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Preventing obesity and cardiovascular disease in at-risk youth

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Preventing Obesity and Cardiovascular Disease in at-risk Youth

An Honors College Project Presented to
the Faculty of the Undergraduate
College of Health and Behavioral Studies
James Madison University

by Allison Patricia Woolf, Nicole Ashley Bauernfeind, Rachel Katharine Civale, Elizabeth Rose Spellman

Fall 2017

Accepted by the faculty of the Department of Nursing, James Madison University, in partial fulfillment of the requirements for the Honors College.

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PUBLIC PRESENTATION

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Abstract

The literature review that was conducted focuses on exploring the most effective way to prevent development of Cardiovascular Disease (CVD) as a late effect of childhood obesity or risk thereof. Our research focused on the 8-10 year old at-risk and obese pediatric populations and whether the use of interactive educational interventions in the community setting can be of use to reduce CVD development and improve overall health status. Our findings determined that interactive educational interventions early in childhood can improve health outcomes for these populations and prevent subsequent development of CVD. We minimized the inclusion of all research whose evidence was categorized as a level I. Limitations to our review included focusing on the pediatric population between the ages of 8 and 10 years at risk for or already diagnosed as obese, rather than on the entirety of the population. A second limitation involves research in that it should be conducted to determine how results vary between children who modify both diet and exercise routines as compared to those who only modify one.

Keywords: Obesity, Children, Community Health Nursing, Pediatrics, Education, Cardiovascular Disease (CVD)

Table 1. Evidence

Author, Yr. / LOE	Sample	Study Purpose	Variables	Study Outcomes
Bardi et al., 2014 LOE: V	N = 74 schools (2006) and 69 schools (2010)	To describe activities used to initiate health promotion in the school setting.	Growth, nutrition, hydration, photovoice, roleplay, and fitness health promotion activity variables implemented in schools.	Student participation in health promotion activities three or more times a week resulted in students eating sweets less than once/week. Schools have decreased antismoking efforts as compared to anti-bullying and increased physical activity.
Brown et al., 2016 LOE: III	N = 17 studies concerning school-based, obesity-related interventions	To examine the effectiveness of school-based interventions focused on the alteration of dietary intake and physical activity to reduce the incidence of childhood obesity.	Physical activity, fruit intake, vegetable intake, sedentary time, screen time (including TV viewing time only), and sugar sweetened beverage intake behavioural moderators.	Six out of fourteen studies resulted in an improvement in BMI in the total intervention group, while nine out of fifteen studies resulted in an improvement in BMI in the total intervention group or subgroup. Studies that analysed subgroupings reported that improvements in BMI were greater for older children, girls, and white girls, while others found neither sex differences nor weight status differences.
Callen et al., 2013 LOE: V	N = 4 documents reviewed by experts in the field of education and practice	To bring together and analyze a large sum of documents that are related to community health nursing and BSN degrees to compile the most effective terms, theories, professional values, and core competencies in order to create the best outcomes.	None	The best outcomes in community health nursing and nursing care depend on the knowledge of the individual guiding interventions, such as registered nurses with BSN degrees.
Chen et al., 2016 LOE: III	N = articles discussing theories surrounding intake of oral herbs to decrease obesity	To determine whether using and supporting certain herbs in the youth population will decrease the likelihood of childhood obesity and associated chronic diseases.	Outcomes of gut microbiota-herb interactions targeting obesity.	When dealing with both chronic obesity and its prevention in youth, traditional herbs hold great potential to improve people's health and wellness, particularly in the area of chronic inflammatory diseases although the mechanisms of action remain poorly understood.
Dietz et al., 2015 LOE: III	N = 130 3-11 year olds	To examine how practical opportunities for diet and physical activity shape behavioral intentions and achieved behaviors.	None	The most feasible modifiable behaviors that healthcare providers can help with include guiding the individual to healthy food options and vendors, shopping more effectively on a limited budget, and guiding and helping them to alleviate their depression, use a community based approach to promote safe physical activity, and helping personalize choices to individual morbidity.

Guest et al., 2013 LOE: II	N = 21 child and family health nurses from two rural and one regional cluster	To determine the effectiveness of implementing The Framework in community health nursing.	Three methods of implementing a statewide professional practice framework (Online learning, clinical practice consultancies and skill assessments related to routine infant and child health surveillance); results of/from evaluation questionnaires and focus groups.	Online learning, skills assessments and model of clinical practice consultancies were identified as central to ongoing orientation, education and professional development.
Harrell et al, 1996. LOE: II	N = 1,274 3rd and 4th graders from 12 schools across North Carolina	To determine the effectiveness of a classroom based intervention that is focused on reducing CVD risk factors in elementary aged children.	Whether the students participated in an 8 week exercise program and 8 weeks of nutrition and smoking program, as opposed to not participating in any program.	Children in the intervention group had significantly greater knowledge and a significant increase in self reported physical activity than the children that were in the control group. Children in the intervention group had reduced total cholesterol levels, an increase in aerobic power, a decrease in body fat and a small increase in diastolic blood pressure.
Hayman et al, 2007. LOE: II	N = 113 evidence based articles concerning cardiovascular health in adolescents	To exemplify the importance of early childhood education to prevent CVD and the role that Advanced Practice Nurses play in the role of educating the population.	None	A life course approach for primary prevention of CVD needs to begin in early childhood. The development and maintenance of healthy lifestyle behaviors and therapeutic lifestyle changes are essential in reducing the risk of CVD. Interventions are more effective when APN's are the educators.
Kavey et al, 2003. LOE: I	N= 47 evidence based articles concerning common risk factors in children and adolescents that lead to later development of atherosclerotic disease	To determine the best method to prevent the development of atherosclerotic disease in adults by focusing on the health of children and adolescents.	None	Results indicated two different prevention guidelines, one that promotes cardiovascular health promotion across the entire pediatric population and the second, to identify and focus on children who are at high risk for developing atherosclerotic disease. It is necessary to begin implementing primary prevention methods early in youth to prevent progression of the disease in middle adulthood.
Knox et al, 2012. LOE: III	N = 115 7th, 8th, and 9th grade children	To study CVD risk factor response in adolescents following implementation of brisk walking in curriculum lessons, called Activity Circuit Knowledge, in an attempt to increase school time physical activity.	Activity participation	Prevalence of elevated waist circumference, systolic blood pressure, triglycerides, and reduced high density lipoprotein cholesterol decreased in the intervention group. There were significant improvements in the ratio of high density lipoprotein cholesterol to total cholesterol.

Lanas et al., 2016 LOE:III	N = 7,524 women and men, aged 35 to 74 years	To determine the prevalence of obesity in South America and improve upon limited population-based data regarding the topic.	Demographic characteristics, age, sex, education, occupation, household income, health care access, personal history of CVD and risk factors, physical activity, diet, height, weight, waist circumference, and blood pressure.	The prevalence of obesity and central obesity were 35.7% and 52.9%, respectively. The prevalence of obesity and central obesity was higher in women, and even higher in women with lower education compared with women with higher education. In men and women obesity was associated with a higher prevalence of diabetes, hypertension, dyslipidemia, low physical activity, and a lower prevalence of smoking.
Lavon et al., 2006 LOE: VI	N=50 high school students from 9 different counties in Mississippi	To implement a CVD information intervention program for school aged students and to test the students basic knowledge of CVD information.	None	The knowledge students had about health risk and preventative measures increased, showing that education is an important factor in CVD prevention programs.
Lewallen, et al., 2015 LOE: VII	N = CSH and whole child approaches	To inform best practices that touch on both the physical and emotional needs of students in order to most effectively educate the population.	None	By focusing on children and youth as students, addressing critical education and health outcomes, organizing collaborative actions and initiatives that support students, and strongly engaging community resources, the Whole School, Whole Community, Whole Child approach offers important opportunities that will improve educational attainment and healthy development for students.
Loprinzi et al., 2015 LOE: IV	N = 2,629 youth aged 6-17 years	To determine if simultaneously consuming a healthy diet and regularly being physically active in American youth more often results in favorable CVD biomarkers.	None	Children who were consuming a healthy diet and were active had significantly lower waist circumference, c-reactive protein, and triglycerides than children consuming an unhealthy diet and who were inactive. Those eating healthy and who were active also had lower c-reactive proteins and total cholesterol levels than those only doing physical activity. No significant differences in risk factor levels were found among the children engaging in both healthy behaviors and those only consuming a healthy diet.
Mozaffarian, D., 2016 LOE: I	N = 325 surveys covering 88.7% of the global adult population	To summarize the modern evidence for health effects of diet on cardiometabolic diseases, including key evidence-based priorities, relevant mechanisms, and major unanswered questions, and the evidence on barriers and opportunities for behavior change in the clinic, health system, and population, including novel policy and technology strategies.	None	The global challenge of diet related obesity, diabetes mellitus, and CVD need to become a priority in clinical care, advocacy, research, and policy.

Nigg, C. R., et al., 2016 LOE: V	N = 590 articles using Google Scholar, Medline, and EBSCOhost databases and the keywords childhood, obesity prevention, and nutrition	To effectively prevent or reduce obesity in children ages 2-10 years.	Variables of interventions include the home, school, and/or community environments. Intervention components included health education or promotion, behavior modification, and/or school health policy.	In order for strategies to be most effective, changes should simultaneously occur in the child's home, school, and community environments.
Reinehr et al., 2006 LOE: VI	N= 203 obese children aged 6-14 years	To determine the effectiveness of an obesity intervention program in children for decreasing weight and CVD risk one year after completion of the intervention.	None	Children who were not exposed to the intervention had higher blood pressures, insulin resistance indexes, insulin and HDL, and LDL cholesterol levels than the 174 children who were exposed to the intervention. SDS-BMI decreased in 126 children who were exposed to the intervention.
Serassuelo Junior, H., et al., 2015 LOE: VI	N = 785 schoolchildren, 410 girls and 375 boys participated in the study	To investigate the impact of overweight and obesity on self perception and overall self-concept in children and adolescents.	BMI, age, skin color, and socioeconomic status.	The obese group was more likely to present imbalance in behavior and emotion. The results demonstrated a negative impact on the child's perception of their overall self-concept and its domain that is caused by obesity. The magnitude of the effect caused by obesity, especially in adolescence, extends beyond objective observations in the biological context.
Siegrist et al., 2011 LOE: IV	N =15 secondary schools in southern Germany	To implement a comprehensive randomized controlled school and family based lifestyle intervention trial in secondary schools.	None	Interventions did not have a direct correlation to the decrease of BMI but did increase physical activity levels amongst the targeted group.
Siltanen et al, 2014 LOE: IV	N = 72 children's health visits	To define how useful the Weighty Matter Toolkit (WMT), a new version to health counseling, is as opposed to normal protocol used in family-oriented care.	The nurse educating the family, the type of education received.	The use of the WMT made communication more individualized and more informal than a regular health visit. The WMT diversified the content of the discussion allowing the concentration to be on more than just physical skills the family had.
Weiss et al, 2016 LOE: II	N = 52 men and women ages 45-65	To test the hypothesis that weight loss from calorie restriction and exercise combined improves CVD risk factors to a greater extent than weight loss from weight loss or calorie restriction or exercise alone.	How the clients went about losing 6-8% of their weight.	Reduced risk of CVD was found to be equal in dietary restriction alone, exercise alone, and combined exercise and dietary restriction. There are benefits not directly related to weight loss, such as decreased BP, plasma lipids, and fasting blood glucose. Exercise is a protective factor against CVD and calorie restriction alone is not beneficial, but combining them is.

Table 2. Classification of Evidence

Level of Evidence	Definition	Number of Articles Reviewed
I	Evidence from a systematic review or meta-analysis of all randomized and controlled trials(RCTs), or evidence-based clinical practice guidelines based on systematic reviews of RCTs	2
II	Evidence based from at least one well-designed RCT or single non-randomized trial	4
III	Systematic review of correlational/observational studies	5
IV	Single correlational/observational study	3
V	Evidence from systematic reviews of descriptive and qualitative studies	3
VI	Evidence from a single descriptive or qualitative study	3
VII	Evidence from the opinion of authorities and/or reports of expert committees	1

Introduction

Obesity has become an epidemic in the pediatric population and has been proven to lead to later development of other chronic conditions, such as Cardiovascular Disease (CVD). The prevalence of obesity in conjunction with risk factors of CVD is very high and has been widely stated in literature to be a focus of public health (Lanas et al., 2016). Chronic illnesses that lead to comorbid conditions, such as obesity, are often reversible or preventable by implementing early educational interventions and lifestyle modification practices. It has been shown through research that obesity, in general, is associated with a higher prevalence of diabetes, hypertension, dyslipidemia, low physical activity, and a lower prevalence of smoking (Lanas et al., 2016). All of the aforementioned factors qualify as modifiable and can be targeted first and foremost through educational means. Educational interventions in the at-risk pediatric population, which is defined as those being at risk for or medically diagnosed as being obese, have shown to prevent later development of CVD and improve health outcomes in this population (Lewallen, Hunt, Potts-Datema, Zaza & Giles, 2015). The following literature review has been conducted to analyze and explore previously conducted studies on the reduction of obesity and subsequent development of CVD in the at-risk pediatric population. Interventions reviewed in the studies included incorporating exercise and healthy eating habits as therapeutic lifestyle modifications in daily life. To improve the quality of the cultivation of findings, level I evidence studies were excluded. Findings indicate that the most effective differences in relation to childhood obesity and subsequent development of CVD are made through the integration and involvement of youth, education, and their guardians, as well as assuring that the target audience is consistently stimulated throughout the learning process. It was also found that including parents in the process led to greater benefit from the information being disseminated. Obesity is a global

challenge and therefore must be brought to the forefront of clinical care, advocacy, research, and policy (Mozaffarian, 2016).

Study Commonalities

There are a plethora of interactive educational activities available for effective intervention in the lives of at-risk or obese children. These activities are likely to improve overall health outcomes and reduce the risk of comorbid incidence of CVD. Factors necessary to bolster the effectiveness of educational interventions were identified. Intervention through the school system proved to be the most effective way to implement education interventions. This medium for intervention provides for a community based approach to the prevention of potentially life complicating chronic illnesses. Schools that implemented educational programming about healthy eating and exercising found that students participated in health promotion activities more frequently (three or more times per week) and consumed sweets less frequently (less than once per week) (Bardi et al., 2014). The level of education of the individual presenting the educational material had an influence on the effectiveness of the intervention, as well – the higher the education level, the better the outcomes (Callen et al., 2013). Lifestyle modification intervention early in life is key to the prevention of obesity and later development of other chronic conditions. A recurrent theme in the literature is that early prevention impacts lifelong engagement in health promoting lifestyle choices and better outcomes into adulthood. (Hayman et al., 2007). In this particular case, early prevention and lifestyle modifications aimed at health status improvement include healthy eating and exercise. School-based interventions reviewed focused on the alteration of dietary intake and physical activity. Reduced incidence was empirically demonstrated by lowered body mass index in study participants (Brown et al., 2016). The earlier the intervention can take place and be reinforced the more likely the healthy habits will become a permanent change in target populations (Kavey et al., 2003). Studies indicated that children perform better educationally and have better outcomes when positive choices and

activities are demonstrated to them as opposed to being independently learned. Increasing a child's understanding by age appropriate education about the importance of the interventions and their desired outcomes enhances children's motivation to participate and become engaged. Furthermore, by targeting children with educational materials that are interactive and game-like, the ability to learn and retain information has been proven to be vastly increased (Siltanen et al., 2014). Lastly, once children have an understanding of why they need to be active and maintain their health, it is important for parents to become involved. Parental participation in these educational interventions helps to promote reinforcement and commitment outside of the school setting. In particular, parental involvement helps children maintain healthy eating and exercise habits and may even help parents simultaneously make such changes (Nigg et al., 2016). These findings together have demonstrated the importance of intervening early to reduce the development of negative health outcomes later in life.

Study Differences

In reviewing the research, we found that certain aspects of interventions were manipulated to determine what would allow for the best outcomes. One of the most important variables found within the studies involved the means by which children were educated about necessary preventative measures to reduce their likelihood of developing CVD. It was found in the synthesis article by Callen et al. (2013) that, in order to deliver the most effective knowledge and subsequently obtain the most desirable outcomes, it would be necessary to have a nurse with minimum of a Bachelor of Science in Nursing to educate the target audience. There was evidence to suggest that the knowledge of the individual disseminating the health information and proposed interventions to children was directly related to the degree by which the children benefited from what they were taught. Though not as practical to uphold in every school across the nation, another article by Hayman et al. (2007) suggested that advanced practice nurses would provide the most benefit for making permanent treatment changes that lead to reduced risk for the development of CVD in youth culture. Other articles suggested the opposite and found that those closest to the children would be of most benefit in helping them make desired changes; however, the literature failed to mention their effect on lifelong outcomes. Harrel et al. (1996) found in their school based educational program that it is just as beneficial to students at the time of its implementation if their parents and/or personal educators took the initiative to echo the health values the children are being taught to engage in. This article did not speak of longitudinal effects, but it did find that, after a 16-week duration, students who participated experienced a marginal increase in health related knowledge, a significant increase in self-reported physical activity, and better physical health overall. This personal approach to health related changes was confirmed in the article analysis performed by Nigg et al. (2016). The authors found that long

term change in youth habits begin and are most effectively implemented when the child is surrounded by positive influences in both the home and community.

Another important difference in the research reviewed revolves around just what exactly should be targeted when educating children, whether it be nutrition, physical activity, information about CVD's effects, or a mixture of each. Several articles found that improved diet is the foundation needed to lower lifelong risk of CVD development. Loprinzi et al. (2015) found that, by looking at specific biomarkers related to CVD following implementation of several interventions in three groups, (those only eating healthy, those only exercising, and those who partake in both healthy activities) children who only participated in increased physical activity showed poorer results than those in the healthy diet and healthy diet and increased physical activity groups. Furthermore, children engaged in healthy diet and healthy diet combined with increased physical activity groups did not demonstrate significant outcome differences. The study concludes that the most important aspect to target when educating youth on prevention of CVD is diet, as opposed to physical activity. This finding was confirmed in Mozaffarian's (2016) global survey of the adult population. Those surveyed agreed that youth who refuse to follow and maintain a healthy diet and eating habits not only increase their risk for developing heart disease as they age, but also diabetes type II and obesity. Siegrist, Hanssen, Lammel, Haller, and Halle (2011) countered this point by arguing that physical activity did indeed make a necessary difference. Though they did not test cardiovascular biomarkers in their study, they focused on the body mass index of children when determining the outcomes of their interventions. Physical activity had a significant impact on the Body Mass Index (BMI) of children, while healthy diet alone did not. A study by Knox et al. (2012) also found that, through implementation of physical activity-based interventions solely within the school setting, students benefited by a reduction in

risk factors associated with four of the five elements of metabolic syndrome. This correlates directly with the prevalence of CVD in that, although the biomarkers were not specifically examined, physical activity makes a significant difference in long-term health outcomes. Different still, Lavon, Monique, Brenda, and Clifton (2006) focused on educating youth populations about CVD, how it is caused, and basic preventative measures. This impacted participants by vastly increasing their health knowledge (2006). Brown et al. (2016), Bardi et al. (2014), and Dietz et al. (2015) studied the effects of a combination of all three aspects. This proved to make difference in youth health outcomes. Weiss et al. (2016) confirmed the use of these methods by implementing and testing whether education about CVD's causes and basic preventive measures led to a decrease in its risk factors. The article confirmed that, as a result of targeting any combination of the three core health values of physical activity, diet, and education make a difference in the health outcomes of youth.

Finally, it is also important to consider which population of youth would benefit most significantly from implementing any number of health related interventions. Those who are at highest risk for the development of CVD were identified as an ideal audience to educate and subsequently improve health related outcomes for (Kavey et al., 2003). This specific population is also commonly linked to the obese population, which makes them subject to significant self-concept issues related to an imbalance in behavior and emotion (Serassuelo Junior, et al., 2015). Youth with family members who are suffering from cardiovascular related illnesses, obesity, metabolic disease, or any other number of existing chronic illnesses are typically at higher risk for developing CVD when they are older (Lanas et al., 2016). Therefore, though the entire population would benefit from interventions, certain researchers argue that, in order to make the most observable difference, it is beneficial to focus on higher risk populations. This can be

accomplished by determining family incidence of CVD, obesity, metabolic disease, or other chronic illnesses.

Inconsistencies/Gaps Among Studies

When examining the research, inconsistencies and gaps were found among the studies. While multiple studies examined various interventions, the literature was inconclusive about which were the most effective for preventing childhood obesity and subsequent development of CVD in adulthood. In a long term study conducted by Reinehr, de Sousa, Toschke, and Andler (2006), physical activity was utilized as the sole intervention for the reduction of CVD risk factors in obese children. Two years after the randomized controlled trial, the subjects of the study had reduced their blood pressure, BMI, and continued physical activity. The authors concluded that encouraging physical activity is an effective long term intervention. This study differs from that of other research that strictly utilized childhood education about preventing CVD by reducing risk factors as the sole intervention in reducing the likelihood of children developing CVD as adults. The study used guided instruction as the primary intervention. Fifty high school students from nine different counties in Mississippi were given a test prior to and after the guided instruction to determine if their learning was successful. The study demonstrated that the children's basic knowledge about CVD and risk factors were greatly improved (Lavon, Monique, Brenda & Clifton, 2006). However, it is unknown if this is an effective strategy to reduce the development of CVD in adulthood. Another study by Loprinzi et al. (2015) concluded that children who ate a heart healthy diet and had regular physical activity concurrently had more favorable outcomes in reducing their risk of CVD development than those who only ate a heart healthy diet or participated in physical activity. When examining the conclusions from these three studies it is found that a gap in the research exists – a conclusion does not exist outlining which intervention is the best for prevention of childhood obesity and the subsequent development of CVD. To come to the most accurate conclusion of how to prevent these major

health issues, a longitudinal study needs to be conducted to incorporate all three methods of intervention: education about CVD, healthy eating, physical activity, and a combination of all three. Only then will the most effective way to prevent childhood obesity and the development of CVD be determined.

Along with inconsistent conclusions on how to best educate children on CVD risk factors, articles differ in whether or not varying groups of children should be targeted for the education. For example, there are currently two different guidelines recommended by the American Heart Association for primary prevention of CVD. One set of guidelines recommends education for the entire pediatric population on CVD and its risk factors while the other guidelines recommend offering intervention to groups of children who are determined to be at high risk for developing the disease (Kavey, Daniels, Lauer, Atkins, Hayman & Taubert, 2003). The main difference between the two guidelines is that, for children deemed at higher risk for development of CVD, more goal setting and measuring of progress that includes family members is mentioned. Current studies discuss early primary prevention in the entire pediatric population as being an important factor for reducing childhood obesity and the subsequent development of CVD. Few articles implemented strategies in specific high-risk groups of children. Additional studies need to be conducted to determine the most effective obesity and CVD prevention methods for children deemed high-risk. Determining the best methods to track their progress over time would also be of benefit to this population of children.

Linking Evidence to Practice

In utilizing thorough review of the research related to childhood obesity and the subsequent development of CVD and as future health care providers, we are able to make several prevention recommendations for practice. We have taken notice of knowledge required for implementation into practice and revealed its potential benefit to the future children and families we will come into contact with throughout our nursing careers. Likewise, we have uncovered its usefulness to us as we prepare to educate young children attending an after school enrichment program in Rockbridge, Virginia. Such recommendations, we found, may also be useful to those working within the school system and who may influence and/or play a role in the lives of children.

First, we recommend standardized teaching on healthy eating and exercising be promoted in the school system and utilized within the healthcare arena. This will ensure children and their families become knowledgeable about prevention measures necessary to reduce obesity and the subsequent development of CVD. It is recommended that children be introduced to obesity related prevention measures when they are of the primary school age, as first-hand interventions have proven to be more effective in the younger than the older child. Furthermore, we recommend children be exposed to obesity-related prevention interventions by knowledgeable adults who have pursued higher education to ensure that they receive high quality and accurate information. Lastly, we recommend that parents be included in their children's education about prevention measures, and that they play an active role to promote reinforcement of teachings and improve adherence to specific interventions.

Knowledge about obesity, CVD, and its related factors is needed to ensure proper implementation and standardization of prevention measures within the school system and

healthcare arena. Knowledge surrounding the process of implementation in respective locations is also necessary to ensure protocol is adhered to and information communicated is delivered methodologically. Furthermore, it would be of benefit to children to be educated by individuals who have knowledge about their growth and development at various ages. This is likely to enhance a child's understanding of and assimilation to preventive education. Finally, healthcare workers, as well as those working within the school system, must be knowledgeable about the parent-child interaction and how to assist parents who may be reluctant or hesitant to become active participants in their child's healthcare. Such knowledge may also be beneficial in helping improve the relationship between parents and children so as to enhance the attainment of education that is received via parental interaction. Parental participation and adoption of CVD prevention recommendations will enhance the child's understanding and incorporation of the education and may also serve to diminish CVD risk factors in parents themselves. This may also provide children a source of comfort and reduce the stress of inconsistencies between school and the home environment.

Recommendations previously discussed are useful to both children and those who may come into contact with children, such as healthcare workers, or nurses, parents/guardians, and teachers and others working within the education system. Recommendations may be of benefit to children, as they are likely to improve their understanding and retention of information, as well as their adherence to prevention measures as they grow, develop, and mature with time. Such recommendations may be useful to healthcare workers and those of the education system, as it is likely to enhance their delivery of knowledge surrounding prevention measures to children at risk and, in turn, increase the amount of information such children retain following education. Parents/guardians, too, may find the recommendations listed helpful so as to improve their

relationship with their child and increase their confidence and feelings of self-worth. This can be achieved in that it will allow children to take charge of their health and parents to be of assistance when support and encouragement is needed. Lastly, such recommendations may be of benefit to parents by helping improve their ability to enforce their child's understanding of information and increase their adherence to interventions implemented.

Implementation

We presented findings from the research we analyzed at the YMCA After School Enrichment Program for at-risk youth in the Rockbridge, Virginia area. The program provides families with affordable after-school childcare geared towards academic development and progression. The enrichment program served as the perfect medium through which we could present our research findings; in this setting we were able to disseminate the information we gathered in an educational manner through utilization of an interactive Bingo game. We found the game to be of benefit to the children we served in that it was engaging and helped them to retain knowledge about CVD risk and prevention.

In a previous course we were enrolled in at James Madison University, we presented information to Second Home, an after-school enrichment program in Harrisonburg, Virginia, on healthy eating and physical activity. Our goal was to help reduce obesity and subsequent CVD development in children 6 years of age and older. Though rewarding, the experience taught us that our topic and teaching plan were too complex for children as young as 6 years. It encouraged us to do more research on effective ways to promote development of healthy lifestyles at an early age. In combining this experience with our review of the literature, we modified our plan and modeled our teaching after the Whole School, Whole Community, Whole Child (WSCC) approach being implemented by US Centers for Disease Control and Prevention (CDC) experts (Lewallen, Hunt, Potts-Datema, Zaza, & Giles, 2015). Furthermore, we focused on online learning, assessment of skills, and evaluation of teachings. This specific framework proved to be an effective method after effectiveness evaluation, thus leading to its utilization within our implementation plan (Guest, Keatinge, Reed, Johnson, Higgins, & Greig, 2013).

Our research indicated that the most effective method for reduction of CVD development risk is to teach children, at a young age, the importance of healthy eating and exercise, provide interactive opportunities to assist their learning, and emphasize parental involvement. We educated 8-10 year-old children, specifically, so as to ensure they were old enough to understand information presented and young enough to incorporate teachings into their daily life and utilize obtained knowledge to carry out healthy lifestyle modifications.

We had the children rotate through three different stations of interactive learning, each focusing on a different aspect of healthy lifestyles. At the first station, we focused on healthy eating patterns and used MyPlate images to provide children a visual representation of a balanced, healthy meal. We also educated children on the basic development of CVD using both a regular and peanut butter-clogged straw to sip water. This demonstrated vessel resistance to blood flow, a characteristic of CVD. Our fourth station consisted of an interactive Bingo game utilizing words discussed throughout our presentation. Each word called was followed by an explanation so as to reinforce prior teaching. The children were instructed to take the board game home with them and explain, to their parents, what they learned that day at the enrichment program. It was our hope that this would encourage the parents to understand the importance of and either begin or continue to promote healthy lifestyles for their children. The information disseminated seemed to be well-received and retained by children, which was likely due to its interactive nature and that it was provided by young student nurses they viewed as role models. In retrospect, we are confident our presentation at the Rockbridge YMCA assisted at-risk children in better understanding how they can lead healthy lifestyles and reduce their risk of becoming obese and developing CVD.

Potential Limitations of Implementation

A few limitations existed pertaining to our implementation plan despite our utilization and review of evidence-based research surrounding the topic. The first limitation involved the educational backgrounds and socioeconomic status of the children with whom we interacted. Because many of them came from diverse family backgrounds, some of a lower socioeconomic status, we were unable to assess each child's ability to fully understand the material we presented them. To counteract this, we utilized simple learning materials which included an array of brightly-colored pictures and symbols. It was our hope that this would minimize the difficulty some children may have had in learning and remembering the information we presented. Furthermore, we had approximately an hour to implement our plan due to organizational scheduling, which likely affected the children and their ability to fully benefit from what was being taught. To counteract this, we utilized repetition in carrying out interactive activities so that information could more easily be committed to memory. Additionally, children of the age and family backgrounds we worked with had some difficulty focusing for long periods of time, following directions, and listening. To minimize disruption and maintain order, we ensured staff members remained close by and helped supervise the children. Other limitations surrounded the fact that our population size for implementation was small, consisting of approximately 15 children and three adult staff members and, due to the nature of our plan, provided us no quantitative data for overall evaluation post-implementation. Furthermore, our implementation plan focused on community-based nursing at an individual/family level rather than at the community/systems level mentioned in the article by Nigg et al. (2016). Lastly, limitations to our plan included our collective limited experience in working with and educating children of their specific age, educational level, and socioeconomic status. We were unaware of how the children

would respond to our implementation plan and whether they would truly benefit from our time spent with them. To overcome this, we tailored our plan to most closely meet their perceived needs. We understood the likelihood that our plan would not be carried out entirely as planned due to the nature of its implementation, but remained flexible to counteract the troubles we faced. We felt this to be of benefit to us, as students, as it helped to minimize stress development and maximize the overall impact we had on the children we served.

Conclusion

As summarized above and gathered through research analysis, the most effective interventions in reducing obesity and CVD development risks in youth include implementation of physical activity and healthy eating pattern educational lessons. This can be accomplished through utilization of interactive games and involvement of parental figures in education. Furthermore, children may benefit from information delivered via individuals with a high level of education. However, discrepancies exist surrounding the level of education needed and what should be included in educational programs to be of most benefit. Though there are many other methods that may be useful in preventing obesity and subsequent development of CVD, such as the use of herbal medicines that interact with the microbiota of the gut to promote metabolism, further research needs to be conducted on this topic to effectively reduce the current childhood obesity epidemic (Chen et al., 2016). More particularly, longitudinal studies incorporating physical activity and healthy eating interventions need to be carried out to determine the effectiveness of long term prevention of CVD. Keeping our potential limitations in mind, we implemented our findings at an after school enrichment program through the YMCA. We utilized the most effective teaching methods discovered through current research to prevent childhood obesity and subsequent development of CVD. Through the use of educational resources, we hope to have had a substantial and positive effect on an understudied and needy population. It is our hope that our compilation of research brought much needed attention to the current childhood obesity epidemic and contributed to continued research surrounding CVD development and its reduction in adulthood.

Appendix A: Heart Healthy Bingo Card Vocabulary Words

Vegetable - How many of you like and/or eat vegetables? Vegetables are foods like green beans, corn, and broccoli that, like fruits, help us maintain a healthy weight so that we are less likely to develop heart disease. It is important we listen to our parents and eat our vegetables at dinner and other mealtimes so that we can ensure our bodies grow big and strong and we receive the nutrients we need to remain healthy.

Fruit - Do you all like to eat fruits? Can somebody give me an example of a fruit they like to eat or of their favorite fruit? Fruits are good for us and can help us maintain a healthy weight so that we are less likely to develop heart disease. Bananas, mangos, kiwi, apples, pears, grapes, and berries are examples of healthy and yummy fruits we can incorporate into our diet daily.

Dairy – Can you name some examples of dairy products? Milk, yogurt, cheese, fortified cereal, and fortified orange juice are examples of products that meet this criteria! Dairy products are foods we commonly receive our Calcium from. Calcium is important because it helps to make our bones strong. The bones are considered a bank for calcium, which is why we must consume it regularly.

MyPlate - The colorful divided plate includes sections for vegetables, fruits, grains, and foods high in protein. Information about MyPlate can be easily accessed online. User-friendly, interactive websites that discuss MyPlate provide simple, important messages about eating healthy that are easy to understand. Examples are as follows:

- Fill half your child's plate with vegetables and fruits.
- Make at least half the grains you serve whole grains, like oatmeal and brown rice.

- Serve fat-free or low-fat (1%) milk and water, rather than sugary drinks.
- When buying pre-packaged foods, choose ones that are low in sodium.
- Don't serve oversized portions.

Fat - Fats are nutrients (meaning useful to the body) in food that the body uses to help the brain and nerves build and protect themselves. The body also uses fat as fuel. If fats eaten aren't burned as energy or used as building blocks, they're stored by the body in fat cells. This is the body's way of thinking ahead; by saving fat for future use, it plans for times when food might be scarce. Although fats can enhance the taste of our food, consuming an excess amount of it can cause us to gain weight. Fats can be found in desserts and snacks (including potato chips, chocolate, cake, doughnuts, pastries, and cookies), specifically. Children also receive fats from whole-milk products and meats, such as bacon, hot dogs, and certain cuts of red meat.

Tooth Brush - Who here uses a toothbrush at home? How many times do you brush your teeth per day? It is important to remember that brushing our teeth not only keeps them fresh and clean, but also may reduce our chances of developing illnesses such as heart disease! Brushing our teeth keeps germs from building up in our mouths and later affecting our heart's ability to pump blood efficiently to the organs of our body!

Sugar - What foods do you think contain the most sugar? What is your favorite food that contains sugar? Believe it or not, we get a majority of our dietary sugar through drinks. Sugary drinks such as fruit drinks, sports drinks, sweetened waters and teas, energy drinks, and soda have been identified as the primary source of added sugars in American diets. We must make sure to minimize our intake of sugary drinks to less than one to two per week.

Limit Screen Time - Who enjoys playing videogames and watching television? These habits can lead to excessive snacking lifestyles that don't allow for much movement. This

increases your risk for development of obesity and heart disease. Limit screen time to 2 hours per day and use the rest of your free time to play outside.

Food Labels - Most packaged foods come with a Nutrition Facts label, also known as the food label. These labels contain important information about fat and calories, serving sizes, sodium content, and more, but can be hard to understand. Let's look at one now and see if you can name some of the pieces!

Carbohydrates - Foods we eat, such as potatoes, french fries, rice, and noodles contain carbohydrates. Carbohydrates can contribute to buildup of plaque and keep our heart from pumping the blood our organs need to function. It is important we minimize our consumption of high carbohydrate-containing foods to ensure our organs receive the oxygen they need to keep them happy and reduce our chance of developing heart disease.

Protein - Who knows what protein is? Protein can be found in foods we eat, such as meat, peanuts, beans, and fish. Protein can help the muscles of our body, such as our heart, to remain strong and contract as they should. Having strong muscles reduces our chance of developing heart and other harmful diseases. It is important to remember to eat protein-containing foods each day!

Family - Family meals are typically nutritious, which means that, in eating them, you are more likely to receive the veggies, fruits, and whole grains you need to stay healthy! In addition, when you eat with your family you are less likely to crave and eat unhealthy snacks and junk food. Eating meals with your family allows you to talk with them and discuss your day over a meal. This can be fun for everyone! Ask your parents to eat together around the table every once in a while if you don't already!

Heartbeat - A heartbeat results when our heart muscle contracts, forcing oxygen-filled blood through our vessels, called arteries, and to our organs to keep them alive and happy. If we put our right hand over our heart on the upper left portion of our chest, we can feel it beat 60-100 times per minute, on average.

Heart - The heart has 4 different sections called chambers that are filled with blood, it is about the size of your fist. The heart is a muscle that pumps blood out to tubes called arteries and veins. Arteries carry blood away from the heart to the body and veins carry blood towards the heart. The blood travels to the lungs to get oxygen to provide energy to the cells of the body. Once the body's cells have used up the oxygen within the blood, the blood returns back to the heart and the process begins again.

Stress - Stress is a normal part of life. It can be good for you when it motivates you to get things done like homework, but can have a negative effect on our health when it becomes too much. If you are ever feeling too stressed, speak up and ask for help! Some great ways to relieve stress can be found through coloring, writing in a journal or notebook, exercising, and talking with close friends and family.

Listening and Learning - It is important to listen and learn. You can learn from individuals of all ages in many settings. Remember to keep your ears open and you may discover something new each day!

Blood Pressure - Who has ever been to the doctor and had a band placed around your arm? This is called a blood pressure cuff. The blood pressure cuff is blown up with air, like a balloon, and may squish your arm for a few seconds. Be sure not to worry, however, because it won't hurt you! A nurse uses the cuff to measure how hard your heart is working to pump blood

through your body. Blood pressure can be too high, too low, or just right and it is usually checked each time you go to the doctor.

Breakfast - Breakfast is the most important meal of the day. It gives you the fuel you need to stay awake and have energy for the day! Skipping breakfast can cause you to eat more calories for the day so try to have breakfast everyday. Like other meals it is important to incorporate a variety of foods and consume fruits, vegetables, grains, protein and dairy products. Some healthy and quick breakfast options may include yogurt, whole grain cereal, fresh fruit, or a whole grain muffin!

Exercise and Play - Exercising is important for heart health and maintaining a healthy weight. It is recommended to try to get at least 60 minutes of physical activity each day. This does not need to be all at once and can be achieved in smaller spurts throughout the day! You may not even realize you are exercising when you are! Playing sports, doing jumping jacks, playing tag, and touching your toes are all forms of exercise. Exercise helps to strengthen your muscles, improve your heart health and balance, increase your flexibility, and makes you feel good! Get up and Go!

Sleep - Who here likes to sleep? Sleep gives our bodies time to rest and recover. While we are sleeping our muscles are repaired and our bodies grow. Children of your age are recommended to receive 9-11 hours of sleep per night. To receive a good night's sleep, try to wake up and go to bed around the same time each morning and night. If you are having trouble falling asleep make sure you are in a quiet and dark environment. Sweet dreams!

Salt - Salt, or sodium, can be found in many different foods and helps bring out the flavors we love in them. Salt is acceptable to incorporate into our diet, but within limits. The kidneys are responsible for regulating the amount of salt our bodies retain and excrete. We

excrete salt when we have consumed too much. It is important to pay attention to how much salt we are eating because consuming too much can lead to high blood pressure and hypertension development. Food labels can give us a better idea of how much salt we are consuming. To limit the amount of salt we take in each day, attempt to refrain from grabbing the shaker at dinnertime!

Water - Water is needed to live and without it your body would not function properly. In fact, water makes up about half of your body weight! Water is in blood and helps to digest food and rid the body of waste. You can receive water by eating, as well as drinking, because it is contained within many of the foods you consume! Fruits and vegetables, specifically, contain a lot of water. It is important to drink water throughout the day and when you are thirsty, especially if you are exercising in hot weather. Your body controls how much water you have in your system, which can be observed through the color of your pee. If your pee is light yellow, you are likely adequately hydrated. If your pee appears dark yellow, drink up!

Smoking - Smoking is one of the worst things you can do to your body. It can cause you to have bad breath, yellow teeth, smelly clothes, cough more frequently, get sick more often, and make it difficult for you to keep up with friends while playing games. That doesn't sound like fun! Smoking can cause negative health effects, it hurts your heart and lungs, and can increase your chance of getting cancer later on in life. If you have friends or family members that smoke, help them to quit for good!

Healthy Weight - Who has ever been weighed on a scale at the doctor's office? Your weight is an important indicator of your growth and overall health. Doctors measure your weight annually so they can track your growth over time. The foods you eat and the amount of exercise you get all affect your weight. Therefore, it is important to eat well balanced meals and receive at

least 30 minutes of exercise per day. Remember that weight is based on height and can vary from person to person!

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