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Nutrition Education Interventions for Children

Emily A. Didylowski

The College at Brockport, edidylowski@gmail.com

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Nutrition education interventions for children

A senior honors thesis

Submitted in partial fulfillment of the requirements for graduation in the honors college

Emily A Didylowski

Nursing major

State University of New York- The College at Brockport

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Thesis director: Dr. Susan Lowey

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Introduction

Adequate nutrition is an essential component to longevity and quality of life. Obesity is a major factor that contributes to morbidities such as diabetes, heart disease and various cancers (Yip, Gates, Gates & Hanning, 2015). The Centers for Disease Control and Prevention (CDC) describe obesity as, “A weight that is higher than what is considered as a healthy weight for a given height” (CDC, 2015). This definition refers to body mass index, or BMI. BMI is calculated using two factors: height and weight. BMI charts are fairly accessible and outline normal ranges and abnormal ranges. While adult and child BMI’s are calculated the same, a child’s BMI is interpreted differently. Similar to measuring a child’s overall growth, a child’s BMI is plotted on a chart, and using multiple parameters, the chart assesses what percentile that child’s BMI falls under. For example, a child that falls into the 95th percentile for BMI would be considered obese (CDC, 2015).

When viewing a nationwide health issue, evaluating statistics is vital. In 2011 to 2014, 12.7 million children (ages 2-19) were classified as being obese. The age range with the highest rate of obesity (20.5%) were adolescents, aged 12-19 years old. The ethnicity with the highest rate of obesity were those of Hispanic origins (21.9%), followed by African-Americans (19.5%) (CDC, 2017a). According to the CDC, 1 in every 4 deaths are due to heart disease, and it is the leading cause of death in both men and women (CDC, 2017c). “Eighty-six percent of young children consume a sweetened beverage or dessert daily [1] and over 80% of 4-18 year old children do not meet recommendations for fruit or vegetable intakes [2]” (Ventura & Garst, 2013, p.1). Obesity is a very preventable disease, especially when interventions are performed early. Overweight and obese children are twice as likely to become obese adults compared to

kids with normal BMI's (Yip et al., 2015). Childhood is an ideal period in the lifespan to begin education on healthy eating. It is the hope that educating children on nutrition will create healthy behaviors which will influence their adult life, leading to decreased rates of obesity and obesity-related illnesses, such as diabetes and heart disease. The American Dietetic Association details that children are beginning to develop illnesses that adults typically suffer from, such as type 2 diabetes, hypertension and dyslipidemia, thus "raising the spectre of myocardial infarction becoming a paediatric disease" (Devault et al., 2009, p. 680). The United States has weight loss programs such as Weight Watchers and Jenny Craig, but these programs are mainly for people that are already overweight or obese. Few programs exist that actually aim to educate people about nutrition and prevent obesity. Even fewer programs are available for children, specifically.

There are many determinants of health that lead a child to developing obesity. Determinants of health "are the range of various personal, social, economic, and environmental factors" that influence the overall health of an individual or population (Stanhope & Lancaster, 2014). Obesity is traditionally thought of as a largely preventable disease, if individual behaviors are modified. However, in some people, there can be some genetic predisposition to obesity. For example, some endocrine disorders such as hypothyroidism can cause obesity in a child. Some children are also not as efficient in storing fat as others, which is a genetic predisposition (Montusi & Sanyal, 2012). While women are more likely to become obese (36.5%) as compared to men (33.7%), there is limited evidence of gender comparison and obesity rates in children (Obesity Society, 2014).

Individual behaviors play a much larger role in the development of obesity in children. Firstly, diet and health-related choices greatly affect a child's weight. Many other factors impact diet choices, such as advertising and access of healthy foods and unhealthy foods. Parents

influence a child's diet considerably, as they are the ones to usually shop for groceries and pack lunches for their kids (Montusi et al., 2012). School lunch programs, and guidelines for nutrition within schools influence a child's diet greatly, as well. Inadequate physical activity is an individual behavior, or modifiable risk factor, that contributes to childhood obesity. The rise of technology has contributed to lowered physical activity, and has shifted outdoor play to indoor play. Playing video games and watching television often accompanies unhealthy snacking (Montusi et al., 2012). While most schools implement recess and gym class, many kids age six and older need at least an hour of physical activity, with most of the hour being vigorous activity (Mayo Clinic, 2016). Gym class is rarely held every day in most public schools, and the activity is rarely vigorously aerobic. However, some children are involved in after-school sports, which helps their physical activity levels, and therefore directly helps to decrease their risk of developing obesity. Individual choices made by children and their parents are a determinant of obesity development.

Social factors is another determinant of health, and can be extensively applied to the obesity epidemic in the United States. An important factor to note when discussing childhood obesity prevention is the role of the parents. The younger a child is, the more he or she relies on the parent for nutritional knowledge and support. Employment status, career choice and living wages of the parents can also influence the child's nutritional status. For example, parents that have full time jobs with high-earning salaries may raise their children in a healthier environment. They may be more likely to shop at organic markets and buy healthier, more expensive foods for their family. Conversely, a single parent that works a part-time job and lives paycheck to paycheck may not be concerned with the nutritional value of their child's meals, but more concerned about being able to afford groceries alone. Quality of schools and living conditions

falls under the social factors that determine childhood obesity development. Children that live in poorer communities are more likely to attend schools with limited resources (Huang, Cheng & Thiese, 2013). “High-need” schools often need resources like health education programs and school nurses to carry out and advocate for these programs the most, but because of the high disparity and lack of funding in these schools, resources are unavailable. Although the presence of school nurses has shown beneficial effects on physical and mental health, many schools do not even have school nurses (Huang et al., 2013).

Health services is another determinant of health, which is access to and quality of health services. As stated above, quality of schools and lack of resources in schools can directly contribute to increased obesity rates over time in children. However, primary care providers and nurses are also able to intervene to help lower obesity rates. For example, many children in lower socioeconomic families may have to pay more for services because of lack of insurance, or high co-pays with insurance. Obesity screenings are performed at primary care check-ups for children and are a secondary prevention for obesity. If parents do not have adequate insurance, or have high co-pays, they may be less likely to take their child for their check-up at their primary care physician. Some families may have limited transportation, or may work during regular office hours of their child’s primary care doctor. This disparity presents an issue as well and needs intervention.

The last determinant of health is policies. Policies are developed and implemented by public health professionals and governing bodies (Stanhope et al., 2014). Insurance availability has improved since Obamacare was enacted. Medicaid is insurance that is available for low-income families, while Children’s Health Insurance Program (CHIP) is an insurance program that insures children whose families make too much money to qualify for Medicaid, but not

enough to actually afford medical costs (United States Center for Medicare and Medicaid Services, 2018). These two federal insurance programs help children to be able to be assessed by doctors and nurses in the primary care setting for obesity as well as other health-related issues.

Significance in nursing

Although the topic of this literature review is not hospital-based, the topic of nutritional education is very significant in the realm of nursing and community-oriented nursing. All nurses, specifically community health nurses, should be working to “preserve, promote and maintain health of individuals, families and groups in the community” (Stanhope et al., 2014, p. 2). Most of the programs that will be discussed in this review are based in schools, so school nurses play a crucial role in evaluating the outcomes and progress of the programs that are implemented by assessing children in a longitudinal manner to see if they are improving their dietary habits and losing weight. Many patients that nurses care for in the hospital are ill or unhealthy because of his or her poor eating habits. Heart disease is directly correlated with excess consumption of high-fat and high-cholesterol foods, and many adult patients have some form of heart disease, or are on the track to developing heart disease (CDC, 2017c). Nurses are often the beacon of teaching and education for patients, but most of the time, this education is on new medications or safety. Nutritional education acts as a primary prevention to preventing obesity. Since nurses spend the most time with patients in the hospital than any other health-care personnel, they can serve as a nutrition education source for every patient, regardless of his or her morbidity (Delucia, Ott & Palmieri, 2009). The goal is for the majority of patients in the hospital to have diseases that are not primarily caused by poor diet. If nutrition programs can reach the majority of children, then healthy behaviors and habits can be developed and carried into adulthood, thus

hopefully decreasing obesity rates and also the number of lifestyle-based sick patients in the hospital.

Research questions that were addressed in this review included the following: What setting is most effective for teaching children nutrition education? Who is most effective at teaching children nutrition education? What kind of curriculum works best for nutrition education? Is there an age that is most effective in teaching children nutrition education? How can educators reach the largest amount of children? And, what should the future model look like for nutrition education?

The purpose of this review is to summarize current approaches to educating children on nutrition. This review will attempt to define what an ideal nutritional education program should look like in the future, based on the most current evidence.

Background

Programs for children in daycare

Current initiatives exist to help fight and prevent childhood obesity. The CDC has guidelines for programs that states and communities can put into place. Since 60% of children under six years old attend daycare weekly, the CDC established the Early Care and Education effort (ECE), which targets young children (ages 2-5) who attend daycare or pre-school. The framework for this initiative is called the Spectrum of Opportunities, which outlines standards and practices for obesity prevention in the daycare/pre-school setting that can impact children positively. The ECE effort is not a required national standard, but a guideline that states and communities can implement into daycare centers and preschools to help prevent obesity. The issue with this initiative, is that “successful ECE efforts require strong partnerships with diverse stakeholders, including but not limited to costs, stakeholder support, available resources, reach,

timing cycles and ECE provider needs” (CDC, 2018a). If this policy is implemented in a day care, for example, the provider(s) of care will need to obtain training, obtain an obesity prevention certificate, and figure out a way to incorporate what he or she learned into a curriculum. The ECE effort is therefore merely a suggestion for communities and states, and most daycare centers and pre-schools do not have the proper funding to implement such practices. An option for these daycare centers is to charge the families a fee so that staff members can acquire appropriate training and include nutrition education materials in curricula, but then families may not be able to afford childcare, deterring low-income families, especially. Since there is a positive correlation between low-income and childhood obesity, it seems that the ECE effort that the CDC has outlined is unrealistic for many families in the United States (Vachaspati, Turner & Chaloupka, 2012). Only “25 states dedicate a portion of their total funding to implement obesity prevention initiatives in the ECE setting” and there are “47 standard components for preventing childhood obesity in ECE settings”, and the highest number of components that is met is 14 out of 47, in Mississippi (CDC, 2018a). While the idea behind the ECE effort is valid, since it is not a national standard it is difficult to assess the effectiveness of the strategy. Even if the ECE effort is effective at decreasing obesity rates in young pre-school aged children, it has been, and will likely continue to be extremely challenging to create a nationwide effect.

Programs for low-income families

The Childhood Obesity Research Demonstration (CORD) 2.0 project, also founded by the CDC, focuses on improving nutrition and managing weight in communities that are largely populated by low-income families. The project is a grant program, and the two current grantees are the Massachusetts Department of Public Health and Arizona State University-Tempe. These

grantees emphasize the role of health care providers, the health care team and community members for managing childhood obesity (CDC, 2017b). These people are responsible for screening children for obesity using BMI measurements and providing access to healthy weight programs to children at risk. However, although the screenings are covered by the grant, the grantees are currently working with state and community stakeholders and Medicaid offices to provide these low-income families with access to the weight-loss programs for their children (CDC, 2017b). The grantees are also responsible for evaluating the effectiveness of the programs, so that if they do have a positive effect, the valuable information can be utilized to develop new programs (CDC, 2017b). Although statewide initiatives are not as universal as nationwide initiatives, starting at the state level is a viable beginning to creating a national standard for childhood obesity prevention and screening.

Programs for public schools

The department of health and human services has recognized that schools play a vital role in preventing childhood obesity. However, state governors and state boards of education hold the power to help the schools within the states. Ten strategies to help address childhood obesity have been used by various states, are evidence-based and are outlined on the CDC website. Only the strategies that are particularly important will be described here, as many of them are broad. One strategy that is particularly interesting is strategy 2: “use state and local data to guide decision-making and policy formulation”, which emphasizes the importance of collecting factual data about nutrition behaviors and existing school policies and health programs. “States can obtain this information by encouraging schools to participate in data collection surveys, such as the Youth Risk Behavior Survey” (CDC, 2010). These surveys measure items such as consumption of fruits and vegetables, physical activity and alcohol/drug use, but they fail to assess nutrition

alone, which should be the ideal focus in preventing obesity in children. Strategy 4 concentrates on creating and enforcing policies through legislative action, and requiring schools to develop wellness policies with specific elements, and report back to the state with the progress of the policy (CDC, 2010). Strategy 4 would be difficult to enact because it would need to go through state senates, but it would probably have a desirable outcome on obesity rates. Strategy 5 is important to note because many of the authors of the articles in this literature review model their research around the idea of certifying and training staff on nutrition. Strategy 5 highlights the significance of requiring certification in nutrition education for all key positions in schools, and providing professional development many formats. The professional development factor would serve as an incentive for educators to further develop their resume. Another strategy that is relevant is strategy 7: “Set nutrition standards for foods and beverages offered in schools”. School meals are nutritionally regulated by the federal government, but snack bars and vending machines are not. Therefore, many of these options are high in fat and calories (CDC, 2010). This strategy recommends that “schools reinforce nutrition lessons they are teaching in the classroom with a school nutrition environment that makes it easy for children to make healthy choices” (CDC, 2010). Strategy 8 focuses on the importance of state agencies promoting health education and holding schools and teachers accountable for student performance on the subject. However, health education encompasses multiple topics and subjects, such as safe sexual behaviors and drug and alcohol use. While health education courses that do cover multiple topics can be beneficial as a whole, it is important to note that nutrition education specifically may be overlooked, especially in the high school population in which the primary concern may be to teach students about safe sex. Perhaps an improvement to this strategy can be to create a separate

education requirement with an isolated curriculum revolving around nutrition and healthy diet habits.

In the fall of 2017, “about 50.7 million students attended public school” (National Center for Education Statistics, 2017). Therefore, school-based nutrition programs are sensible to implement in the United States. The CDC has already outlined recommendations for developing healthy eating school-based programs. The CDC suggests that each program includes “recommendations regarding school policies, curriculums, instructions to students, integration of school food services and nutrition education, staff training, family and community involvement” (Veugelers et al., 2005, p. 432). These recommendations are very broad, and include many components, which makes developing an ideal program difficult. The effectiveness of these school programs is therefore difficult to establish and evaluate (Veugelers et al., 2005). When programs are not properly assessed and evaluated for effectiveness, the original goal of decreasing obesity rates and improving nutrition education becomes lost. Many of the programs available do in fact include a family-oriented or community aspect. Some include peer-led nutrition education, with staff that is trained on the nutrition curriculum. Some studies included in this review focus solely on evaluating the effectiveness of other researcher’s nutrition programs, and if a certain approach or setting works best.

State involvement

While the CDC has many guidelines and strategies outlined on their website to help combat the epidemic of childhood obesity, there is an issue in state involvement, as evidenced by only 25 states participating in the ECE effort, for example. Our nation is quite literally split on the issue of obesity prevention. However, perhaps what needs to happen first is smaller-scale programs and initiatives that show promise and positive affect. If programs work in a more

focused and small sample size, they can be evaluated further by gradually increasing the sample size.

The learning aspect

It is important for researchers that are creating these nutrition education programs to understand how children learn, as well. The way that children currently engage best may be completely different than how kids learned ten years ago. The rise of the internet in the last fifteen years has changed the way that children learn and interact (Olinger, 2011). This shift from textbook-style learning and comprehension to internet-style learning has caused children to learn in pieces rather than whole parts. Most kids are more likely to read a short blog about a topic, rather than a long, scholarly article. The influx of technology use has caused a decrease in attention spans and concentration rates, in children and adults (Olinger, 2011). The way in which children learn presently is important for researchers to know in order to develop the most effective nutrition education program. For example, since technology is so prevalent currently, and kids often play on iPads instead of reading long novels, program developers may think about avoiding utilizing written reading materials and handouts for nutrition education. If the ideal nutrition program were to be technology-based, it is also significant to note that perhaps adults that fall into the baby boomer generation may not be the best educators for these children, since most baby boomers did not grow up in an era with a lot of technology and may be biased towards more traditional styles of learning and teaching.

Food literacy

One factor that is associated with increasing obesity is the lowered “food literacy” rates. Food literacy includes cooking skills and access to food. Since fast food meals are widely accepted and consumed, parents are preparing meals for their children less often, which means

that the practice of “eating out” is learned by children and therefore, children never learn cooking skills. Evidence exists that adolescents that engage in food preparation are more likely to have healthier dietary intake (Brooks & Begley, 2013). Although recent changes have been implemented in schools to improve the nutritional value of school breakfasts and lunches, the availability of high-fat foods like pizza is still widespread, and in fact, dangerously high (Masse & Niet, 2013). The time in which children gain the most weight is during the summertime, due to multiple factors. During the summertime, children watch more TV and are less physically active. Children also consume higher calorie foods, because they are more available to them when they are home all day versus at school all day during the academic year (Tilley, Weaver, Beets, Turner-McGrievy, 2014). Since the most rapid weight gain in children occurs in the summer months, many nutritional education programs and interventions focus on intervening during the summertime.

Final thoughts

The CDC has created many initiatives and policies to help enact change and combat obesity in children. However, the lack of nationwide involvement, universality and availability of proper resources causes these initiatives to remain as ideas and guidelines. Many states and communities do not know where to start to help prevent obesity. This literature review will take a step back and examine smaller scale programs that are effective in children, and will attempt to describe what an ideal model for nutrition education should be.

Methods

A literature review was performed to identify current models of nutrition education for children, as well as evaluation of models. Databases used were Medline, CINAHL, PubMed, ScienceDirect and Google Scholar. Databases were searched for peer-reviewed articles, and the

articles were published from the year 2005 to 2017. In order to elicit the most relevant articles to construct this literature review, keywords were used while searching the various databases.

Keywords included *children, child, youth, nutrition, school-based nutrition programs, nutrition programs, childhood obesity prevention, nutrition education, nutrition promotion, nutrition curriculum, summer day camp, diet, intervention and healthy eating.*

The inclusion criteria for the twenty articles that will be discussed in this systematic review is as follows:

- a. Articles must be peer-reviewed.
- b. Articles that are research studies must be IRB approved.
- c. Articles must be either research studies or literature reviews.
- d. Articles must be focused on nutrition education interventions in children (age 0-18 years).
- e. Articles that include adults should focus on changing the child's nutrition, not the adult's.
- f. Articles are aimed at improving nutrition education, and/or decreasing obesity rates, and/or increasing healthy food consumption.

Exclusion criteria are as follows:

- a. Articles concentrate on nutrition education for disease-specific interventions (ex: Diabetes).
- b. Articles that focus on nutrition education for adults only (age 19+).
- c. Articles that described interventions to improve obesity rates with physical activity only.

- d. Articles that focused on implementing policies (ex: Healthy free-school breakfast programs) to help nutrition in children instead of implementing education components to enact change.
- e. Articles with interventions based in the hospital environment.

Articles retrieved from the databases were screened for applicability and the abstracts of those articles determined to be relevant were reviewed. Articles that met both inclusionary criteria and found to have utilized sound methodological standards were included in the sample for this literature review. The final search retrieval resulted in twenty articles to be reviewed.

Some of the articles (nine) found were exclusively used to construct the introduction and background sections of this review, but only twenty of the total of twenty-nine articles will be analyzed further to help answer the various research questions explained in the introduction of this review. Of the twenty articles, the publication dates ranged from 2005 to 2017, and eleven of the twenty were published within the last five years. It is valuable to note that there is no exclusion criterion listed for articles that are not based in the United States. While many of these articles implemented interventions in other areas (Canada, Korea, Australia, United Kingdom, Spain, Brazil), there is no plausible reason to exclude these studies. Perhaps experts and policymakers need to look globally at what other countries are creating to help educate children on nutrition and combat obesity rates. After analyzing the articles, the methods and technology used in these various international interventions are all available in the United States.

While not stated as an “inclusion criterion” it is also important to note that the majority of the articles being reviewed were developed by either registered dietitians and/or individuals with advanced degrees in public health. Eleven articles include either a registered dietitian or someone who works at a nutrition institution in the author list. Of the remaining nine articles to

be reviewed, four have medical doctors listed as authors, one has education experts, three have authors with masters in public health, and one article has an author that is specialized in “family and consumer sciences and education”(Concannon, Rafferty & Swanson-Farmarco, 2011). For this review, it is important to evaluate the producers of the articles being analyzed because since the purpose of this review is to identify and understand the best model of nutrition education, the authors should specialize in one or both of these areas. The next most useful specialty is medicine and public health, because doctors receive an extensive education in overall health and those who study public health understand how to implement policies and how to affect large populations with such policies.

Results

The search retrieval resulted in twenty articles, with varying outcomes and themes in regards to nutrition education in children. Of the twenty articles, five (25%) were literature reviews. Of these reviews, three (60%) described and outlined interventions occurring in schools. The other literature reviews discussed alternative methods for education, such as online platforms and cooking classes outside of the classroom or school. The remaining fifteen articles were research studies, with the majority (14, 93.33%) classifying as quantitative studies. Of the fifteen research studies, nine (60%) were conducted in the United States. The remaining studies were conducted in Canada (1), Thailand (1), Italy (1), the United Kingdom (1), Korea (1) and Japan (1), accounting for the remainder of 40%. Of the fifteen research studies, the sample sizes ranged from ten students to 8,156 students. It is notable to mention that four of the articles included children from low-income backgrounds in the sample. Within the sample of the fifteen quantitative research studies, five were randomized controlled trials (RCT) (26.67%), thus displaying that each of these five studies implemented a control group and randomization,

increasing the validity and decreasing the bias of the results. Apart from the five RCT's, three (20%) other studies implemented a control group, but with no randomization. The publication dates for all twenty articles ranged from 2005 to 2017, with the majority (eleven, 55%) of them with more recent publication dates, within the last five years. The other research studies were quantitative, comparative descriptive studies (eight, 53%). Of these eight descriptive studies, one study implemented a longitudinal design, in which children were observed for four times or more over a period of one year or more (Tanaka et al., 2005). Another study instituted a quasi-experimental design, with a longitudinal component, as the study was conducted for two years (Hollar et al., 2010).

All of the literature reviews were published within the last five years. Two of the five reviews focused on specific nutrition education interventions, such as using “peer-led” teaching and online platforms. The other three reviews were more broad, focusing on nutrition education interventions in general, in the school setting and outside of the school setting.

The twenty studies that are included in the final analysis are mostly recent, with the majority being quantitative research studies, and many also classifying as randomized controlled trials. The strong search retrieval, including various aspects of nutrition education, will help conclusions and implications to be drawn for further research.

Table I. *Summary of findings: nutrition education approaches in school-aged children*

Article name	Purpose	Type of study (review or research study)/ sample size	Methods	Main outcomes
“Peer-led nutrition education programs for school-aged youth: a systematic review of the literature” (Yip et al., 2016)	To summarize the effectiveness of various peer-led nutrition education programs in schools in the US and Canada.	Literature review 17 articles	Online search retrieval	Peer-led nutrition education has the potential to improve knowledge, but youth diets are affected by individual factors and larger aspects, and improved knowledge does not always cause dietary change. Curriculum-based approaches are effective. Teacher-led programs are effective. Parental involvement is effective.
“Effectiveness of School Programs in Preventing Childhood Obesity: A Multilevel Comparison” (Veugelers & Fitzgerald, 2005)	To evaluate the effectiveness of school programs to prevent obesity, improve dietary quality and increase physical activity.	Research study 5200 fifth grade students 279 principals	Quantitative descriptive study	Coordinated programs in schools are more effective than schools having policies alone. Schools are an efficient setting to teach nutrition education. Teachers that use a curriculum-based approach are effective.
“Snacks in the Stacks: Teaching Youth Nutrition in a Public Library” (Concannon, Rafferty & Swanson-Farmarco, 2011)	To educate children on nutrition and prepare healthy snacks in a new venue, a public library.	Qualitative research study 10-30 students per session, middle/high school students	Qualitative program research	Participants stated that they continue to make the healthy snacks with their parents at home. Hands-on approach is effective. Curriculum approach is effective.
“Teaching Healthy Eating to Elementary School Students: A Scoping Review of Nutrition Education Resources” (Peralta et al., 2016)	To understand the availability and quality of resources that are accessible for teachers to support nutrition education programs.	Literature review 32 articles	Online search retrieval	Curriculum, cross-curriculum and experiential learning approaches work the best for nutritional learning in elementary school aged children.

<p>“The Effectiveness of School-Based Nutritional Education Program among Obese Adolescents: A Randomized Controlled Study” (Iw-Iw et al., 2012)</p>	<p>To determine the change in body weight and BMI, as well as diet behaviors 4 months after a nutrition education intervention in a school.</p>	<p>Research study 49 obese girls</p>	<p>RCT & prospective cohort study</p>	<p>Intervention group showed significant decrease in BMI (P=0.016). Pediatrician-led education is effective.</p>
<p>“Kaledo, a board game for nutrition education of children and adolescents at school: cluster randomized controlled trial of healthy lifestyle promotion” (Viggiano et al., 2015)</p>	<p>To promote nutrition and improve diet behavior.</p>	<p>Research study 3,110 9-19 year olds</p>	<p>Cluster RCT</p>	<p>After 6 months, nutrition knowledge increased and BMI’s lowered. Study proved that Kaledo and board-game based learning is an effective obesity prevention tool. Game-based learning, hands-on approaches are effective.</p>
<p>“Promoting healthy weight in primary school children through physical activity and nutrition education: a pragmatic evaluation of the CHANGE! Randomized intervention study” (Fairclough et al., 2013)</p>	<p>To assess the effectiveness of the CHANGE! Intervention on measures of physical activity, body size and food intake.</p>	<p>Research study 318 children aged 10-11 years old</p>	<p>RCT</p>	<p>The CHANGE! Intervention worked to decrease BMI. Teacher-led curriculum and cross-curricular programs with family involvement proves to be effective for nutrition education. SCT is effective as a framework. Web-based programs are effective as a component.</p>
<p>“Healthy Eating in Summer Day Camps: <i>The Healthy Lunchbox Challenge</i>” (Tilley et al., 2014)</p>	<p>To describe the development and evaluate the <i>Healthy Lunchbox Challenge</i> in summer day camps.</p>	<p>Research study 1,977 children, 241 staff</p>	<p>Quantitative descriptive study</p>	<p>Incentive programs are effective. Parental involvement is effective. Hands-on approach is effective. Curriculum-based programs are effective.</p>
<p>“Exposure to Multiple Components of a Garden-Based Intervention for Middle School Students Increases Fruit and Vegetable Consumption” (Evans et al., 2012)</p>	<p>To measure the effects of different levels of exposure to a multiple component garden based intervention on middle schools students FV consumption.</p>	<p>Research study 246 adolescents, 70% low income</p>	<p>Quantitative descriptive study</p>	<p>Garden-based interventions are effective. Curriculum-based programs are effective. Hands-on approach is effective. Social cognitive theory is effective as a theoretical framework.</p>

<p>“My Painted Plate: Art Enhances Nutrition Education with Children” (Forman et al., 2015)</p>	<p>To investigate the impact of visual art on the effectiveness of nutrition education to improve knowledge, self efficacy and dietary behavior of children.</p>	<p>Research study 69 children, lower income</p>	<p>Quantitative descriptive study</p>	<p>Hands-on and curriculum-based programs are effective.</p>
<p>“Nutrition Education Program Improves Preschoolers’ At-Home Diet: A Group Randomized Trial” (Williams et al., 2014)</p>	<p>To evaluate whether a nutrition education program in child-care centers improved children’s at-home daily consumption of fruits and vegetables and other at home dietary behaviors.</p>	<p>Research study 1,143 parents, low income</p>	<p>Group RCT</p>	<p>Curriculum- based education delivered by registered dietitian was effective, parental involvement contributes to effectiveness.</p>
<p>“Cooking Classes Increase Fruit and Vegetable Intake and Food Safety Behaviors in Youth and Adults” (Brown & Hermann, 2005)</p>	<p>To increase FV intake and improve food safety behaviors.</p>	<p>Research study 602; 229 youth, 373 adults</p>	<p>Quantitative descriptive study</p>	<p>Youth benefitted from the hands-on/curriculum-based approach.</p>
<p>“Online platforms to teach Nutrition Education to children: a non-systematic review” (Rodriguez et al., 2016)</p>	<p>To analyze the available evidence about programs focused on nutrition education for children through the use of the internet.</p>	<p>Literature review 9 articles</p>	<p>Online search retrieval</p>	<p>Internet platforms are somewhat effective for nutrition education and provides easy access to nutrition education and expert, internet provides easy record keeping of food consumed. Communicating with peers online is effective in learning. Parental involvement and curriculum-based approaches are effective.</p>
<p>“Adolescent food literacy programmes: A review of the literature” (Brooks & Begley, 2013)</p>	<p>To explore what is known about food literacy programs for adolescents.</p>	<p>Literature review 19 articles</p>	<p>Online search retrieval</p>	<p>Limited nutrition education programs exist that are effective for adolescents (aged 13-17), probably due to the complexity of that specific developmental stage. Peer-led programs are effective. Hands-on, garden-based approaches are effective. Curriculum programs are effective. Parental involvement is effective.</p>

“Effects of an Integrated Health Care Program for Children” (Kim et al., 2016)	To examine the effects of an integrated health care program in elementary school children.	Research study 52 fifth grade students	Quantitative descriptive study	Improved nutrition knowledge and dietary habits after the program. However, the study concluded that long-term nutrition education is needed.
“Effect of a Two-Year Obesity Prevention Intervention on Percentile Changes in Body Mass Index and Academic Performance in Low-Income Elementary School Children” (Hollar et al., 2010)	To assess the effects of a school-based obesity prevention program that included dietary, curricula, and physical activity performance on BMI percentiles.	Research study 4588 children, low income elementary school children	Quasi-experimental design Quantitative descriptive study	Curriculum-based approaches delivered by a registered dietitian or teacher is effective.
“School-based Nutrition Programs Produced a Moderate Increase in Fruit and Vegetable Consumption: Meta and Pooling Analyses from 7 Studies” (Howerton et al., 2007)	To evaluate the effectiveness of school based nutrition interventions on child FV consumption with length of the program as a factor.	Research study 8156 children	Meta/Pooling Analysis	Family involvement, teacher involvement, monthly thematic elements, fresh choices in cafeteria are all effective components in nutrition education. Social cognitive theory as a framework is effective.
“It’s All About Kids: Preventing Overweight in Elementary School Children in Tulsa, OK” (DeVault et al., 2009)	To evaluate the impact of the “It’s All About Kids” nutrition component on knowledge, attitudes and behaviors related to nutrition	Research study 140 fourth grade students	RCT	Hands-on and curriculum based interventions, along with a game-based component are effective in teaching children about nutrition education.
“Predictive Factors in the Success of Intervention to Treat Obesity in Elementary School Children” (Tanaka et al., 2005)	To evaluate a combined nutrition education program involving family and to determine predictive factors in the success of intervention.	Research study 36 obese children	Longitudinal design Quantitative descriptive study	As the visits increased, the index of obesity decreased. Doctor-led tutorials are effective. Parental involvement contributed to the motivation to eat healthy.
“The effect of participation in school-based nutrition education interventions on body mass index: A meta-analysis of randomized controlled community trials” (Augusto Cardoso da Silveira et al., 2013)	To evaluate the effectiveness of school-based nutrition education interventions in preventing obesity among children and adolescents.	Literature review	Meta-analysis of RCT	This review concluded that school-based nutrition education programs are effective in reducing BMI of children, and game-based as well as parental involvement is effective.

Findings

Setting

For this review, assessing multiple settings was essential to determine the optimal setting for nutrition education. Of the twenty articles, thirteen included interventions occurring in schools. Of these thirteen articles, three were literature reviews, which individually described and/or evaluated multiple programs in the school setting. However, some of the interventions within the remainder of the articles (seven) took place in other locations- such as summer day camps, health clinics, daycare centers and community centers such as public libraries. However, to answer the research question of, “What setting is the best for teaching children nutritional education?”, a conclusion that can be drawn that nutrition education in schools is most effective in preventing obesity (Veugelers et al., 2005). While the interventions and programs in alternate settings are unique, not every child has the opportunity to go to day camp, or to a cooking class. However, most children go to public school, and many of these interventions could be applied to the school or after-school setting. Schools play a vital role in improving overall health in children, as children generally attend classes five days per week for most of the year, and schools can reach nearly every demographic and socioeconomic profile (Hollar et al., 2010). This notion also answers the question, “How can educators reach the largest amount of children?”.

Curriculum and experiential approaches

Programs that utilized curriculum approaches were shown to be effective. Curriculum approaches is a very broad category, and all but one source from the sample utilized some sort of curriculum method, whether it was the sole component of the program or a part of the intervention. Curriculum methods can vary, but the goal is that they provide an organized way to deliver education material, with syllabus planning and curriculum materials for the educators and

learners. Subcategories of curriculum approaches are cross-curricular and experiential learning concepts. Cross-curricular components are those in which content is embedded across multiple subjects, with the goal of increasing exposure to the idea and also helping children to make connections. While only two sources included a cross-curricular approach, one of these sources was a literature review, and within that review, thirty-two resources were assessed, and thirteen of the thirty-two programs implemented a cross-curricular approach (Peralta, Dudley & Cotton, 2016). Experiential learning components are essentially hands-on strategies in which children “learn by doing”. Experiential learning, or as many other studies referred to it as “hands-on” learning, has been shown to be very effective in children learning about nutrition, specifically in younger children (8-10 year olds) (Peralta et al., 2016). Of the twenty articles in the sample, eight implemented a hands-on approach, and two of the articles were literature reviews. One literature review focused on food literacy levels in children, and nearly all of the programs discussed had a hands-on component, mostly of which were cooking classes (Brooks et al., 2013). Many of the hands-on programs included in this review were cooking classes, with a curriculum style approach included, as well. The curriculum aspect, together with the experiential, hands-on component, helps the children learn accurate information about proper nutrition, while peaking the child’s interest and reinforcing the didactic material. With this evidence, the research question, “What kind of program works best for nutrition education?” can be partly answered. The programs that included both a written or spoken curriculum and experiential component were very effective at increasing nutritional knowledge (Brooks et al., 2013).

Peer-led programs

Another notable strategy for delivering nutrition education is through peers. Multiple studies included a peer-led component, and one literature review that is included in this review (seventeen articles) was dedicated solely to evaluating the effectiveness of peer-led nutrition education programs. Since the 1990's, peer-led components to promote health have been increasing, and are thought to be effective because children, specifically in middle and high school, are highly influenced by their peers (Yip et al., 2016). Another literature review (nineteen articles) included programs with peer-led components, as well. While oftentimes peer influence and "peer pressure" is thought of as negative, researchers have been utilizing the notion positively to teach children about nutrition, and the evidence shows that it is effective (Yip et al., 2016).

Teacher-led programs

Since many of the articles in this sample took place in schools, teachers were often the source of education for the children. The teachers were taught using other educational materials developed by healthcare providers and registered dietitians, but sometimes "they may not have delivered the interventions exactly as specified in the intervention protocols" (Howerton et al., 2007, p.195). While utilizing teachers for nutrition education delivery is convenient, especially if the interventions are school-based, teachers need to be vigorously trained and must adhere to the intervention protocol in order for children to receive accurate information and for their knowledge levels to increase.

Parental involvement

Since parents oftentimes are a child's role model, and usually buy groceries and provide food for the family, a child's nutrition often depends on the lifestyle, habits and income of the

parents. Researchers therefore believe that parental involvement in nutrition education and learning programs is essential and helpful. A theme within this literature review was parental involvement, and if studies did not include parental involvement, the implications sections stated that in future programs, a parental or familial component should be implemented. Of the twenty articles, eight included parental involvement, and fifteen programs within a literature review of thirty-two sources also included parental involvement components (Peralta et al., 2016). In some articles, parents were educated separately, and in others parents were educated with their child. Some interventions were more interactive, such as family fun nights and specific nutrition-based readings to be completed with a parents. The *Healthy Lunchbox Challenge* was an innovative, incentive-based program in summer day camps that included parent and staff education and involvement. The primary goal of the program was to improve the lunches that children brought to camp, but also as a secondary goal, the researchers wanted to improve camp staff and parent knowledge and nutrition (Tilley et al., 2014). This multifaceted program was able to have positive effects on eating habits and the nutritional value of lunches brought to camp. Parental involvement is helpful in reinforcing nutritional education for children.

The Role of the Healthcare Provider

Health-care providers (registered nurses, registered dietitians, pediatricians) are able to accurately recognize a child who is at risk for obesity, assess a child's nutrition habits, while also providing education to parents and the child about healthy eating habits. Some of the sources utilized a health care provider for direct education. For example, one curriculum intervention in a day care was administered by a registered dietitian, in conjunction with classes for parents and weekly newsletters (Williams et al., 2014). The dietitian also taught the child-care center staff the educational materials, so that they could implement the curriculum when the dietitian was not

present. One program utilized a doctor approach in which a pediatrician educated the parent and child together (Tanaka et al., 2005). Another intervention included a nurse, providing reinforcement of education face-to-face after an online educational program (Rodriguez, Marti, Gasch & Rivera, 2016).

Who is most effective at teaching children nutrition education?

The question, “Who is most effective at teaching children nutrition education?” is difficult to answer after this review. In schools, teachers are readily available and widespread, and seem like the obvious deliverer of education material, since they are trained in education. A shortcoming of this idea, as mentioned prior, is that sometimes the teachers do not adhere to the intervention protocol that they were taught. In most of these studies, if a teacher was taught nutrition material, it was by the program developer, who was usually a registered dietitian or researcher. However, in some studies, the registered dietitian did most of the teaching to the parents and children, to prevent error and maintain reliability and validity of the study. To maintain an effective long-term outcome, parental involvement is a common theme in many of these studies because parents help to reinforce learning and keep their children on track with nutritious diets. However, in multiple studies, parents had to be educated on the material either in conjunction with their children or separately, thus not making them the most effective teacher, but more of an effective learning reinforcement for the child at home.

Thus, this particular research question is very involved and multifaceted. Some studies in this review showed positive results when a pediatrician educated, assessed and re-assessed the child (Tanaka et al., 2005). However, teachers, especially in schools, are readily available and are specially trained in delivering adequate education. Further implications and interventions to better answer this research question will be discussed in the next section.

Game-based learning

One study used games to teach children about nutrition education. The intervention was developed in Italy and is called Kaledo. It is a board game, aimed at children and adolescents in the school setting. The treated group had significantly lower BMI's after eighteen months. This intervention specifically improved BMI scores, whereas many of the other studies in this sample had an outcome of improving nutritional knowledge, only (Viggiano et al., 2015). In a literature review within this sample, fourteen of thirty-two resources had a games-based approach, including board game, crossword, or trivia-style games. This review noted that the games were adaptable and should be used with other curricular, pedagogical approaches (Peralta et al., 2016). Another intervention used a multi-faceted model with curriculum, game-based and experiential components. The game-based component included tic-tac-toe and bingo games geared around nutritional topics (Devault et al., 2009). This intervention did not specifically measure BMI pre/post intervention, however, the results showed promise and proved that a multi-faceted program utilizing game-based learning is beneficial.

Garden-based interventions

Although only two articles in the sample included garden-based interventions, one of them is a literature review. In this specific review, five of the nineteen articles assessed included a garden-based or farm-to-table theme. Some of the interventions were interactive taste-testing sessions using seasonal, local ingredients and some were educational sessions about gardening and cooking with vegetables. The idea behind garden-based nutrition education is that the reason that children in the United States are so obese is because of low fruit and vegetable consumption. Studies have shown that with garden-based nutrition education programs, significant increases in fruit and vegetable intake have been seen (Evans et al., 2012).

Online platforms

Although our society is largely technology-driven, and many curricula in schools are, as well, only four articles in this sample had a web-based component. Two articles were literature reviews, and one review had thirty-two resources, with ten of them using an online component. However, many of the web-based tools were used with other tools, such as positive reinforcement, to help the children to learn effectively about nutrition (Peralta et al., 2016). The other literature review assessed online platforms only, with a few of the programs having an in-person teaching component. The review concluded that the internet is an effective learning tool for nutrition education in children because of the potential to reach a large audience, much like the setting of a school would. However, many of the articles included in this specific review were outdated, so more research must be conducted to assess the efficacy of delivery of nutrition education through online platforms (Rodriguez et al., 2016). The other studies that included a web-based component were multi-faceted and included other aspects and parts to delivering adequate nutrition education, therefore the effectiveness of online-only education is still widely undetermined.

Which age is best to teach children nutrition education?

While the idea of “the earlier the better” is sometimes true, this notion may not hold true for this specific research question. If a child is too young and cannot speak or communicate yet, the educator will likely be solely teaching the parents. However, in this review, out of twenty sources, eight were focused on a mixed children (age 6-12) and teen/adolescent (age 10-19) population, one solely on adolescent girls, and one solely on pre-school aged (age 2-5) children. The other ten articles focused only on preventing obesity and improving nutritional knowledge in elementary-school children (age 6-12). The sample was very split in terms of assessing ages, and

it appears specifically that “few existing adolescent food literacy programmes have demonstrated a positive impact on dietary behaviours” (Brooks et al., 2013, p. 158). To combat this issue, the age that may be best for teaching children nutrition education is elementary-aged children (age 6-12), children that can read and have an adequate attention span. For example, in fourth grade, “children can read and have an attention span of at least 30 minutes”. However, it is important to note that nutrition education can be started at this age, it should not be stopped at this age. Also, learning curves exist and developmental delays are an important factor to consider, as all children develop at different speeds. In order to have a long-term, positive effect on obesity rates in the United States, nutrition education must continue throughout all stages of development. However, beginning in fourth grade can be the most beneficial starting point for a didactic, multi-faceted intervention. The younger a child is, the more individualized the educational intervention has to be in order for effective learning to occur.

Discussion

Outcomes

The findings of this literature review imply that many nutrition education interventions for children exist currently. Of these interventions, many are multi-faceted and interactive, which seems to be the gold standard of an adequate nutrition education program. For example, one program called CHANGE! implemented a teacher-led, cross-curricular learning approach with web-based components, as well as a parental influence and social cognitive theory as a theoretical framework (Fairclough et al., 2013). This particular study also showed significant decreases in BMI long-term, which is a very reliable indicator of improved nutritional knowledge. While many programs included game-based learning, web-based learning, or hands-

on approaches, the programs that utilized multiple components were the most effective at reducing BMI z-scores.

The determination made in the results section of this review was that schools are an ideal setting for nutrition education. While the majority of articles within this literature review were focused in schools, some were not, such as the *Healthy Lunchbox Challenge*, which took place in a summer day camp and *Snacks in the Stacks*, which occurred in a public library. After reviewing the articles that took place outside of school, it can be concluded that these interventions are not location-dependent, and can likely be transferred to the school setting. However, perhaps the developers of these programs should continue their original research and trial these unique and effective interventions in schools.

Implications in nursing practice

Nurses and advanced practice nurses that work in primary care settings, schools and hospitals should take the information from this literature review and apply it to their individual nursing practice. In primary care settings, nurses often screen children for obesity as a secondary prevention for obesity and overweight. While this is helpful, nurses should also educate parents and children not only on proper nutrition, but also enforce the idea of positive reinforcement and involvement with the parents. As evidenced by multiple articles in this review, the idea of positive reinforcement helps children to become motivated to eat healthy. Nurses could suggest to parents creative ideas, such as allowing the child more friend time if their child eats all of their vegetables. It is important to emphasize that the incentive should not be food-related, as this negates the purpose. The incentive should also not be more television or video game time, as this also decreases physical activity and thus could skew results and actually cause obesity. Nurses could also teach the children generally about adequate nutrition, since delivery of nutrition

education by health care providers have been shown in this review specifically to increase nutritional knowledge and decrease BMI (Iw-Iw, Saetae & Manaboriboon, 2012).

School nurses play an important role in this topic, since the setting that is most efficient for nutrition education is in schools. The issue is that many schools, particularly in low-income areas, do not employ a school nurse (Huang et al., 2013). School nurses that are presently employed could help develop the curriculum to be taught by the teachers, or be the teacher themselves. School nurses should also identify children in the school that are at risk for developing obesity, and intervene using a collaborative approach with the child, the child's parents, and the child's primary care provider.

Pediatric nurses in the hospital setting also can use this literature review in their practice. Many children, regardless of their diagnosis, are at risk for developing obesity, whether it be due to their socioeconomic status or their overall lifestyle. Most of the time, the parents have the most control over this situation, so pediatric nurses should educate the parents and child (depending on the child's age) about proper nutrition, and collaborate with either a care coordinator or social worker on the specified unit to ensure that the family can have access to healthy foods if the socioeconomic status of the family is poor. As mentioned above with primary care nurses, inpatient pediatric nurses can also teach parents the idea of positive reinforcement and involvement with healthy eating.

Limitations and implications for further research

This literature review focused on the general nutrition education resources that are available to children. One of the research questions that was posed in the beginning of the review was, "Is there an age that is most effective in teaching children nutrition education?" While the possible answer to this question was explored in the results section of this review, this question is

still open for further discussion. Many of the articles reviewed did not focus on adolescents and high school students specifically, thus implying that either there is a gap in the literature, or that many researchers believe that teaching children nutrition education earlier in life is the most beneficial and therefore refrain from conducting research on that specific age population. No matter the reason, future studies should focus on continuing education throughout adolescence and tailoring current education resources that are effective in younger kids to intrigue the adolescent population.

Another issue that seemed to recur in the articles was the lack of a long-term follow-up and/or a reliable outcome measurement. While most of the studies had a positive outcome, in the “limitations” sections of some of the studies, a lack of a reliable, long-term outcome measurement was noted. The most effective results measurement is the reduction of BMI z-scores, because this shows an application of learning from the nutrition education resource, but also displays somewhat of a long-term effect. A few researchers utilized BMI scores to measure program effectiveness, such as the developers of Kaledo, the nutrition board game (Viggiano et al., 2015). The CHANGE! intervention also decreased BMI over time (Fairclough et al., 2013). One study that utilized a pediatrician to deliver nutrition tutorials to already obese adolescents consequently used BMI percentiles to measure curriculum effectiveness. However, more studies need to be conducted that use a combined outcome measurement of qualitative opinions of program participants, as well as BMI reduction percentiles or scores.

A multi-faceted program including a physical activity component could be a beneficial approach. A limitation of this review was not searching for and including more articles that included physical activity interventions, since it is clear that physical activity levels are a

determinant of childhood obesity. Future literature reviews should search for studies that implement physical activity and nutritional education components.

One of the determinants of obesity is health services and access to resources. Many families of low socioeconomic status have trouble accessing healthy food, and some are even unable to afford proper primary care. While the idea of nutrition education occurring in schools provides for some nutrition education to reach children, the continuation of healthy eating and promotion must be present for effective reduction of BMI and prevention of obesity, and this continuity is sometimes difficult or impossible for families of low socioeconomic status to achieve. This literature review specifically did not focus on accessing these families, but future studies should solely focus on nutrition education resources for children in poverty, since they are most often, at highest risk (Huang et al., 2013).

Implications in policy development

The background section of this literature review detailed that the CDC outlines strategies and guidelines for obesity prevention. However, mandated obesity prevention policies need to be enacted in order for considerable change to occur nationwide. While this review did not specifically focus on policy development, and articles that solely focused on policy development to enact change were excluded from this study, some studies had a policy element. One study stated that “the effectiveness of school-based healthy eating and physical activity programs is critical to evidence-based health policy and to justify broader implementation of successful programs” (Veugelers et al., 2005, p.3). Ideally, the most effective and evidence-based nutrition program model should be tested and trialed in multiple schools so that stakeholders and government agencies can see that the program model is efficient and effective. However, the issue is that there is no one model that currently exists to trial. Researchers can take the

information from this literature review, and the suggestions outlined above, to attempt to develop a single model nutrition education program to implement in schools. Although policy enactment could take years on this subject matter, school boards and leaders should take action and initiative by trialing nutrition education models by using the information from this literature review. School boards, officials and nurses must recognize that they play a larger role than just educating students on traditional subject matter, and that nutrition education in schools is a vital component that can decrease obesity rates in the United States.

Future model

The overarching research question presented in the introduction of this literature review was, “What should the future model look like for nutrition education?”. After reviewing the current research, the setting for nutrition education should be schools. While some interventions took place outside of schools, those interventions were not location-dependent. Since many of the programs in this review were located in schools, teachers often taught curriculum to children. In many interventions, peers also participated in teaching their classmates nutrition education. This idea supports the use of the social cognitive theory, “which focuses on the interaction between social and environmental factors on behavior”, which many of the studies in this literature review included as a theoretical framework (Fairclough et al., 2013, p.3). Most often, the peer leaders and teachers would learn the nutrition education information from a third-party resource, such as researchers or dietitians. Ideally, since the presence of teachers and peers has shown to be beneficial, a collaborative approach utilizing a peer-led curriculum, with the guidance of teachers, along with parental involvement and positive reinforcement at home would be the ideal model. The actual curriculum would ideally be flexible enough to be able to implement within regular classes in elementary, middle and high school. In elementary school,

nutrition class could happen in conjunction with gym class. Gym class in most schools is usually a few times per week, so perhaps gym time can be split between physical activity, and nutrition curriculum. Peers and gym teachers could teach the material collaboratively. Cross-curricular approaches are also effective, so perhaps if teachers could incorporate the nutrition curriculum during math, english and science classes, this would increase the child's exposure to proper nutrition information. Since the hands-on approach is helpful for students to effectively learn, the peer leaders could help during a cooking lesson, for example. Perhaps during recess, children can have the option of playing Kaledo, the nutrition board game, and whoever wins the game receives a prize, displaying positive reinforcement, which has also been shown to be an effective learning tool in younger children (Tilley et al., 2014). During computer time, games could be available that increase healthy nutrition. Overall, the nutrition education model for elementary-aged children should be multi-faceted, with a specific emphasis on the hands-on and cross-curricular approach.

While the standard nutritional model could be effective alone, other elements could be incorporated to reinforce good nutrition. For example, monthly themes in promotion of good health occurred in schools could be implemented. One month could be "nutrition awareness month", and children in schools could participate. Upon participation, children would receive prizes or incentives. For example, maybe an after school healthy cooking class could be offered, run by some staff and parent volunteers. If a child participates, he or she would receive a sticker, that could be tallied and at the end of the nutrition month, he or she could win an even more attractive prize in accordance with the amount of stickers he or she received throughout the month. *The Healthy Lunchbox challenge* is also a good program which was discussed in this review. Although this intervention occurred in a summer day camp, it can be transferred to a

school setting, in which children work with their parents to create a healthy lunchbox (Tilley et al., 2014). Including these monthly thematic elements, along with the basic didactic curricular approach in the classroom, may help increase nutritional knowledge and decrease obesity rates.

Conclusion

This literature review attempted to summarize the current nutrition education models, while answering various research questions to seek to understand the gaps in the literature and in which areas further research must occur. After reviewing the twenty articles, it was determined that a school-based multi-faceted, disciplined nutrition education approach, taught by teachers with the help of fellow peers, may be the most effective model presently. With the help of parental involvement and positive reinforcement at home, a beneficial, long-term outcome is likely to be seen.

Future studies should examine low socioeconomic status populations, and assess how at-home proper nutrition can be encouraged and met. More research is also needed to determine if a physical activity component should also be included in the nutrition education model, since physical activity has been shown to decrease the risk for chronic disease and obesity (Veugelers et al., 2005). This literature review also failed to find adequate learning programs for adolescents and teens, so future reviews and studies should target the older age groups in order to provide a cohesive continuity of nutrition education throughout primary school.

Obesity leads to mortality-related diseases, and a decreased quality of life. Psychosocially, overweight children are often bullied by peers, which can lead to depression (Walden Behavioral Care, 2017). School-based nutrition education programs provide an excellent opportunity to help decrease obesity rates and increase nutritional knowledge because school settings can reach many children, and children are learning alongside their peers,

providing a social aspect supporting the social cognitive theory. In order to acquire interest of all children, multi-faceted approaches utilizing game-based, web-based, and hands-on lessons should be used. To effectively enact change in the future, school officials, school nurses, and healthcare providers must collaborate and not ignore the evidence that school-based programs are an effective environment to implement nutritional education. Proper nutritional education that is initiated early in the life span will help to decrease childhood obesity rates, will decrease obesity-associated chronic diseases that develop later in life, and increase overall quality of life.

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