.[3] While schools are prime locations for delivering school-based weight management interventions related to childhood obesity, participants in this study reported that the pandemic had overall negative impacts on interventions

addressing PA and healthy eating behaviors. Understanding these impacts is essential in adapting school-based interventions to account for changes from COVID-19 so that students are still able to receive health information and access health promotion interventions. As remote learning options may become more common in the future, based on lessons learned during the pandemic, school-based interventions need to be explored from both a traditional school model and a remote learning model. Additional studies examining strategies for intervention adaptation as well as their outcomes on student health behaviors are needed to further guide school-based efforts in response to the pandemic.

Author Disclosure Statement

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Table 1. Demographic Characteristics of Interview Participants ($N = 28$)		
	n	**%**
School administrator type		
Principal	11	39.3%
Assistant principal	16	57.1%
Assistant director	1	3.6%
Years of experience as school administrator		
0-5	12	42.9%
6-10	6	21.4%
11-15	3	10.7%
16-20	2	7.1%
21-25	2	7.1%
26-30	2	7.1%
31+	1	3.6%
Academic level		
Elementary	13	46.4%
Middle	5	17.9%
High	8	28.6%
Prekindergarten-12th grade	1	3.6%
6th grade-12th grade	1	3.6%

Table 1. Demographic Characteristics of Interview Participants (*N* = 28) *continued*		
	n	**%**
South Carolina school district region		
Upstate	7	25.0%
Midlands	9	32.1%
Pee Dee	6	21.4%
Lowcountry	6	21.4%
South Carolina school district classification		
Rural	10	35.7%
Urban	18	64.3%

Table 2. Demographic Characteristics of Survey Participants (N = 1311)		
	n	**%**
School personnel role		
Curriculum coordinator	3	0.2%
Instructional coach/specialist	30	2.3%
Interventionist	27	2.1%
Media specialist/school librarian	26	2.0%
School counselor	3	0.2%
School nurse	49	3.7%
Speech language pathologist/speech therapist	10	0.8%
Teacher:	1163	88.7%
academic (n = 755, 64.9%)		
career and technology education (n = 2, 0.2%)		
English language learners/ English for speakers of other languages (n = 24, 2.1%)		
fine/related arts (n = 90, 7.7%)		
gifted and talented (n = 21, 1.8%)		
physical education (n = 40, 3.4%)		
special area/elective (n = 94, 8.1%)		
special education/resource (n = 137, 11.8%)		

Table 2. Demographic Characteristics of Survey Participants (N = 1311) *continued*		
	n	**%**
Years of experience as school personnel		
0-5	272	20.7%
6-10	259	19.8%
11-15	225	17.2%
16-20	217	16.6%
21-25	151	11.5%
26-30	99	7.6%
31+	88	6.7%
Academic level[a]		
Elementary	625	47.7%
Middle	359	27.4%
High	389	29.7%
South Carolina school district region[a]		
Upstate	229	17.5%
Midlands	437	33.3%
Pee Dee	221	16.9%
Lowcountry	424	32.3%
South Carolina school district classification[a]		
Rural	378	28.8%
Urban	935	71.3%

[a]Participants were able to select multiple responses if they worked with multiple academic levels or were employed in multiple school districts.

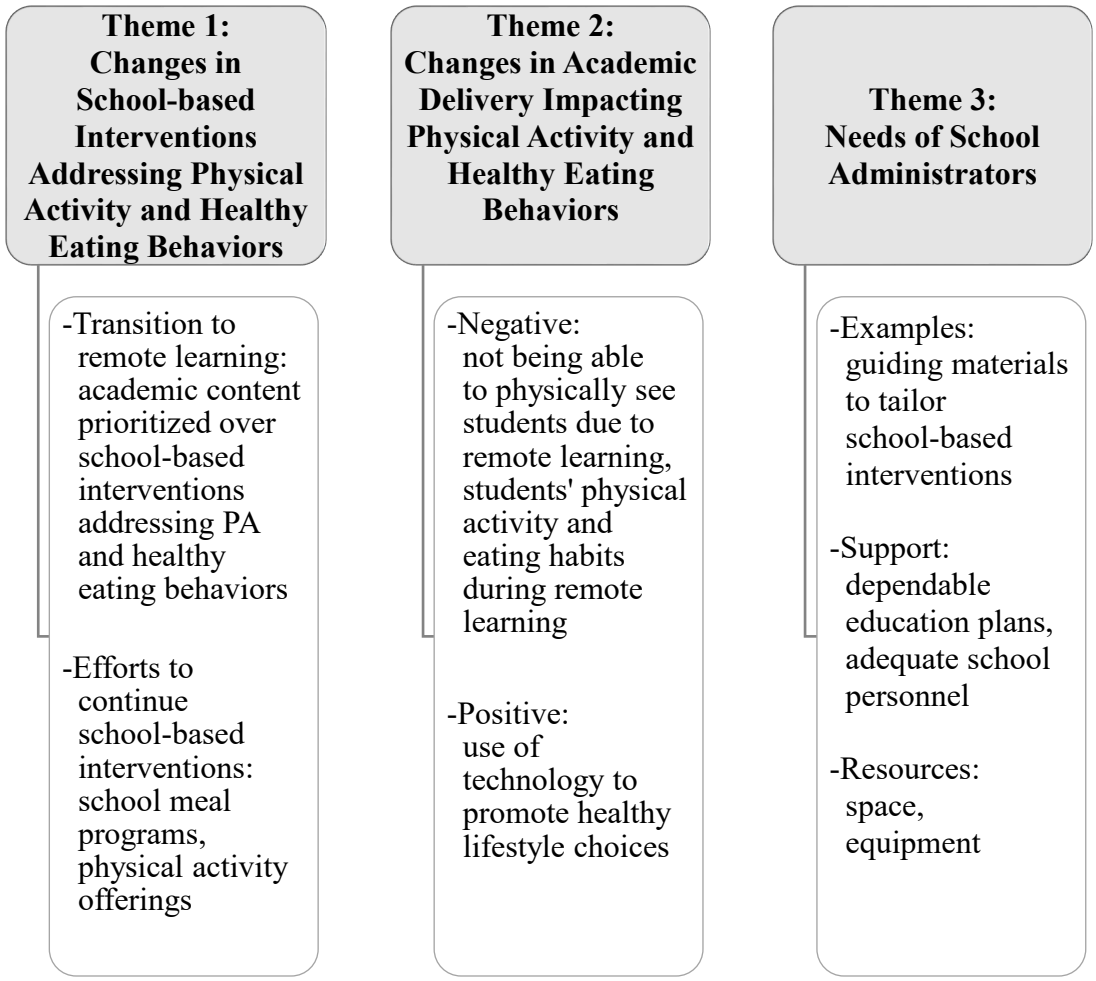

Figure 1. Coronavirus Disease 2019 (COVID-19) Themes with Support Information from Interviews (*N* = 28)

Table 3. Exemplary Statements by Theme from Interviews with School Administrators (*N* = 28)	
Theme	**Exemplary Statements**
1. Changes in School-Based Interventions Addressing Physical Activity and Healthy Eating Behaviors	"I will say that COVID-19 was the worst travesty to ever happen to education in my 14 years of experience because it shut everything down. Overnight we had to redo our entire curriculum. So, when you're redoing a curriculum in 24 hours, you're focused on reading and math and everything else hits the back burner." (Participant 1: elementary school administrator from Upstate region and rural school district) "Physical activity was not something that was mentioned or required." (Participant 22: 6th grade-12th grade administrator from Lowcountry region and urban school district) "With COVID, we've provided over 50,000 meals to our families. But we didn't provide just meals, we provided fresh fruits, fresh vegetables, corn, tomatoes, peaches, and milk. They also got a bag of vegetables and that kind of thing. So, fresh vegetables they could take home. That was for every family who came through the line." (Participant 7: elementary school administrator from Upstate region and rural school district) "We also had a virtual field day that students got to take part in. There were different activities that they noted, and they could share that information with our PE coach. They made videos of themselves doing it and posted them. They were excited about it." (Participant 21: elementary school administrator from Upstate region and rural school district)

Table 3. Exemplary Statements by Theme from Interviews with School Administrators (*N* = 28) *continued*	
Theme	**Exemplary Statements**
2. Changes in Academic Delivery Impacting Physical Activity and Healthy Eating Behaviors	"We're one-to-one, and it's very easy for the child to get locked behind the Chromebook all day. Even if they're in Google Classroom and the assignment may be a physical activity, it's very hard to measure that when they're not in class together, and the coach and the teacher can actually see them moving, doing the jumping jacks. I know many of our children probably became couch potatoes and probably reverted back to not-so-healthy eating." (Participant 20: middle school administrator from Pee Dee region and urban school district) "We were asking kids to go outside and walk in the neighborhood and those types of things. But again, I imagine a lot of our parents weren't comfortable with their kids just being outside playing under the pretense. We did hear a lot of our parents are in the mind frame of, 'If it's not safe to go to school, why would I let my kids run around the neighborhood?' So, I do believe that physical activity took a hit." (Participant 3: elementary school administrator from Midlands region and urban school district) "I have heard from parents who are working from home, 'Yeah, the kids live and eat so unhealthy. We just have packaged things, and I'm working, and I'll say, just go put in a Hot Pocket, just leave me alone right now.' And just to have that open dialogue to understand, and maybe some parents didn't go out grocery shopping, so they just had freezer stuff." (Participant 24: elementary school administrator from Midlands region and urban school district) "Especially during the shutdown, the school nurse would communicate with students via email about, 'Hey, don't forget to go out and take a walk today, fresh air and exercise. I know it's hard being at home, but here's some things you can do to remain healthy.' Little things like that, just informational stuff." (Participant 16: high school administrator from Upstate region and rural school district)

Table 3. Exemplary Statements by Theme from Interviews with School Administrators (*N* = 28) *continued*	
Theme	**Exemplary Statements**
3. Needs of School Administrators	"I would think the biggest thing would be just seeing some good ideas and some good models. So, if we saw some good models and some good exemplars of what would be an effective way to do this when kids are spread all over the county, then it might be good." (Participant 25: high school administrator from Midlands region and urban school district) "Every district has an entirely different plan. And you would like to assume that the state would just have one plan for everyone to follow. If we have one plan to follow, we can go by the guidelines, and everyone would be headed in the same direction. As of right now, everybody is doing their own thing, and you just don't know how it's going to work out." (Participant 9: high school administrator from Pee Dee region and rural school district) "An extra set of hands would be great. I would love to have someone that was able to disinfect our playgrounds after every class goes to recess, especially if I could just have someone on our kindergarten playground to disinfect after a class went out to recess. I think that can be huge because their area is too small not to use the equipment for recess. I'm not sure how it would even be possible for them not to use the equipment. So, I'm a little nervous about that. So, having just extra sets of hands to disinfect in the building, I think would be helpful." (Participant 15: elementary school administrator from Midlands region and urban school district) "We would probably need more space. I know that's impossible, but we probably also need maybe some different activities, like ideas that they can do for the kids so they can be active without being in close contact. More ideas to help with how to keep them active without being close to each other." (Participant 5: middle school administrator from Midlands region and urban school district)

Table 4. Coronavirus Disease 2019 (COVID-19) Pandemic Survey Responses (*N* = 1311)		
	n	**%**
Impact of COVID-19 pandemic on schools' abilities to address physical activity and healthy eating behaviors		
Negative impact	635	48.4%
Positive impact	44	3.4%
No impact	99	7.6%
Unsure	431	32.9%
No response	102	7.8%
COVID-19 pandemic will affect future school-based interventions related to physical activity and healthy eating behaviors		
Strongly agree	474	36.2%
Agree	402	30.7%
Unsure	293	22.3%
Disagree	35	2.7%
Strongly Disagree	5	0.4%
No response	102	7.8%

CONCLUSION

Overview of Manuscripts

This dissertation consists of four manuscripts: (1) an integrative review of the barriers and facilitators to school-based interventions addressing physical activity (PA) and nutritional intake in primary and elementary schools,[1] (2) the qualitative descriptive component of the study exploring the perspectives of SC public school administrators on school-based interventions addressing PA and healthy eating behaviors,[2] (3) the quantitative descriptive aspect of the study examining the viewpoints of SC public school personnel on barriers and facilitators to PA and healthy eating behaviors in schools,[3] and (4) the qualitative and quantitative elements of the concurrent multi-methodological study of the impacts of the coronavirus disease 2019 (COVID-19) pandemic on school-based interventions addressing PA and healthy eating behaviors.[4] Information from this dissertation provides the foundation for future studies on mitigating barriers and maximizing facilitators to school-based interventions addressing PA and healthy eating behaviors, with the ultimate goal of decreasing rates of childhood obesity. Additionally, findings may help school systems to adapt school-based interventions to changes from the COVID-19 pandemic so that students can still receive and benefit from content on healthy lifestyle practices.

The integrative review investigated and synthesized the barriers and facilitators related to implementation and success of obesity-targeted interventions in primary and elementary schools through critical appraisal of the literature.[1] The most commonly reported barriers involved teachers' lack of time and insufficient resources to implement interventions. The main facilitators included adequate training and support for school

officials. Researchers must understand the barriers and facilitators to school-based interventions targeting PA and healthy eating behaviors because these factors are critical in the creation, adaptation, and implementation of interventions. Findings from the integrative review guided the design of the dissertation study and informed the development of the interview guide and the needs assessment survey.

The qualitative descriptive manuscript explored SC public school administrators' perceptions of and experiences with barriers and facilitators regarding awareness, selection, and implementation of school-based interventions addressing PA and healthy eating behaviors.[2] Four themes emerged from the interviews ($N = 28$): weight-related terminology or stigma, experiences with school-based interventions addressing PA and healthy eating behaviors, barriers to school-based interventions addressing PA and healthy eating behaviors, and facilitators to school-based interventions addressing PA and healthy eating behaviors. Findings revealed negative beliefs, comments, and bullying behaviors were more prevalent toward students perceived as being overweight and school-based interventions were present in schools. Furthermore, barriers and facilitators inhibited or enhanced intervention implementation, based on the extent to which they were present. These results support the need to understand relevant barriers and facilitators so they can be accounted for in future intervention research.

The quantitative descriptive manuscript identified SC public school personnel perspectives on the most common barriers and facilitators to PA and healthy eating behaviors in schools.[3] Overall, participants ($N = 1311$) identified the main barriers as insufficient time for PA ($n = 514$, 39.2%) and limited access to healthy foods for healthy eating behaviors ($n = 271$, 20.7%). The primary facilitators were adequate support from

school-level administrators for PA (n = 264, 20.1%) and adequate support from cafeteria staff for healthy eating behaviors (n = 234, 17.8%). Results suggest that overarching barriers and facilitators to school-based interventions addressing childhood obesity are present, so common strategies to mitigate challenges and maximize supports can be used in schools.

The concurrent multi-methodological manuscript examined the impacts of the COVID-19 pandemic on school-based interventions addressing PA and healthy eating behaviors from the viewpoints of SC public school officials.[4] Three themes emerged from interviews with school administrators (N = 28): changes in school-based interventions addressing PA and healthy eating behaviors, changes in academic delivery impacting PA and healthy eating behaviors, and needs of school administrators. From the needs assessment survey (N = 1311), 635 (48.4%) participants indicated that schools' abilities to address PA and healthy eating behaviors were negatively impacted by COVID-19. The majority of participants (n = 876, 66.8%) strongly agreed or agreed that the pandemic would affect future school-based interventions related to PA and healthy eating behaviors. Understanding these impacts is essential in adapting school-based interventions based on changes from COVID-19 so students may receive health information and access health promotion interventions in remote learning environments and during social distancing.

Limitations and Lessons Learned

There are limitations of the dissertation study. All study participants were part of the education system in SC, self-reported measures were used for data collection, there was missing data from the survey, and the goal of a 10% survey response rate was not

met. These factors potentially limit the generalizability of findings and contribute to potential biases. Contact information was not available for everyone who met inclusion criteria, and not all school districts with separate research approval processes approved the study. Furthermore, it is unknown whether school administrators and personnel interested in school-based weight management interventions may have been more inclined to participate in the study.

Several lessons were learned from the study. School counselors and food service workers should be included in future study populations as they were identified as important school members who influenced school-based interventions addressing PA and healthy eating behaviors. When defining inclusion criteria for research participants, it would be helpful to specify a minimum length of time required in qualifying roles so that participants have adequate education experience to fully answer study questions. For mass recruitment through electronic mail (e-mail) messages, it is worth considering the use of a third party company that does not have daily limits on the number of messages that can be sent to recipients. This process would ensure that all potential study participants receive recruitment materials at the same time.

Importance of Theoretical Frameworks to Guide Overall Findings

The Social Ecological Model (SEM) allowed for examination of barriers and facilitators through multilevel approaches and factors beyond the individual person.[5-9] These factors included relationships school administrators and personnel had with other school members, school elements related to health behaviors, and the influence of external community and social/policy aspects. The Steps in Quality Intervention Development (6SQuID) Model focused on the process of quality intervention design

through six steps. This study incorporated the first two steps of the 6SQuID Model to define and understand the barriers and facilitators to school-based interventions that school administrators and personnel perceived and experienced, as well as identifying factors that shaped the problem and had the greatest potential for change.[10,11] Collecting and analyzing data along with interpreting findings in the context of the SEM and the 6SQuID Model allowed for knowledge synthesis about barriers and facilitators in school settings, thus providing a framework for future Intervention Mapping (IM) informed by school-based findings.[12]

Research Trajectory

Further research in this area is warranted. This dissertation study was designed to inform future IM to adapt and implement school-based PA and healthy eating interventions in SC that account for barriers and facilitators. This understanding of barriers and facilitators is important because they directly influence whether or not school-based interventions are offered and the extent to which they are delivered. Future studies are needed to examine how mitigating challenges and maximizing supports impact the implementation and outcomes of school-based interventions. Future studies should also extend beyond SC to other states and countries to explore geographically and demographically diverse populations. A promising opportunity for interprofessional collaboration exists for health care members and education professionals to work together on school-based interventions that address students' health and academic needs.

Contributions of Research to Science and Nursing

The results of this dissertation provide important insights into successful implementation of school-based weight management interventions that account for

barriers and facilitators. Insufficient time was the main barrier and adequate support was the primary facilitator identified in the integrative review and from the qualitative and quantitative aspects of the study. One strategy to address these factors is to infuse PA and healthy eating behavior content into academic instruction using evidence-based materials. A helpful resource is CDC Healthy Schools from the Centers for Disease Control and Prevention.[13] This program provides a plethora of information, including data to support the relationship between healthy behaviors and academic achievement, professional development offerings on the subject of school health, and guided examples of how to incorporate PA and nutrition into education lessons.

As schools continue to navigate learning in the midst of the COVID-19 pandemic, it is also important to consider how school-based health interventions can be delivered in both in-person and remote environments. Educating school officials regarding the importance of PA and healthy eating behaviors to facilitate student weight management, which can further serve as a protective factor against COVID-19, is a priority.[14] To help with this, school districts and individual schools can capitalize on existing resources, such as school nurses, to design instructional programs that could be shared with school members. This awareness may help encourage implementation of school-based interventions during the pandemic. Technology is also a promising avenue to support school-based interventions, ranging from actual delivery of intervention content to the creation of a virtual space where school administrators and personnel can share strategies for implementation. Finally, school officials can advocate for students to still receive healthy school meals, despite changes in eating locations.

This research is innovative because this is one of the first studies to investigate barriers and facilitators to school-based interventions targeting PA and healthy eating behaviors and the impacts of COVID-19 on these interventions from the perspectives of public school administrators and personnel at all academic levels in SC. Insights from school systems and personnel are needed to explain how and why school-based interventions have or have not been implemented. Identifying and understanding the actual and perceived barriers and facilitators will enable tailored intervention adaptation. Findings from the study will inform future IM to adapt and implement interventions that can be integrated into school day schedules after minimizing barriers and maximizing facilitators. This innovation applies to multiple fields of research, including health, education, and implementation science. Study results may inform health policies among medical professionals, educators, and researchers developing, adapting, and implementing interventions that target childhood obesity behaviors. Furthermore, the approach used in this study to identify barriers and facilitators in the context of the SEM[5-9] and the 6SQuID Model[10,11] can be expanded to explore other areas of health existing in schools, such as asthma, diabetes, and mental health issues.

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LIST OF APPENDICES

Appendix A. Institutional Review Board for Human Research (IRB) Approval Documents (Initial Review and Amendments)

Institutional Review Board for Human Research (IRB)
Office of Research Integrity (ORI)
Medical University of South Carolina

Palmetto Place Office Park
1 South Park Circle, Bldg. 1, Suite 401
Charleston, SC. 29407
Federal Wide Assurance # 1888

APPROVAL:
This is to certify that the research proposal **Pro00100489** entitled:
Barriers and Facilitators Regarding Awareness, Selection, and Implementation of School-Based Interventions Addressing Physical Activity and Healthy Eating Behaviors: Perspectives of School Administrators and Personnel

submitted by: **Logan Camp-Spivey**
Department: **Medical University of South Carolina**
Sponsor: **Sigma Theta Tau International Honor Society of Nursing: Mu Rho Chapter**

for consideration has been reviewed by **IRB-I - Medical University of South Carolina** and approved. In accordance with 45 CFR 46.101(b), the referenced study is exempt from Human Research Subject Regulations. No further action or Institutional Review Board (IRB) oversight is required, as long as the project remains the same. However, you must inform this office of any changes in procedures involving human subjects. Changes to the current research protocol could result in a reclassification of the study and further review by the IRB.

Because this project was determined to be exempt from further IRB oversight, consent document(s), if applicable, are not stamped with an expiration date.

Approval Date: **6/17/2020**

Type: **Exempt**

Administrator, **IRB-I - Medical University of South Carolina**
Kristin Zaks*

***Electronic Signature**: This document has been electronically signed by the IRB Chairman through the HSSC eIRB Submission System authorizing IRB approval for this study as described in this letter.*

Important Note: Approval by the Institutional Review Board does not, in and of itself, constitute approval for the implementation of this research. Other MUSC clearances and approvals or other external agency or collaborating institutional approvals may be required before study activities are initiated. Research undertaken in conjunction with outside entities, such as drug or device companies, are typically contractual in nature and require an agreement between the University and the entity.

Institutional Review Board for Human Research (IRB)
Office of Research Integrity (ORI)
Medical University of South Carolina

Palmetto Park Place
1 South Park Cir. Bldg. 1 Suite 401
Charleston, SC 29407
Federal Wide Assurance # 1888

APPROVAL: **Protocol: MS1_Pro00100489**
MUSC Amendment #: Ame1_Pro00100489
Amendment Title: Amendment 1 for IRB Study #Pro00100489

This is to certify that the amendment to the research proposal entitled:
Barriers and Facilitators Regarding Awareness, Selection, and Implementation of School-Based Interventions Addressing Physical Activity and Healthy Eating Behaviors: Perspectives of School Administrators and Personnel

Submitted by: **Logan Camp-Spivey**
Department: **Medical University of South Carolina**
Sponsor: **Sigma Theta Tau International Honor Society of Nursing: Mu Rho Chapter**

for consideration has been reviewed by **IRB-I - Medical University of South Carolina** and approved with respect to the study of human subjects as adequately protecting the rights and welfare of individuals involved, employing adequate methods of securing informed consent from these individuals and not involving undue risk in the light of potential benefits to be derived therefrom. No IRB member who has a conflicting interest was involved in the review or approval of this amendment, except to provide information as requested by the IRB. If this amendment required a change in the currently approved Informed Consent, then all previous Informed Consent documents should be marked obsolete.

Approval Date: **7/21/2020**

Amendment Type: **Expedited**

Chairman, IRB I - Medical University of South Carolina
*** Mark Hamner, MD**

* ***Electronic Signature***: *This document has been electronically signed by the IRB Chairman through the HSSC eIRB Submission System authorizing IRB approval for this study as described in this letter.*

Important Note: Approval by the Institutional Review Board does not, in and of itself, constitute approval for the implementation of this research. Other MUSC clearances and approvals or other external agency or collaborating institutional approvals may be required before study activities are initiated. Research undertaken in conjunction with outside entities, such as drug or device companies, are typically contractual in nature and require an agreement between the University and the entity.

MUSC
Medical University of South Carolina
Changing What's Possible

Institutional Review Board for Human Research (IRB)
Office of Research Integrity (ORI)
Medical University of South Carolina
Palmetto Place Office Park
1 South Park Circle, Bldg. 1, Suite 401
Charleston, SC. 29407
Federal Wide Assurance # 1888

APPROVAL: **Protocol: MS2_Pro00100489**
MUSC Amendment #: Ame2_Pro00100489
Amendment Title: Amendment 2 for IRB Study #Pro00100489
Protocol Version #:
Protocol Version Date:

This is to certify that the amendment to the research proposal entitled:
Barriers and Facilitators Regarding Awareness, Selection, and Implementation of School-Based Interventions Addressing Physical Activity and Healthy Eating Behaviors: Perspectives of School Administrators and Personnel

Submitted by: **Logan Camp-Spivey**
Department: **Medical University of South Carolina**
Sponsor: **Sigma Theta Tau International Honor Society of Nursing: Mu Rho Chapter**
Sigma Theta Tau International Honor Society of Nursing: Gamma Omicron at-Large Chapter

For consideration has been reviewed by **IRB-I - Medical University of South Carolina** and approved with respect to the study of human subjects as adequately protecting the rights and welfare of individuals involved, employing adequate methods of securing informed consent from these individuals and not involving undue risk in the light of potential benefits to be derived therefrom. No IRB member who has a conflicting interest was involved in the review or approval of this amendment, except to provide information as requested by the IRB. If this amendment required a change in the currently approved Informed Consent, then all previous Informed Consent documents should be marked obsolete.

Approval Date: **11/12/2020**

Amendment Type: **Expedited**

Administrator, IRB-I - Medical University of South Carolina
Kristin Zaks*

* ***Electronic Signature***: *This document has been electronically signed through the HSSC eIRB Submission System authorizing IRB approval for this study as described in this letter.*

Important Note: Approval by the Institutional Review Board does not, in and of itself, constitute approval for the implementation of this research. Other MUSC clearances and approvals or other external agency or collaborating institutional approvals may be required before study activities are initiated. Research undertaken in conjunction with outside entities, such as drug or device companies, are typically contractual in nature and require an agreement between the University and the entity.

Institutional Review Board for Human Research (IRB)
Office of Research Integrity (ORI)
Medical University of South Carolina

Palmetto Park Place
1 South Park Cir. Bldg. 1 Suite 401
Charleston, SC 29407
Federal Wide Assurance # 1888

APPROVAL: **Protocol: MS3_Pro00100489**
MUSC Amendment #: Ame3_Pro00100489
Amendment Title: Amendment 3 for IRB Study #Pro00100489

This is to certify that the amendment to the research proposal entitled:
Barriers and Facilitators Regarding Awareness, Selection, and Implementation of School-Based Interventions Addressing Physical Activity and Healthy Eating Behaviors: Perspectives of School Administrators and Personnel

Submitted by: **Logan Camp-Spivey**
Department: **Medical University of South Carolina**
Sponsor: **Sigma Theta Tau International Honor Society of Nursing: Mu Rho Chapter**

Sigma Theta Tau International Honor Society of Nursing: Gamma Omicron at-Large Chapter

for consideration has been reviewed by **IRB-I - Medical University of South Carolina** and approved with respect to the study of human subjects as adequately protecting the rights and welfare of individuals involved, employing adequate methods of securing informed consent from these individuals and not involving undue risk in the light of potential benefits to be derived therefrom. No IRB member who has a conflicting interest was involved in the review or approval of this amendment, except to provide information as requested by the IRB. If this amendment required a change in the currently approved Informed Consent, then all previous Informed Consent documents should be marked obsolete.

Approval Date: **1/8/2021**

Amendment Type: **Expedited**

Administrator, IRB I - Medical University of South Carolina
*** Kristin Zaks**

* ***Electronic Signature***: *This document has been electronically signed by the IRB Chairman through the HSSC eIRB Submission System authorizing IRB approval for this study as described in this letter.*

Important Note: Approval by the Institutional Review Board does not, in and of itself, constitute approval for the implementation of this research. Other MUSC clearances and approvals or other external agency or collaborating institutional approvals may be required before study activities are initiated. Research undertaken in conjunction with outside entities, such as drug or device companies, are typically contractual in nature and require an agreement between the University and the entity.

Appendix B. Lexington County School District One Research Study Approval Document

EMPOWER ONE
LEXINGTON COUNTY SCHOOL DISTRICT ONE

October 5, 2020

Dear Ms. Camp-Spivey,

Members of the Research Committee of Lexington County School District One have considered your proposal to conduct research in Lexington One for your project titled, "Barriers and Facilitators regarding Awareness, Selection, and Implementation of School-Based Interventions addressing Physical Activity and Healthy Eating Behaviors: Perspectives of School Administrators and Personnel." The Research Committee has recommended your project for conditional approval by the Senior Leadership Team. That recommendation has been supported at the Senior Leadership level.

Lexington County School District One receives many requests from researchers who want to collect data here. Each proposal is considered carefully. The district approves only those requests that are determined to be of value to the district, that do not interfere with the educational programs of the district, and that respect the privacy and due process rights of students and employees.

Your interest in this topic is commendable, and I have been notified that your request has been approved on the condition that you address the requirements listed below:

- Due to the demands of this study, you must discuss the procedures and study requirements with the principal at each participating school. Please remember that the principal at any participating schools has the final authorization for studies in their buildings. Please seek approval from the building principal before commencing your study.

Administrators in Lexington County School District One recognize the value of your research, and we wish you success with your project.

Best Regards,

Shane M. Phillips, Ph.D.
Chair, Research Committee

C: Dr. Gloria Talley

Lexington County School District One
100 Tarrar Springs Road • P.O. Box 1869 • Lexington, SC 29071-1869 • 803-821-1000 • www.lexington1.net

Appendix C. Richland School District Two Research Study Approval Document

From: John Arnold <jarnold@richland2.org>
Sent: Thursday, July 30, 2020 10:09 AM
To: Camp-Spivey, Logan <camplo@musc.edu>
Subject: Re: [-EXTERNAL-] Re: Conducting Research In Richland School District Two

CAUTION: External

Logan,

The Richland School District Two research committee has approved your application to conduct research in our district. You must complete all research activities by December 22, 2020. You will need to request an extension from the research committee if you need to continue research activities beyond that date. Please remember the committee reserves the right to terminate the study at any time if circumstances change or the members feel it is in the best interest of our students, their families, or staff.

Additionally, the invitation for teachers to participate in your survey and for administrators to participate in interviews will need to go through me. Please provide me with an email message to forward to school principals. The principals will be asked to forward your email to their faculty and school nurse. Remember, principals always have final approval of all research activity conducted on their campus and may deny permission to conduct research even if the proposal has been approved by the district's research committee.

Finally, you must submit a copy of all final reports, dissertations, or publications based on this research to me upon completion of your study.

Please feel free contact me if you need additional information or assistance.

Respectfully,

John

Appendix D. South Carolina Association of School Nurses Research Study Approval Document

Dawn MacAdams <dmacadam@richland2.org>
Thu 8/13/2020 10:53 AM
To: Camp-Spivey, Logan

CAUTION: External

I just sent it

On Thu, Aug 13, 2020 at 10:35 AM Camp-Spivey, Logan <camplo@musc.edu> wrote:

> Hello, my name is Logan Camp-Spivey, and I am a PhD candidate in Nursing Science from the Medical University of South Carolina. I am completing a research study to understand the barriers and facilitators regarding awareness, selection, and implementation of school-based interventions addressing physical activity and healthy eating behaviors. I am also interested in learning about how the COVID-19 pandemic may have affected school-based interventions.
>
> If you are interested in participating in this study, it will involve answering questions on a needs assessment survey (link below). It should take less than 10 minutes to answer the survey questions. In return for your time and effort, the first 500 participants will have the opportunity to receive a $5 gift card via e-mail for completing the survey.
>
> Please note that if your e-mail address is posted on your school's website, you may receive this e-mail again from camplo@musc.edu. If you are interested in taking the survey, please only take the survey one time. Thank you!
>
> Click here to complete the Needs Assessment Survey (https://redcap.musc.edu/surveys/?s=3AH7PJ7ANR)
>
> If you have any questions, please contact me at camplo@musc.edu or (864) 542-6115. I appreciate your time!
>
> Best Wishes,
> Logan Camp-Spivey, MSN, RN
> PhD Candidate in Nursing Science
> Medical University of South Carolina

--
Dawn MacAdams, MSN, RN, NCSN
Nationally Certified School Nurse
Richland School District Two
Coordinator of Health Services
Mailing Address:
Richland School District Two at R2i2
124 Risdon Way
Columbia, SC 29223
(office) -803-738-8459 or Cisco ext. 13386
(fax) - 803-738-3308
dmacadam@richland2.org

Physical Address:
Richland School District Two at R2i2
763 Fashion Drive
Columbia, SC 29229

ALL STUDENTS DESERVE A SCHOOL NURSE ALL DAY, EVERY DAY!

Appendix E. Research Study Recruitment Message to School Administrators

Hello, my name is Logan Camp-Spivey, and I am a PhD candidate in Nursing Science from the Medical University of South Carolina. I am completing a research study to understand the barriers and facilitators regarding awareness, selection, and implementation of school-based interventions addressing physical activity and healthy eating behaviors. I am also interested in learning about how the COVID-19 pandemic may have affected school-based interventions.

If you are interested in participating in this study, it will involve one interview that will last approximately 30-45 minutes. In return for your time and effort, you will receive a $20 gift card via e-mail. If you are interested, please contact me at camplo@musc.edu or (864) 542-6115 to schedule an interview. Thank you!

Best Wishes,
Logan Camp-Spivey, MSN, RN
PhD Candidate, College of Nursing
Medical University of South Carolina

Appendix F. Research Study Recruitment Message to School Personnel

Hello, my name is Logan Camp-Spivey, and I am a PhD candidate in Nursing Science from the Medical University of South Carolina. I am completing a research study to understand the barriers and facilitators regarding awareness, selection, and implementation of school-based interventions addressing physical activity and healthy eating behaviors. I am also interested in learning about how the COVID-19 pandemic may have affected school-based interventions.

If you are interested in participating in this study, it will involve answering questions on a needs assessment survey (link below). It should take less than 10 minutes to answer the survey questions. In return for your time and effort, the first 500 participants will have the opportunity to receive a $5 gift card via e-mail for completing the survey.

Click here to complete the Needs Assessment Survey (https://redcap.musc.edu/surveys/?s=3AH7PJ7ANR)

If you have any questions, please contact me at camplo@musc.edu or (864) 542-6115. Thank you!

Best Wishes,
Logan Camp-Spivey, MSN, RN
PhD Candidate, College of Nursing
Medical University of South Carolina

Appendix G. Statement of the Research and Interview Guide

TITLE OF RESEARCH: Barriers and Facilitators Regarding Awareness, Selection, and Implementation of School-Based Interventions Addressing Physical Activity and Healthy Eating Behaviors: Perspectives of South Carolina Public School Administrators and Personnel

Hello, my name is Logan Camp-Spivey, and I am a PhD candidate in Nursing Science from the Medical University of South Carolina. Thank you for your willingness to participate in our research on school-based interventions addressing physical activity and healthy eating behaviors. Before we start the interview, I want to provide you with some important information about our study.

The purpose of this study is to understand the barriers and facilitators regarding awareness, selection, and implementation of school-based interventions addressing physical activity and healthy eating behaviors. We are also interested in learning about how the COVID-19 pandemic may have affected school-based interventions.

The research study includes participation in one interview that will last approximately 30-45 minutes. If you wish to continue the discussion longer, we will continue, but I will also provide the opportunity for you to stop the interview after 45 minutes should you wish to stop.

The interview will be audio recorded and transcribed. To protect your privacy and confidentiality, all audio recordings and interview transcripts will be stored on a password-protected server and all names will be removed from the transcripts. We plan to publish the results of this study, but will not include any information that would let others know who you are or that you participated in this research.

We hope that the information gained from the study will help in the adaptation and implementation of school-based interventions to encourage physical activity and healthy eating behaviors. In return for your time and effort, you will receive a $20 gift card via e-mail for participation in this study.

Your participation in this study is voluntary. You may decline to take part in or stop the interview at any time. If you have any questions about this study after we finish today, you may contact Logan Camp-Spivey, the lead researcher, at camplo@musc.edu or (864) 542-6115.

Do you have any questions about this study?

Do you agree to participate?

(If yes) Okay, let us begin.

1. Begin qualitative interview using Interview Guide.

Barriers and Facilitators to School-Based Interventions Addressing Physical Activity and Healthy Eating Behaviors

Demographic Information

Instructions: The following questions are personal questions about you.

1. **Which South Carolina school district(s) are you employed in?**

2. **Which type of school(s) are you employed in?**
   - Examples – elementary, middle, high

3. **How many years of experience do you have as a school administrator?**

General School Questions

Instructions: We will begin by talking about childhood obesity in general.

Childhood obesity is a condition in which a child is significantly overweight for his or her age and height. Behaviors that lead to excess weight gain include inadequate participation in physical activity and consumption of high-calorie, low-nutrient foods.

4. **What role can schools play in the weight-related health of children?**
   - Probes that can be used to elicit additional information or clarification:
     - Can you tell me more?
     - Can you give me more details?

5. **What concerns or experiences do you have regarding the use of weight-related terminology or stigma that may exist in your school?**
   - Probes that can be used to elicit additional information or clarification:
     - Can you tell me more?
     - Can you give me more details?

School-Based Interventions

Instructions: We will now talk about school-based interventions addressing physical activity and healthy eating behaviors.

6. **What experiences do you have with school-based interventions addressing physical activity and/or healthy eating behaviors?**
   - Probes that can be used to elicit additional information or clarification:
     - What school-based interventions are you aware of?
     - What school-based interventions have you selected?
     - What school-based interventions have you implemented?
     - Can you tell me more?
     - Can you give me more details?

7. **What barriers or types of things did you find challenging regarding your experiences with school-based interventions?**
   - Probes that can be used to elicit additional information or clarification:
     - Please describe the barriers as they relate to:
       - your personal attitudes, beliefs, knowledge, and behaviors
       - your relationships with students, students' families, and other school officials
       - school elements of physical settings, physical activity and food options, and access to health promoting resources
       - school relationships with community partners, stakeholders, opportunities for physical activity, and access to healthy foods
       - government mandates/policies/programs related to physical activity and nutrition
     - Can you tell me more?
     - Can you give me more details?

8. **What facilitators or types of things did you find supportive regarding your experiences with school-based interventions?**
    - Probes that can be used to elicit additional information or clarification:
        - Please describe the facilitators as they relate to:
            - your personal attitudes, beliefs, knowledge, and behaviors
            - your relationships with students, students' families, and other school officials
            - school elements of physical settings, physical activity and food options, and access to health promoting resources
            - school relationships with community partners, stakeholders, opportunities for physical activity, and access to healthy foods
            - government mandates/policies/programs related to physical activity and nutrition
        - Can you tell me more?
        - Can you give me more details?

9. **I know that the COVID-19 pandemic caused many changes in schools, including how programs are delivered and even what programs can be delivered at this time. In your school, how has the COVID-19 pandemic affected or how do you foresee the pandemic affecting school-based interventions addressing physical activity and/or healthy eating behaviors?**
    - Probes that can be used to elicit additional information or clarification:
        - Can you tell me more?
        - Can you give me more details?
        - What would you need as an administrator to account for changes from the COVID-19 pandemic?

Closing Statement: Thank you very much for your time, help, and cooperation. If you have any questions about your rights as a study participant, please ask me or call the Institutional Review Board at the Medical University of South Carolina at 843-792-4148.

Appendix H. Interview Codebook

- **Schools' Role in Weight-Related Health**
  - education
  - physical activity
    - negative effect
    - no effect
    - positive effect
  - healthy eating
    - negative effect
    - no effect
    - positive effect
  - anthropometric data collection (added 10/21/2020 from Pro00100489008)
  - monitoring dietary intake (added 11/14/2020 from Pro00100489016)

- **Weight-Related Terminology or Stigma**
  - no/limited concerns
  - negative comments/beliefs
    - overweight
    - underweight
    - food consumption (added 11/8/2020 from Pro00100489009)
    - athletic/physical activity abilities (added 11/9/2020 from Pro00100489006)
  - bullying
    - overweight
    - underweight
  - acceptance of being overweight (added 8/16/2020 from Pro00100489023)
  - students' clothing choices (added 8/16/2020 from Pro00100489023)
    - cover body
    - expose body
  - image concerns (added 10/6/2020 from Pro00100489027)
  - recognition/acknowledgement/acceptance of differences/others (added 10/12/2020 from meeting with Dr. Nichols)
  - societal messages on ideal body type (added 10/12/2020 from meeting with Dr. Nichols)
  - weight issues affecting academic performance (added 10/20/2020 from Pro00100489007)
    - overweight: negative effect, no effect, positive effect, unsure
    - underweight: negative effect, no effect, positive effect, unsure
  - actions of students' parents/families/school personnel to control students' weight (added 10/20/2020 from Pro00100489007)
    - increased/decreased physical activity
    - increased/decreased food intake

- influence of students' biological sex (added 10/20/2020 from Pro00100489007)
  - males: more positively/negatively affected
  - females: more positively/negatively affected
- strict policy against negative comments/bullying (added 10/21/2020 from Pro00100489008)
- awareness of impact on students (added 10/21/2020 from Pro00100489008)
  - negative effect
  - no effect
  - positive effect
- avoidance of using weight-related terminology (added 10/26/2020 from Pro00100489001)
- focus on healthy lifestyle instead of weight (added 10/26/2020 from Pro00100489001)
- healthy body image (added 10/27/2020 from Pro00100489024)
- influence on relationships (added 10/27/2020 from Pro00100489024)
  - overweight: negative effect, no effect, positive effect, unsure
  - underweight: negative effect, no effect, positive effect, unsure
- weight issues affecting participation in activities (added 10/27/2020 from Pro00100489024)
  - overweight: negative effect, no effect, positive effect, unsure
  - underweight: negative effect, no effect, positive effect, unsure
- parent/family involvement (added 10/27/2020 from Pro00100489024)
- recommendation/referral for help (added 10/27/2020 from Pro00100489024)
- weight-related status symbol (added 11/1/2020 from Pro00100489015)
  - overweight
  - underweight
- weight-related communication (added 11/1/2020 from Pro00100489015)
  - expected
  - unexpected
  - male students: more/less direct (added 11/9/2020 from Pro00100489006)
  - female students: more/less direct (added 11/9/2020 from Pro00100489006)
  - intent: joking, serious (added 11/16/2020 from Pro00100489028)
- increased awareness of weight status at younger age (added 11/2/2020 from Pro00100489014)
  - overweight
  - underweight
- strict policy against actions of school personnel to control students' weight (added 11/4/2020 from Pro00100489014)
  - increased/decreased physical activity
  - increased/decreased food intake

  - dress code issues (added 11/7/2020 from Pro00100489004)
    - female students/male students
    - body type differences
  - disciplinary actions (added 11/7/2020 from Pro00100489025)
  - improved understanding/responses from students as they get older to not use weight-related terminology (added 11/7/2020 from Pro00100489025)
  - eating disorders (added 11/13/2020 from Pro0010048910)
  - school activities that attract attention to students' weight (added 11/15/2020 from Pro00100489016)
    - overweight
    - underweight
  - concerns (added 11/20/2020 from Pro00100489012)
  - students' responses to negative comments/bullying (added 11/20/2020 from Pro00100489012)
  - accommodations for students' weight (added 11/23/2020 from Pro00100489017)
    - overweight
    - underweight
  - student population influences (added 11/24/2020 from Pro00100489022)
  - students in middle school making more weight-related comments/having more weight-related issues (added 11/24/2020 from Pro00100489022)
  - awareness of students' weight status (added 11/25/2020 from Pro00100489026)
    - overweight
    - underweight
  - protective behaviors (added 12/18/2020 from meeting with Dr. Nichols)

- **Experiences with School-Based Interventions**
  - physical activity interventions
    - no knowledge
    - no experience
    - knowledge (added 10/3/2020 from Pro00100489020)
    - experience
  - healthy eating interventions
    - no knowledge
    - no experience
    - knowledge (added 10/3/2020 from Pro00100489020)
    - experience
    - limited experience (added 11/7/2020 from Pro00100489025)

- student participation (added 8/16/2020 from Pro00100489023)
  - sex
    - males more/less involved in physical activity/healthy eating school-based interventions
    - females more/less involved in physical activity/healthy eating school-based interventions
- school-based interventions (added 8/17/2020 from Pro00100489023)
  - developed at school level
  - commercial/government/educational/community product/program
  - research study (added 10/27/2020 from Pro00100489024)

- **Barriers**
  - intrapersonal
    - knowledge deficit
      - contributory factors of childhood obesity
      - intervention awareness, selection, implementation
    - view of academics
      - more important than health interventions
      - what school evaluations are based on
    - beliefs (added 10/16/2020 from meeting with Dr. Nichols)
      - perspectives of growth and development
    - limited input and/or decision making authority (added 10/21/2020 from Pro00100489008)
      - physical activity interventions
      - healthy eating interventions
    - actions (added 11/7/2020 from Pro00100489004)
  - interpersonal
    - choices/motivation/empowerment/actions of school members (motivation – added 9/22/2020 from meeting with Dr. Nichols), (empowerment – added 10/12/2020 from meeting with Dr. Nichols), (actions – added 10/20/2020 from Pro00100489007)
      - students
      - students' families
      - school personnel
    - stigma/social implications associated with overweight/underweight/physical inactivity/unhealthy eating (physical inactivity/unhealthy eating – added 10/14/2020 from Pro00100489003), (underweight – added 11/9/2020 from Pro00100489006)
      - negative comments/beliefs
      - bullying

- curricula concerns
  - time
  - staffing
- socioeconomic factors of students and/or students' families (added 8/19/2020 from Pro00100489023)
  - less educated
  - lower incomes
  - employment issues
  - single parent/caregiver
  - life stressors
  - lack of time
  - transportation issues (added 10/6/2020 from Pro00100489027)
  - constantly changing places of residence (added 10/22/2020 from Pro00100489018)
  - personal hygiene issues (added 10/26/2020 from Pro00100489001)
  - lack of proper clothing attire (added 10/28/2020 from Pro00100489001)
  - lack of caregiver stability (added 11/18/2020 from meeting with Dr. Nichols)
  - lack of space (added 11/22/2020 from Pro00100489002)
- student access/usage issues (added 10/17/2020 from Pro00100489021)
  - technology
  - Internet
  - school-based interventions (added 11/13/2020 from Pro00100489010)
- knowledge deficit of school members (added 10/20/2020 from Pro00100489007)
  - students
  - students' families
  - school personnel
- problems with communication (added 10/22/2020 from Pro00100489018)
  - students
  - students' families
  - school personnel
- resistance to change (added 10/23/2020 from meeting with Dr. Nichols)
  - students
  - students' families
  - school personnel
- health behaviors/practices not a priority (added 10/24/2020 from Pro00100489013)
  - students
  - students' families
  - school personnel

- lack of trusting relationships/support/buy-in (added 10/27/2020 from Pro00100489024)
  - students
  - students' families
  - school personnel
- physical/mental inabilities to participate in physical activities/healthy eating (added 10/27/2020 from Pro00100489024)
  - students
  - students' families
  - school personnel
- health issues/medications affecting weight/appetite/ability to participate in physical activities/healthy eating (added 11/5/2020 from Pro00100489014)
  - students
  - students' families
  - school personnel
- multiple responsibilities (added 11/13/2020 from Pro00100489010)
  - students
  - students' families
  - school personnel
- parents as priority, not students (added 12/9/2020 from meeting with Dr. Nichols)

– institutional
- inadequate resources
  - funding
  - space, facilities, equipment, materials (added 10/24/2020 from Pro00100489013)
  - data (added 11/7/2020 from Pro00100489025)
- scheduling conflicts
  - access to spaces for interventions
  - access to supplies for interventions
- punishment and reward systems
  - punishment example – taking away recess
  - reward example – unhealthy foods
- offerings (added 10/6/2020 from Pro00100489027)
  - physical activities
  - food
- changes in leadership/administration (added 10/12/2020 from meeting with Dr. Nichols)
- inconsistencies (added 10/16/2020 from meeting with Dr. Nichols)
- lack of health education for students' parents/families (added 10/20/2020 from Pro00100489007)
- changes in program offerings (added 11/2/2020 from Pro00100489015)

        - lack of culture of caring/looking out for others (added 11/10/2020 from Pro00100489006)
        - distribution of meals (added 11/24/2020 from Pro00100489022)
        - supervision (added 12/18/2020 from meeting with Dr. Nichols)
        - food distribution (added 12/18/2020 from meeting with Dr. Nichols)
    - community
        - lack of/limited community support and engagement (limited – added 11/23/2020 from Pro00100489017)
            - limited/no community partnerships
            - limited/no participation from community in interventions
            - choices of community members
        - insufficient communication
            - limited/no information about interventions being shared
            - schools and community partners not in contact
        - community characteristics (added 9/18/2020 from meeting with Dr. Nichols)
            - food availability
            - family/cultural beliefs/practices
            - food insecurity (added 12/2/2020 from meeting with Dr. Nichols)
        - environmental factors (added 10/16/2020 from meeting with Dr. Nichols)
            - bad weather
            - limited access to physical activity spaces and/or healthy food items
            - unsafe neighborhoods/communities
            - rural/suburban/urban area (added 11/20/2020 from Pro00100489012)
        - loss of community partnerships (added 11/21/2020 from Pro00100489002)
    - social/policy
        - safety concerns regarding interventions
            - physical activity spaces and equipment
            - food storage options
        - inadequate/unclear policies in school settings
            - physical activity
            - healthy eating
        - competing requirements from government/educational/external agencies/entities (added 10/3/2020 from Pro00100389020)
            - academic expectations
            - mandates
            - priorities (added 10/16/2020 from meeting with Dr. Nichols)
        - inadequate resources/support from government/educational/external agencies/entities (added 10/24/2020 from Pro00100489013)

- **Facilitators**
  - intrapersonal
    - knowledge
    - motivation
      - desire to improve health of students through interventions
      - willingness to offer interventions
    - beliefs
      - importance of physical activity and healthy eating
      - school appropriate location for interventions
    - actions (added 10/7/2020 from Pro00100489027)
      - role modeling physical activity
      - role modeling healthy eating
    - input and/or decision making authority (added 11/21/2020 from Pro00100489002)
      - physical activity interventions
      - healthy eating interventions
  - interpersonal
    - choices/motivation/empowerment/knowledge/actions of school members (motivation – added 9/22/2020 from meeting with Dr. Nichols), (empowerment – added 10/12/2020 from meeting with Dr. Nichols), (knowledge – added 10/20/2020 from Pro00100489007), (actions – added 10/20/2020 from Pro00100489007)
      - students
      - students' families
      - school personnel
    - support and communication
      - school personnel
      - parent/family involvement
    - adequate supports
      - training, technical assistance
      - staff, teamwork
    - intervention properties
      - flexible, easy to implement
      - no negative effects on learning
    - socioeconomic factors of students and/or students' families (added 8/19/2020 from Pro00100489023)
      - more educated
      - higher incomes
      - adequate time
      - more residency permanence (added 10/24/2020 from Pro00100489013)

- trusting relationships (added 10/30/2020 from Pro00100489011)
  - students
  - students' families
  - school personnel
- goal setting (added 11/6/2020 from meeting with Dr. Nichols)
  - students
  - students' families
  - school personnel
- interprofessional collaboration (added 11/6/2020 from meeting with Dr. Nichols)
- student access/usage abilities (added 11/10/2020 from Pro00100489006)
  - technology
  - Internet

– institutional
- adequate resources
  - funding
  - space, facilities, equipment, materials (added 10/24/2020 from Pro00100489013)
  - champion (added 9/18/2020 from meeting with Dr. Nichols)
  - technology (added 10/17/2020 from Pro00100489021)
  - Internet resources, social media (added 11/2/2020 from meeting with Dr. Nichols)
- low-cost/free materials
  - limited/no extra costs to school
  - limited/no effect on school budget
- variety (added 9/18/2020 from meeting with Dr. Nichols)
- interventions (added 9/22/2020 from meeting with Dr. Nichols)
  - physical activity
  - healthy eating
- innovation (added 10/3/2020 from Pro00100489020)
- cross-curricular nature of interventions (added 10/12/2020 from meeting with Dr. Nichols)
  - physical activity
  - healthy eating
- buy-in (added 10/12/2020 from meeting with Dr. Nichols)
- responsiveness to needs (added 10/16/2020 from meeting with Dr. Nichols)
- convenient location (added 10/22/2020 from Pro00100489018)
- culture/value of health (added 10/24/2020 from Pro00100489013)
- health education/information for students' parents/families (added 10/26/2020 from Pro00100489001)
- inclusivity (added 11/7/2020 from Pro00100489004)
- culture of caring/looking out for each other (added 11/10/2020 from Pro00100489006)

        - accessibility (added 11/27/2020 from Pro00100489026)
    - community
        - external community members/partnerships
            - providing guidelines and resources
            - leading interventions
            - participation in interventions (added 11/9/2020 from Pro00100489006)
        - strong relationships
            - school members and community partners
            - focus on student health
        - resources (added 10/12/2020 from meeting with Dr. Nichols)
        - environmental factors (added 10/16/2020 from meeting with Dr. Nichols)
            - good weather
            - adequate access to physical activity spaces and/or healthy food items
            - safe neighborhoods/communities
        - values/practices health behaviors (added 10/24/2020 from Pro00100489013)
            - physical activity
            - healthy eating
    - social/policy
        - established health policies in school
            - physical activity
            - healthy eating
        - support from government/educational/external agencies/entities (added 8/17/2020 from Pro00100489023)
            - guidelines/recommendations
            - health standards
            - funding
            - mandates (added 9/18/2020 from meeting with Dr. Nichols)
            - resources (added 10/22/2020 from Pro00100489018)
        - incentives
            - awards/recognition for intervention implementation
        - tracking unhealthy food offerings (added 12/18/2020 from meeting with Dr. Nichols)

- **COVID-19**
    - physical activity interventions
        - negative effect
        - no effect
        - positive effect
        - unsure (added 10/4/2020 from Pro00100489020)
        - assessment of students (added 10/30/2020 from Pro00100489011)
    - healthy eating interventions
        - negative effect

        - no effect
        - positive effect
        - unsure (added 10/4/2020 from Pro00100489020)
        - assessment of students (added 10/30/2020 from Pro00100489011)
    - needs of administrators (added 9/2/2020 from Pro00100489005)
        - support
        - personnel
        - time
        - space
        - money
        - resources
        - knowledge/ideas/plans/examples (examples – added 11/7/2020 from Pro00100489025)
        - safe in-person activities
        - unsure
        - students held accountable for schoolwork (added 11/13/2020 from Pro00100489010)
        - no needs (added 11/22/2020 from Pro00100489002)
        - students able to physically return to school (added 11/22/2020 from Pro00100489002)
        - parental education (added 11/23/2020 from Pro00100489017)
    - academic delivery (added 10/12/2020 from meeting with Dr. Nichols)
        - negative effect
        - no effect
        - positive effect
        - unsure
    - health (added 10/26/2020 from Pro00100489001)
        - negative effect
        - no effect
        - positive effect
        - unsure
    - fear of effects (added 10/26/2020 from Pro00100489001)
        - students
        - students' families
        - school personnel
    - school transportation issues (added 11/5/2020 from Pro00100489014)
        - negative effect
        - no effect
        - positive effect
        - unsure
    - mask concerns (added 11/5/2020 from Pro00100489014)

- Opportunities (added 9/22/2020 from Pro00100489019)

Appendix I. Audit Trail

- **Interview: Pro00100489023**
  - Level 1 Codes – 8/2/2020-8/4/2020
  - Level 2 Codes – 8/2/2020-8/23/2020
  - Emergent Codes:
    - Weight-Related Terminology or Stigma: acceptance of being overweight
      - added 8/16/2020
    - Weight-Related Terminology or Stigma: students' clothing choices – cover body, expose body
      - added 8/16/2020
    - Experiences with School-Based Interventions: student participation – sex: males more/less involved in physical activity/healthy eating school-based interventions, females more/less involved in physical activity/healthy eating school-based interventions
      - added 8/16/2020
    - Experiences with School-Based Interventions: school-based intervention – developed at school level, commercial/government/educational/community product/program
      - added 8/17/2020
    - Facilitators: social/policy – support from government/educational/external agencies/entities
      - added 8/17/2020
    - Barriers: interpersonal – socioeconomic factors of students and/or students' families – less educated, lower incomes, employment issues, single parent/caregiver, life stressors, lack of time
      - added 8/19/2020
    - Facilitators: interpersonal – socioeconomic factors of students and/or students' families – more educated, higher incomes
      - added 8/19/2020

- **Meeting with Dr. Nichols to review Interview: Pro00100489023**
  - Original Meeting Date – 8/7/2020
  - Reviewed transcript, Level 2 codes to be re-done
  - Follow Up Meeting Date – 8/26/2020
  - Reviewed transcript, discussed coding for consensus

- **Interview: Pro00100489005**
  - Level 1 Codes – 8/30/2020
  - Level 2 Codes – 9/2/2020
  - Emergent Codes:
    - COVID-19: needs of administrators – support, personnel, time, space, money, resources, knowledge/ideas/plans, safe in-person activities, unsure
      - added 9/2/2020

- **Interview: Pro00100489019**
  - Level 1 Codes – 9/14/2020
  - Level 2 Codes – 9/15/2020
  - Emergent Codes:
    - none

- **Meeting with Dr. Nichols to review Interview: Pro00100489005 (interview needs to be re-coded with emergent codes from 9/18/2020 meeting and future meetings)**
  - Meeting Date – 9/18/2020
  - Reviewed transcript, discussed coding for consensus
  - Deleted Codes (from interview):
    - Barriers: intrapersonal – knowledge deficit (intervention awareness)
  - Added Codes (to interview):
    - none
  - Emergent Codes (added to Codebook, need to be added to interview):
    - Barriers: community – community characteristics – food availability, family/cultural beliefs/practices
      - added 9/18/2020
    - Facilitators: institutional – adequate resources – champion
      - added 9/18/2020
    - Facilitators: institutional – variety
      - added 9/18/2020
    - Facilitators: support from government/educational/external agencies/entities – mandates
      - added 9/18/2020

- **Meeting with Dr. Nichols to review Interview: Pro00100489019 (interview needs to be re-coded with emergent codes from 9/18/2020 meeting and future meetings)**
  - Meeting Date – 9/22/2020
  - Reviewed transcript, discussed coding for consensus
  - Deleted Codes (from interview):
    - Barriers: intrapersonal – knowledge deficit (intervention awareness)
  - Added Codes (to interview):
    - Barriers: community – community characteristics – family beliefs/practices
    - Facilitators: interpersonal – support and communication – school personnel
    - Facilitators: institutional – adequate resources – champion
    - Facilitators: institutional – variety
    - Facilitators: social/policy – established health policies in school – healthy eating, support from government agencies – guidelines/recommendations, health standards, mandates
    - COVID-19: physical activity interventions – positive effect
  - Emergent Codes (added to Codebook, need to be added to interview):
    - Barriers: interpersonal – choices/motivation of school members – students, students' families, school personnel
      - added 9/22/2020

        - Facilitators: interpersonal – choices/motivation of school members – students, students' families, school personnel
            - added 9/22/2020
        - Facilitators: institutional – interventions – physical activity, healthy eating
            - added 9/22/2020
        - Opportunities
            - added 9/22/2020

- **Interview: Pro00100489020**
    - Level 1 Codes – 9/30/2020-10/1/2020
    - Level 2 Codes – 10/3/2020-10/4/2020
    - Emergent Codes:
        - Facilitator: institutional – innovation
            - added 10/3/2020
        - Experiences with School-Based Interventions: physical activity interventions – knowledge; healthy eating interventions – knowledge
            - added 10/3/2020
        - Barriers: social/policy – competing requirements from government/educational/external agencies/entities – academic expectations, mandates
            - added 10/3/2020
        - COVID-19: physical activity interventions – unsure; healthy eating interventions – unsure
            - added 10/4/2020

- **Interview: Pro00100489027**
    - Level 1 Codes – 10/5/2020
    - Level 2 Codes – 10/6/2020-10/7/2020
    - Emergent Codes:
        - Barriers: interpersonal – socioeconomic factors of students and/or students' families – transportation issues
            - added 10/6/2020
        - Barriers: institutional – offerings – physical activities, food
            - added 10/6/2020
        - Weight-Related Terminology or Stigma: image concerns
            - added 10/6/2020
        - Facilitators: intrapersonal – actions – role modeling physical activity, role modeling healthy eating
            - added 10/7/2020

- **Meeting with Dr. Nichols to review Interview: Pro00100489020 (interview needs to be re-coded with emergent codes from 10/12/2020 meeting and future meetings)**
    - Meeting Date – 10/12/2020
    - Reviewed transcript, discussed coding for consensus

- Deleted Codes (from interview):
  - Facilitators (from CL56): intrapersonal – knowledge, interpersonal – choices of school members (students, school personnel), adequate supports (staff, teamwork); institutional – adequate resources (space, equipment), variety, interventions (healthy eating), innovation
  - Barriers (from CL217): interpersonal – choices of school members (students)
  - Facilitators (from CL247): intrapersonal – knowledge; interpersonal – choices of school members (students, school personnel), adequate supports (staff, teamwork); institutional – adequate resources (space, equipment), variety, interventions (healthy eating), innovation; community – external community partnerships (providing resources, leading interventions), strong relationships (school members and community partners, focus on student health)
- Added Codes (to interview):
  - Opportunities (to CL28): incorporating diversity into interventions, addressing physical differences
  - Opportunities (to CL37): promotion of positive body image
  - Opportunities (to CL56): expansion of farm-to-school program to other schools
  - Facilitators (to CL123, CL128, CL130): institutional – adequate resources
  - Opportunities (to CL123, CL128, CL130): support
  - Opportunities (to CL247): food access program
  - Opportunities (to CL222, CL2/23): adopting healthy eating behaviors at home
- Emergent Codes (added to Codebook, need to be added to interview):
  - Weight-Related Terminology or Stigma: recognition/acknowledgment/acceptance of differences/others
    - added 10/12/2020
  - Weight-Related Terminology or Stigma: societal messages on ideal body type
    - added 10/12/2020
  - Barriers: interpersonal – empowerment of school members
    - added 10/12/2020
  - Barriers: institutional – changes in leadership/administration
    - added 10/12/2020
  - Facilitators: interpersonal – empowerment of school members
    - added 10/12/2020
  - Facilitators: institutional – cross-curricular nature of intervention – physical activity, healthy eating
    - added 10/12/2020
  - Facilitators: institutional – buy-in
    - added 10/12/2020
  - Facilitators: community – resources
    - added 10/12/2020
  - COVID-19 – academic delivery – negative effect, no effect, positive effect, unsure
    - added 10/12/2020

- **Interview: Pro00100489003**
  - Level 1 Codes – 10/11/2020
  - Level 2 Codes – 10/13/2020-10/14/2020
  - Emergent Codes:
    - Barriers: interpersonal – stigma/social implication associated with obesity/physical inactivity/unhealthy eating
      - added 10/14/2020

- **Meeting with Dr. Nichols to review Interview: Pro00100489027 (interview needs to be re-coded with emergent codes from 10/16/2020 meeting and future meetings)**
  - Meeting Date – 10/16/2020
  - Reviewed transcript, discussed coding for consensus
  - Deleted Codes (from interview):
    - none
  - Added Codes (to interview):
    - Opportunities (to Comment 12): promote healthy food options at home
    - Barriers (to Comment 81): intrapersonal – knowledge deficit
    - Opportunities (to Comment 81): understanding overweight and obesity
    - Opportunities (to Comment 101): provide healthy food options
    - Facilitators (to Comment 110, Comment 113, and Comment 114): institutional – adequate resources (champion)
    - Opportunities (to Comment 259, Comment 262): consider student behavioral issues when designing/adapting/planning future school-based interventions
    - Opportunities (to Comment 321, Comment 322): develop multiple methods of school-based intervention delivery
    - Barriers (to Comment 325): intrapersonal – knowledge deficit
  - Emergent Codes (added to Codebook, needs to be added to interview):
    - Barriers: intrapersonal – beliefs – perspectives of growth and development
      - added 10/16/2020
    - Barriers: institutional – inconsistencies
      - added 10/16/2020
    - Barriers: community – environmental factors – bad weather, limited access to physical activity spaces and/or healthy food items, unsafe neighborhoods/communities
      - added 10/16/2020
    - Barriers: social/policy – competing requirements from government/education/external agencies/entities – priorities
      - added 10/16/2020
    - Facilitators: community – environmental factors – good weather, adequate access to physical activity spaces and/or healthy food items, safe neighborhoods/communities
      - added 10/16/2020

- **Meeting with Dr. Nichols to review Interview: Pro00100489003 (interview needs to be re-coded with emergent codes from 10/16/2020 and 10/23/2020 meetings and future meetings)**
  - Meeting Date – 10/16/2020 (to p. 8), 10/23/2020 (rest of interview)
  - Reviewed transcript, discussed coding for consensus
  - Deleted Codes (from interview):
    - none
  - Added Codes (to interview):
    - Opportunities (to Comment 15): finding ways to increase physical activity
  - Emergent Codes (added to Codebook, needs to be added to interview):
    - Facilitators: institutional – responsiveness to needs
      - added 10/16/2020
    - Barriers: interpersonal – resistance to change – students, students' families, school personnel
      - added 10/23/2020

- **Interview: Pro00100489021**
  - Level 1 Codes – 10/11/2020-10/14/2020
  - Level 2 Codes – 10/17/2020
  - Emergent Codes:
    - Barriers: interpersonal – student access/usage issues – technology, Internet
      - added 10/17/2020
    - Facilitators: institutional – adequate resources – technology
      - added 10/17/2020

- **Interview: Pro00100489007**
  - Level 1 Codes – 10/16/2020
  - Level 2 Codes – 10/20/2020
  - Emergent Codes:
    - Weight-Related Terminology or Stigma: weight issues affecting academic performance – overweight – negative effect, no effect, positive effect, unsure, underweight – negative effect, no effect, positive effect, unsure
      - added 10/20/2020
    - Weight-Related Terminology or Stigma: actions of students' parents/families/school personnel to control students' weight – increased/decreased physical activity, increased/decreased food intake
      - added 10/20/2020
    - Barriers: institutional – lack of health education for students' families
      - added 10/20/2020
    - Barriers: interpersonal – knowledge deficit of school members – students, students' families, school personnel
      - added 10/20/2020
    - Facilitators: interpersonal – knowledge of school members – students, students' families, school personnel
      - added 10/20/2020

        - Weight-Related Terminology or Stigma: influence of students' biological sex – males – more positively/negatively affected, females – more positively/negatively affected
            - added 10/20/2020
        - Barriers: interpersonal – actions of school members
            - added 10/20/2020

- **Interview: Pro00100489008**
    - Level 1 Codes – 10/18/2020
    - Level 2 Codes – 10/21/2020
    - Emergent Codes:
        - Schools' Role in Weight-Related Health: anthropometric data collection
            - added 10/21/2020
        - Weight-Related Terminology or Stigma: strict policy against negative comments/bullying
            - added 10/21/2020
        - Weight-Related Terminology or Stigma: awareness of impact on students – negative effect, no effect, positive effect
            - added 10/21/2020
        - Barriers: intrapersonal – limited input and/or decision making authority
            - added 10/21/2020
        - Barriers: interpersonal – lack of communication
            - added 10/21/2020
        - Facilitators: interpersonal – adequate communication
            - added 10/21/2020

- **Interview: Pro00100489018**
    - Level 1 Codes – 10/19/2020
    - Level 2 Codes – 10/22/2020-10/23/2020
    - Emergent Codes:
        - Facilitators: social/policy – support from government/educational/external agencies/entities – resources
            - added 10/22/2020
        - Barriers: interpersonal – problems with communication – students, students' families, school personnel
            - added 10/22/2020
        - Barriers: interpersonal – socioeconomic factors of students and/or students' families – constantly changing places of residence
            - added 10/22/2020
        - Facilitators: institutional – convenient location
            - added 10/22/2020

- **Interview: Pro00100489013**
  - Level 1 Codes – 10/23/2020
  - Level 2 Codes – 10/24/2020
  - Emergent Codes:
    - Facilitators: institutional – culture/value of health
      - added 10/24/2020
    - Facilitators: community – values/practices health behaviors – physical activity, healthy eating
      - added 10/24/2020
    - Facilitators: interpersonal – socioeconomic factors of students and/or students' families – more residency permanence
      - added 10/24/2020
    - Barriers: institutional – inadequate resources – materials
      - added 10/24/2020
    - Facilitators: institutional – inadequate resources – materials
      - added 10/24/2020
    - Barriers: social/policy – inadequate resources/support from government/educational/external agencies/entities
      - added 10/24/2020
    - Barriers: interpersonal – health behaviors/practices not a priority – students, students' families, school personnel
      - added 10/24/2020

- **Interview: Pro00100489001**
  - Level 1 Codes – 10/25/2020
  - Level 2 Codes – 10/26/2020
  - Emergent Codes:
    - Weight-Related Terminology or Stigma: avoidance of using weight-related terminology
      - added 10/26/2020
    - Weight-Related Terminology or Stigma: focus on healthy lifestyle instead of weight
      - added 10/26/2020
    - Facilitators: institutional – health education/information for students' parents/families
      - added 10/26/2020
    - Barriers: interpersonal – socioeconomic factors of students and/or students' families – personal hygiene issues
      - added 10/26/2020
    - COVID-19: health – negative effect, no effect, positive effect, unsure
      - added 10/26/2020
    - COVID-19: fear of effects – students, students' families, school personnel
      - added 10/26/2020

- **Interview: Pro00100489024**
  - Level 1 Codes – 10/25/2020
  - Level 2 Codes – 10/27/2020-10/28/2020
  - Emergent Codes:
    - Weight-Related Terminology or Stigma: healthy body image
      - added 10/27/2020
    - Experiences with School-Based Interventions: school-based interventions – research study
      - added 10/27/2020
    - Weight-Related Terminology or Stigma: influence on relationships – overweight – negative effect, no effect, positive effect, unsure, underweight – negative effect, no effect, positive effect, unsure
      - added 10/27/2020
    - Weight-Related Terminology or Stigma: weight issues affecting participation in activities – overweight – negative effect, no effect, positive effect, unsure, underweight – negative effect, no effect, positive effect, unsure
      - added 10/27/2020
    - Weight-Related Terminology or Stigma: parent/family involvement
      - added 10/27/2020
    - Weight-Related Terminology or Stigma: recommendation/referral for help
      - added 10/27/2020
    - Barriers: interpersonal – lack of trusting relationships/support/buy-in – students, students' families, school personnel
      - added 10/27/2020
    - Barriers: interpersonal – physical/mental inabilities to participate in physical activities/ healthy eating – students, students' families, school personnel
      - added 10/27/2020
    - Barriers: interpersonal – socioeconomic factors of students and/or students' families – lack of proper clothing attire
      - added 10/28/2020

- **Interview: Pro00100489011**
  - Level 1 Codes – 10/29/2020
  - Level 2 Codes – 10/30/2020
  - Emergent Codes:
    - Facilitators: interpersonal – trusting relationships – students, students' families, school personnel
      - added 10/30/2020
    - COVID-19: physical activity interventions – assessment of students; healthy eating interventions – assessment of students
      - added 10/30/2020

- **Interview: Pro00100489015**
  - Level 1 Codes – 10/31/2020
  - Level 2 Codes – 11/1/2020-11/2/2020
  - Emergent Codes:
    - Weight-Related Terminology or Stigma: weight-related status symbol – overweight, underweight
      - added 11/1/2020
    - Weight-Related Terminology or Stigma: weight-related communication – expected, not expected
      - added 11/1/2020
    - Barriers: institutional – changes in program offerings
      - added 11/2/2020

- **Meeting with Dr. Nichols to review Interviews: Pro00100489021 and Pro00100489007 (interviews needs to be re-coded with emergent codes from 11/2/2020 meeting and future meetings)**
  - Meeting Date – 11/2/2020
  - Reviewed transcripts, discussed coding for consensus
  - Deleted Codes (from interview):
    - none
  - Added Codes (to interview):
    - none
  - Emergent Codes (added to Codebook, needs to be added to interviews):
    - Facilitators: institutional – adequate resources – Internet resources, social media
      - added 11/2/2020 from Pro00100489021

- **Interview: Pro00100489014**
  - Level 1 Codes – 11/3/2020
  - Level 2 Codes – 11/4/2020-11/5/2020
  - Emergent Codes:
    - Weight-Related Terminology or Stigma: increased awareness of weight status at younger age – overweight, underweight
      - added 11/4/2020
    - Weight-Related Terminology or Stigma: strict policy against actions of school personnel to control students' weight – increased/decreased physical activity, increased/decreased food intake
      - added 11/4/2020
    - Barriers: interpersonal – health issues/medications affecting weight/appetite/ability to participate in physical activities/healthy eating – students, students' families, school personnel
      - added 11/5/2020
    - COVID-19: school transportation issues – negative effect, no effect, positive effect, unsure
      - added 11/5/2020
    - COVID-19: mask concerns
      - added 11/5/2020

- **Interview: Pro00100489004**
  - Level 1 Codes – 11/5/2020
  - Level 2 Codes – 11/7/2020
  - Emergent Codes:
    - Weight-Related Terminology or Stigma: dress code issues – female students/male students, body type differences
      - added 11/7/2020
    - Facilitators: institutional – inclusivity
      - added 11/7/2020
    - Barriers: intrapersonal – actions
      - added 11/7/2020

- **Meeting with Dr. Nichols to review Interviews: Pro00100489008, Pro00100489018, and Pro00100489013 (interviews needs to be re-coded with emergent codes from 11/6/2020 meeting and future meetings)**
  - Meeting Date – 11/6/2020
  - Reviewed transcripts, discussed coding for consensus
  - Deleted Codes (from interviews):
    - none
  - Added Codes (to interviews):
    - Opportunities (to Comment 79 from Pro00100489008): how to capitalize resources to maximize school-based interventions
    - Barriers (to Comment 19 from Pro00100489018): interpersonal – curricula concerns (time)

        - Opportunities (to Comment 19 from Pro00100489018): interprofessional collaboration
        - Opportunities (to Comment 37 and Comment 39 from Pro00100489018): offer program to all interested students and families
        - Barriers (to Comment 228): interpersonal – knowledge deficit of school members (students' parents), health behaviors/practices not a priority (students' parents)
        - Opportunities (to Comment 132 and Comment 133 from Pro00100489013): improve resources and materials
        - Opportunities (to Comment 173 from Pro00100489013): support students to encourage participation in PE
    - Emergent Codes (added to Codebook, needs to be added to interviews):
        - Facilitators: interpersonal – goal setting – students, students' families, school personnel
            - added 11/6/2020 from Pro00100489013
        - Facilitators: interpersonal – interprofessional collaboration
            - added 11/6/2020 from Pro00100489013

- **Interview: Pro00100489025**
    - Level 1 Codes – 11/6/2020
    - Level 2 Codes – 11/7/2020
    - Emergent Codes:
        - Weight-Related Terminology or Stigma: disciplinary actions
            - added 11/7/2020
        - Experiences with School-Based Interventions: healthy eating interventions – limited experience
            - added 11/7/2020
        - Barriers: institutional – inadequate resources – data
            - added 11/7/2020
        - COVID-19: needs of administrators – examples
            - added 11/7/2020

- **Interview: Pro00100489009**
    - Level 1 Codes – 11/8/2020
    - Level 2 Codes – 11/8/2020
    - Emergent Codes:
        - Weight-Related Terminology or Stigma: negative comments/beliefs – food consumption
            - added 11/8/2020

- **Interview: Pro00100489006**
  - Level 1 Codes – 11/8/2020
  - Level 2 Codes – 11/9/2020-11/10/2020
  - Emergent Codes:
    - Weight-Related Terminology or Stigma: weight-related communication – male students – more/less direct, female students – more/less direct
      - added 11/9/2020
    - Facilitators: community – participation in interventions
      - added 11/9/2020
    - Weight-Related Terminology or Stigma – negative comments/beliefs – athletic/physical activity abilities
      - added 11/9/2020
    - Barriers: interpersonal – stigma/social implications associated with underweight
      - added 11/9/2020
    - Facilitators: institutional – culture of caring/looking out for each other
      - added 11/10/2020
    - Barriers: institutional – lack of culture of caring/looking out for each other
      - added 11/10/2020
    - Facilitators: interpersonal – student access/usage abilities – technology, Internet
      - added 11/10/2020

- **Interview: Pro00100489010**
  - Level 1 Codes – 11/11/2020
  - Level 2 Codes – 11/13/2020
  - Emergent Codes:
    - Weight-Related Terminology or Stigma: eating disorders
      - added 11/13/2020
    - Barriers: interpersonal – multiple responsibilities – students, students' families, school personnel
      - added 11/13/2020
    - Barriers: interpersonal – student access/usage issues – school-based interventions
      - added 11/13/2020
    - COVID-19: needs of administrators – students held accountable for schoolwork
      - added 11/13/2020

- **Interview: Pro00100489016**
  - Level 1 Codes – 11/11/2020
  - Level 2 Codes – 11/14/2020-11/15/2020
  - Emergent Codes:
    - Schools' Role in Weight-Related Health: monitoring dietary intake
      - added 11/14/2020
    - Weight-Related Terminology or Stigma: school activities that attract attention to students' weight – overweight, underweight
      - added 11/15/2020

- **Interview: Pro00100489028**
  - Level 1 Codes – 11/12/2020
  - Level 2 Codes – 11/16/2020
  - Emergent Codes:
    - Weight-Related Terminology or Stigma: weight-related communication – intent – joking, serious
      - added 11/16/2020

- **Meeting with Dr. Nichols to review Interviews: Pro00100489001 and Pro00100489011 (interviews needs to be re-coded with emergent codes from 11/18/2020 meeting and future meetings)**
  - Meeting Date – 11/18/2020
  - Reviewed transcripts, discussed coding for consensus
  - Deleted Codes (from interviews):
    - none
  - Added Codes (to interviews):
    - Barriers (to Comment 12 from Pro00100489001): interpersonal – multiple responsibilities (school personnel)
  - Emergent Codes (added to Codebook, needs to be added to interviews):
    - Barriers: interpersonal – socioeconomic factors of students and/or students' families – lack of caregiver stability
      - added 11/18/2020 from Pro00100489001

- **Interview: Pro00100489012**
  - Level 1 Codes – 11/17/2020
  - Level 2 Codes – 11/20/2020-11/21/2020
  - Emergent Codes:
    - Barriers: environmental factors – rural/suburban/urban area
      - added 11/20/2020
    - Weight-Related Terminology or Stigma: concerns
      - added 11/20/2020
    - Weight-Related Terminology or Stigma: students' responses to negative comments/bullying
      - added 11/20/2020

- **Interview: Pro00100489002**
  - Level 1 Codes – 11/17/2020
  - Level 2 Codes – 11/21/2020-11/22/2020
  - Emergent Codes:
    - Facilitators: input and/or decision making authority – physical activity interventions, healthy eating interventions
      - added 11/21/2020
    - Barriers: community – loss of community partnerships
      - added 11/21/2020
    - Barriers: interpersonal – socioeconomic factors of students' and/or students' families – lack of space
      - added 11/22/2020
    - COVID-19: needs of administrators – no needs
      - added 11/22/2020
    - COVID-19: needs of administrators – students able to physically return to school
      - added 11/22/2020

- **Interview: Pro00100489017**
  - Level 1 Codes – 11/22/2020
  - Level 2 Codes – 11/23/2020
  - Emergent Codes:
    - Weight-Related Terminology or Stigma: accommodations for students' weight – overweight, underweight
      - added 11/23/2020
    - Barriers: community – limited community support and engagement
      - added 11/23/2020
    - COVID-19: needs of administrators – parental education
      - added 11/23/2020

- **Interview: Pro00100489022**
  - Level 1 Codes – 11/22/2020
  - Level 2 Codes – 11/24/2020
  - Emergent Codes:
    - Weight-Related Terminology or Stigma: student population influences
      - added 11/24/2020
    - Weight-Related Terminology or Stigma: students' in middle school making more weight-related comments/having more weight-related issues
      - added 11/24/2020
    - Barriers: institutional – distribution of meals
      - added 11/24/2020

- **Interview: Pro00100489026**
  - Level 1 Codes – 11/24/2020
  - Level 2 Codes – 11/25/2020-11/27/2020
  - Emergent Codes:
    - Weight-Related Terminology or Stigma: awareness of students' weight status – overweight, underweight
      - added 11/25/2020
    - Facilitators: institutional – accessibility
      - added 11/27/2020

- **Meeting with Dr. Nichols to review Interviews: Pro00100489024 and Pro00100489015 (interviews needs to be re-coded with emergent codes from 12/2/2020 meeting and future meetings)**
  - Meeting Date – 12/2/2020
  - Reviewed transcripts, discussed coding for consensus
  - Deleted Codes (from interviews):
    - none
  - Added Codes (to interviews):
    - Opportunities (to Comment 253 from Pro00100489024): educate parents about children's food intake and eating patterns
  - Emergent Codes (added to Codebook, needs to be added to interviews):
    - Barriers: community – food insecurity
      - added 12/2/2020 from Pro00100489015

- **Meeting with Dr. Nichols to review Interviews: Pro00100489014, Pro00100489004, and Pro00100489025 (interviews needs to be re-coded with emergent codes from 12/9/2020 meeting and future meetings)**
  - Meeting Date – 12/9/2020
  - Reviewed transcripts, discussed coding for consensus
  - Deleted Codes (from interviews):
    - none
  - Added Codes (to interviews):
    - Opportunities (to Comment 60 from Pro00100489014): exposure to healthy foods with home-school connection
    - Opportunities (to Comment 118 from Pro00100489014): present teachers with data on engaging with students, offer training on teacher-student engagement strategies
    - Opportunities (to Comment 138 from Pro00100489014): increase mind-body connection, integrate health content into academic curricula
    - Opportunities (to Comment 59 from Pro00100489004): establish community partnerships
    - Opportunities (to Comment 37 from Pro00100489025): healthy eating interventions
    - Opportunities (to Comment 50 from Pro00100489025): healthy eating education

        - Opportunities (to Comment 63 from Pro00100489025): skill development/building, collection/interpretation/application of data
    - Emergent Codes (added to Codebook, needs to be added to interviews):
        - Barriers: interpersonal – parents as priority, not students
            - added 12/9/2020 from Pro00100489004

- **Meeting with Dr. Nichols to review Interviews: Pro00100489009, Pro00100489006, Pro00100489010, and Pro00100489016 (interviews needs to be re-coded with emergent codes from 12/18/2020 meeting and future meetings)**
    - Meeting Date – 12/18/2020
    - Reviewed transcripts, discussed coding for consensus
    - Deleted Codes (from interviews):
        - Barriers (from Comment 35 from Pro00100489009): community – community characteristics (food availability)
        - Barriers (from Comment 54 from Pro00100489006): community – community characteristics (food availability)
    - Added Codes (to interviews):
        - Barriers (to Comment 35 from Pro00100489009): community – community characteristics (food insecurity)
        - Opportunities (to Comment 68 from Pro00100489009): embrace cultural/value differences
        - Opportunities (to Comment 127 from Pro00100489009): state plan – need for examples to meet mandates, state could provide example templates for schools to tailor
        - Opportunities (to Comment 130 from Pro00100489009): state plan – need for examples to meet mandates, state could provide example templates for schools to tailor
        - Barriers (to Comment 54 from Pro00100489006): community – community characteristics (food insecurity)
        - Opportunities (to Comment 138 from Pro00100489006): use food to create sense of culture
        - Barriers (to Comment 162 from Pro00100489006): community – community characteristics (food insecurity)
        - Barriers (to Comment 178 from Pro00100489006): community – community characteristics (food insecurity)
        - Opportunities (to Comment 122 from Pro00100489010): work with other schools on school-based interventions
        - Opportunities (to Comment 48 from Pro00100489016): influence policy to require healthy eating
        - Opportunities (to Comment 130 from Pro00100489016): examine virtual PE course to see if anything can be incorporated into cross-curricular activities
    - Emergent Codes (added to Codebook, needs to be added to interviews):
        - Weight-Related Terminology or Stigma: protective behaviors
            - added 12/18/2020 from Pro00100489006
        - Barriers: institutional – supervision
            - added 12/18/2020 from Pro00100489006

        - Barriers: institutional – food distribution
            - added 12/18/2020 from Pro00100489006
        - Facilitators: social/policy – tracking unhealthy food offerings
            - added 12/18/2020 from Pro00100489016

- **Meeting with Dr. Nichols to review Interviews: Pro00100489028, Pro00100489012, Pro00100489002, Pro00100489017, Pro00100489022, and Pro00100489026**
    - Meeting Date – 1/15/2021
    - Reviewed transcripts, discussed coding for consensus
    - Deleted Codes (from interviews):
        - none
    - Added Codes (to interviews):
        - none
    - Emergent Codes:
        - none

- **Final Coding of Interviews for Themes: COVID-19**
    - Date: 1/24/2021
    - Order of Final Coding:
        - Pro00100489023
        - Pro00100489005
        - Pro00100489019
        - Pro00100489020
        - Pro00100489027
        - Pro00100489003
        - Pro00100489021
        - Pro00100489007
        - Pro00100489008
        - Pro00100489018
        - Pro00100489013
        - Pro00100489001
        - Pro00100489024
        - Pro00100489011
        - Pro00100489015
        - Pro00100489014
        - Pro00100489004
        - Pro00100489025
        - Pro00100489009
        - Pro00100489006
        - Pro00100489010
        - Pro00100489016
        - Pro00100489028
        - Pro00100489012
        - Pro00100489002

    - Pro00100489017
    - Pro00100489022
    - Pro00100489026

- **Final Coding of Interviews for Themes: Weight-Related Terminology or Stigma**
  - Date: 1/30/2021
  - Order of Final Coding:
    - Pro00100489023
    - Pro00100489005
    - Pro00100489019
    - Pro00100489020
    - Pro00100489027
    - Pro00100489003
    - Pro00100489021
    - Pro00100489007
    - Pro00100489008
    - Pro00100489018
    - Pro00100489013
    - Pro00100489001
    - Pro00100489024
    - Pro00100489011
    - Pro00100489015
    - Pro00100489014
    - Pro00100489004
    - Pro00100489025
    - Pro00100489009
    - Pro00100489006
    - Pro00100489010
    - Pro00100489016
    - Pro00100489028
    - Pro00100489012
    - Pro00100489002
    - Pro00100489017
    - Pro00100489022
    - Pro00100489026

- **Final Coding of Interviews for Themes: Experiences with School-Based Interventions addressing PA and Healthy Eating Behaviors, Barriers to School-Based Interventions addressing PA and Healthy Eating Behaviors, and Facilitators to School-Based Interventions Addressing PA and Healthy Eating Behaviors**
  - Dates: 1/31/2021-2/2/2021
  - Order of Final Coding:
    - Pro00100489023 – 1/31/2021
    - Pro00100489005 – 1/31/2021
    - Pro00100489019 – 1/31/2021

- Pro00100489020 – 1/31/2021
- Pro00100489027 – 1/31/2021
- Pro00100489003 – 1/31/2021
- Pro00100489021 – 1/31/2021
- Pro00100489007 – 1/31/2021
- Pro00100489008 – 2/1/2021
- Pro00100489018 – 2/1/2021
- Pro00100489013 – 2/1/2021
- Pro00100489001 – 2/1/2021
- Pro00100489024 – 2/1/2021
- Pro00100489011 – 2/1/2021
- Pro00100489015 – 2/1/2021
- Pro00100489014 – 2/1/2021
- Pro00100489004 – 2/1/2021
- Pro00100489025 – 2/1/2021
- Pro00100489009 – 2/1/2021
- Pro00100489006 – 2/1/2021
- Pro00100489010 – 2/2/2021
- Pro00100489016 – 2/2/2021
- Pro00100489028 – 2/2/2021
- Pro00100489012 – 2/2/2021
- Pro00100489002 – 2/2/2021
- Pro00100489017 – 2/2/2021
- Pro00100489022 – 2/2/2021
- Pro00100489026 – 2/2/2021

Appendix J. Statement of the Research and Needs Assessment Survey

TITLE OF RESEARCH: Barriers and Facilitators Regarding Awareness, Selection, and Implementation of School-Based Interventions Addressing Physical Activity and Healthy Eating Behaviors: Perspectives of South Carolina Public School Administrators and Personnel

Hello, my name is Logan Camp-Spivey, and I am a PhD candidate in Nursing Science from the Medical University of South Carolina. Thank you for your interest in participating in our research on school-based interventions addressing physical activity and healthy eating behaviors. Before you start the survey, I want to provide you with some important information about our study.

The purpose of this study is to understand the barriers and facilitators regarding awareness, selection, and implementation of school-based interventions addressing physical activity and healthy eating behaviors. We are also interested in learning about how the COVID-19 pandemic may have affected school-based interventions.

The research study includes answering questions on a needs assessment survey. It should take less than 10 minutes to answer the survey questions.

The survey is available through a secure link. To protect your privacy and confidentiality, all survey responses will be stored on a password-protected server at the Medical University of South Carolina. We plan to publish the results of this study, but will not include any information that would let others know who you are or that you participated in this research.

We hope that the information gained from the study will help in the adaptation and implementation of school-based interventions to encourage physical activity and healthy eating behaviors. In return for your time and effort, the first 500 participants will have the opportunity to receive a $5 gift card via e-mail for completing the survey.

Your participation in this study is voluntary. You may decline to take part in or stop the survey at any time. If you have any questions about this study, you may contact Logan Camp-Spivey, the lead researcher, at camplo@musc.edu or (864) 542-6115.

If you agree to participate, please click on the link below that will take you to the needs assessment survey.

Click here to complete the Needs Assessment Survey

Needs Assessment Survey: Barriers and Facilitators to School-Based Interventions Addressing Physical Activity and Healthy Eating Behaviors

Hello, my name is Logan Camp-Spivey, and I am a PhD candidate in Nursing Science from the Medical University of South Carolina. Thank you for your interest in participating in our research on school-based interventions addressing physical activity and healthy eating behaviors. Before you start the survey, I want to provide you with some important information about our study.

The purpose of this study is to understand the barriers and facilitators regarding awareness, selection, and implementation of school-based interventions addressing physical activity and healthy eating behaviors. We are also interested in learning about how the COVID-19 pandemic may have affected school-based interventions.

The research study includes answering questions on a needs assessment survey. It should take less than 10 minutes to answer the survey questions.

The survey is available through a secure link. To protect your privacy and confidentiality, all survey responses will be stored on a password-protected server at the Medical University of South Carolina. We plan to publish the results of this study, but will not include any information that would let others know who you are or that you participated in this research.

We hope that the information gained from the study will help in the adaptation and implementation of school-based interventions to encourage physical activity and healthy eating behaviors. In return for your time and effort, the first 500 participants will have the opportunity to receive a $5 gift card via e-mail for completing the survey.

Your participation in this study is voluntary. You may decline to take part in or stop the survey at any time. If you have any questions about this study, you may contact Logan Camp-Spivey, the lead researcher, at camplo@musc.edu or (864) 542-6115.

Self-Screening Questions Instructions: Please answer the following questions about your work.

During the 2019-2020 school year, were you employed as a certified public school teacher or as a licensed public school nurse in South Carolina?

◯ Yes
◯ No

During the 2019-2020 school year, did you only work in a virtual program or school?

(examples: South Carolina Connections Academy, South Carolina Whitmore School, VirtualSC, etc.)

Note - This does not refer to virtual learning, due to school closures from the COVID-19 pandemic, from schools with physical campuses that typically have in-person instruction.

◯ Yes
◯ No

During the 2019-2020 school year, was the school where you were employed a Career and Technology Education (CATE) Center?

(examples: Abbeville City Career Center, Lee County Career & Technology Center, Daniel Morgan Technology Center, etc.)

◯ Yes
◯ No

During the 2019-2020 school year, was the school where you were employed a residential educational program?

(examples: South Carolina Governor's School for the Arts and Humanities, South Carolina Governor's School for Science & Mathematics, etc.)

◯ Yes
◯ No

During the 2019-2020 school year, was the school where you were employed an alternative school for students with discipline issues?

(examples: Berkeley Alternative, Birchwood School at the South Carolina Department of Juvenile Justice, etc.)

◯ Yes
◯ No

During the 2019-2020 school year, was the school where you were employed specifically for children with mental, physical, emotional, or learning disabilities?

(examples: McCarthy Teszler School, South Carolina School for the Deaf and Blind, etc.)

◯ Yes
◯ No

Demographic Information Instructions: Please read the following questions carefully and select your applicable responses.

During the 2019-2020 school year, which South Carolina school district(s) were you employed in?

Select all that apply.

- ☐ Abbeville
- ☐ Aiken
- ☐ Allendale
- ☐ Anderson 1
- ☐ Anderson 2
- ☐ Anderson 3
- ☐ Anderson 4
- ☐ Anderson 5
- ☐ Bamberg 1
- ☐ Bamberg 2
- ☐ Barnwell 19
- ☐ Barnwell 29
- ☐ Barnwell 45
- ☐ Beaufort
- ☐ Berkeley
- ☐ Calhoun
- ☐ Charleston
- ☐ Charter Institute at Erskine
- ☐ Cherokee
- ☐ Chester
- ☐ Chesterfield
- ☐ Clarendon 1
- ☐ Clarendon 2
- ☐ Clarendon 3
- ☐ Colleton
- ☐ Darlington
- ☐ Dillon 3
- ☐ Dillon 4
- ☐ Dorchester 2
- ☐ Dorchester 4
- ☐ Edgefield
- ☐ Fairfield
- ☐ Florence 1
- ☐ Florence 2
- ☐ Florence 3
- ☐ Florence 4
- ☐ Florence 5
- ☐ Georgetown
- ☐ Greenville
- ☐ Greenwood 50
- ☐ Greenwood 51
- ☐ Greenwood 52
- ☐ Hampton 1
- ☐ Hampton 2
- ☐ Horry
- ☐ Jasper
- ☐ Kershaw
- ☐ Lancaster
- ☐ Laurens 55
- ☐ Laurens 56
- ☐ Lee
- ☐ Lexington 1
- ☐ Lexington 2
- ☐ Lexington 3
- ☐ Lexington 4
- ☐ Lexington/Richland 5
- ☐ Marion 10
- ☐ Marlboro
- ☐ McCormick
- ☐ Newberry
- ☐ Oconee
- ☐ Orangeburg
- ☐ Pickens
- ☐ Richland 1
- ☐ Richland 2

☐ Saluda
☐ SC Public Charter School District
☐ Spartanburg 1
☐ Spartanburg 2
☐ Spartanburg 3
☐ Spartanburg 4
☐ Spartanburg 5
☐ Spartanburg 6
☐ Spartanburg 7
☐ Sumter
☐ Union
☐ Williamsburg
☐ York 1
☐ York 2
☐ York 3
☐ York 4
☐ Other

If 'Other', please specify.

_____

During the 2019-2020 school year, which type of school(s) were you employed in?

Select all that apply.

☐ primary
☐ elementary
☐ intermediate
☐ middle
☐ junior
☐ high
☐ other

If 'other', please specify.

_____

During the 2019-2020 school year, which grade(s) did you teach or work with?

Select all that apply.

☐ pre-kindergarten
☐ kindergarten
☐ 1st
☐ 2nd
☐ 3rd
☐ 4th
☐ 5th
☐ 6th
☐ 7th
☐ 8th
☐ 9th
☐ 10th
☐ 11th
☐ 12th
☐ other

If 'other', please specify.

_____

During the 2019-2020 school year, what was your primary role at the school where you were employed?

Select one response.

- ◯ academic teacher (examples: English language arts, mathematics, reading, science, social studies/history, etc.)
- ◯ English language learners/English for speakers of other languages teacher
- ◯ fine/related arts teacher (examples: art, drama, music, etc.)
- ◯ gifted and talented teacher
- ◯ physical education teacher
- ◯ special area/elective teacher (examples: computer, foreign/world languages, study skills, etc.)
- ◯ special education/resource teacher
- ◯ media specialist/school librarian
- ◯ interventionist
- ◯ instructional coach/specialist
- ◯ curriculum coordinator
- ◯ school nurse
- ◯ other

If 'other', please specify.

At the end of the 2019-2020 school year, how many years of public school teaching or public school nursing experience did you have?

Use the drop-down list to select one response.

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7
- ◯ 8
- ◯ 9
- ◯ 10
- ◯ 11
- ◯ 12
- ◯ 13
- ◯ 14
- ◯ 15
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- ◯ 17
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- ◯ 54
- ◯ 55
- ◯ 56
- ◯ 57
- ◯ 58
- ◯ 59
- ◯ 60
- ◯ 61
- ◯ 62
- ◯ 63
- ◯ 64

○ 65
○ 66
○ 67
○ 68
○ 69
○ 70
○ over 70

Barriers to School-Based Interventions Instructions: Please read the following questions carefully and select your applicable responses.

Which of the following makes it harder or do you find challenging when you think about encouraging students' physical activity in your school?

Select all that apply.

- ☐ inadequate support from district-level administrators
- ☐ inadequate support from school-level administrators
- ☐ inadequate support from school-level instructional support staff
- ☐ inadequate support from teachers
- ☐ inadequate support from school nurses
- ☐ inadequate support from cafeteria staff
- ☐ inadequate support from parents/families
- ☐ inadequate cooperation from students
- ☐ inadequate policies on age-appropriate physical activities
- ☐ inadequate training on age-appropriate physical activities
- ☐ insufficient funds
- ☐ insufficient resources
- ☐ insufficient time
- ☐ limited opportunities for physical activities
- ☐ other

If 'other', please specify.

_____

Of the ones you selected for physical activity, which one do you think is the biggest challenge to overcome?

Select one response.

- ◯ inadequate support from district-level administrators
- ◯ inadequate support from school-level administrators
- ◯ inadequate support from school-level instructional support staff
- ◯ inadequate support from teachers
- ◯ inadequate support from school nurses
- ◯ inadequate support from cafeteria staff
- ◯ inadequate support from parents/families
- ◯ inadequate cooperation from students
- ◯ inadequate policies on age-appropriate physical activities
- ◯ inadequate training on age-appropriate physical activities
- ◯ insufficient funds
- ◯ insufficient resources
- ◯ insufficient time
- ◯ limited opportunities for physical activities
- ◯ other

If 'other', please specify.

_____

Of the ones you selected for physical activity, which one do you think is the most important to address first?

Select one response.

◯ inadequate support from district-level administrators
◯ inadequate support from school-level administrators
◯ inadequate support from school-level instructional support staff
◯ inadequate support from teachers
◯ inadequate support from school nurses
◯ inadequate support from cafeteria staff
◯ inadequate support from parents/families
◯ inadequate cooperation from students
◯ inadequate policies on age-appropriate physical activities
◯ inadequate training on age-appropriate physical activities
◯ insufficient funds
◯ insufficient resources
◯ insufficient time
◯ limited opportunities for physical activities
◯ other

If 'other', please specify.

_____

Which of the following makes it harder or do you find challenging when you think about encouraging students' healthy eating behaviors in your school?

Select all that apply.

☐ inadequate support from district-level administrators
☐ inadequate support from school-level administrators
☐ inadequate support from school-level instructional support staff
☐ inadequate support from teachers
☐ inadequate support from school nurses
☐ inadequate support from cafeteria staff
☐ inadequate support from parents/families
☐ inadequate cooperation from students
☐ inadequate policies on age-appropriate nutrition
☐ inadequate training on age-appropriate nutrition
☐ insufficient funds
☐ insufficient resources
☐ insufficient time
☐ limited access to healthy foods
☐ other

If 'other', please specify.

_____

Of the ones you selected for healthy eating behaviors, which one do you think is the biggest challenge to overcome?

Select one response.

◯ inadequate support from district-level administrators
◯ inadequate support from school-level administrators
◯ inadequate support from school-level instructional support staff
◯ inadequate support from teachers
◯ inadequate support from school nurses
◯ inadequate support from cafeteria staff
◯ inadequate support from parents/families
◯ inadequate cooperation from students
◯ inadequate policies on age-appropriate nutrition
◯ inadequate training on age-appropriate nutrition
◯ insufficient funds
◯ insufficient resources
◯ insufficient time
◯ limited access to healthy foods
◯ other

If 'other', please specify.

_____

Of the ones you selected for healthy eating behaviors, which one do you think is the most important to address first?

Select one response.

◯ inadequate support from district-level administrators
◯ inadequate support from school-level administrators
◯ inadequate support from school-level instructional support staff
◯ inadequate support from teachers
◯ inadequate support from school nurses
◯ inadequate support from cafeteria staff
◯ inadequate support from parents/families
◯ inadequate cooperation from students
◯ inadequate policies on age-appropriate nutrition
◯ inadequate training on age-appropriate nutrition
◯ insufficient funds
◯ insufficient resources
◯ insufficient time
◯ limited access to healthy foods
◯ other

If 'other', please specify.

_____

Facilitators to School-Based Interventions Instructions: Please read the following questions carefully and select your applicable responses.

Which of the following makes it easier or do you find supportive when you think about encouraging students' physical activity in your school?

Select all that apply.

☐ adequate support from district-level administrators
☐ adequate support from school-level administrators
☐ adequate support from school-level instructional support staff
☐ adequate support from teachers
☐ adequate support from school nurses
☐ adequate support from cafeteria staff
☐ adequate support from parents/families
☐ adequate cooperation from students
☐ adequate policies on age-appropriate physical activities
☐ adequate training on age-appropriate physical activities
☐ sufficient funds
☐ sufficient resources
☐ sufficient time
☐ sufficient opportunities for physical activities
☐ other

If 'other', please specify.

Of the ones you selected for physical activity, which one do you think is the biggest support?

Select one response.

◯ adequate support from district-level administrators
◯ adequate support from school-level administrators
◯ adequate support from school-level instructional support staff
◯ adequate support from teachers
◯ adequate support from school nurses
◯ adequate support from cafeteria staff
◯ adequate support from parents/families
◯ adequate cooperation from students
◯ adequate policies on age-appropriate physical activities
◯ adequate training on age-appropriate physical activities
◯ sufficient funds
◯ sufficient resources
◯ sufficient time
◯ sufficient opportunities for physical activities
◯ other

If 'other', please specify.

Of the ones you selected for physical activity, which one do you think is the most important to address first?

Select one response.

◯ adequate support from district-level administrators
◯ adequate support from school-level administrators
◯ adequate support from school-level instructional support staff
◯ adequate support from teachers
◯ adequate support from school nurses
◯ adequate support from cafeteria staff
◯ adequate support from parents/families
◯ adequate cooperation from students
◯ adequate policies on age-appropriate physical activities
◯ adequate training on age-appropriate physical activities
◯ sufficient funds
◯ sufficient resources
◯ sufficient time
◯ sufficient opportunities for physical activities
◯ other

If 'other', please specify.

Which of the following makes it easier or do you find supportive when you think about encouraging students' healthy eating behaviors in your school?

Select all that apply.

☐ adequate support from district-level administrators
☐ adequate support from school-level administrators
☐ adequate support from school-level instructional support staff
☐ adequate support from teachers
☐ adequate support from school nurses
☐ adequate support from cafeteria staff
☐ adequate support from parents/families
☐ adequate cooperation from students
☐ adequate policies on age-appropriate nutrition
☐ adequate training on age-appropriate nutrition
☐ sufficient funds
☐ sufficient resources
☐ sufficient time
☐ sufficient access to healthy foods
☐ other

If 'other', please specify.

Of the ones you selected for healthy eating behaviors, which one do you think is the biggest support?

Select one response.

◯ adequate support from district-level administrators
◯ adequate support from school-level administrators
◯ adequate support from school-level instructional support staff
◯ adequate support from teachers
◯ adequate support from school nurses
◯ adequate support from cafeteria staff
◯ adequate support from parents/families
◯ adequate cooperation from students
◯ adequate policies on age-appropriate nutrition
◯ adequate training on age-appropriate nutrition
◯ sufficient funds
◯ sufficient resources
◯ sufficient time
◯ sufficient access to healthy foods
◯ other

If 'other', please specify.

_____

Of the ones you selected for healthy eating behaviors, which one do you think is the most important to address first?

Select one response.

◯ adequate support from district-level administrators
◯ adequate support from school-level administrators
◯ adequate support from school-level instructional support staff
◯ adequate support from teachers
◯ adequate support from school nurses
◯ adequate support from cafeteria staff
◯ adequate support from parents/families
◯ adequate cooperation from students
◯ adequate policies on age-appropriate nutrition
◯ adequate training on age-appropriate nutrition
◯ sufficient funds
◯ sufficient resources
◯ sufficient time
◯ sufficient access to healthy foods
◯ other

If 'other', please specify.

_____

COVID-19 Pandemic Instructions: Please read the following questions carefully and select your applicable responses.

What impact has the COVID-19 pandemic had on your school's ability to address physical activity and healthy eating behaviors?

Select one response.

◯ positive impact
◯ no impact
◯ negative impact
◯ unsure

If 'positive impact', please explain.

_____

If 'negative impact', please explain.

_____

The COVID-19 pandemic will affect future interventions in your school addressing physical activity and healthy eating behaviors.

Select one response.

◯ strongly agree
◯ agree
◯ unsure
◯ disagree
◯ strongly disagree

Needs Assessment Survey: Barriers and Facilitators to School-Based Interventions Addressing Physical Activity and Healthy Eating Behaviors Gift Card Compensation

Thank you for taking the Needs Assessment Survey: Barriers and Facilitators to School-Based Interventions Addressing Physical Activity and Healthy Eating Behaviors.

The first 500 participants who take this survey are eligible to receive a $5 gift card via e-mail.

Note - This e-mail address will be used for gift card purposes only, will be deleted from your response after gift card distribution, and will not be reported with any study data.

If you are one of the first 500 participants, would you like to provide your e-mail address to receive a $5 gift card?

◯ Yes
◯ No

If 'Yes', please provide the e-mail address you would like for the gift card to be sent to. _____

Appendix K. Dissertation Proposal

Barriers and Facilitators Regarding Awareness, Selection, and Implementation of School-Based Interventions Addressing Physical Activity and Healthy Eating Behaviors: Perspectives of South Carolina Public School Administrators and Personnel

Logan J. Camp-Spivey, MSN, RN
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Dissertation Committee Chair:
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Dissertation Committee:
Susan D. Newman, PhD, RN, CRRN
Associate Professor, College of Nursing, Medical University of South Carolina

Robert N. Stevens, PhD, MS
Director of the South Carolina Association of Positive Behavior Support,
State Co-chair for the South Carolina Department of Education School Climate Grant

Specific Aims

The World Health Organization identifies childhood obesity as one of the 21st century's most serious public health challenges, with approximately 14.4 million children and adolescents considered overweight or obese in the United States.[1,2] Behaviors that lead to excess weight gain include inadequate participation in physical activity (PA) and consumption of high-calorie, low-nutrient foods.[3] Lasting negative health outcomes are associated with obesity, including increased rates of chronic illnesses, diminished quality of life, and shorter life span.[3,4] Childhood obesity is also linked to psychological and social problems, such as anxiety, depression, and stigmatization.[1,3,4] School-based interventions can improve PA and healthy eating behaviors because children spend approximately 6 hours each weekday attending school, making these accessible and convenient locations for health interventions.[5-11] In addition, childhood is a formative period during which children establish health habits; lifestyle changes in this age group are easier compared to adulthood.[12,13]

Recent studies explored the barriers and facilitators to implementing school-based interventions in primary and elementary schools from the perspectives of students, family members, school personnel, and community stakeholders.[14-48] However, there is a notable gap in the literature on system-wide barriers and facilitators regarding awareness, selection, and implementation of school-based interventions addressing PA and healthy eating behaviors from the perspectives of school administrators and the needs of school personnel at all academic levels, including elementary, middle, and high schools. This research is ***important*** because school administrators decide whether and which PA or healthy eating interventions can be offered and school personnel are involved at various

stages, from initial planning to content delivery.[49] Furthermore, the educational system in South Carolina (SC) warrants attention because the state ranks 3rd in the nation for the number of youth ages 10-17 who are obese.[50] Lack of knowledge about barriers and facilitators limits implementation of school-based interventions that might improve health practices and reduce health risks. Finally, there is no synthesized understanding of the interventions that SC schools have or have not initiated to address obesity-related behaviors and reasons behind these decisions. To improve the knowledge of these interventional activities and decisions, it is imperative to understand the characteristics of settings, involved individuals, and leadership practices in SC schools. These characteristics help to explain processes of implementation and their outcomes among SC schools that have adopted interventions. Furthermore, information is needed on how the coronavirus disease (COVID-19) has effected barriers and facilitators to school-based health interventions.[51]

Upon completion of this study, our *immediate goal* is to adapt and implement school-based PA and healthy eating interventions in SC that account for barriers and facilitators. Our *long-term goal* is to reduce rates of childhood obesity by informing school system-wide PA and dietary policies that promote health. The following research question will guide the study: What do public school administrators and personnel in South Carolina perceive and experience as barriers and facilitators regarding awareness, selection, and implementation of school-based interventions addressing physical activity and healthy eating behaviors? To that end, our primary *objective* for the current study is to understand these barriers and facilitators from the perspectives of public school administrators and personnel in order to inform future Intervention Mapping (IM).[52] The

rationale underlying the proposed research is that, once we know what school administrators and personnel perceive and experience as barriers, facilitators, preferences, and needs, we can adapt interventions to the needs of individual schools and implement activities to mitigate barriers and support facilitators for educators and students.

Our study uses a multi-methodological approach, guided by the Social Ecological Model (SEM)[53-57] and aspects of the Steps in Quality Intervention Development (6SQuID) model.[58,59] We will conduct semistructured interviews with public school administrators and distribute a needs assessment survey to public school personnel working at all academic levels in SC to accomplish the following specific aims:

Aim 1: *Describe actual and perceived barriers and facilitators* school administrators and personnel encounter regarding awareness, selection, and implementation of school-based physical activity and healthy eating interventions.

- Aim 1a. Identify actual and perceived concerns and experiences within school settings regarding the use of weight-related terminology and any stigma that may exist.
- Aim 1b. Assess ability to recruit and engage school administrators and personnel to participate in an exploratory study on school-based interventions.

Aim 2: *Identify greatest challenges and supports, priority focal areas, and school-based interventions* that have been implemented along with their outcomes.

Impact: Findings from this study will expand knowledge on barriers and facilitators to school-based interventions, which may enhance successful adaptation and implementation of school-based interventions to promote PA and healthy eating behaviors and to ultimately reduce rates of childhood obesity.

A. SIGNIFICANCE

A.1. Problem of Childhood Obesity

In the United States, the prevalence of childhood obesity is 19.3% and affects approximately 13.7 million children and adolescents.[2,60] Youth who are obese face numerous physical health risks associated with the cardiovascular, pulmonary, and endocrine systems, such as hypertension, asthma, and diabetes.[3,4] Childhood obesity is also linked to psychological and social problems, including anxiety, depression, and stigmatization.[1,3,4] Another important consideration is that children who are obese are likely to have more pronounced rates of obesity and comorbid disease risk factors as adults.[3]

At the state level, childhood obesity is a severe problem in South Carolina (SC) because nearly 37% of youth are overweight or obese, and the state ranks 3rd in the nation for the number of people ages 10-17 who are obese.[50,61,62] SC has an overall health ranking of 42 out of 50 states.[63] Health disparities in SC that contribute to the obesity epidemic are related to the state's rurality, educational challenges, diminished access to and affordability of health care, and health communication difficulties related to geographic locations and income.[64] The affordability and income barriers are pronounced because 22.6% of children in SC live in poverty, and poverty is associated with early childhood obesity.[63,65] Childhood obesity is especially concerning because it contributes to health problems in adulthood and because SC is located in the stroke belt, with high rates of cardiovascular disease and diabetes.[63,66] Addressing and accounting for these issues in research may decrease childhood obesity and reduce life-threatening chronic illnesses.

A.2. State of Problem for Implementing School-Based Interventions Addressing Childhood Obesity

School-based interventions targeting physical activity (PA) and healthy eating patterns have successfully improved PA and dietary behaviors associated with developing childhood obesity.[5-8,13,67] Despite this evidence, not all schools implement these types of interventions.[9] In addition, some schools that have tried to implement interventions have faced challenges that are important to understand. Yet, these system-wide barriers and facilitators regarding awareness, selection, and implementation of school-based interventions, and the needs of those involved, have not been adequately characterized from the perspectives of school administrators and personnel at all academic levels (elementary, intermediate, middle, junior high, and high schools).

A.3. Increased Scientific Knowledge Regarding Treatment of Childhood Obesity and Changes in Field

This study is designed to increase knowledge concerning perceived and experienced barriers and facilitators regarding awareness, selection, and implementation of school-based interventions addressing PA and healthy eating behaviors among public school administrators and personnel in SC. This research advances the evidence of what school administrators identify as barriers and facilitators to recognizing, selecting, and implementing obesity interventions in schools. As administrators make decisions about whether and which interventions can be offered, school personnel are often involved at various stages, from initial planning to content delivery.[49] The wide age range and developmental needs of students suggest variation in barriers and facilitators, thus data is needed from school administrators and personnel at various academic levels, from

elementary to secondary schools.[12,68] It is also necessary to understand the perspectives and experiences of school administrators and personnel who have not implemented such interventions to identify reasons for non-implementation or non-adoption. Following this project, our immediate goal is to use formative study data to adapt and implement targeted school-based interventions in SC that account for barriers and facilitators. Our long-term goal is to reduce rates of childhood obesity by informing school system-wide PA and dietary policies that promote health.

Study findings may inform prevention and treatment strategies for childhood obesity. Currently, childhood obesity is primarily treated in clinical settings. Numerous challenges exist with this treatment approach, including time and resource constraints, inability to attend appointments, and misunderstanding of medical orders.[69-71] Children spend approximately 6 hours each weekday at school, making school systems convenient venues for promoting healthy lifestyles and encouraging daily PA and nutritious eating habits.[10] By identifying barriers and facilitators to school-based interventions, these factors can be considered to improve health.

A.4. Impacts of the Coronavirus Disease 2019 (COVID-19) Pandemic on School-Based Interventions Addressing Childhood Obesity

In January 2020, the United States had its first confirmed case of the coronavirus disease (COVID-19).[72] By March 2020, all 50 states had reported COVID-19 cases, and the disease had reached pandemic status.[73] In response, schools across the nation transitioned to remote learning to slow the spread of the virus and to protect students and other school members.[74] This unprecedented move interrupted academic education as well as school-based health initiatives.[75] Of particular interest is how the pandemic

impacted school-based interventions addressing physical activity (PA) and healthy eating behaviors. This information is especially important as school closures from COVID-19 have been associated with weight gain due to disruptions in students' daily routines.[51,76] One study predicts that these closures could potentially lead to 1.2 million new childhood obesity cases.[51,77]

As the pandemic continues and schools adjust to required restrictions, there is a need to understand how school-based interventions addressing PA and healthy eating behaviors are impacted from the perspectives of school administrators and other school personnel. This information may help school systems to adapt school-based interventions so that students can still receive and benefit from content on healthy lifestyle practices, with the ultimate goal of decreasing rates of childhood obesity.

B. INNOVATION AND CONCEPTUAL FRAMEWORKS

B.1. Innovation

This research is innovative because there are no known studies that investigate perceived and experienced barriers and facilitators regarding awareness, selection, and implementation of school-based interventions targeting PA and healthy eating behaviors among public school administrators and personnel at all academic levels in SC. Insights from school systems and personnel are needed to explain how and why school-based interventions have or have not been implemented. Identifying and understanding the actual and perceived barriers and facilitators will enable tailored intervention adaptation. Data will be collected from school administrators and from school personnel, such as teachers and school nurses. Findings from the study will inform future Intervention Mapping (IM) to adapt and implement interventions that can be integrated into school

day schedules after minimizing barriers and maximizing facilitators.[52] This innovation applies to multiple fields of research, including health, education, and implementation science. Study results may inform health policies among medical professionals, educators, and researchers developing, adapting, and implementing interventions that target childhood obesity behaviors.

B.2. Conceptual Framework for Examining Educational Systems

Examining barriers and facilitators through multilevel approaches accounts for factors beyond the individual person. The Social Ecological Model (SEM) will guide this research.[53-57] This theory addresses the interrelations of the social, cultural, and physical environments; human health; and health behaviors. Core components of this model include intrapersonal, interpersonal, institutional, community, and social/policy levels.[53-57] Intrapersonal factors involve the attitudes, beliefs, behaviors, and knowledge of school administrators and personnel regarding school-based PA and healthy eating interventions. Interpersonal components explore the relationships school administrators and personnel have with students, students' families, and other school officials, and how these personal connections act as barriers and facilitators to school-based interventions. The institutional level refers to the organizational characteristics existing within school systems, such as physical settings, PA and food options, and access to health promoting resources. Community considerations include school-level relationships in terms of partnerships, involvement of stakeholders, and social norms that can impede and promote school-based interventions. Social/policy elements encompass the broad societal aspects that help create an environment in which healthy PA and eating behaviors are inhibited or fostered, with a focus on programs and policies regulating PA and nutrition in school settings.

Collecting and analyzing data along with interpreting findings in the context of the SEM will allow for knowledge synthesis about barriers and facilitators in school settings, thus providing a framework for future IM that is informed by school-based findings.[52-57] IM is a rigorous and elaborate approach for developing and adapting theory- and evidence-based interventions.[52,59,78] IM involves six systematic steps, beginning with understanding various aspects of a health problem and ending with planning evaluations to assess the implementation of an intervention.[52,59,78]

B.3. Conceptual Model for Intervention Mapping

The Steps in Quality Intervention Development (6SQuID) Model focuses on the process of quality intervention design through six steps: defining and understanding the problem and its causes; identifying modifiable causal or contextual factors; determining a change mechanism; clarifying how the change mechanism will be delivered; testing and adapting the change mechanism; and collecting evidence of effectiveness.[58,59] This study will incorporate the first two steps of the 6SQuID Model. Questions on the interview guide will be developed based on these two steps. Analyses of interview and survey responses will clarify the problems stakeholders perceive and experience, as well as identify the problems' causes. This method will define and characterize the barriers and facilitators regarding awareness, selection, and implementation of school-based interventions targeting PA and healthy eating behaviors.[58,59] To determine factors that shape the problem and have the greatest potential for change, we will examine data to describe challenges and supports, identify priority focal areas, and itemize interventions that have been implemented along with their outcomes.[58,59]

C. APPROACH

C.1. State of the Science

Beginning in 2019 and updated in 2021, we completed an integrative review on the barriers and facilitators to primary and elementary school-based interventions addressing PA and healthy eating behaviors.[14-48] Commonly reported barriers involved teachers' lack of time and insufficient resources.[14-16,19,23,28,33,37-40,44-46,48] The main facilitators were adequate training and support.[14-17,19-26,28-48] However, it is unclear if these barriers and facilitators are common at academic levels beyond primary and elementary schools, and if similar barriers and facilitators exist in SC schools. Therefore, this study addresses the perceived and experienced barriers and facilitators of public school administrators and personnel at all academic levels in SC regarding awareness, selection, and implementation of school-based interventions addressing PA and healthy eating behaviors. This research is needed to understand the challenges and supports that educational team members encounter as they consider, introduce, and deliver school-based interventions.[6,9,13] The identified challenges and supports will inform adaptation and tailoring of interventions. Minimizing barriers and maximizing facilitators may support school infrastructures and enable the creation of environments more conducive to intervention delivery, thus helping schools become settings to improve health.

C.2. Design Overview

A concurrent multi-methodological design will explore the perceived and experienced barriers and facilitators of SC school administrators and personnel regarding awareness, selection, and implementation of school-based interventions addressing PA and healthy eating behaviors.[79-82] A multimethod approach is appropriate because the

qualitative and quantitative aspects are relatively complete on their own, and two different sample populations are being studied to form a comprehensive understanding of the phenomena.[81,82] The qualitative descriptive component will include one-time in-depth Key Informant Interviews (KIIs) with public school administrators.[80,83,84] Semistructured interviews are the optimum method because there has been no statewide research on the perceptions and experiences of SC public school administrators concerning barriers and facilitators.[23,27,28,40,83] The quantitative descriptive component will involve distributing a needs assessment survey to public school personnel to identify the most important barriers and facilitators. Survey results will guide future action, and barriers and facilitators rated as most important will be given priority.[85] The interview guide and the needs assessment survey was developed by the Principal Investigator (PI) with input from the dissertation committee based on a literature review,[14-48] the SEM,[53-57] and the first two steps of the 6SQuID model.[58,59] Knowledge of what school administrators and personnel perceive and experience as barriers, facilitators, preferences, and needs will inform future IM.[52]

C.3. Setting, Sample Population, and Sample Size Considerations

The participants in this study will be recruited over a 5-month time period through electronic mail (e-mail) messages from the PI, school districts, and a professional school-related organization in SC[86] and through snowballing.[79] All recruitment materials will be approved by the Institutional Review Board for Human Research (IRB) at the Medical University of South Carolina (MUSC).[87] Detailed study materials and the link to the needs assessment survey in the Research Electronic Data Capture (REDCap) system[88-90] will be sent electronically to eligible participants.

Qualitative component. For school administrator recruitment, a purposive sampling plan with snowballing will be used so that administrators from all academic levels are represented.[40,79,91] The objective for participant recruitment will be data saturation, with a goal of up to 30 KIIs.[23,40,83,91]

Quantitative component. For school personnel recruitment, a consecutive sampling strategy will be used to reach the goal of a 10% survey response rate.[79] A power analysis was not conducted due to the descriptive quantitative design.[92-94]

C.4. Inclusion and Exclusion Criteria

Inclusion criteria are: English-speaking public school administrators and personnel employed in SC elementary and secondary schools during the 2019-2020 academic year. School administrators are defined as people currently serving in leadership roles in schools, such as principals and assistant principals. School personnel are defined as people working in certified or licensed roles within schools, such as teachers and school nurses. Exclusion criteria are: retired school administrators and personnel, those working in educational settings outside of SC, and those employed in private schools. The rationale for excluding retired participants, those not working in SC, and those employed in private schools is they may not be aware of current school system-wide factors affecting PA and healthy eating interventions. Thus, they may identify barriers and facilitators that do not exist or are otherwise not applicable.

C.5. Recruitment and Retention

The overall goal of study recruitment will be to achieve a representative sample of SC public school administrators and personnel who work with students at all academic levels across the state.[95] This diversity is vital to identify common themes accurately and

to account for unique challenges and supports. The PI will explain the study and provide all recruitment materials to potential participants and officials responsible for sending materials to school district employees and organization members.

Qualitative component. The PI will verbally explain and present the study to each interested school administrator participant prior to KIIs. The KIIs will be completed within one session and last between 30-45 minutes, thus attrition of participants is expected to be low. Compensation in the form of $20 gift cards will be provided to school administrators who participate in KIIs.

Quantitative component. Before participants access the needs assessment survey on REDCap,[88-90] the PI will provide a written description of the study along with the PI's contact information for questions. The surveys will be completed within one session and take approximately 10 minutes, thus attrition of participants is expected to be low. Participants will have the option to provide their contact information for a gift card. The first 500 participants will be eligible to receive a $5 gift card.

D. PROCEDURES

D.1. Screening and Assignment

Qualitative component. The PI will screen potential participants based on inclusion and exclusion criteria. Eligible participants will be assigned to an interview session. Ineligible participants will be thanked for their time and assigned as non-participants. All SC public school administrators who meet inclusion criteria and provide consent will be included in the study based on the purposive sampling plan with snowballing until data saturation is achieved.[40,79,91]

Quantitative component. At the beginning of the survey, potential participants will self-screen for eligibility based on their responses to questions. Study candidates meeting inclusion criteria will proceed to the needs assessment survey. Those not meeting inclusion criteria will be thanked for their time. Children will not be involved because we are investigating the perceptions of school administrators and personnel.

D.2. Safety of Data

KII audio recordings, transcripts, and any identifying information for participants will be securely stored in password-protected files on servers at MUSC, accessible only by the PI and dissertation committee members. This study will utilize REDCap provided through MUSC.[88-90] All survey responses, Excel spreadsheets, and IBM Statistical Package for the Social Sciences (SPSS) data files[94,96,97] will be securely kept in password-protected files on servers at MUSC, accessible only by the PI, dissertation committee members, and MUSC's College of Nursing statistician. No participant information will be disclosed to non-study or non-regulatory personnel. Upon completion of the study, all data will be kept according to MUSC's requirements.

Instructions for reporting adverse events will be included in study materials. This information will be provided a second time at the conclusion of KIIs and at the end of the needs assessment survey. Reported events will be recorded in detail in an adverse event log, and dissertation committee members will be notified for further guidance. Events will be reported to the IRB in accordance with the MUSC IRB Adverse Event Reporting Policy.[87] Weekly meetings will be scheduled with the dissertation committee chair to review and evaluate all procedures, resulting outcomes, and potential risks. KII audio recordings and transcripts will be reviewed by the PI and dissertation committee chair to

determine fidelity to the protocol. Any protocol modifications will be approved by the MUSC IRB prior to implementation.[87]

D.3. Participant Groups

Qualitative component. Participants will partake in individual, semistructured KIIs that will be audio recorded. KIIs will be completed via telephone or through an MUSC approved videoconferencing platform. KIIs are projected to last between 30-45 minutes.

Quantitative component. Participants will respond to items on a needs assessment survey distributed through REDCap.[88-90] Participants will use their personal electronic devices with Internet access to respond to the survey. The surveys are projected to take approximately 10 minutes to complete.

D.4. Data Collection Techniques

Qualitative component. A semistructured interview guide will be used for qualitative data collection. The first set of questions will gather demographic information from participants. The PI will then ask general questions about childhood obesity and schools' roles in children's weight-related health. Probes will be used to elicit further details. These questions are based on the first two steps of the 6SQuID model.[58,59] The next set of questions are specific to school-based interventions addressing PA and healthy eating behaviors along with barriers and facilitators. The probes for these questions are based on the levels of the SEM.[53-57] The final question is about COVID-19's effects on school-based interventions. KII audio recordings will immediately be uploaded to password-protected files on servers at MUSC and then securely sent to a professional transcription service. Interview transcripts will be reviewed to identify emerging themes

and response patterns that will be explored with subsequent participants. Interview questions will be revised as needed to reflect collected data.[23,28,83,91,98]

Quantitative component. A needs assessment survey will be used for quantitative data collection. The survey will be accessed by participants electronically through REDCap.[88-90] There are four sections in the survey. The first solicits demographic information. The second contains semistructured, select-all-that-apply and single response questions with the option for write-in responses about barriers. The third uses the same format to ask about facilitators. The fourth is specific to COVID-19's effects on school-based interventions. These questions are based on the SEM[53-57] and the first two steps of the 6SQuID model.[58,59] Responses will identify challenges and supports for school-based interventions.

D.5. Trustworthiness of Qualitative Research

Trustworthiness will be achieved by meeting the criteria of credibility, transferability, dependability, and confirmability.[99,100] Credibility will be promoted by using well-recognized research methods, recruiting participants from a variety of educational backgrounds, and conducting debriefing sessions with the PI and the dissertation committee. For transferability, the PI will provide detailed contextual information for others to determine if results are applicable to their situations. To attain dependability, the research process will be logical, traceable, and clearly documented through an audit trail. Confirmability will be established by including rationales behind study decisions to demonstrate how conclusions and interpretations have been reached. In addition, ensuring confidentiality will improve trustworthiness so that participants feel comfortable providing truthful responses to interview and survey questions. Awareness

by the PI of previous insider and current outsider positions in the SC school system will ensure the acquisition of balanced and shared perspectives from participants while also maintaining objectivity.

D.6. Data Analysis

To ensure thorough and thoughtful data analysis, the PI will meet weekly with the dissertation committee chair to discuss techniques and emerging findings. In addition, the PI will contact the dissertation committee as needed with questions and concerns and to ensure consensus regarding data. The dissertation committee chair and the dissertation committee will provide confirmation and oversight throughout the entire study.

Qualitative component. To address both Aims 1 and 2, thematic analysis of interview transcripts will be conducted.[23,28,83,91,98] The PI will confirm the accuracy of transcripts by comparing them to audio recordings, and then examine the verbatim transcripts multiple times to develop first- and second-level codes.[23,28,83,91,98] Level 2 codes will encompass common subjects and themes from all interviews. Consistent with the conceptual frameworks, themes will be analyzed in the context of the SEM[53-57] and the 6SQuID model.[58,59] The PI will maintain a codebook with coding schemes, definitions, and examples to guide the analysis of interview data and serve as an audit trail from data collection to data analysis.[23,28,83,98] The PI will also maintain a personal reflective journal to detail feelings and insights about the study.[23,28,83,91,98] Journal entries made after each interview will document potential biases and serve as a record of emerging concerns about the research. The ability to recruit and engage school administrators will be assessed by the participant response rate (goal N = up to 30 participants).

Quantitative component. To address both Aims 1 and 2, univariate descriptive statistics using frequency counts and percentages from the needs assessment survey will be reported.[19,93,94,101] Survey responses will be imported from REDCap[88-90] into IBM SPSS 27.[94,96,97] Analysis of survey results will allow the most common barriers and facilitators to school-based interventions to be identified. Bivariate descriptive statistical analyses will be performed to further explore how actual and perceived barriers and facilitators, greatest challenges and supports, and priority focal areas compare by school roles (examples: teacher, school nurse), academic levels (examples: elementary, secondary), and school district classifications (examples: rural, urban).[19,91,93,94,101] Information will be utilized to create contingency tables to describe these relationships.[19,91,93,94,101] The ability to recruit and engage school personnel will be assessed by the participant response rate (goal of 10% survey response rate).

D.7. Potential Problems, Alternative Strategies, and Benchmarks for Success (Table 1)

Potential problems and alternative strategies. The study's main potential problem involves recruitment of participants. To account for this, all recruitment materials will highlight information about the amount of time study participation will take and actual (KIIs) or potential (surveys) gift card compensation. To encourage participation, recruitment and data collection will not begin until the current school year is completed in June 2020. Another limitation of the study is the psychometric properties of the needs assessment survey are not known. However, there are currently no validated needs assessment surveys on barriers and facilitators to school-based interventions addressing PA and healthy eating behaviors. Therefore, the use of this survey could provide

groundwork for future psychometric testing and developing a validated instrument. Finally, respondent factors, such as social desirability and recall issues, could result in measurement errors.[101,102] To reduce these possible errors, the PI will create a comfortable and trusting research environment and provide information about the confidentiality of the study. In addition, participants will be asked to take their time when providing responses without distractions or interruptions.[101,102]

Table 1. Benchmarks for Success

Outcomes	Measures	Benchmarks
Aim 1. Describe actual and perceived barriers and facilitators school administrators and personnel encounter regarding awareness, selection, and implementation of school-based PA and healthy eating interventions.	1. Develop interview guide and needs assessment survey 2. Actual and perceived barriers and facilitators	1. Approval by dissertation committee by May 31, 2020 2. Qualitative component – in-depth responses to all questions 2. Quantitative component – all survey questions answered
Aim 1a. Identify actual and perceived concerns and experiences within school settings regarding the use of weight-related terminology and any stigma that may exist.	1. Weight-related terminology and stigma	1. Qualitative component – in-depth responses to weight-related terminology and stigma question
Aim 1b. Assess ability to recruit and engage school administrators and personnel to participate in an exploratory study on school-based interventions.	1. Recruitment and engagement	1. Qualitative component – goal to enroll 6 participants per month between June-October 2020 1. Quantitative component – goal to have 10% survey response rate by October 2020
Aim 2. Identify greatest challenges and supports, priority focal areas, and interventions that have been implemented along with their outcomes.	1. Greatest challenges and supports, priority focal areas 2. Implemented interventions with outcomes	1. Qualitative component – common themes constructed from interviews 1. Quantitative component – frequency of responses from surveys 2. Qualitative component – in-depth responses to implemented interventions question

D.8. Study Timeline

Task	May 2020	June 2020	July 2020	Aug 2020	Sept 2020	Oct 2020	Nov 2020	Dec 2020	Jan 2021	Feb 2021	Mar 2021	Apr 2021	May 2021
Defend proposal	X												
Finalize interview guide	X												
Finalize survey and enter into REDCap	X												
Submit study to IRB; make revisions if necessary	X	X											
Study recruitment/enrollment		X	X	X	X	X							
Data collection		X	X	X	X	X	X						
Data analysis		X	X	X	X	X	X	X	X				
Data safety monitoring		X	X	X	X	X	X	X	X				
Formulate manuscripts and dissertation compendium					X	X	X	X	X	X	X	X	
Dissertation defense													X
Disseminate findings													X

PROTECTION OF HUMAN SUBJECTS

This study includes interviews and a needs assessment survey and is eligible for exempt review (category 2).

Risks to Human Subjects

There is minimal risk to human subjects in this multi-methodological study that involves public school administrators and personnel working in SC's educational system. These potential risks are breach of confidentiality and study burden. The recruitment goal for the qualitative component is up to 30 participants. The recruitment goal for the quantitative component is a 10% survey response rate. Participants will be recruited through e-mail messages from the PI, school districts, and a professional school-related organization in SC and through snowballing. IRB approval will be sought through MUSC.

Qualitative component. The PI will screen participants for eligibility based on inclusion and exclusion criteria. Inclusion criteria are: English-speaking public school administrators employed in SC elementary and secondary schools during the 2019-2020 academic year. For the purposes of this study, school administrators are defined as people currently serving in leadership roles in schools, such as principals and assistant principals. Eligible participants will be assigned to an interview session. The PI will verbally explain and present the study to each interested school administrator. For school administrators who agree to participate in the study, the PI will ask questions from the interview guide.

Quantitative component. Before participants access the needs assessment survey and at the beginning of the needs assessment survey in REDCap, the PI will provide a

written description of the study along with the PI's contact information for questions. At the beginning of the survey, participants will self-screen for eligibility based on their responses to questions. Inclusion criteria are: English-speaking school personnel employed in SC elementary and secondary schools during the 2019-2020 academic year. Study candidates meeting inclusion criteria will proceed to the needs assessment survey. By completing the electronic survey, participants will agree that they have read and fully understood the study's description and are providing willing consent to take part in this study.

Rigorous efforts will be made to protect against risks. Breach of confidentiality refers to participants' responses being connected with their personal identity, and study data being accessed by non-study and non-regulatory personnel. Study burden involves the time school administrators and personnel will have to take in order to participate in interviews and complete surveys.

Adequacy of Protection Against Risks

All research team members will have the required human participants research training.

Breach of Confidentiality. To reduce the risk of a breach of confidentiality, all interview audio recordings and transcripts will be securely kept in a password-protected file on servers at MUSC, accessible only by the PI and dissertation committee members. Transcripts will not contain participant identifiers and any identifying information will be deleted. Participants will each be assigned a unique identifier, and this record will be stored separately in a password-protected file on servers at MUSC, accessible only by the PI and dissertation committee members. All survey responses, Excel spreadsheets, and

IBM SPSS data files will be securely kept in a password-protected file on servers at MUSC, accessible only by the PI, dissertation committee members, and MUSC's College of Nursing statistician. No participant identifying information will be disclosed to non-study or non-regulatory personnel or included in any study reports. Upon completion of the study, all collected data will be kept according to MUSC's requirements.

Study Burden. To reduce study burden while still allowing participants sufficient time to answer questions, interviews will last between 30-45 minutes, and the needs assessment survey will take approximately 10 minutes to complete. Participants will be able to choose how interviews will be conducted (telephone, videoconference) and select dates and times to be interviewed based on their schedules. The needs assessment survey will be completed electronically at the convenience of participants using any device with Internet connection.

Potential Benefits of the Proposed Research to Human Subjects and Others

There will be no direct benefits to participants in this study. School administrators participating in interviews will be given gift card incentives as compensation for their time and willingness to participate. The first 500 Survey respondents will be eligible to receive a gift card.

Importance of the Knowledge to be Gained

At present, little is known about the perceived and experienced barriers and facilitators regarding awareness, selection, and implementation of school-based interventions addressing PA and healthy eating behaviors among public school administrators and personnel in SC. This study will begin to address this gap in knowledge and will lay the groundwork for the adaption and implementation of school-

based interventions to mitigate barriers and support facilitators. Thus, this study may ultimately help decrease rates of childhood obesity by informing prevention and treatment strategies.

Inclusion of Women, Children, and Minorities

Women and minorities will be included in the study within the available population. All participants meeting inclusion criteria will be eligible for the study, regardless of other demographic characteristics. Children will not be involved in this research because we are investigating the perceptions of school administrators and personnel, not school children.

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