

**School nurses' nursing interventions in the prevention  
of childhood obesity**

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Abstract  <p>There is an urgency to control childhood obesity before adulthood because its comorbidities have become a major challenge globally to nursing hence nurses are over-burdened in their work. As a result, School-based childhood obesity prevention programmes have emerged to improve child physical activity, to eradicate passive lifestyle, poor nourishment and escalating childhood obesity rates. Various systematic reviews have confirmed that school-based obesity prevention interventions can be successful, however few studies have conducted how the nursing efforts are effective when nurses educate, support and work directly fighting against childhood obesity.</p> <p>The aim of this review was to explore school nurses' interventions in the prevention of pediatric obesity. The purpose was to avail the most current information on childhood obesity prevention to the school nurses and the future nursing students. This was intended to collect all the valid information in one publication for easier research for those in need of the information.</p> <p>The study was implemented as a literature review. The data was gathered from the article databases of CINAHL, EBSCOhost and PubMed and in the campus' library and in the publication accounts of units of nursing science of Finnish higher learning institutions.</p> <p>The major generated themes were; <b>Improved Quality of Life, social intervention, behavioral, environmental and cultural interventions.</b> All the studies suggested further research because these strategies may not be successful in all contexts as various settings may be based on the countries' policies as well and not all schools have school nurses neither nursing schools in their environs.</p>		
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## 1 Introduction

Globally childhood obesity is one of the most severe public health challenges of the 21st century. The problem is steadily affecting many low- and middle-income countries, majorly in urban settings. The prevalence has increased at an alarming rate. Obese juveniles are likely to stay obese into adulthood and more likely to develop noncommunicable diseases at a tender age. Obesity, as well as its comorbidities, are largely preventable. Prevention of childhood obesity therefore needs high priority. (WHO 2018.) Obese juveniles between two- and nineteen-years face both psychological and many physical health problems associated with obesity, these include type 2 diabetes, elevated cholesterol, asthma, sleep apnea, hypertension, and orthopedic complications (Centers for Disease Control and Prevention 2016).

Psychosocial concerns related to childhood obesity include depression, poor quality of life, and low self-esteem, behavioral problems, and difficulty in school (Morrison 2015). The rate of childhood obesity among school-age children today is approximately one in five. It is a complex challenge that should be addressed in the school setting because the juveniles spend a significant part of their time in school. Therefore, if not prevented the challenges which are already being faced by the public health pediatric nurses from dependency by the obese patients to multiple complications are yet to double. (Ogden et al. 2016.)

This literature review aim is to explore school nurses' interventions in the prevention of pediatric obesity. The purpose is to avail the most current information on childhood obesity prevention to the school nurses and the future nursing students.

## 2 Childhood obesity

### 2.1 Definition and Diagnosis of childhood obesity

Obesity is generally defined in terms of some calculation of estimated body fat or secondary hypercholesterolemia. Although different modes can be used to estimate body fat, body mass index (BMI) a weight-to-height ratio ( $wt/ht^2$ ) is the most prevalent and can be used in any pediatric practice to evaluate body fat for children aged older than 2 years. The Centers for Disease Control (CDC) regards BMI higher than the 95th percentile for children and teens of the same age and sex to define obesity or as indicative of a child being overweight and BMI higher than the 85th as prognostic of a high risk of becoming overweight in the future. (CDC, 2017.)

The Centers for Disease Control's (CDC) definition of childhood obesity is similar to the diagnosis of Australian Traditional-Medicine Society (2016), which states that body weight is commonly classified using Body Mass Index (BMI), where the standard for obesity is a BMI greater than or equal to 30. Obesity is also defined as an excessive fat accumulation that presents a risk to health. This presentation is often the result of an excessive caloric intake with a deficit in energy expenditure. (McHugh 2016,5.)

However, the American Medical Association and the American Academy of Pediatrics have comparatively severe thresholds, with juveniles having a BMI higher than the 95th percentile being identified as obese and a child having a BMI higher than the 85th percentile being identified as overweight. (Boisvert & Harrell 2015,40.) The diagnosis of obesity is expressed using terms such as overweight, weight concerns, obesity, excessive weight for height, excessive weight for length, weight gain, weight increase or BMI based on the definitions by both Centers for Disease Control and World Health Organization. (Gentile 2016, 3).

According to Danish clinical guidelines for examination and treatment of overweight and obese juveniles in a paediatric setting (2015, 62) a complex obesity is suspected when BMI of children and adolescents correspond to an iso BMI of minimum 30 or BMI corresponds to an ISO BMI of 25. Therefore, the affected children should be referred for examination and treatment in a paediatric setting. Obtaining a thorough medical history is pivotal, a structured interview to ensure collection of all relevant information besides physical examination focused on BMI, waist circumference, growth, pubertal stage, blood pressure, neurology and skin and provide comprehensive paraclinical investigations for obesity and obesity related conditions. (Johansen 2015.) Based on the Finnish growth standards ISO-BMI ( $<25 \text{ kg/m}^2$ ) is low while ISO-BMI ( $\geq 25 \text{ kg/m}^2$ ) is high. (In Vivo 615-619, 2014).

## 2.2 Prevalence of Childhood Obesity

Most researchers on pediatric obesity prevalence have based their studies on gender/sex, social status, education level, habitation/ settings and ethnic groups however, the patterns might differ among adults and juveniles. They have also proved that the prevalence of childhood obesity has escalated at an alarming rate. For instance, a recent evidence suggests that it is still a serious concern and has become a worldwide phenomenon (Ogden et al. 2017,73.)

According to the WHO 2016, the prevalence of obesity among children and adolescents aged 5-19 has risen dramatically from just under 1% in 1975 to just over 18% in 2016, in short, the worldwide prevalence of pediatric obesity nearly tripled between this period. In 1995, there were 18 million juveniles worldwide under the age of 5 classified as weighty, compared with 2010, when the statistic was nearly 43 million. The rise has occurred similarly among both boys and girls: in 2016, 18% of girls and 19% of boys were overweight. (WHO, 2016.) See Table 1. below.

Similarly, in the same year 2016, the number of overweight children under the age of five, is estimated to be over 41 million. Almost half of all overweight children under five lived in Asia and one quarter lived in Africa, this is a serious matter because

overweight if the major indicator for imminent obesity. Generally, over 340 million children and adolescents aged 5-19 were overweight or obese in 2016. From 2014 to 2016, the prevalence of pediatric obesity increased from 9.3% to 13 % among children aged two to five years and it was 17.3% among low income Hispanics. (Skinner 2018.) Finally, in 2015 the number of overweight children under the age of 5 is estimated to be over 42 million. (WHO 2015.) For the progress in figures, refer to table 1

Table 1. General global Pediatric obesity prevalence (WHO 2016)

Year	Age	% total	% boys	% girls	Total
1975	5-19	<1%	-	-	-
1995	<5	-	-		18 million
2010	<5	-	-		43 million
2014	2-5	9.3%	-	-	-
2015	<5	-	-		42million
2016	2-5	13%	-	-	41million
2016	5-19	18%	19%	18%	>340 million

Table 1. above clearly numerates the general escalation in pediatric obesity in a number of years however, there is still a gap that needs to be filled in the research for instance , in 2010 <5 = 43 million which could mean 0-5years or something else hence hard to compare with specific ages in 2016, 2-5 = 41 million.



Paediatric obesity's prevalence in African Americans in the United States youth continues to be one of the highest of all major ethnic groups. Presently, 38.1% of 6-11-year-old and 39.8% of 12-19-year-old African American youth are overweight and obese in comparison to 34.2% and 34.5% of all ethnic groups, respectively (Ogden, Carroll, Kit, & Flegal, 2014). (Refer to Table 2. Below) Furthermore, the United States' National Health and Nutrition Examination Survey (NHANES) data shows the drop in the trend in overweight and obesity prevalence over a 5-year span (2007–2008 to 2011–2012) for all youth except for 12 to 19 year-old African Americans which extends to adulthood for example, pervasiveness in 20 to 39 year-old AA adults (46%) was the highest of all ethnic groups as was observed from 2007–2008 (44.1%) to 2011–2012 (46%) in African American adults. (Ogden et al. 2014). Refer to Table 2 and Figure 1 below for the summary of paediatric obesity prevalence among the African Americans in comparison to other ethnic groups in the US.

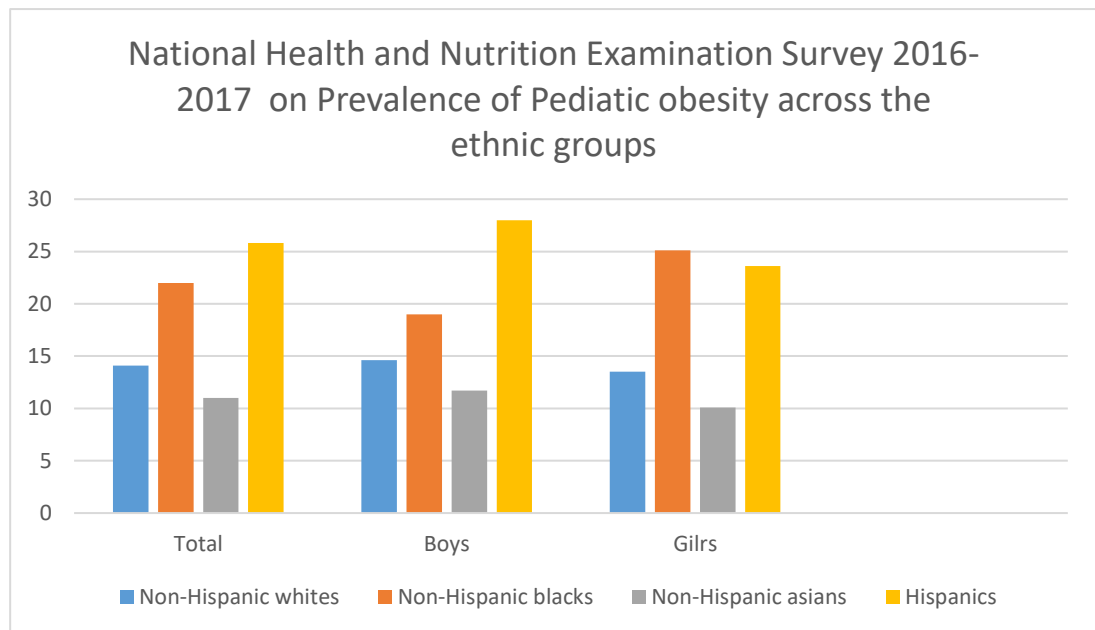


Figure 1. National health and nutrition examination 2016-2017 on prevalence of pandemic obesity across the ethnic groups

Figure 1. Gives an illustration on the prevalence of obesity among youth 2-19 years by sex and race and None and Hispanic origin United States 2016-2017

In Africa most recent studies have established that the extent to which world health organization BMI for age definition of obesity underestimates the prevalence of extra body fats in African juveniles. The extra body fats were present in nearly a third of juveniles suggesting that urban African environments are now highly obesogenic including the juveniles in the following African countries Ghana, Kenya, Mauritius, Morocco, Namibia, Senegal, Tunisia and United Republic of Tanzania. The excessive fatness was above three times more common than the prevalence of BMI-defined obesity. This difference is large enough to be a significant for public health. For instance, the cause of policy action to prevent and control obesity is much weaker at apparent prevalence of about 8% based on BMI for age (Reilly, 2018, 1773-1774.) Refer to figure. 1 below for further illustrations based on ethnic groups.

Table 2. Childhood obesity prevalence according to ethnicity based on United States' National Health and Nutrition Examination Survey (NHANES) data (2014)

Ethnic group	Age in years	%
African Americans	6-11	38.1
African American	12-19	39.8
Other ethnic groups	6-11	34.2
Other ethnic groups	12-19	34.5

In Asia, pediatric obesity prevalence studies have been extensively done in Indian populations as compared to other countries, especially a comparative account between urban and rural areas. Very few earlier investigations in India have reported an increased prevalence of childhood obesity ranging from 5.5% to 17% (WHO 2015). Another study in India findings show that India has the third- highest number of obese and overweight people (11% of juveniles, and 20% of all adults) after US and

China, also, a recent study mapping global malnutrition trends has also proved this. According to the study, a total of 56 per 1000 juveniles die before their 5th birthday, and 47.9% of juveniles under the age of five are retarded. The project highlighted the global challenges substituted by the double burden of under nutrition and overweight and obesity (Shah et al. 2017, 21-26.)

Equivalently, in Australia today 25% of Australian juveniles are obese or overweight. It has become Australians' single biggest challenge to public health (Monash University 2013). Since 1976 Caucasian have had the lowest obesity rates for all the childhood age brackets. In comparison to Aboriginal and Torres Strait Islander Australian's are 1.9 times as likely as non-Indigenous Australians to be obese. (Australia Indigenous healthinfor.net 2016).

Furthermore, the problem of childhood obesity is steadily affecting many low- and middle-income countries; particularly in urban settings, the progress is extremely worrying. In the developed world, it is now the most common health concern affecting children for instance, childhood obesity as a multi-factorial problem is distressing the lives of 31.8% of juveniles in the United States, with grater ratios among Hispanic and non-Hispanic Black minors (Ogden et al., 2016). Epidemiological studies showing that juvenile obesity is an escalating health problem in many European countries as well. Particularly in countries surrounding the Mediterranean Sea, overweight and obesity predominance rates are reported to be at the lead (Chesi A, & et al. 2015; 26:711–21.)

Finally, other results from some survey indicated that among children included in the study, obesity was more prevalent than overweight. This finding is like the report by Hernandez et al. (2017) where the prevalence of overweight and obesity was reported as high as 20.1% and 28.1 %, respectively, in Mexican-origin in the United States' children between 5 and 19 years old (Hernandez-Valero 2017.) Findings from various research confirm the previously reported disparities in overweight/ obesity rates in the Hispanic population in the United States compared with the national

rates, emphasizing the importance of interventions targeting this population (Ogden 2014).

### 2.3 Causes of pediatric obesity

Nutritional consumption is significant during childhood because children's bodies are undergoing developmental and growth stages and can be affected by poor nutrition and unhealthy weight. Studies suggest that migrant families have inadequate diets because of multiple barriers. Food insecurity plays an important role in the nutritional challenges faced by Migrants and Seasonal Farm Workers (MSFW) in that the consumption of vegetables and fruits is dependent on seasonal variation because of cost and accessibility (Lee & Won 2015, 2.)

Another common risk factor for juveniles' obesity is physical inactivity. Regular exercise is beneficial for maintaining normal weight. Recently, a decrease in physical activity has been shown to be positively correlated with the rise in paediatric obesity. Parents' obesity and levels of physical activity predict a risk for being overweight among their children before age 7 years. Low level of physical activity for instance, lack of participation in sports may also influence weight gain, particularly for juveniles who are already overweight or obese. Overweight and obese juveniles are less likely to participate in exercise and sports, increasing the likelihood that they will remain overweight. Subsequently, obese juveniles compared with their normal-weight peers, report that sedentary behaviours, such as watching television, provide more positive reinforcement than physically active behaviours. (Boisvert 2015, 41.)

Additionally, exposure to unhealthy nutrition is equally a great danger for paediatric obesity. The unhealthy food environment to which children are exposed via junk foods, fast foods, and cafeteria meals encourage their consumption of these food-stuffs. Juveniles' eating habits tend to favour a higher consumption of high-calorie foods, fat, saturated fat, too much sodium, and carbonated soft drinks, and a lower intake of vitamins, milk, fruits, and vegetables. A big population of juveniles are

exposed to high-sugar snacks, foods, and soft drinks that are associated with weight gain. (Harrell et al. 2015,2.)

Moreover, a family's social climate, culture and general environments shape the development of food preferences, patterns of food intake, and eating styles that affect juveniles' weight status. Psychosocial factors, such as a family's social interactions, can also affect eating behaviour and weight status. A poor family environment is characterized by negative, cold, and unsupportive family changes. Such dynamics can lead to diminished positive interactions at mealtimes in households with obese juveniles compared to households of normal-weight juveniles. Family ethnicity and culture, too, can influence eating trends. Parents and other family members may pass on cultural messages and attitudes about weight, size, and shape. This transmission has been sighted to be the case in African American communities. Often adult family members act as role models, coping with stress by using food to moderate negative moods hence nurturing binge eating. Some researchers have mentioned that African American girls and women are less exposed in the home to dieting as a means of maintaining a healthy weight, and they receive less negative social pressure from their families about being overweight. (Boisvert & Harrell 2015,41.)

In addition to environmental factors, biological factors, sociocultural and psychological factors, too have been shown to influence weight status and gain. Environmental factors are broadly understood, incorporating a child's lifestyle, level of physical activity, availability of unhealthy food choices and diet, and the family's social climate and ethnic culture. Similarly, psychological aspects of paediatric obesity include access to and use of new recreational technologies for instance, texting or playing games on cell phones and social media like Facebook and Twitter. (Boisvert et al. 2016, 42.)

The man-made environment has also been identified as determinants of obesity, with important effects on individual behaviours and overall rates of child and adult obesity. These contributions to the environment are unlikely to have been as important in spawning the global epidemic as changes in the global food system, the

ways in which people have responded to them for example, decreased walking and biking spaces and increased traffic congestion have changed with time. Urban neighbourhoods with a higher housing density, fewer parks, or a greater risk of crime provide fewer opportunities for safe, unsupervised outdoor play or for family-oriented physical activities, such as walking or cycling. Parental fears about neighbourhood security tend to increase indoor sedentary activity. Socioeconomic factors also play a key role in physical activity and eating behaviour. Less fortunate urban neighbourhoods have more fast-food outlets and fewer supermarkets and farmers' markets selling nutritious foods, effectively restricting children's access to healthier eating options. (Harrell et al. 2015,4)

Various studies have also established the association between genetics and childhood obesity to be 1.45% of the body weight variation, while heritability studies have estimated that 40 to 70% of this variance is under genetic influence (Waalén 2014.) Genetic interactions likely play a significant role in obesity development, as the disease is also attributed to many environmental sources. In addition to genetic predisposition, various environmental factors also affect energy intake and expenditure, the two primary driving forces behind extra weight/ obesity development. These environmental risk factors include high dietary sugar consumption, poor sleep habits, comfortable ambient temperature, low physical activity and large-scale social forces such as media influence. (Güngör 2014.)

Finally, fatal macrosomia is another risk factor for paediatric obesity and it is defined as birth weight of a new-born above the 90th percentile for gestational age after adjustment for biological make up and ethnicity, and occurs in approximately 1–10 % of all deliveries with 1–2 % of the neonates. Macrosomia is also defined as a birth weight greater than or equal to 4000 g however, others use 4500 g as the cut-point. (Gaudet et al. 2014.)

However, Mohammadbeigi et al. (2013), has a different definition for it; Macrosomia is defined as birthweight over 4,000 g irrespective of gestational age and affects 3-15% of all pregnancies. The prenatal diagnosis of macrosomia by

ultrasonography has been regularly inaccurate, and this condition is usually diagnosed by measuring birth weight after delivery. Male babies are more likely to be macrocosmic compared to their females' counterparts. Fatal macrosomia is a heterogeneous condition in terms of diagnosis and etiologic factors. Several predisposing conditions have been identified: maternal diabetes or glucose intolerance, maternal overweight prior to pregnancy, gestational weight gain, 20 kg, gestational age or 41 weeks, previous history of macrocosmic birth, maternal age for instance 30 years at birth, high parity, ethnicity (Mohammadbeigi et al 2013.)

### **3 Paediatric nursing and Childhood Obesity**

#### **3.1 School Nurse Roles**

The school nurse is a professional who has undergone through the public nursing course and is entrusted to provide health promotion to all people irrespective of age just like any other nurses and to the community at large. Health promotion is concerned with boosting the health status of individuals and communities and upholding health, personal and public agendas (World Health Organization (WHO 1986; Green & Tones 2010; Scriven 2017,129). Currently, school-based childhood obesity prevention programs have increased in response to reductions in juvenile physical activity (PA), poor diet, increased sedentariness, and escalating pediatric obesity rates. Numerous systematic reviews have proved that school-based obesity prevention/treatment interventions are effective, yet few studies have examined the school nurse role in obesity interventions. (Tucker 2015, 22.)

For instance, in the United States of America, and in some European countries there are multiple obesity prevention programs which exist across and many of these include school-based approaches, a setting where school nurses can be influential. The position of the National Association of School Nurses (NASN) is that the school nurse has the knowledge and expertise to promote the prevention of overweight and

obesity and address the needs of overweight and obese youth in schools (NASN 2014, 450.)

Jones (2010, 450), supports the idea by NASN by emphasizing that school nurses are privileged to hold the public's trust and as such, it is important for them to critically and thoughtfully think about the social conditions and public policies that have profound effects on health. The Nurses Code of Ethics mandates that nurses advocate, promote and work to protect the health and rights of all patients, collaborate with others to promote efforts to meet health needs, and shape social policy Fundamentally pediatric nurses care for juveniles who live within a broad range of family and social situations, therefore they must be comprehensive in their approach to addressing the problem of childhood obesity. (American Nurses Association 2001;2015, 450.)

Moreover, school nurses have the privilege of working with many juveniles in both primary and secondary schools. In this position they have opportunity to support students with various issues from friendships to exam stress, psychological health crises to a bereavement in the family. They work with individuals as well as groups and have been able to adjust their health education and health promotion actions to the needs of individual schools by creating, professional rapports (Dawe 2017, 4; RCN 2016,3). Finally, based on the knowledge concerning the significance of early interventions and the impact that health inequalities can have, it's not sensible to ignore a service as vital as school nursing. (Stephenson 2018, 130). However, most surveys have proved that Registered School Nurses have felt undervalued and unappreciated, calling for their role to be recognised and valued on a par with health visiting. This is due to underfunding and a lack of resources and school nursing numbers prevent the school nursing workforce from becoming the early intervention support that so many juveniles need to ensure they get the best start in life (Stephenson 2018, 130.)



### 3.2 Quality of Life in School-Age Children with Obesity

According to Powell et al. (2016), Pediatric obesity is associated to a variety of physical and psychosocial problems. A better knowledge of perceived quality of life of school age children with obesity is vital for both school and health personnel working with this population. The school age juveniles with obesity have revealed substantially Lower Quality of Life (QOL) scores than the pediatric healthy normative sample in various studies therefore, living with obesity is a burden. To manage this, school nurses suggest that a holistic approach that includes environmental and psychosocial interventions might be most effective. Generally, quality of life involves both physical and psychosocial dimensions and the school nurse is well positioned as the health professional in the school setting with the knowledge to case manage these students. (Dawe 2019, 34). School age juveniles living with obesity often visit the school nurse due to linked health challenges managed during the school day. Many of these problems are associated with an increased risk due to weight such as type II diabetes, respiratory complaints, hypertension, psychosocial concerns and orthopedic problems. The National Association of School Nurses (NASN 2013, 62) position statement on OW and 17 CO clearly discusses the role of the school nurse in addressing this problem.

The same idea on the lower QOL experienced by the Obese juveniles or those with symptoms of obesity when compared to the healthy pediatric population, has been proved in the previous researches (Trevino et al., 2013; Wallander et al., 2013). The obese juveniles suffer both physically and psychosocially for instance, they experience pain in their joints as well as chest pain, they have difficulty with daily school activities such as climbing stairs and participating in exercises. From a psychosocial perspective, the school nurses in a study confirmed that these students are often teased which makes them sad and they have low self-esteem. This is consistent with earlier research (Morrison, et. al, 2015,15.)

### 3.3 The experiences of school nurses providing care for school children that are overweight or obese

The experiences of school nurses providing care for the obese juveniles based on recent studies include the following; limited time, workload, limited resources, and supervisory pressure which may prevent obesity interventions thus leading school nurses to a “*seize the moment*” approach and leave school nurses with feelings of “*I wish I could do more*”. However, themes identified in this study may be used to further develop successful school-based interventions for obesity (Powell et al. 2016,31.)

According to Quelly, (2014), a study completed by Florida school nurses revealed similar findings that pediatric obesity practices vary greatly among school nurses and that the school nurse’s self-efficacy has the most important influence on childhood obesity actions. It also found a significant influence of perceived barriers to practice such as lack of resources and time, potential for stigmatization, and inappropriate parental responses. However previous studies have not focused on school nurses from rural settings, though a few of the studies included some school nurses that worked in rural areas. The current studies have focused on school nurses working in rural areas thus enhancing awareness of the unique challenges faced by school nurses working in rural areas. (Quelly 2014.)

School nurses lack time to attend to obese juveniles to their satisfaction due to other priorities which is an overwhelming factor that directs the practices in the school setting. They also have heavy workload based on their aspect of operation for instance, having multiple schools to differing priorities, in addition, limited resources within the school setting and in the community and inaccessibility to appropriate referral services for students affects school nurse operations, finally, the pressure from the school administrators and the expectations of school nurse practice may contradict with the school nurses priorities as well as pressure to avoid interrupted academic time. All these challenges have been termed as ‘*jumping hurdles*.’ (Hendershot

et al., 2008; Morrison- Sandberg et al., 2011; Stalter, Chaudry, & Polivka, 2010; Stalter et al., 2011; Steele et al., 2011, Quelly, 2014.)

School nurses have a “*seize the moment*” approach for interventions in relation to childhood obesity and obesity practices in the school context for example, during the visits with the school nurse for health issues, juveniles often report to the school nurses office for chronic issues or acute problems and school nurses use this time to provide interventions relevant to obesity where applicable. However, sometimes it comes up in conversation where school nurses are often regarded throughout different school day activities such as hall monitoring, lunchtime in the cafeteria, or monitoring playground safety where more casual time may be used by the school nurse to provide interventions connected to obesity. This kind of approach does not satisfy the school nurses as they are unable to offer holistic approach to assist the affected learners. (Tucker 2015, 32-39.)

Finally, another major challenge faced by the school nurses include moral distress and this describes some of the feelings experienced when school nurses are unable to provide services that they feel would benefit the juveniles. Hence, they are forced to prioritize where they provide care that often takes priority over obesity interventions with limited time available for non-urgent care, this leaves still unsatisfied wishing that they could be able to do more. There is an understanding of obesity as a vital issue for school age children and a desire of school nurses to provide interventions and help for these students, however a feeling exists that it is impossible given the circumstances (Tucker 2015, 38-39.)

## **4 Aim, purpose & research question**

The aim of this review was to explore school nurses’ interventions in the prevention of pediatric obesity. The purpose was to avail the most current information on childhood obesity prevention to the school nurses and the future nursing students

Research question: What are the school nurses' nursing interventions in the prevention of childhood obesity?

## **5 Methods and implementations of the study**

### **5.1 Literature review**

A literature review is a selected compilation of documents that are available on a certain topic. It includes scientific data and ideas that are directed towards a given goal or to depict on a point of view. In addition, it demonstrates competence in pursuit for relevant materials. However, in the recent inquiry, the goal is not to be excessive of literature, but to use material that is manageable (Hart 1998, 13.)

Additionally, past researches are analytically assessed in a literature review. The writer compares, classifies, and comments on the previous findings. (Turun yliopisto n.d.) Analyzing individual scientific work in comparison to other papers creates a more absolute view of the research area and may even provide new insights into the topic (Aveyard 2014, 6).

According to Aveyard (2014, 2) literature reviews is a comprehensive study and interpretation of literature that relates to a topic. Widely, there are three objectives for conducting a literature review; first and foremost, as a research method in its' own right therefore, a researcher develops a research question and a number of relevant texts are sourced, interpreted, and made rational in order to respond to the question. Secondly, the literature review may be conducted as a prerequisite to a research project; here the researcher may want to gain an analysis of the literature that exists and develops on an element of this with their own research question. Aveyard (2014), further emphasizes that the process of attempting to source texts may serve to identify a gap in the literature where no research exists that relates to a

research question; in such circumstances the researcher may conduct research to fill this gap in the literature.

Thirdly, there are systematic literature reviews which Vergnes, Marchal-Sixou, Nabet, Maret And Hamel (2015), define as the scientific way of synthesizing a surplus of information, by exhaustively searching out and objectively analyzing the studies dealing with a specific issue. Montuori (2015), re-frames literature reviews as a creative process that can take a deeply built relationship between knowledge, self and world and perceives the literature review as a construction and a creation that emerges out of the dialogue between the reviewer and the field. (Walker 2015, 3.)

A literature review can also be used as a portion of a study or as a major study. It does not only present themes from previous research but also charts possible challenges within the material and gives critique. The investigator finds gaps in research; gives proposals and validation for further studies. (Turun Yliopisto n.d.) As a research approach, an independent literature review is well suited for trainee researcher since the sources have already been published and are easily accessible. Moreover, this type of research requires no ethics approval (Aveyard 2014, 15-16.) For these reasons the study was currently conducted as a literature review.

## 5.2 Literature search

The literature search was conducted based on the inclusion criteria in the Table 3 below. After defining the study question, search term, inclusion and exclusion criteria. The relevant studies for the review were selected into two phases (Bettany- Saltikov 2012,84). Refer to Table 3 below (a summary for the inclusion criteria to achieve relevant and high-quality data.) Consequently, the search outcomes were foremost processed based on title and abstract to exclude irrelevant results. In the second phase, full text of the results passing the first phase were perused to further establish the attainment of inclusion criteria for the literature review.

Table 3. Inclusion criteria

Inclusion criteria
. Free full access, JAMK students
. Scientific publications
. Peer reviewed
. Published between 2014-2020
. Study in English
. Answer the review questions
. Studies on the experiences of childhood obesity worldwide

The data for this literature review was gathered from the article databases of CINAHL and PubMed. The search terms used were childhood OR pediatric obesity OR overweight AND school nurse intervention AND preventions and childhood obesity AND risk factors AND prevalence. Manual search in the campus' library and in the publication accounts of units of nursing science of Finnish higher learning institutions was also enforced to attain all the significant data. Divergent consolidating of appropriate key words was tested at the onset of the data search and 17 articles were found relevant and included. Refer to table 3 for more clarity.

Table 4. Data Search duplicates and older references excluded

Database	Search items	Number of Results	Chosen based on the titles, full text, with reference,	Relevant studies

			abstract 2012-2019	
Cinahl	Childhood OR pediatric obesity OR overweight AND school nurse prevention OR interventions	469	21	6
Cinahl	Childhood obesity AND risk factors AND prevalence	20113	38	4
PubMed	Childhood OR pediatric obesity OR overweight AND school nurse prevention OR interventions	729	89	4
PubMed	Childhood obesity AND risk factors AND prevalence	42	12	3

### 5.3 Data analysis

The selected and appraised data was analyzed by using content analysis which is a conventional approach of analysis. With content analysis it is possible to experience different data side by side. (Kankkunen & Vehviläinen-Julkunen 2009, 133.) Likewise, it allowed the synthesis of study reports by allowing a systematic way of categorizing and counting themes (Dixon-Woods, Agarwal, Jones, Young, Sutton & Noyes 2008, 94).

Elo and Kyngäs (2008, 109) state that, content analysis processes consists of three main phases: preparation, organizing and reporting. Despite this, there are no systematic rules for analyzing data; the key feature of all content evaluation is that words of the several texts are classified into much sub-categories. Tuomi & Sarajärvi

(2009, 108) affirm that content analysis includes three steps. In the first step include data reduction while the second phase consists of clustering the data into subcategories. The third step is abstraction in which subcategories with similarities in their contents are emerged and general categories are formed. (Kankkunen & Vehviläinen Julkunen 2009, 135.)

The data scrutiny commenced by reading carefully through all the preferred studies, testing the data on the research questions of this literature review. The observations to the questions was marked to the studies using possible similar words like the original text. Single word or combinations of few words was used as analytical units in the reduction stage. Once all the articles have been attentively skimmed, and reduction done, the reduced expressions will be into lists collected according to the research questions. The similarities and distinctions between reduced expressions were searched for in the clustering phase of the data analysis. Subcategories that yielded during clustering stage were named in relation to their contents. In the last development of the analysis the subcategories with similarities in their contents were cooperated into a major category.

Table 5. Example of data analysis process

MEANINGFUL UNIT	CONDENSED CODE	SUB-CATEGORIES	CATEGORIES	THEMES
Family education on all the aspects of healthy living.	Involving family in healthy life education.	Creating awareness to the whole family	education	Behavioural intervention
Interventions targeting both physical	Incorporating both physical			



<p>activities and diet through systematic 5-2-1-0 curriculum for fifth graders and parents, school staff, and school nurse involvement; student nurse coaching and modelling.</p> <p>Value system emphasizing self-reliance; subsistence lifestyle combined with a sense of community as an asset for healthy living.</p> <p>Increase awareness and access to the diversity of resource for healthy living.</p>	<p>activities and nutritional education in the curriculum</p>	<p>Integration of physical activities and nutrition in the curriculum</p>		
<p>...educate parents, siblings, grandparents, children, community on healthy living</p> <p>...Interventions targeted P.A with recess as one</p>	<p>Involve both family members and the community on healthy living.</p> <p>Group learning</p>	<p>Community education on habit modification</p> <p>Peer learning</p>	<p>Community based approach</p> <p>Peer learning</p>	<p>Social based intervention</p>

<p>strategy, parents school staff and school nurse involvement.</p> <p>Older children and siblings as role models</p>				
<p>Program goals, self-esteem positive thinking, self-talk stress coping strategies, dealing with emotions, personalities, effective communication. Nutrition; reading labels, portions, sizes, eating for life and social eating. Activity; get moving barriers to goals and energy balance. Let's keep moving heartrate and stretches.</p> <p>BMI and holistic assessment</p>	<p>Integration care and putting all together for healthier you.</p>	<p>Holistic approach in improving lifestyle</p>	<p>Lifestyle change</p>	<p>Improved quality of life</p>
<p>Use nutrition labels to buy healthy food, serves family fresh fruits, serves fresh</p>	<p>Guiding and availing healthy foods</p>	<p>Guiding behaviour towards healthy eating</p>	<p>Healthy nutrition</p>	<p>Behavioural intervention</p>

<p>vegetables, able to ignore children's nagging and tantrums.</p> <p>Family plantation are important to increasing fruit and vegetable intake.</p> <p>Availability of adequate water resources to allow children to drink water instead of sweetened drinks.</p>	<p>and nurturing behaviour.</p> <p>Producing the right food and availing water.</p>			
<p>Change nutritional behaviour and beliefs among children.</p> <p>Adults lifestyle behaviour have a direct influence on children's nutrition pattern.</p>	<p>Adjustment of behaviour, culture and lifestyle in improving nutrition</p>	<p>Behaviour change to adopt good nutrition.</p>	<p>Adoption of healthy nutrition</p>	<p>Behaviour intervention.</p>
<p>...good evidence that physical activities have a positive impact on duration of moderate to vigorous physical activities, effects of leisure on physical activities</p>	<p>Adopting physical activities for leisure time to avoid sedentary behaviour.</p>	<p>Being active during leisure time.</p>	<p>Physical activities interventions.</p>	<p>Behavioural interventions</p>

rate BP, BMI pulse rate...				
Improve physical, activity infrastructure development maintenance and access.	Avail good space and fields for physical activities	Infrastructure for physical activities	Environmental modification	Environmental intervention

## 6 Results

The results are further presented within five main themes: behavioral interventions, environmental interventions, social interventions, culture-based interventions and improved quality of life.

Table 2. above illustrates the main themes and categories. The results are further analyzed in the text.

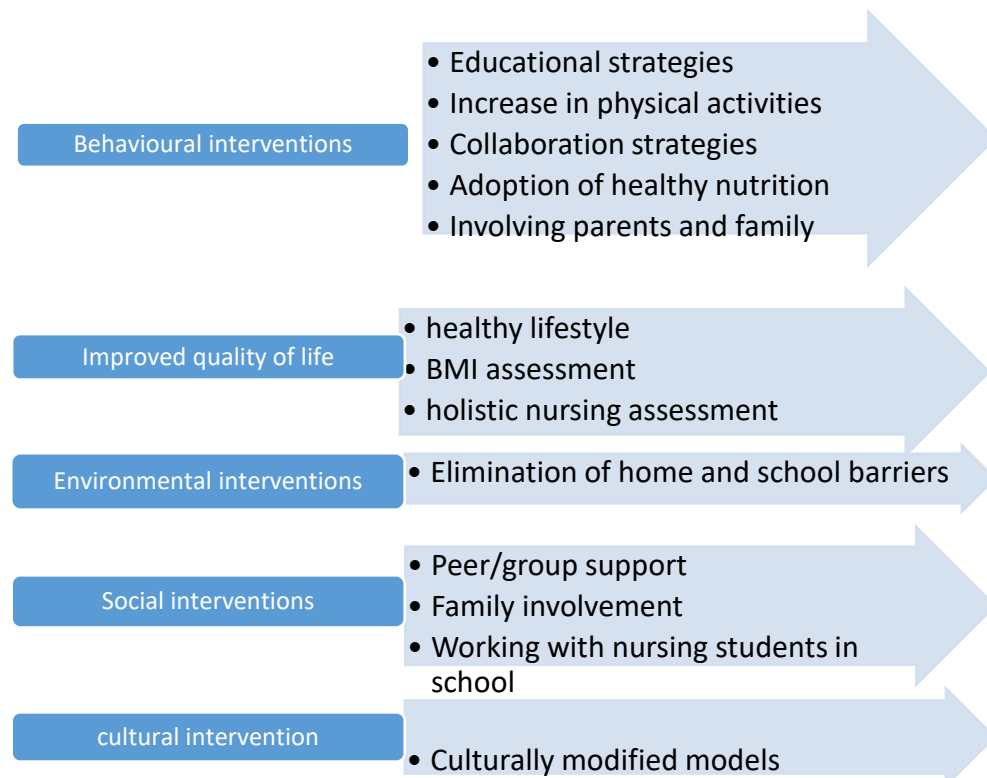


Figure 2. Themes and categories

## 6.1 Behavioral change interventions

### **Educational strategies**

Behavioural interventions involves the increase in physical activities, promotion of healthy dietary behaviour and decreasing sedentary activity by the school nurses' initiatives. One such intervention is Let's Go 5-2-1-0 program that employs modules to teach the importance of diet and activity. This program has been applied effectively by school nurses collaborating with nursing students to implement the school-based obesity intervention program (Tucker & Lanningham-Foster, 2015, 20). One community-based obesity prevention and treatment using the juveniles' Obesity Treatment protocol improves the quality of life in children as well as adolescents (Mollerup et. al, 2017). The treatment protocol is family-centered and includes visits to the pediatrician with instructions influencing diet and sleep (Tucker 2015,17).

### **Increase in Physical Exercise**

School nurses should be the major source of encouragement to the families to actively participate in the physical activities they enjoy and reinforce the health benefits of sustained exercising, to enhance the likelihood that lifestyle changes will be adhered to and comorbidities are prevented. Physical activity is affordable, non-pharmacological intervention for children. Physiologically, exercise improves insulin sensitivity by enhancing the transportation of glucose into muscle cells and the accelerates the production of muscle glycogen, replacing the amount used during physical activity. Moreover, physical activity boosts fat-free mass and muscle tissue volume, which glucose can then be transported into. This results in long-term improvement of insulin sensitivity. Insulin sensitivity is greatly boosted by 40–60 minutes of aerobic exercise daily, but if exercise is not sustained, development in insulin sensitivity are reversed. Furthermore, exercise is connected to an enhancement in endothelial dysfunction, which contributes to atherosclerosis advancement. Therefore, nurse's

ought to emphasize the significance of maintaining physical activity into adulthood to curb the risk of developing cardiovascular disease (Horying 2016, 34.)

### **Collaboration strategies**

School administrative leaders, teachers, and school nurses can partner with healthcare students and possibly social and behavioral science students in the mentorship of these innovative resources such as a service-learning model and the implementation of evidence-based interventions like the Let's Go 5-2-1-0 to explore integration of health messages into the primary school curricular. These have been proved to be effective strategies for reaching children and families in curbing pediatric obesity Relying on existing infrastructure like lunchtimes, recess, and gym class are examples of leveraging existing curricula and structure. Thinking innovatively about delivery of health messaging in the classroom also capitalizes on contemporary survey findings that indicate learning can be enhanced when children are nourished well and engaged in Physical Activities. (Tucker & Lanningham-Foster, 2015, 20.) The nursing students in this case expand activities with children by engaging with them in meal time as in the original study but also at recess after lunch as time permitted (10–20 min), which has been emphasized by In fact, two of three systematic reviews on impacts of recess for childhood obesity (Ickes, Erwin, & Beighle, 2013; Tucker 2015,450-66).

### **Healthy Nutrition**

The school nurse can as well adopt CHEE program in childhood obesity prevention, this is a plot project which was implemented in two summer programs for younger (elementary school age) and older children (high school age) residing in an inner city, community. A manual was developed to review key concepts in relation to healthy eating for example, to eating more green foods that is, fruits and vegetables and fewer yellow and red foods like sweets, snacks, and desserts as well as increasing levels of physical activity daily. Children participated in art activities and games, such as developing commercials and building games to encourage and to provide education

on healthy eating, to improve knowledge about eating higher numbers of green and fewer red foods. Children engaged in activities at each session and discussed the significance of engaging in 30 minutes of physical activities daily. (Burbage et al., 2013.)

The COPE(Creating Opportunities for Personal Empowerment ) program is another promising intervention by school nurse that can be employed to implement healthy nutrition basics to the preadolescents for instance stoplight diet; red, yellow, and green would be used to refer to most unhealthy meal to the most healthy foods where a healthy diet is one rich in fruits like bananas, strawberries, pears, oranges, melons, or avocados and vegetables like; cooked spinach, carrots, peas, sweet potatoes, or beets, whole grains like; whole grain bread, crackers or pastas, lean protein: lamb, soft s small pieces of beef, chicken, fish, or turkey, and low-fat or fat-free dairy; only pasteurized cheeses or yogurts. Reading labels while purchasing food stuff from the food stores is also a perfect way of ensuring healthy nutrition with the aim of preventing childhood obesity, portion sizes, eating for life and healthy social eating and snacking can be healthy too. (Hoying 2016.)

### **Engaging parents and family members**

The home environment should as well be conducive for adoption of change for example, parenting practices and parenting behaviours that intend to influence their child's behaviour in an exact way, such as feeding must be positive towards the obesity preventive measures. According to Pandey et al, 2019, parents have a major role in the development of healthy eating behaviours, food values, and preferences in a child. The health of a child largely depends on the nutritional habits that are formed in the earlier stages of their life. Similarly, parents can control a child's food choices by either restricting them from eating high sugar food, pressurizing them to eat more, or using food as a reward for good behaviour. Some nursing intervention programs that attempted to engage parents to help promote healthy dietary intake among children showed positive effects in children's vegetable consumption. Programs that teach good parenting practices could be effective in encouraging juveniles

to eat more vegetables. A key issue is how to motivate parents to adopt and use effective food parenting practices. (Pandey et al, 2019, 19.)

## 6.2 Environmental interventions

### **Elimination of Home and School barriers**

School-based interventions for obesity majorly focus on aspects related to nutrition and physical activity. However, it's important to note that obese students also struggle with simple physical activities, like climbing stairs and walking down the hall, in addition to psychosocial struggles, such as being teased or bullied because of their weight. School personnel need to be conscious of these issues and be sensitive to environmental interventions that might reduce barriers these students are exposed to, such as creating a class schedule that recognizes their mobility issues. For example, the school nurse needs to consider environmental constraints that create barriers for juveniles to play freely outside both at school and at home, time availability and financial pressure on adults related to food choice and preparation influence once food choices and behaviour due to advertisements. (Ickes et al., 2014, 61.)

The school nurses should aim at improving the home environment of the juveniles by creating awareness because most children share their food setting with parents and siblings. This shared family food environment is possibly the most important influence on juveniles' dietary consumptions and therefore, provides an important situation for improving diets and eating behaviors among juveniles. Parental roles in preparing meals at home and parental feeding styles are major contributing factors to child eating behaviors because family is important, a home-based intervention is crucial. Furthermore, studies conducted by suggested that preparing meals from scratch is the only meal preparation way positively associated with family meals. Preparing meals at home from ready-made food was negatively associated with family meal frequency. (Kornides et al, 2014; Litterback et al., 2014; Pamungkas et al. 2019.)



## 6.3 Improved quality of life

### **Holistic Nursing assessments**

The prevention and management of obesity need the knowledge of determinant and environmental factors that contribute to the progress of the. To help determine health teaching requires, school nurses to assess child and family behavioural and social in relation to weight gain. As a result, a holistic nursing assessment is a priority, and the steps to be outlined based on the following; birth history with the family, antenatal history, birth weight, postnatal history, developmental history, Weight history, dieting history, physical activity/inactivity history, family history, psychological history, BMI measurement, height and weight, perform blood pressure recordings, urinalysis, blood tests such as urea and electrolytes, liver functioning tests, fasting glucose and lipids test, exercise stress tests, ECGs and glucose-tolerance tests and Medical history. All these can be achieved partnering with the nursing students under the supervision of the school nurse. (Rabbitt & Coyne 2012.)

Although the long-term goal is to increase physical activity, these students may be at a low level of physical health. This is important to acknowledge. School nurses and school staff should build a caring rapport with the student, and then gradually increase physical activity, this will create a conducive environment for change. School nurses demonstrate their ability to not only assess quality of life at school, but they also have supportive, long-lasting relationships with these students. They are a significant link between the school system and healthcare system (Powell et al. 2017.)

### **Involving nursing students in School BMI Assessment**

School nurses can play an important role as facilitators for collecting student health information such as weight and height / Body Mass Index. However, there are few available published reports regarding the effectiveness of school nurse delivered pediatric obesity prevention programs. As a result, it has been proved that school nurse with the limited resources can achieve this with the help of a service-learning

framework where nursing students (under faculty supervision) can partner with them to both provide a service to the community. (Tucker 2015.)

## 6.4 Social interventions

### **Peer support**

Group interventions may also be applied to successfully help prevent obesity among students because peer support is critical in decreasing the bullying experienced by the victims. For instance, adapting the ASSIST peer-education model, in promoting healthy lifestyle by reducing smoking uptake, with the view to increasing healthy eating and physical activity amongst adolescents. If several students are likely to have severe obesity in a school, the school nurse can facilitate such an intervention to promote moral support in the prevention (Powell et al. 2017.)

Additionally, structured peer mentoring programs have also been used to prevent childhood obesity among the adolescents in the school setting because they are goal oriented and skill building. Peer-mentoring method provides a practical, flexible, and tailored means to meet various school guidelines for significant practice in a school context. Structured peer mentoring using trained high school mentors to support behaviour modification in younger peers is an innovative approach to meeting the school health guidelines to promote healthy eating and physical activity. Through a well-organized peer mentoring, adolescents are provided consistent social support in a caring and personalized way. This support builds skills and competencies enhancing self-efficacy to sustain a lifetime of physical activity attitude. (Smith et al. 2016, 315-323.)

### **Family involvement**

Furthermore, the social interventions may include the family members and relatives as well, the family may be including anyone related, by birth or not, who is important to the child. This definition includes single parents and separated couples, in addition

to the nuclear family. For instance, all childhood obesity guidelines and expert opinion suggest that nursing intervention programmes should be family based and only entered when the parents appear to be motivated and willing to make changes. To address childhood obesity, the family involvement is a requirement because family is central to a child's care and family-centered care is essential to children's nursing. Therefore, the school nurse would be more successful if she involves the family members too in the prevention interventions. (Rabbitt & Coyne, 2012.)

## 6.5 Cultural interventions

### **Culturally Modified Models**

School nurses can employ culturally adapted approaches like PEN-3 model, a framework which guides in the adaptation or development of health promotion interventions for different races as it has worked for African American students. Furthermore, school nurses can influence the selection of health programming that may come to their schools. They can also apply the PEN-3 model to assess the compatibility of potential school-based health interventions with the target population that they serve. Fundamentally, the cultural strategies can be helpful for school nurses to consider when they are developing new obesity prevention programs and implementing current obesity prevention programs. For instance, they can examine ways to connect with local school community in order to expand an obesity prevention intervention that is targeted to youth, parents, and community residents. (Kannan et al., 2010; Shaw-Perry et al., 2007; Saria et al., 2015, 43.)

School nurses who work in elementary schools can collaborate with other school nurses who work in junior high schools and high schools so that they can advance a mentor–mentee program to incorporate into the current obesity prevention program. Moreover, they are in a significant position where they can access a large group of individuals from within the school environment. For example, they can help to seek ways to access the extended family and the neighbourhood residents. The extended family can be reached out by the schools when the youth are picked up,

dropped off, and at special events at the school. Additionally, the schools are in neighbourhoods where residents are deeply involved in the school community. There is also an opportunity for school nurses to explore using these strategies beyond obesity prevention in the AA youth population as well as with other ethnicities (Kannan et al., 2010; Shaw-Perry et al., 2007; Saria et al., 2015, 43).

## **7 Discussion**

### **7.1 Ethical consideration, Validity and Reliability**

Ethics is one of the significant parts of any research work and in ethical research it is necessary for generating sound factual knowledge for evidence-based practice in nursing ethically. (Grove, et al.2014). Reliability involves the level of consistency that a research instrument attribute to be measured. It's appropriate to use secondary resources as it can save time, money and resources for the researchers who will not have to conduct the study alone (Horstein 2015, 219). Validity of any research instrument can be defined as the degree to which an instrument measures the intended item. It also refers to the extent to which an instrument represents the factors placed under study. In order to achieve content validity, the sourcing of the data of the secondary included a wide range of topics to understand the implications of economic decision making by project manager or the success for a project (Hornstein 2015, 291).

According to Finnish Advisory Board on Research Integrity (TENK), a research must be concluded to the responsible conduct of researcher in an ethically accepted and reliable manner. For instance, the reliability of a research includes respecting others work, citing their work accordingly and giving them credit they deserve. This dissertation is conducted through a literature review and all works of other authors are properly acknowledged in the reference part that means that there was no consent,

participants, interviews or personal contact of characters used to collect the data. (TENK 2016.)

In the literature review the author has used secondary data collection through reading literature that have been done properly and outlined different intervention approaches used by the school nurse to prevent the childhood obesity before it causes serious health problems in juvenile's life. The information search was done using databases offered by Jyväskylä University of Applied Science and all references appropriately used in the thesis. This literature review has followed the code of ethics, regulations and reliability. However, this work met challenges like funding limitations for instance some of the most recent price tagged articles could not be accessed hence it only covers freely accessible publications and this limited deeper investigation. Refer to appendix 2 below. The original data were reliable as the citation and references were justly used and the credit accorded to the original researchers. They were equally proved to be ethically sound as the consent of the older children who participated in the models and programmes were sought before the research and the parents of the little participants granted their consent too.

The question of the research has been used as a major tool for gauging the qualities of the articles incorporated into this work beside other factors like; the year of publication, validity in terms of variables, transferability and applicability, ethical consideration and reliability for instance, content Validity is the extent to which a measure encompasses the construct of interest (Petty et al. 2009). This literature review was found to be valid as the articles chosen either directly answer the research question or contributed to the background of the research work as a whole. In addition, validity means the extent to which the scores from a measure represent the variable they are intended to, this entails the entire experimental concept and establishes whether the results obtained meet all of the requirements of the scientific research approach (Petty et al 2009). This literature review was equally proved to be valid as the variables used in the articles of interest were juveniles between the age of two and nineteen in school context as required by the research question. Furthermore, reliability is also a major factor that supports validity of a research, this survey can be

tested and be retested in terms of reliability and internal consistency, the researcher is more confident that the scores represented in the result can be achieved if the data collection criteria is followed and the same research question is applied.

Finally, the method and data sourced for this literature review were evidence based, contemporary and vast in terms of ethnicity and population as most sources were from American nursing journals, some from Europe and Asia and one from Africa hence can be used by other countries' school nurses to prevent childhood obesity regardless of school healthcare system uniqueness.

## 7.2 Discussion of the results

The studies found during this literature review search demonstrated insufficient data related to school nurse nursing interventions of pediatric obesity. Most articles were generally related to school-based nursing interventions and general nursing interventions. However, the involvement of the parents and family members in every approach chosen has been seriously emphasized by all the researchers in addition to the adoption of school-based obesity prevention interventions that execute innovative resources such as a service-learning model and implement evidence-based interventions like the Let's Go 5-2-1-0 model can be effective strategies for accessing children and families in the fight against pediatric obesity. Multidisciplinary collaboration is equally key in the implementation of these approaches for instance, school administrative leaders, school nurses, teachers, can collaborate with healthcare students and possibly social and behavioral science students in training to explore integration of health messages into the primary school curricula. (Tucker et al. 2015, 17.)

Moreover, building on existing infrastructure such as lunchtimes, recess, and gym class are parts of leveraging existing curricular and structure. Innovative thinking about delivery of health information in the classroom also emphasizes on contemporary study findings that indicate learning can be improved when children are nourished properly and engaged in Physical Activities. This can be successfully adopted by the school nurse globally irrespective of the context. (Lees & Hopkins, 2013.)

Improving dietary and nutritional strategies, as well as increasing physical activity and parent education, is vital to improve health and to prevent disease. Similarly, appropriate timing of the school meals is equally critical considering that juveniles must eat something at home as well after school therefore the meals should be spaced well in terms of time. Another study finding proved that incorporating the 15-week COPE Healthy Lifestyles TEEN program into a required science class for sixth-grade students is acceptable and was well received by urban-dwelling minority students. Integration of the COPE program within the science class was suitable for the theory and content being taught in the students' science class. The results suggest that the intervention program had a positive medium effect on anxiety scores as well as a slight positive effect on healthy lifestyle beliefs. A positive effect was noted on physical activities (Mazurek et al. 2016, 352. & Arfic et al 2019, 15.)

Furthermore, the children's social environment and the policies that shape them have a substantial impact on physical activity they get daily, and lack of physical activity is a major contributor to the obesity epidemic. Therefore, promotion of an activity-friendly environment is one way to help turn around the epidemic this includes the modification on the man-made environment such as buildings, streets, and communities to encourage walking and biking, parks and playgrounds that are plentiful and appealing, and neighborhoods where juveniles feel free and are safe with or without supervision. Such adjustments of projects have greater impact on the environment and essential for the achievement of the goal of making physical activity a regular and natural part of children's daily lives. (Harrell et al. 2015, 16.)

Additionally, biological factors, sociocultural and psychological factors, too must be addressed early in life as they have been confirmed to influence weight status and gain. Parents' education on how to prevent obesity risk factors like overweight and the dangers of childhood obesity is vital. Parents should create a conducive environment for healthy lifestyle with increased level of physical activity, availability healthful diet and the family's social climate and ethnic culture that promote healthy changes. (Boisvert et al. 2016, 42.)

Utilizing new evidence-based methods like structured peer-mentoring programs in a school setting by the school nurses also can be adopted as they have registered positive changes in terms of eating behaviour and physical activities. In this approach the mentee learns behaviours from the role modelling, illustrated support for behaviour modification, and guidance provided from peer mentors. Structured peer mentoring retains the social support and developmental advantages of peer mentoring and adding behaviourally focused instruction where numerous benefits to the use of peer mentors in structured mentoring programs promoting physical activity among teens. (Smith et al. 2016, 315-323.) The peers have the opportunity it promotes healthier choices of food for example; by reinforcing education on nutritional information and product displays like labelling systems of food such as pyramid diagrams to depict calories content. (Brown et al. 2016, 9.)

Culturally adapted interventions may as well offer a solution to improving obesity prevention interventions as they have been proved to have yielded fruits among the African American youth because these interventions may be more relevant to the intended audience, favourable trends have been found in reviews on the effectiveness and significance of these strategies that were able to improve body composition as well as behavioural outcomes. For instance, the PEN-3 model which is a framework that is constructed from a cultural perspective can be used to guide the development, implementation, and appraisal of culturally adapted intervention approach. (Lofton 2016, 32-46.)

Finally, future research should focus on effects of the program over the entire school year or multiple years where concepts are introduced over time and keep juveniles involved and motivated. Periodic effects might also be better understood as well with a full academic year. Building the curricular on well-developed behavioral theories and investigating contexts and challenges associated with prevention plans in different settings will further enlighten what small groups will likely to benefit from various components. As highlighted by Cowell, future research can elaborate the willingness and ability of school nurses to engage in obesity prevention, while also addressing issues of resources and competing interests. (Wang et al., 2013.)



## Conclusion

In summary, school-age juveniles with severe obesity experience lower quality of life psychologically, physically and emotionally. To prevent such incidents students can benefit from tailored interventions that address psychosocial well-being, in addition to physical health interventions that are geared to healthier lifestyles and the management of overweight before obesity is critical. These interventions can be behavioral environmental and social. Pediatric nurses in acute care or clinic contexts, together with school nurses, are well positioned to participate in collaborative efforts to provide school-based interventions for these students.

Considering that childhood obesity is a major public health problem, it is crucial that all health professionals, working in school setting, hospitals and community health care, participate in health promotion and health education strategies and should involve the parents and the families fully in addressing overweight as the major risk factor of childhood obesity which is already a challenge to the school healthcare hence curb childhood obesity (Tucker 2015). Nurses, along with all members of the multidisciplinary team, must recognize the scale of pediatric obesity and, in their daily interventions, help juveniles and families deal with the problem. The focus should be on strategies that will enhance the health of juveniles within the context of the family, school and community. Additionally, the nursing interventions discussed in this literature, broader preventative approaches, in the school setting, community, physical environment and society, are needed to prevent and reduce obesity in juvenile (Hughes and Reilly, 2008; Heitmann et al, 2009; Tucker et al 2015.)

Combining an evidence-based obesity intervention, along with environmental interventions previously discussed, may be a way to help severely obese students function optimally in school. The school nurse has the skills and scope of practice to provide evidence-based interventions, but the intervention must be tailored to the complex role of the school nurse. The most effective interventions involving school nurses use a modular approach that can be delivered in short sessions to accommodate learning activities during the school day (Powell et al. 2017.)

Healthcare staff, providers and policy makers have a responsibility to use the best available evidence -based resources to address the obesity problem. Finally, nurses are in a special position as they interact with families across healthcare and community-based settings and so can help in the prevention and management of overweight and obesity in children and adolescents. The link between childhood obesity and adulthood morbidities has been clearly established. If rates of obesity continue to accelerate persistently, the future generations will experience premature morbidity, chronic poor health and increased mortality. Childhood obesity if not curbed poses a serious health, social and economic problem today and for the future. (Melnik et al., 2015, 353.)

### **Abbreviations**

MBI Body Mass Index

PA Physical Activity

AA African American

TEEN Teenager

COPE Center for Obesity Prevention and Education or COPE Creating opportunities for personal empowerment

CO Childhood Obesity

OW Overweight

GE Genetic

FTO Fat mass and Obesity associated protein

QOL Quality of Life

PEN Person Extended Neighborhood Perception Enablers Nurturer and Positive Existential Negative

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## Appendices

### Appendix 1. A table

Author(s)	Publishing year and country	Title	Research method	Main findings
Benjamin Neelon S., Taveras E., Östöye T., Gillman M.,	USA  2014	Preventing Obesity in In- fants and Tod- dlers in Child- care; results from a Pilot randomized controlled Trial	Qualitative Reasearch:	The study shows innovative approach to promoting healthy childcare environments for in- fants and toddlers, but more rigorous testing is needed to determine its effects on child adiposity and to evaluate its potential for wide-scale dis- semination.
Boisvert JA; Harrell WA	Canada  2015	Integrative Treatment of Pediatric Obe- sity: Psycho- logical and Spiritual Con- siderations	Qualitative research	(BMI)—a weight-to-height ra- tio (wt/ht <sup>2</sup> ) <sup>1</sup> —is the most prevalent and can be used in any pediatric practice to evalu- ate body fat for children aged older than 2 years. <sup>2</sup>

Deavenport-Saman, Alexis; Piridzhanyan, Anet; Solomon, Olga; Phillips, Zoe; Kuo, Tony; Yin, Larry	USA, 2019	Early Childhood Obesity Among Underserved Families: A Multi-level Community–Academic Partnership.	Qualitative Research	The intervention demonstrated favorable results at all levels. A community–academic partnership is a promising approach for creating environmental change to address early childhood obesity among underserved families.
Ramalakshmi; Kurian, Midhu	INDIA 2018	Assessing the Knowledge Regarding Childhood Obesity among High School Children in Public Schools at Patel Nagar, Dehradun.	Qualitative research: Descriptive study	One of the best strategies to reduce childhood obesity is early recognition and control measures are essential before the adolescent reaches an obese state
Gentile N, Cristiani V, Lynch BA; Wilson PM, Weaver AL Rutten LJ; Jacobson DJ	England 2016	The effect of an automated point of care tool on diagnosis and management of childhood obesity in primary care	Qualitative research	Records of children with BMI > 95th percentile were electronically searched for terms of documentation of diagnosis of obesity and nutrition and physical activity counselling

Jacqueline Hoying, PhD, RN, NEA-BC1, and Bernadette Mazurek Melnyk	USA, 2016	Urban-Dwelling Minority Sixth-Grade Youth Improving Physical Activity and Mental Health Outcomes	Qualitative research; A Pilot Study	To determine whether the COPE intervention could improve PA, healthy lifestyle beliefs, and mental health of preadolescents in an urban school setting.
Laureen H. Smith, PhD, RN1, and Rick L. Petosa, PhD2	USA, 2016	A Structured Peer-Mentoring Method for Physical Activity Behaviour Change Among Adolescents	Qualitative research	Structured peer-mentoring method provides a feasible, flexible, and tailored means to meet the current guidelines for best practice in a school setting in the support of behavior change in younger peers is an innovative method to meeting the school health guidelines to promote healthy eating and physical activity.
Knierim, Shanna Doucette; Moore, Susan L.; Raghunath, Silvia Gutiérrez; Yun, Lourdes; Boles, Richard	USA 2018	Home Visitation for Delivering an Early Childhood Obesity Intervention in Denver: Parent and Patient Navigator Perspectives.	Qualitative Case study	Many existing home-based programs have reported and successfully worked through the types of challenges we identified in our program in order to implement successful, evidence-based home visiting programs (American Academy of Pediatrics Council on Child



E.; Davidson, Arthur J.				and Adolescent Health 1998; Finello et al 2016a, b.
Lofton S., Julion ., Mc Naughton D.,	USA  2016	A Systematic Review of Lit- erature on Cul- turally Adapted Obe- sity Prevention Interventions for African American Youth	Qualitative Research: Systematic Review	The study is about components of the interventions that stood out as most promising in this review were interventions that targeted both parents and the youth together, a mentor– mentee relationship in which the youth and the mentors en- gaged in the activities to- gether, and emphasized healthful activities that the youth preferred
Marie Kainoa Fialkowski, Barbara De- Baryshe, An- drea Bersa- min, Claudio Nigg, Rachael Leon Guer- rero, Gena Rojas, Aufa’i Apulu Ropeti Areta, Agnes Vargo, Tayna Belyeu-	2014 USA	A Community Engagement Process Identi- fies Environ- mental Priori- ties to Prevent Early Child- hood Obesity: The Children’s Healthy Living (CHL) Program for Remote Underserved Populations in the US Affili- ated Pacific	Qualitative Research  Case Study	Community engagement pro- cess (CEP) used by the Chil- dren’s Healthy Living (CHL) Program for remote under- served minority populations

Camacho, Rose Castro, Bret Luick, Ra- chel Novotny, the CHL Team		Islands, Hawaii and Alaska		
Marcela Ma- ria PANDOLFI, <sup>1</sup> Jane de Eston ARMOND, <sup>1</sup> Neil Ferreira NOVO, <sup>1,2</sup> Carolina Nunes FRANÇA <sup>1,3</sup> and Patrícia COLOMBO- SOUZA <sup>1</sup>	2016 São Paulo, Brazil	Timing of school meals as a predispos- ing factor for childhood overweight and obesity	a cross- sectional study	Being overweight is more prev- alent than obesity in children. Moreover, the frequency of obesity in boys was higher than in girls.  Improving dietary and nutri- tional strategies, as well as in- creasing physical activity and parent education, is critical to improve health and to prevent disease.
Natasha Dawe & Katrina Sealey	Britain, 2019	School nurses: undervalued, underfunded and over- stretched	Qualitative study	School-based childhood obe- sity prevention programs have grown in response to reduc- tions in child physical activity (PA), increased sedentariness, poor diet, and soaring child obesity rates

Shah, Dipika; Maiya, Arun	2017, India	Prevalence of Childhood Obesity in Anand District	Equations & formulas, re- search, ta- bles/charts	Present study documents prev- alence of obesity as 20%. Ur- ban children and boys are at higher obesity spectrum. WC is more suitable as an outcome measure to diagnose obesity.
Powell, Shan- non Baker; Engelke, Mar- tha Keehner; Neil, Janice A	2018, USA	Seizing the Moment: Ex- periences of School Nurses Caring for Stu- dents With Overweight and Obesity	Qualitative research	School nurses are well posi- tioned to assess, intervene, and evaluate efforts to posi- tively impact students who are overweight or obese.
Shannon Baker Powell, Martha Keehner Engelke, and Melvin S. Swanson	2018, USA	Quality of Life in School-Age Children with Obesity	Qualitative research	Quality of life is an important concept associated with child- hood obesity. It has been found that children and ado- lescents with obesity describe a significantly lower level of quality of  life when compared to those who are of normal weight.
Sparano, Sonia; Ahrens, Wolfgang; He- nauw, Stefaan;	USA, 2013	Being Macro- somic at Birth is an Independent Predictor of Overweight in Children:	Qualitative Research	Fetal macrosomia, also in the ab- sence of maternal/gestational dia- betes, is independently associated with the development of over- weight/obesity during childhood. Improving the understanding of

Marild, Staffan; Molnar, Denes; Moreno, Luis; Suling, Marc; Tornaritis, Michael; Veidebaum, Toomas; Siani, Alfonso; Russo, Paola		Results from the IDEFICS Study		fetal programming will contribute to the early prevention of childhood overweight/obesity.
Tucker S., M. Lanningham-Foster L.,	USA 2015	Nurse-Led School-Based Child Obesity Prevention	Qualitative Research: systematic review	School-based obesity prevention interventions that use innovative resources such as a service-learning model and implement evidence-based interventions like the Let's Go 5-2-1-0 can be effective strategies for reaching children and families in the fight against childhood obesity.

## Appendix 2. Quality of the articles

### Quality of the articles

Author	Abstract/ title	Introduction and aims	Methods and data	sampling	Data analysis	Ethical and bias	Transferability or generalization	Implications	Total	Comments
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								/us eful nes s		
Benjamin et al. (2014), USA.	4	4	3	4	3	5	3	4	27	Good
Boisvert et al. (2015), Canada	4	4	3	3	3	4	3	4	28	Good
Deavenport-Saman et al. (2019), USA.	4	4	3	3	2	4	2	4	26	Good
Ramalakshmi & Kurian, (2018), India.	5	2	3	2	3	4	3	4	25	Good
Gentile et al. (2016), England.	5	5	3	3	3	4	4	5	32	Very
Jacqueline et al. (2016), USA.	5	5	4	4	5	4	3	5	35	Very
Knierim et al. (2018), USA.	3	2	3	2	3	4	3	5	25	Good
Laureen H. Smith, PhD,	4	4	5	5	5	4	4	4	35	Very

RN1, and Rick L. Pe- tosa, PhD2										good
Lofton et al. (2016), USA.	4	4	5	4	5	4	3	5	34	Very
Marie et al. (2014), USA.	3	3	3	3	3	3	3	4	25	Good
Marcela et al. (2016), São Paulo, Brazil.	3	3	3	3	3	4	3	3	24	Neutr
Natasha & Katrina ( 2019), Britain.	5	4	4	4	4	4	5	5	35	Very
Shah & Maiya (2017), India.	3	4	3	3	2	2	2	3	22	Neutr
Powell, et al. (2018), USA.	4	4	4	5	4	3	4	4	31	Very
Shannon & Martha (2018), USA.	4	5	4	3	4	4	4	4	32	Very

Sparano et al. (2013), USA.	3	3	3	3	2	2	3	3	28	Good
Tucker & Lanning-ham-Foster. (2015), USA.	5	5	5	4	5	4	5	5	38	Very