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Childhood and Adolescent Obesity: Related Comorbidities and Interventions

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Childhood and Adolescent Obesity: Related Comorbidities and Intervention Methods

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NURS 4500: Nursing Research & Senior Thesis

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Abstract

Background

The prevalence of childhood and adolescent obesity in the United States has steadily risen over the years and has become a public health concern. Obesity is defined as a BMI at or above the 95th percentile for children and teens of the same age and sex. Obese children and adolescents are at risk for poor health and poor quality of life. Furthermore, there are numerous comorbidities associated with childhood and adolescent obesity. While some of the associated diseases are acute, others can become chronic and result in lifelong conditions.

Objective

The purpose of the present thesis is to explore and summarize the currently available literature regarding diseases that relate to childhood and adolescent obesity, factors that can affect obesity, and possibly effective prevention methods.

Summary of Findings

Children and adolescents who are obese are likely to have various comorbidities. Some of these comorbidities include increased risk for hypertension, obstructive sleep apnea, and other cardiometabolic risk factors. Due to obesity and related comorbidities, children and adolescents have poorer physical and mental health. Some of the mental health deficits seen in obese children include depression, learning disabilities, and attention deficit disorder. Research has shown that food environments and sleep duration can be factors in obesity in children.

Proposal

The gathered information will then be utilized to formulate a proposal on how nurses across school settings can play a direct role in the prevention of exacerbation of obesity and comorbidities associated with childhood and adolescent obesity.

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Introduction

Obesity in the childhood and adolescent population is a rising public health concern in the United States. This puts children and adolescents at a risk for poor health and quality of life. According to the Centers for Disease Control and Prevention (CDC), “1 in 5 children and adolescents in the US have obesity”. On their website page titled, “CDC Healthy Schools”, the CDC reported that “in the United States, the percentage of obese children and adolescents has more than tripled since the 1970s”. The percentage of obese children and adolescents is growing exponentially over time and it is essential to find methods and interventions that are useful and effective in decreasing this prominent issue.

Problem Statement

There are an array of health problems that stem from childhood and adolescent obesity. While some of the consequences of obesity are immediate health risks, there are also lifelong chronic health conditions that are associated with childhood and adolescent obesity. To ensure the health of children, adolescents, and future generations, it is paramount to explore and discuss chronic diseases that relate to childhood/adolescent obesity, lifestyle factors that can affect obesity, and interventions that can be implemented to prevent them.

Nurses play a direct role in the prevention and treatment of childhood obesity whether that be in a hospital setting or the school environment. Nurses can assist families in preventing obesity and comorbidities by providing them with knowledge and education. The purpose of this thesis is to explore and summarize current research regarding comorbid diseases related to childhood and adolescent obesity, identify specific factors that play a role in obesity, and discover nursing intervention methods that can be implemented to prevent the comorbidities and the exacerbation of obesity in children and adolescents.

Literature Review

The objective of this literature review is to consolidate existing literature on the topic of comorbidities and prevention methods for childhood and adolescent obesity. The questions being answered in this literature review are: what are some of the comorbidities that stem from childhood and adolescent obesity, what are some factors that cause obesity, and how can we prevent them?

The internet was the primary medium utilized to find articles relating to childhood and adolescent obesity. The search terms used were “childhood”, “adolescent”, “obesity”, “comorbidities”, and “prevention”. PubMed Central was the only database used to find articles related to the topic. PubMed Central was the chosen primary database because it is widely known to be a reliable source with open access to full texts and literature.

The conducted search with the previously mentioned search terms yielded more than one hundred articles. The articles included in this literature review were each methodically selected based on their relevance to the topic and the information they provided. Each article was read thoroughly and the information it provided was analyzed and taken into consideration before deciding whether or not it would be included in the literature review.

Although a refined search on PubMed Central yielded countless results, only a total of six articles were chosen for this literature review. The articles that will be discussed in this literature review will be divided into two categories. The first category will consist of articles that discuss various comorbidities that are related to childhood and adolescent obesity. The second category will consist of articles examining how certain factors influence childhood and adolescent obesity. See the Appendix for a Literature Review Table with a summary of each article.

Category 1: Comorbidities Related to Childhood and Adolescent Obesity

When children and adolescents have obesity it is common for them to have or develop other diseases. These related diseases are also known as comorbidities. Through researching comorbid diseases that relate to obesity, it was found that there are numerous related comorbidities. Halfon et al, (2013), Munthali et al, (2016,) Norris et al, (2020), and Watson et al, (2014) all published research regarding how obesity in childhood can lead to the development of comorbid diseases. With the knowledge provided from these various studies, nurses may have a better clinical guideline for identifying comorbidities associated with pediatric obesity.

Halfon et al. (2013) examined the relationship between weight status and the overall health of children in the United States using a quantitative, cross-sectional study design. The study performed a cross-sectional analysis of data on 43,297 children with ages ranging from 10-17 from the National Survey of Children's Health. Through their study, it was found that obese children were more likely to have an array of physical and mental health deficits, compared with children classified as not overweight. Some of the mental health deficits include internalizing or externalizing problems, hyperactivity disorder, depression, learning disabilities, and attention deficit disorder. These specific mental health deficits were in conjunction with school-related problems. The physical health deficits that they found to be associated with pediatric obesity include bone, joint, and muscle problems, asthma, allergies, ear infections, and headaches. Compared with children classified as not overweight, obese children were also more likely to have reported poorer general health. In conclusion in their study, obesity and overweight in children were associated with poorer health status, poorer school performance, and decreased emotional functioning (Halfon et al., 2013).

Munthali et al. (2016) researched to “explore distinct sex-specific adiposity trajectories from childhood to late adolescence and examined their relationship with blood pressure”. Their study utilized a quantitative, cohort design which included 1,824 black participants with ages ranging from 5 to 18 years old. The participants each had their height and weight measured to calculate their BMI. Participants also had their blood pressure and mean arterial pressure measured. Through their research, Munthali et al. (2016) found that “the early onset obesity or overweight trajectories are associated with elevated blood pressure in late adolescence”. Their research suggests that patterns of adiposity compared to cross-sectional BMI measures may be a favored predictor of future systolic and diastolic blood pressure, mean arterial pressure, and elevated blood pressure. The results yielded from their study confirmed that although there is heterogeneity in BMI trajectories and that trajectories differ between boys and girls, being in an obese or overweight trajectory was associated with an increased risk of elevated blood pressure (Munthali et al., 2016).

Norris et al. (2020) utilized a quantitative, correlational study design “to determine whether the duration of obesity is related to heterogeneity in cardiometabolic risk”. The researchers examined obesity duration in relation to the numerous cardiometabolic disease risk factors collected in mid-adulthood such as systolic and diastolic blood pressure, high-density lipoprotein cholesterol, and glycated hemoglobin. Their study was comprised of 20,746 participants which included men and women of ages ranging from 10 to 40. It was discovered that all worse values for all cardiometabolic disease risk factors were associated with a longer duration of being obese. Elevated glycated hemoglobin levels happened to have the strongest association with obesity duration. Participants with obesity for greater than 5 years had relatively higher levels of glycated hemoglobin by 5% when compared with participants who were never

obese. Most importantly, their research concluded that there is a gradually increasing risk for hypertension associated with an increasing duration of time being obese (Norris et al., 2020).

Watson et al. (2014) aimed to “determine if cardiometabolic risk markers are increased among obese youth with obstructive sleep apnea as compared with their equally obese peers without obstructive sleep apnea”. The study utilized a quantitative approach and included 96 participants with ages ranging from 12 to 16 years old. According to their study, obesity in children can lead to obstructive sleep apnea, and not only is it linked to obesity and insulin resistance but also a high prevalence of cardiometabolic diseases and type 2 diabetes in adults. Their research found that obese youth with ages ranging from 12 to 16 years old with greater severities of obstructive sleep apnea have higher fasting insulin and lower fasting insulin sensitivity. Obese participants with moderate or severe obstructive sleep apnea also had elevated homeostasis model assessment insulin resistance (HOMA-IR), compared with participants who had mild or no obstructive sleep apnea. Their conclusion to the study was that obstructive sleep apnea is associated with increased insulin resistance in obese non-diabetic youth (Watson et al., 2014).

Category 2: Various Factors That Influence Childhood Obesity

Through researching childhood and adolescent obesity, it was discovered that certain lifestyles and environmental factors play a role in the development and exacerbation of obesity. More specifically, sleep and food environments are the two factors that will be discussed in this category since they were the most prevalent in the research that was found. Understanding how and why these factors play a large role in the development and exacerbation of childhood obesity may help practitioners and nurses to formulate more effective preventative interventions for obesity in the childhood population.

A study formulated by Scharf and DeBoer (2015) sought to evaluate the bedtime and wake time of 4 to 5-year-old children and their association with weight gain. Scharf and DeBoer used a cross-sectional and longitudinal study design and acquired data regarding the timing and duration of weekday sleep via a parent questionnaire. They utilized a nationally representative sample of children from the Early Childhood Longitudinal Study - Birth Cohort which included 10,700 initial participants. At 4 years of age, 15.9% of those children were overweight and 15.6% of them were obese. At 5 years of age, 16.6% of those children were overweight and 15.2% were obese. Compared with the normal-weight children, the obese children had a later bedtime. Their findings suggest that bedtime is a modifiable risk factor for overweight and obesity. Preschool children who have a later bedtime are at risk for heavier weight status and increased weight gain over time. By setting an earlier bedtime, parents may help their preschool children restrain from gaining unhealthy weight (Scharf & DeBoer, 2015). With the information provided by this study, healthcare professionals can recommend earlier bedtimes and promote longer sleep durations for younger children who are at risk for weight gain or obesity.

Wang et al. (2019) created a study to examine the association of residential food environments with childhood obesity and the variation of the associations across genders and urbanicity. They utilized the US Early Childhood Longitudinal Study - Kindergarten Cohort data with 9440 kindergarteners followed from 1998 to 2007. From the results of their study, it was learned that children with decreased exposure to full-service restaurants, retail bakeries, fruit and vegetable markets, and beverage stores were more likely to become obese. Children with decreased exposure to dairy-product stores were generally less likely to become obese. There were mixed findings between the associations of fruit and vegetable markets with child weight status between genders. Wang et al. (2019) concluded that “exposure to different food

environments seemed to lead to different childhood obesity risks during 1998-2007; the association varied across gender and urbanicity”. According to the researchers, this study contains important public health implications. The findings from this study indicate that improving food environments across the United States can prevent childhood obesity.

Discussion of Literature Review

The literature reviewed in category 1 all pointed to the fact that having obesity leads to the development of various comorbidities. The most prevalent comorbidity discussed in the research is cardiometabolic issues. Obese children are either at risk for or have elevated blood pressure. Children who have obesity are also subject to having obstructive sleep apnea, higher fasting insulin, mental health deficits, and school-related problems. The research discussed in category 2 discovered that later bedtime and food environments were factors that influenced obesity in children. Later bedtime and shorter sleep duration in 4 and 5-year-olds, put them at risk of being overweight or obese. Certain food environments were associated with a risk of obesity that differed between boys and girls.

The various studies previously discussed did have strengths and limitations. Most of the studies had large nationally representative sample sizes. Some of the studies accounted for the variances among race and gender. As for limitations, a couple of the studies relied on data that was given by parental reports, such as the studies by Halfon et al. (2013) and Scharf and DeBoer (2015). The study by Munthali et al. (2016) only utilized black participants so the sample was small and not nationally representative.

The literature review has undoubtedly provided insightful information on comorbidities of obesity and factors that put children at risk for obesity. However, the literature failed to

mention whether health promotion in the school setting could help to prevent obesity or the exacerbation of this disease.

Proposal For Further Research

The literature that has been reviewed previously provided valuable insight on the various comorbidities of obesity and how food environments, as well as sleep, are direct factors that influence childhood obesity. Without proper interventions and treatment, obese children and adolescents may develop comorbid diseases, such as cardiopulmonary issues or obstructive sleep apnea, which can become lifelong chronic conditions. Despite these findings, the literature failed to identify whether or not direct interventions in the school setting have any effect on childhood and adolescent obesity and the formulation of comorbidities. The proposed study would aim to answer the following questions: How can education on food and nutrition in the school setting impact the obesity rate of children and adolescents in the United States? If both parents and children are educated on the importance of proper diet and nutrition, will the rate of obesity in children and adolescents in the United States decrease? The ultimate goal of the proposed research is to see if the implementation of an education program in an elementary school regarding the importance of proper nutrition will decrease the BMI of students. If the BMI of students decreases, the likelihood of them developing chronic comorbidities will also likely decrease.

Theoretical Framework

Nola Pender's Health Promotion Model is an applicable theoretical framework for the proposed research study. Pender defines health as not only the absence of disease and illness but as a positive dynamic state. Her nursing theory focuses on three main areas: individual characteristics and experiences, behavior-specific cognitions and affect, and behavioral

outcomes. Along with a strong focus on those three main areas, the model also includes five key concepts which are the person, environment, illness, health, and nursing. Pender believed that the quality of life of patients could be improved by preventing illnesses or problems before their occurrence. The purpose of Pender's theory is to assist nurses in understanding what the major determinants of health are, and how to utilize those as a basis to promote healthy lifestyles. The end goal of Pender's model is for clients to display health-promoting behavior (Petiprin, 2019).

The proposed research study follows the theoretical framework of Pender's Health Promotion Model by aiming to prevent comorbidities and the exacerbation of childhood obesity. By implementing an education program, the goal is that children, with the assistance of their parents, will consequently adjust their lifestyles to be more healthy. With the newfound knowledge of healthy eating and lifestyle, children and parents can work together at promoting their health by preventing the exacerbation of obesity and related comorbidities and lowering their BMI. Over time, the children should experience better health and quality of life.

Research Design

The proposed study will be a quantitative, quasi-experimental, longitudinal study. 100 student participants will have their BMIs measured at the beginning of the school year and again at the end of the school year. These two BMI measurements will then be compared and analyzed to determine whether or not the implemented education intervention was successful in the reduction of BMI and obesity rate of school students.

Sample

For this proposed research, a convenience sample will be used. 100 students with ages ranging from 5 to 11 years with varying socioeconomic demographics will be recruited from an elementary school for this research. To recruit participants, researchers will contact Bahia Vista

Elementary School in Marin County of California in regards to having their students participate in this study. The purpose and methods of the research will be explained to the administration at Bahia Vista. Once the school agrees to allow student participation, the researchers will then contact the parents and students and receive informed consent and assent and begin the research.

Ethical Considerations

Prior to the conduction of research and retrieval of informed consent, the proposal will be presented to an Internal Review Board (IRB) for reviewal of ethical considerations and approval. For this specific study, the proposal will be presented to the Institutional Review Board for Protection of Human Participants (IRBPHP) at Dominican University of California. Once the proposal is approved by the IRBPHP, parents, and students will be contacted by the researchers to obtain informed consent and assent. Informed consent will be comprised of the purpose of the study, how the study will be conducted, what is required of the participants, how the data will be utilized, privacy and confidentiality, right to withdraw, recruitment criteria, chances of publication, and the benefits of the study.

In this research proposal, the sample consists of children who are considered to be a vulnerable population. Assent must be given by the students because they are minors, and the parents must offer consent before the study can begin. Parents and students will be assured by the researchers that their information and the collected data will remain confidential and they have a right to withdraw from the study at any time. The consent forms issued to parents will provide sufficient information regarding participation in the study in simple language. It will also assure parents that participation is voluntary. Once consent forms are retrieved from the parents of all participating students and signed by the researcher and a witness, the proposed research may begin.

Methodology

The 100 selected participants will each have their BMIs measured and recorded at the beginning of the school year before the implementation of an intervention. The ethnicity and annual household income of each participant will also be recorded. After the initial data is collected, an education intervention will be implemented. The 100 participants and their parents will go through an education program regarding proper diet and nutrition and BMI measurements. The education program will be taught to the participants and their parents in a single 3-hour session by school nurses. The education program will take place at Bahia Vista Elementary school in the multi-purpose room after school hours. A presentation format will be utilized as the educational module. Participants will also be given a physical, printed copy of the presentation at the end of the program session to serve as a take-home reference for all the information that has been presented and taught.

The education program will teach the participants and their parents the correct food groups, proper portion sizes, which foods are healthy, and the importance of a healthy diet. Participants and their parents will also be taught the consequences of an unhealthy diet and how it can lead to obesity or exacerbation of obesity. The school nurses will also educate children and parents on the definition of a BMI measurement and how it correlates to obesity. Children and their parents will also be allowed to ask any questions related to a healthy diet and lifestyle, which will be answered by school nurses. At the end of the education program, children and their parents should understand how to make healthy food choices and why it is necessary to adhere to a healthy diet.

The proposed study will be a longitudinal study. At the end of the school year, the selected participants will each have their BMIs measured and recorded again to see whether the education program was effective in reducing BMI in school aged-children.

Data Analysis

A T-Test will be utilized to compare the difference in BMI values pre- and post-educational intervention. Descriptive statistics including the mean, median, and percentages will be utilized to analyze the results. The initial BMI recordings will be analyzed to see how many of the participants are obese if any. The initial BMI recordings will be compared with the second BMI recordings to see if the percentage of obese participants has decreased. If the education program is successful, the results should display a percentage of decrease in the BMI values of the participants or a decrease in the percentage of obese participants.

Socioeconomic background is a factor that may skew the results of the study. Although the participants may acquire the knowledge on proper diet and nutrition, they may not have the ability to access proper food resources depending on their socioeconomic status. Without access to the proper foods, the participants that come from lower-income families may not be able to adhere to the education intervention provided by the study. Since the results may be affected by this factor, it is important to take into consideration the socioeconomic status of each participant when analyzing the data.

Conclusion

Children and adolescents with obesity are at high risk for comorbidities. These comorbidities include cardiometabolic issues, type 2 diabetes, obstructive sleep apnea, higher fasting insulin, mental health deficits, etc. While some of these comorbid diseases have been

identified, there are still more to be researched and possibly linked with obesity. Factors such as sleep and food environments play a role in obesity in the childhood and adolescent population.

With the percentage of childhood and adolescent obesity on the rise, proper education intervention methods need to be applied in clinical practice. Health promotion should be a prioritized method of reducing obesity. The number of obese children and adolescents will continue to rise in the United States if there is no baseline for education programs on proper nutrition and diet in the school setting. If proper nutrition is taught in schools using education programs, children and adolescents will be able to maintain healthy weight and BMIs and reduce the risk of developing comorbidities.

The proposed study, if successful, can be used as a guideline practice for school nurses in the United States. School nurses across the country can begin to incorporate education programs on proper nutrition at their local schools. This intervention can drastically change the quality of life of children and adolescents. With health promotion as the main intervention for pediatric obesity, we may finally begin to see a drastic reduction in the percentage of obese children and adolescents in the United States.

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Appendix

Literature Review Table

Author(s)	Purpose of Study	Population of Interest/Sample Size	Study Design	Study Methods	Major Findings	Strengths	Limitations
Halfon, N., Larson, K., & Slusser, W. (2013). Associations between obesity and comorbid mental health, developmental, and physical health conditions in a nationally representative sample of US children aged 10 to 17. <i>Academic pediatrics, 13</i> (1), 6–13. https://doi.org/10.1016/j.acap.2012.10.007	To examine the relationships between weight status and health of US Children	43,297 US children aged 10-17 years old	Quantitative, Cross-sectional	Cross-sectional analysis of data was performed on 43,297 children aged 10-17 from the 2007 National Survey of Children's Health. Logistic regression models were utilized to assess the associations between weight status and 21 indicators of general health, psychosocial functioning, and specific health disorders, adjusting for	Compared with children classified as not overweight, obese children were more likely to have reported good/fair/poor health, activity restrictions, internalizing problems, externalizing problems, grade repetition, school problems, and missed school days. Attention deficit/hyperactivity disorder, conduct disorder, depression,	Relationships between weight status and a broad set of mental health, developmental, and physical health comorbidities were examined while controlling for other measures of social and economic status. The study had a nationally representative sample which allowed for the first comprehensive national profile	The cross-sectional nature of the data and the reliance on parental reports of child height, weight, and comorbid conditions. The cross-sectional nature of the data limits the researcher's ability to determine whether obesity is causing the comorbid condition (ie, a complication), and whether the comorbid condition is

				sociodemographic factors.	learning disability, developmental delay, bone/joint/muscle problems, asthma, allergies, headaches, and ear infections were all more common in obese children.	examining associations between weight status and a broad set of comorbid conditions for US children.	responsible for obesity, or if both are related to some unmeasured third factor.
Munthali, R. J., Kagura, J., Lombard, Z., & Norris, S. A. (2016). Childhood adiposity trajectories are associated with late adolescent blood pressure: birth to twenty cohort. <i>BMC public health</i> , 16, 665. https://doi.org/10.1186/s12889-016-3337-x	To explore distinct sex-specific adiposity trajectories from childhood to late adolescence and examined their association with blood pressure.	1824 black participants aged 5-18 years old	Quantitative, Cohort	Weight and height at 5 years and 7–18 years old were used to calculate BMI (weight (kg)/height (m ²)), used as a marker for adiposity at corresponding years. Participants' seated blood pressure was measured 3 times with a 2 min	The early onset obesity or overweight trajectories are associated with elevated blood pressure in late adolescence. Patterns of adiposity could be a preferred predictor of future SBP, DBP, MAP, and elevated BP in late adolescents compared to	The longitudinal study in black South African children is a representative sample of South African children hence more relevant in understanding the different BMI trajectories in black South African children. The analysis was stratified according to sex	Due to the limited sample size we might not be able to capture all trajectories; this also influenced the observation that the high-risk trajectory in boys comprised of very few individuals that might influence association analysis. Adiposity

				<p>interval between each measurement.</p> <p>Blood pressure measurements were taken after 5 min of seated rest. The mean average for the second and third right arm readings was recorded for the current analysis.</p> <p>The mean arterial pressure (MAP) was calculated from systolic blood pressure (SBP) and diastolic blood pressure (DBP) using the formula; $MAP = (SBP + (2 * DBP))/3$.</p>	<p>cross-sectional BMI measures.</p> <p>Our results confirm that there is heterogeneity in BMI trajectories in the study sample and that trajectories vary between boys and girls.</p> <p>Being in an early onset obese or overweight trajectory was associated with an increased risk of elevated BP in both girls and boys.</p>	<p>and performed in a South African black population, which gives us an in-depth understanding of the difference in BMI developmental patterns in black boys and girls in South Africa.</p>	<p>trajectories explain only 5 % variation in late adolescent blood pressure and we do not know yet what the other factors are, which would explain the remaining variance.</p>
Norris, T., Cole, T. J., Bann, D.,	To determine whether the	Men and women aged 10-40.	Quantitative; Correlational	The study harmonized body	A greater obesity duration was	The derivation, using over	The definition of obesity was

<p>Hamer, M., Hardy, R., Li, L., Ong, K. K., Ploubidis, G. B., Viner, R., & Johnson, W. (2020). Duration of obesity exposure between ages 10 and 40 years and its relationship with cardiometabolic disease risk factors: A cohort study. <i>PLoS medicine</i>, 17(12), e1003387. https://doi.org/10.1371/journal.pmed.1003387</p>	<p>duration of obesity is related to heterogeneity in cardio metabolic risk.</p>	<p>20,746 participants.</p>		<p>mass index (BMI) and cardio metabolic disease risk factor data from 20,746 participants enrolled in 3 British birth cohort studies.</p> <p>Obesity duration was examined in relation to a number of cardiometabolic disease risk factors collected in mid-adulthood: systolic (SBP) and diastolic blood pressure (DBP), high-density-lipoprotein cholesterol (HDL-C), and glycated hemoglobin (HbA1c).</p>	<p>associated with worse values for all cardiometabolic disease risk factors.</p> <p>The strongest association with obesity duration was for HbA1c: HbA1c levels in those with obesity for <5 years were relatively higher by 5% compared with never obese, increasing to 20% higher in those with obesity for 20 to 30 years.</p> <p>For obesity duration, a similar pattern was observed to that seen for SBP and DBP, i.e., a gradually increasing risk</p>	<p>130,000 serial BMI observations across the life course, of individualized obesity parameters, which enabled the researchers to distinguish between obesity severity and duration.</p> <p>The pooling of data from 3 nationally representative cohorts means the observed associations are based on a far larger sample than most previous studies and are likely to be generalizable to the underlying population.</p>	<p>based on BMI, which despite exhibiting a strong positive correlation with direct estimates of fat mass [59], is only an indicator of total body adiposity.</p> <p>Measurement protocols for weight and height were not consistent within and between studies, which may have introduced bias if self-reported measurements were systemically under or overreported.</p> <p>The biomedical sweep in the NSHD cohort was conducted 9 and 7 years later</p>
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					for hypertension with increasing time spent obese.		than the NCDS and BCS cohorts, respectively, which may impair cross-cohort comparability.
Scharf, R. J., & DeBoer, M. D. (2015). Sleep timing and longitudinal weight gain in 4- and 5-year-old children. <i>Pediatric obesity, 10</i> (2), 141–148. https://doi.org/10.1111/ijpo.229	To evaluate associations between sleep timing (including bedtime and wake time) and its association with weight gain in 4-5 year-old children.	10,700 participants	Quantitative, Correlational	The researchers obtained approximately 10,700 parent interviews. The primary caregiver completed a computer-assisted interview at home by trained assessors.	Odds of obesity were higher at 4 years for children sleeping <9.44 hours nightly and at 5 years for children going to bed at 9:00 pm or later or waking before 6:30. Assessed longitudinally, both short sleep duration and later bedtime at 4 years were associated with an increase in BMI-z-score	Use of nationally representative data. Adjustment for multiple potential confounders and assessment of longitudinal data to clarify these relationships over time.	Parental report of the time of sleep was used instead of measured sleep time, though prior studies have shown parental reports to be within 20 minutes of actual sleep time. Napping was not recorded and may play a role in catching up on total sleep debt. This was an observational study that thus

					<p>between 4-5 years.</p> <p>Children with shorter nighttime sleep duration and later bedtimes were more likely to be obese and to gain weight over time.</p>		<p>lacks the ability to conclude any true causality.</p>
<p>Wang, Y., Jia, P., Cheng, X., & Xue, H. (2019). Improvement in food environments may help prevent childhood obesity: Evidence from a 9-year cohort study. <i>Pediatric obesity</i>, 14(10), e12536.</p>	<p>To examine the association of residential FEs with childhood obesity and variation of the association across gender and urbanicity.</p>	<p>Children who lived in the contiguous United States and had complete basic sociodemographic information, residential location (ZIP code), and a measured BMI in 1998 and 2007.</p> <p>The final analytical samples included 6100 children.</p>	<p>Quantitative</p>	<p>The researchers used the US Early Childhood Longitudinal Study—Kindergarten Cohort data, with 9440 kindergarteners followed up from 1998 to 2007.</p> <p>The Dun and Bradstreet commercial datasets in 1998 and 2007 were used to construct 12 FE measures</p>	<p>Decreased exposures to full-service restaurants, retail bakeries, fruit/vegetable markets, and beverage stores were generally obesogenic, while decreased exposure to dairy-product stores was generally obesoprotective.</p>	<p>Large-scale longitudinal study using nationally representative data.</p> <p>The study allowed for covariates which include age, gender, race/ethnicity, parental education, and socioeconomic status (SES).</p>	<p>The classification of food venues needs to be improved.</p> <p>Due to the limited number of children relative to a wide range of food outlets of interest, we did not differentiate many detailed categories of food outlets represented by</p>

				<p>of children, ie, changes in the food outlet mix and density of supermarkets, convenience stores, full-service restaurants, fast-food restaurants, retail bakery, dairy-product stores, health/dietetic food stores, confectionery stores, fruit/vegetable markets, meat/fish markets, and beverage stores.</p> <p>Two-level mixed-effect and cluster robust logistic regression models were fitted to examine associations.</p>			<p>six-digit or eight-digit SIC codes. Food offerings in the same type of food outlets may greatly vary by region, except for the case of national chain stores.</p> <p>Individual exposure needs to be measured at a refined level with consideration of food affordability and consumption.</p>
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<p>Watson, S. E., Li, Z., Tu, W., Jalou, H., Brubaker, J. L., Gupta, S., Huber, J. N., Carroll, A., & Hannon, T. S. (2014). Obstructive sleep apnoea in obese adolescents and cardiometabolic risk markers. <i>Pediatric obesity</i>, 9(6), 471–477. https://doi.org/10.1111/j.2047-6310.2013.00198.x</p>	<p>To determine if cardiometabolic risk markers are increased among obese youth with obstructive sleep apnea as compared with their equally obese peers without OSA.</p>	<p>96 patients with age range between 12-16.</p>	<p>Quantitative</p>	<p>A retrospective analysis was performed on 96 patients (age 14.2 ± 1.4 years) who underwent polysomnography for suspected OSA. Fasting lipids, glucose, insulin, and hemoglobin A1c (HbA1c) were performed as part of routine clinical evaluation. Patients were categorized into two groups by degree of OSA as measured by the apnea hypopnea index (AHI): none or mild OSA (AHI < 5) and moderate or severe OSA (AHI ≥ 5).</p>	<p>Despite similar degrees of obesity, patients with moderate or severe OSA had higher fasting insulin ($p = 0.037$) and homeostasis model assessment-insulin resistance [HOMA-IR ($p = 0.0497$)], as compared with those with mild or no OSA.</p> <p>Obstructive sleep apnea is linked with greater cardiometabolic risk markers in obese youth.</p>	<p>This is one of few studies addressing race/ethnicity differences in obesity-related OSA, and is the only pediatric study we are aware of to compare race-related differences in OSA and obesity associated cardiometabolic risk markers. The study population included white, black, and Hispanic youth who were referred for sleep evaluation due to symptoms of OSA.</p>	<p>There were no uniform measures of glucose tolerance other than fasting laboratory values utilized for clinical purposes available for analysis. While no patients were noted to have tonsillar or adenoid hypertrophy, neuromuscular disease, or other craniofacial abnormalities associated with OSA, prospective work should exclude patients with these potential confounding conditions. Due to the lack of uniform documentation of pubertal</p>
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