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Title

Relationship Between Childhood Obesity and Anxiety Among U.S. Children: The Moderating Effects of Gender and Urbanicity

Doctor Of Public Health

By

Name

Mph [1], Capella University, 2018

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Doctoral Study Submitted in Partial Fulfillment

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Walden University

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Abstract

Rates of childhood obesity[5] (2-19 years) in the United States (U.S.) are approximately 20%, and are associated with physical and mental health complications. Although obesity[6] is associated with mental health problems, there is limited research on the moderating effects of gender and urbanicity on the association between obesity[7] and anxiety. This quantitative, cross-sectional, secondary data analysis of the 2022-2023 National Survey of Children's Health examines this link among children aged 10-17. The research engages with the Social Ecological Model to examine the interaction of gender and urbanicity on the association between body mass index (BMI) classification and parent-reported anxiety, adjusting for depression, age, race/ethnicity, and socioeconomic[8] status. Weighted logistic regression models with interaction are used. Results will guide culturally tailored interventions for obesity[9] and anxiety among at-risk groups, such as rural areas and gender-specific groups.

Keywords: childhood obesity[10], anxiety, National Survey of Children's Health, gender, urbanicity, Social Ecological Model, logistic regression, moderation

Dedication

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Section 1: Foundation of the Study and Literature Review (APA Level 0 Heading)

Topic of the Study

The problem of childhood obesity[14] is one of the most acute issues in the 21st-century United States public health. The data provided by the Centers for Disease Control and Prevention (CDC) indicates that obesity[15] rates among children and adolescents aged 2-19 reflected a worrisome increase because in 2017-2020, it was estimated to be about 20 per cent compared to 16.9 per cent in 2009-2010 (Contreras et al., 2021; Crouch et al., 2023)[16]. In addition to the documented physical outcomes, such as higher risks of type 2 diabetes, cardiovascular disease, and musculoskeletal disorders, childhood obesity[17] is now increasingly viewed as a antecedent[18] and predictor of abnormal mental health conditions (especially anxiety and depression). The physical and mental health of children are closely interconnected, requiring strict scientific consideration, and mental disorders during childhood have long-term implications during adulthood.

Although there is a growing body of literature on mental health issues in youth related to obesity[19], there are still some gaps in the knowledge about the influence of demographic and geographic factors on such relationships. In particular, there are not many studies that have investigated the moderating effects of gender and urbanicity concomitantly, which are two factors with different and possibly interactive effects on the obesity-anxiety relationship. The knowledge of the rural and urban residence or gender identity as either reinforcing or reducing the psychiatric burden of childhood obesity[20] is critical to the formulation of specific, context-specific interventions. This paper fills that

gap by using a nationally representative sample, the 2022-2023 National Survey of Children's Health (NSCH), to test the joint moderation effect between gender and urbanicity on the relationship between children's obesity[21] and anxiety in the United States aged between 10 and 17.

In this section, the theoretical and empirical background of the study is presented. It features following key subsections: (a) a review of the background literature that determines the scope and importance of childhood obesity[22] and the mental health correlates of obesity[23]; (b) a clear statement of the research problem and the research gap identified; (c) the purpose of the study; (d) the research questions and hypotheses; (e) the theoretical framework used to conduct the research; and (f) the nature of the study such as the research design, sources of data, variables, and method of analysis. The given structure is created to build the logical flow between a sociologically stated problem and a scientifically based research question.

Background

Childhood obesity[24] is a multifactorial disorder, with a complex association of biological, behavioral, and environmental variables. It has grown significantly in the United States over the last 40 years due to changes in dietary choices, a decline in physical activities, screen time, and wider social determinants of health encompassing food insecurity, poverty, and restricted availability of safe recreational areas (Contreras et al., 2021; Forster et al., 2023)[25][16]. Rural populations are especially underprivileged (with less access to healthy food choices, fewer recreational opportunities, and greater socio-economic[8] vulnerability) (Crouch et al., 2023; Foster et al., 2020)[16]. Studies based on NSCH data have observed a steadily higher risk of rural children being overweight or obese than children in urban areas, despite demographic factors such as race/ethnicity and household income (Crouch et al., 2023)[16].

Childhood obesity[26] has a significant mental health burden that is multidimensional in nature. Obese children are at a higher risk of anxiety, depression, low self-esteem, social isolation, and peer victimization, which worsen their weight-related behaviors and introduce a vicious cycle of physical and psychological suffering (Beltran-Garrayo et al., 2023; Galler et al., 2024; Kokka et al., 2023)[16]. As Beltran-Garrayo et al. (2023) showed, obese youths displayed much greater scores of anxiety mediated by low body esteem and high levels of teasing, indicating that psychosocial mechanisms of excessive weight and mental health morbidity interrelationship exist. These dynamics were further explained in a longitudinal study by Beltran-Garrayo et al. (2024), which revealed that the relationship between childhood obesity[27] and depressive symptoms in adolescents was mediated by body esteem and that even after adjusting for gender, the relationship is still strong.

Psychiatric comorbidity of obesity[28] in pediatric patients cuts across several diagnostic categories. A large clinical cohort study of children, adolescents, and young adults with obesity[29] and comorbid mental health disorders, Galler et al. (2024) discovered that anxiety disorders were one of the most widespread psychiatric comorbidities in the population. Adolescents with comorbid mental health also exhibited worse treatment outcomes of lifestyle-based weight management interventions; in this case, psychiatric burden is a direct cause of intervention efficacy. Population-level systematic reviews support these clinical findings. Kokka et al. (2023) collected evidence on 14 cross-sectional studies to conclude that 9 studies reported statistically significant relations between psychiatric disorders and obesity[30], and the strongest associations were found with affective disorders (depression, meaningful, but weak) and the strongest, although weak, support for the presence of anxiety.

The cross-cultural consistency of these associations has also been confirmed by epidemiological research. According to the systematic review of childhood obesity[31] and mental health outcomes performed by Ranjani et al. (2021), the evidence of the connection between obesity[32] and mental disorders, namely anxiety and depression, occurs repeatedly in the diversity of different cultural backgrounds, which confirms the validity of these relationships in not only particular nation-specific but also universal settings. A recent cross-sectional study conducted in Europe by Papadimitriou et al. (2025) demonstrated strong evidence (nearly twice as many depressive and anxiety symptoms) of overweight and obese children aged 6-9 years compared to normal-weight children, and that the strength of those associations varied according to gender and urban versus rural dwellers. The gender and urbanicity effects of moderation observed in the European sample indicate that this can be applied to the U.S. pediatric population, but this has not been rigorously assessed using nationally representative U.S. data.

This fact supports the role of gender as a potential moderator of the relationship between obesity[33] and mental health: it is believed that boys and girls might respond to obesity-related stigma and body dissatisfaction more or less (Beltran-Garrayo et al., 2024; Forster[25] et al., 2023)[16]. In a large (German) cohort (4-18), Forster[25] et al. (2023) discovered that the relationships between BMI and mental health outcomes, such as behavioral problems and health-related quality of life, depended on both gender and socioeconomic[8] status, making it important that these moderators be considered together. Likewise, parental mental health has been identified as a significant contextual variable, differentially predicting obesity[34] risk among children across rural and urban environments and income groups (Foster et al., 2020)[16], underscoring the

relevance of considering family and environmental context in obesity studies in children.

Regardless of this accumulating evidence, there is an identifiable gap in the literature. The majority of the available research focuses on the occurrence of obesity and anxiety or depression without considering geographic and gender-based moderation, and only a handful of research studies use nationally representative U.S. data to simultaneously test the hypothesis of these moderators. The NSCH offers a distinct and strong platform toward such analysis since it has validated parent-reported indicators of child health status, mental health diagnosis, BMI-based obesity status and some demographic characteristics such as gender and urbanicity. This research will address this gap and extend the evidence base for the targeted public health interventions.

Problem Statement

The research issue that the study seeks to focus on is that there is no detailed population-level knowledge of the relationship between anxiety and childhood obesity in the U.S. among children aged between 10 and 17, and the extent to which gender and urbanicity moderate this relationship. The prevalence of childhood obesity has risen to about 20% in 2017-2020 compared to about 16.9% in 2009-2010 (Contreras et al., 2021; Crouch et al., 2023); anxiety disorders are considered one of the most common psychiatric diseases in the children population, with the estimated rate of 7-10 per cent across the country. However, the literature on the relationship between obesity and anxiety has not studied the relationship in a systematic manner that incorporates both gender and urbanicity as factors. Thus, there are critical gaps in the evidence base for intervention targeting.

The existing literature reports strong correlations between anxiety and obesity[43] across different study designs and geographic regions (Beltran-Garrayo et al., 2023; Galler et al., 2024; Kokka et al., 2023; Papadimitriou et al., 2025; Ranjani et al., 2021)[16]. The main limitations of these studies are mostly a non-representative sampling frame, single-moderator studies conducted in isolation, and an out-of-the-U.S. context. The NSCH data have been mostly utilized in studies on the prevalence of obesity[44] and rural-urban differences in weight status (Crouch et al., 2023; Foster et al., 2020)[16], without analyzing mental health outcomes as core dependent variables and the moderate effects of gender and urbanicity on each other. The absence of evidence regarding combined moderation restricts the capacity of practitioners working in the sphere of public health, school health, and policymakers in creating gender-sensitive and geographically focused interventions, which would be able to respond to the needs of particular risk groups of anxious obese children.

The given problem is based on and is based on the existing literature on childhood obesity[45] and mental health, namely, the expansion of previous moderated mediation models (Beltran-Garrayo et al., 2024)[16] and rural-urban comparative studies (Contreras et al., 2021; Crouch et al., 2023)[16] with the adoption of a nationally representative sample of the U.S. and the dual moderation. This issue is the rational next scientific step, considering the course of preceding studies, and has direct effects on the progress of obesity-related research in the U.S. in terms of improving the evidence base and enhancing health care practices, as well as in the prevention of the dual burden of obesity[46] and anxiety among children in the U.S.

Purpose of the Study

This study is a quantitative, cross-sectional study that tests[47] the relationship between childhood obesity[48] and anxiety among children aged 10-17 years in the

U.S., using secondary data from the 2022-2023 National Survey of Children's Health (NSCH). In particular, the research will focus on identifying whether the connection between childhood obesity[49] (independent variable: BMICLASS[50], operationalized as BMI 95th percentile per CDC growth charts) and parent-reported anxiety diagnosis (dependent variable) is moderated by the variables of gender and urbanicity and whether the aforementioned variables are controlled by depression, age, race/ethnicity, and socioeconomic[8] status. The secondary objective is to test the relationships between childhood obesity[51] and depression as a dependent variable using the same set of moderators and covariates.

The field-based products of this study, such as a policy brief memo, a community health intervention plan, a visual illustration of the intervention framework,[52] and a focused fact sheet, will be directly important to the policymakers, school-based public health practitioners, pediatric health practitioners and community-based organizations that deal with the rural and urban children. The results of this study will allow allocating the resources available to the community in terms of obesity[53] and anxiety more accurately and efficiently, as well as will[54] facilitate the creation of culturally and geographically specific intervention,[55] by clarifying the data about which subgroups of children (e.g., rural girls or urban boys) are at the highest risk of combined,[56] obesity[57][58], and anxiety.

Research Question(s) and Hypotheses

This study is guided by two primary research questions, each accompanied by a null and alternative[59] hypothesis:

RQ1: What is the association between childhood obesity[60] and anxiety among U.S. children ages 10–17 when the moderating effects of gender and urbanicity

are taken into account, controlling for depression, age, race/ethnicity, and socioeconomic[8] status?

H_{01}: There is no statistically significant association between childhood obesity[61] and anxiety after controlling for covariates and including gender and urbanicity as moderators.

H_{11}: There is a statistically significant positive association between childhood obesity[62] and anxiety after controlling for covariates and including gender and urbanicity as moderators.

RQ2: What is the association between childhood obesity[63] and depression among U.S. children ages 10–17 when the moderating effects of gender and urbanicity are taken into account, controlling for anxiety, age, race/ethnicity, and socioeconomic[8] status?

H_{02}: There is no statistically significant association between childhood obesity[64] and depression after controlling for covariates and including gender and urbanicity as moderators.

H_{12}: There is a statistically significant positive association between childhood obesity[65] and depression after controlling for covariates and including gender and urbanicity as moderators.

The following infographic summarizes the alignment between research questions, variables, data sources, and analytic procedures:

Figure 1 Research Design Alignment Summary

Theoretical and/or Conceptual Framework

Theoretical Framework

The theoretical basis of this research is the social-ecological model (SEM) of Bronfenbrenner (1979), which offers a multi-level[66] framework for explaining

health and human development. The SEM theorizes human development and health outcome as the results of a nested system of interacting environmental systems: microsystem (immediate personal environment), mesosystem (relationships among microsystems), exosystem (external systems whose influence influences the individual), macrosystem (cultural, policy and societal contexts), and chronosystem (temporal aspect of environmental change). These systems within a system dynamically interact to influence health behaviors and lifelong outcomes.

The key theoretical propositions of the SEM applicable in this research are as follows: (a) personal characteristics do not alone determine the individual health outcomes but rather it is a complex interaction of various levels of environmental context that determines the variation in health outcomes; (b) the interplay of individual and community-level factors (such as gender versus urbanicity) is a key determinant of differential health consequences; and (c) effective public health interventions have to simultaneously address factors at different levels of the ecological context to produce a sustained change. These propositions lead directly to the study's analytic approach, in which gender is treated as an individual-level moderator, urbanicity as a community-level moderator, and how the two interact to strengthen or weaken the obesity-anxiety relationship.

The SEM has been used extensively in public health studies on childhood obesity, typically to identify multilevel risk factors and intervention targets (Forster et al., 2023; Foster et al., 2020). Its relevance to this paper is especially high, since the NSCH data focus on variables representing a variety of ecological levels, such as individual (gender, age, weight status), family (parental education, household income, parental mental health), and community (urbanicity, geographic region). With SEM as the theoretical

framework, this study is set to not only add to the body of epidemiological literature in childhood obesity,[73] but also to the body of literature regarding the science of interventions associated with the development[74] of public health, through the identification of ecologically situated high-risk subgroups that have to be targeted through the programming.

Conceptual Framework

Besides[75] the SEM, the study has a conceptual foundation in the emerging literature on psychosocial mechanisms underlying the relationship between childhood obesity[76] and mental health. The existing literature determines that childhood obesity[77] is connected with an increased risk of being exposed to weight-based stigmatization and bullying, lower body esteem, social exclusion, and lower health-related quality of life, all of which are proximal determinants of anxiety and depression (Beltran-Garrayo et al., 2023; Beltran-Garrayo et al., 2024; Kokka et al., 2023)[16]. These psychosocial processes are theoretically cross-located within the ecological levels of the SEM: peer victimization and social comparison are at the microsystem level, attitudes of the family towards weight and mental health of parents are at the mesosystem and exosystem levels, and the cultural norms around the body image and weight gain are at the macrosystem level.

The nature of the conceptual model that guides the present study is that the relationship between childhood obesity[78] and anxiety is mediated by both gender as bodies image concerns, social comparison processes, and help-seeking behaviors vary by gender and non-gender as access to mental health services, physical activity facilities, and community social support varies systematically in rural and urban settings (Contreras et al., 2021; Foster et al., 2020; Papadimitriou et al., 2025)[16]. This theoretical framework aligns with the SEM and allows the development[79] of theoretically significant hypotheses regarding

differences in moderation. The research questions will aim to test the hypothesis that these theoretically hypothesized moderation effects are supported by empirical evidence from the U.S. nationally representative NSCH data.

Figure 2 Sociological Model Applied to this study

Nature of the Study

The selected research design for the study will be a quantitative, cross-sectional design based on secondary analysis of publicly available data from the 2022-2023 National Survey of Children's Health (NSCH). This study should be conducted quantitatively, as the research questions will involve statistical testing of associations and the effects of interactions among specifically defined variables, and the hypotheses will be directional and can be tested using inferential tests. The cross-sectional design is suitable because the NSCH is used to collect data at a single point in time and is targeted for prevalence and association analyses of a population in the context of pediatric health research (Crouch et al., 2023; Foster et al., 2020).

It is also supported by the fact that the choice of the quantitative paradigm is predetermined by the already existing literature, which has been using epidemiological and bio statistical techniques to study the relationships between obesity and mental health issues in pediatric patients without exception (Forster et al., 2023; Galler et al., 2024; Kokka et al., 2023; Papadimitriou et al., 2025). Cross-sectional secondary analysis is a type of research that enables the researcher to make robust statistical inferences on a national scale without incurring the costs, ethical issues, and time involved in primary data collection. It also allows the use of NSCH survey weights, without

which generating nationally representative estimates that can be projected to all children in the target age range in the U.S. is unachievable[85]

The main limitation of the cross-sectional design is that it does not consider the cause-and-effect relationships between childhood obesity[86] and anxiety. The primary and secondary research questions will be tested using logistic regression with interaction terms. In particular, regressions of the independent variable (BMICLASS) on the dependent variables (anxiety and depression) will have interaction terms of gender x BMICLASS and urbanicity x BMICLASS. Each model will incorporate the following covariates (depression or anxiety as a cross-control, age, race/ethnicity, socioeconomic[8] status) and will be adjusted using NSCH survey weights to make them nationally representative.[87]

Literature Search Strategy

The literature search strategy that was used in this study was thorough. Accessed databases included PubMed, PsycINFO, CINAHL, ERIC, Web of Science, ProQuest, and Google Scholar, which were used to access the main databases. Walden University Library was used as the primary source for peer-reviewed academic articles. The search terms and combinations were: childhood obesity[88], pediatric obesity[89], BMI classification, anxiety disorders in children, depression in children, mental health and obesity[90], gender differences in obesity-related mental health, urbanicity and child health, National Survey of Children's Health (NSCH), moderation analysis, logistic regression and survey-weighted analysis. Terms were systematically combined using Boolean operators (AND, OR). To be current and relevant, the literature search was restricted to peer-reviewed empirical research published since 2019. Theoretical works, including Bronfenbrenner's (1979) original writings on the social-ecological model, were incorporated regardless of publication date, given their fundamental role in the theory. Systematic reviews and meta-

analyses prioritized synthesis of evidence on important associations. The use of grey literature, dissertations, and conference proceedings was sparse, and only when the peer-reviewed material did not cover a particular aspect of the research questions.

Theoretical Framework

The theoretical framework for this research is Bronfenbrenner's Social-Ecological Model (SEM). This framework was first proposed by Bronfenbrenner (1979) in his famous book, Ecology of Human Development, which postulated that human development[91] and behaviour result from the dynamic interaction between the individual and various levels of the surrounding world. The main theoretical hypotheses of the SEM are since extensively generalized into the field of public health research as an organizing framework to understand the multilevel[66] determinants of health behaviors and outcomes; (a) individuals do not merely receive health and behavioral outcomes but are the active causal agents of their ecological context; (b) proximal environments (microsystems like family and school) interact with more distal contexts (exosystems and macrosystems like community resources, cultural norms, and policy frameworks); and (c) health and behavioral outcomes are not merely implied by In this context, the gender is an individual level factor, which modifies how children perceive and react to weight-related stigma, whereas urbanicity is a structural factor at the community level that defines the availability of physical activity, healthy food, and access to mental health care. The moderators (gender and urbanicity) are factors at the individual level (individual) and community level (community), respectively, and covariates (age, race/ethnicity, socioeconomic[8] status) are factors that reflect further ecological interactions. This theoretical stance informs the inclusion of interaction terms in the logistic

regression models to test the hypothesis that there are ecological subgroups that differ in the degree of interaction between obesity[92] and anxiety.

SEM has been utilized in numerous previous studies on childhood obesity[93] and health outcomes. Using the NSCH data to test the hypothesis that parental mental health was a differentiating factor for child obesity[94] across rural and urban settings and income status, Foster et al. (2020) utilized[95] a multilevel[66] analysis framework based on[95] SEM concepts[95]. Similarly, Forster[25] et al. (2023) used a socio-ecological approach to explain the relationships between BMI and mental health across age groups, genders, and socioeconomic[8] statuses in a German pediatric cohort. The use of the NSCH by Crouch et al. (2023) also allowed the authors to demonstrate that rural-urban differences in childhood obesity[96] persist even after controlling for demographic covariates, which aligns with the SEM assumption that community-level variables have an independent effect on health outcomes. To start, the multilevel[66] SEM design fits the study design, which focuses on individual (gender) and community (urbanicity) moderators simultaneously. Second, the NSCH dataset includes variables operationalizing various ecological levels, making it a perfect empirical platform for testing the SEM-derived hypotheses. Third, the SEM has a history of research on childhood obesity[97], providing theoretical continuity with the current body of evidence.

Conceptual Framework

The conceptual basis of the current study is extensively supported by the available research that has recorded the nature of psychosocial processes through which childhood obesity[98] predisposes a greater risk of anxiety and depression. The principle of this framework is weight-based stigmatization and its consequences, i.e., lower body esteem, social exclusion, victimization by peers, and lower quality of life (related to health). These psychosocial stressors

play the role of proximal determinants of mental health outcomes. They are theorized to be more intense and to have greater[99] impact with respect to[100] the child's gender and geographic location. Primary writings by major researchers define the conceptual background. The researchers Beltran-Garrayo et al. (2023) proved the conceptual pathway obesity-psychosocial stigmas-anxiety, as the body esteem of the patients and the levels of peer teasing mediated the significantly high levels of anxiety in the obese youth. Beltran-Garrayo et al. (2024) extended this model to a longitudinal level, demonstrating that body esteem mediates the obesity-depression relationship among adolescents. Kokka et al. (2023) have offered a system synthesis that psychiatric comorbidities, such as anxiety, are disproportionately high among obese children working across different study designs. Galler et al. (2024) also established that anxiety disorders are one of the most prevalent psychiatric comorbidities in clinically obese youth and that these comorbidities have a negative impact on[101] treatment outcomes. The following conceptual propositions of the framework: (a) childhood obesity[102] leads to higher exposure to weight-related stigma and social comparison processes; (b) these psychosocial stressors have a negative effect on[103] the treatment outcomes; (c) the intensity of these actions depends on gender (boys and girls are different in the way they internalize body image messages and These propositions are consistent with and generalized to the SEM by defining the psychosocial mechanisms according to which ecological variables are converted into individual mental health outcomes.

The use of this conceptual framework in previous studies has been a[104,105] similar manner[105]. Papadimitriou et al. (2025) established that the association between obesity[106] and anxiety was mediated by gender and rural-urban dwelling among the young children of a European sample. In a cohort of nearly 700 thousand

Germans, Forster[25] et al. (2023) identified a gender and socioeconomic[8] status-dependent mental health relationship with BMI.

Literature Review Related to Key Variables and/or Concepts

The current literature consistently supports a relationship between childhood obesity[107] and mental health outcomes, particularly anxiety, while also highlighting important contextual factors. Several studies using longitudinal and cross-sectional designs (e.g., Beltrán-Garrayo et al., 2023, 2024; Förster et al., 2023)[25][16] demonstrate that higher BMI is associated with increased psychological distress, often mediated by body esteem and social experiences such as teasing. These findings justify the selection of obesity[108] as the independent variable and anxiety/depression as dependent[109] variables. Additionally, studies using NSCH data (Crouch et al., 2023; Foster et al., 2020)[16] validate the appropriateness of a quantitative, cross-sectional methodology with large-scale survey data.

Covariates such as gender, socioeconomic[8] status, and parental mental health are supported by prior findings indicating their influence on both obesity[110] and mental health outcomes. For instance, Papadimitriou et al. (2025) and Contreras et al. (2021) highlight differences across gender and urbanicity, supporting their inclusion as moderators. While most studies report a positive association between obesity[111] and mental health disorders, some inconsistencies remain, particularly regarding anxiety (Kokka et al., 2023)[16], indicating ongoing debate.

Overall, the literature confirms significant associations but reveals a gap in simultaneously examining gender and urbanicity within a single model. This study extends prior research by integrating these moderators to better address the proposed research questions.

Definitions

All major variables considered in this research are operationalized with reference to the 2022–2023 NSCH data dictionary and codebook (Health Resources and Services Administration & U.S. Census Bureau, 2024).

Childhood Obesity (Independent Variable): A BMI at the 95th percentile at age and sex, according to CDC growth charts (Centers for Disease Control and Prevention, 2022). In the NSCH, this is obtained through[112] the variable BMICLASS that[112] classifies children as underweight, healthy, overweight and[112] obese with reference to[112] parent-reported height and weight (Health Resources and Services Administration & U.S. Census Bureau, 2024). In this study, BMICLASS will be categorized as obese (BMI ≥95th percentile) and non-obese.

Anxiety (Primary Dependent Variable): The operationalization of anxiety can be explained as a parent-reported symptom with current anxiety disorder, which is based on the NSCH survey item where the parent is asked whether a doctor or health professional has told the parent his/her child has anxiety, and whether the child has the condition now (Health Resources and Services Administration & U.S. Census Bureau, 2024). This[113] is a dichotomous (yes/no) variable.

Depression (Secondary Dependent Variable): This is analogous in operationalization to anxiety; it is based on the value of the current diagnosis of depression, as reported by parents on the NSCH (Health Resources and Services Administration & U.S. Census Bureau, 2024). It is also a dichotomous (yes/no) variable.

Gender (Moderator Variable): Measured as a dichotomous variable using the NSCH item on which respondents are asked to report on the sex of the child (male/female), and is congruent with the measurement method of the survey (Health Resources and Services Administration & U.S. Census Bureau, 2024).

Urbanicity (Moderator Variable): The geographical location of the child based on the NSCH into metropolitan statistical area (MSA) vs. non-MSA (rural) in line

with the rural-urban classification in the same analyses of previous studies with NSCH data (Crouch et al., 2023; Foster et al., 2020).[16]

Socioeconomic[8] Status (Covariate): Operationalized as a percentage of the federal poverty level (FPL) of household income, a continuous variable in the NSCH, with four levels of analysis (less than 100% FPL, 100–199% FPL, 200–399% FPL and 400% or more FPL) (Health Resources and Services Administration & U.S. Census Bureau, 2024).

Race/Ethnicity (Covariate): Measured using the NSCH race and ethnicity variables, Non-Hispanic White, Non-Hispanic Black, Hispanic, Non-Hispanic Asian, and Non-Hispanic Other/Multiracial (Health Resources and Services Administration & U.S. Census Bureau, 2024).

Age (Covariate): This is the age of the child[114] in years when[114] the survey is filled,[114] but in this case, it[114] is limited to children between the ages of[114] 10 and[114] 17 years.[114]

Depression/Anxiety as Cross-Control Covariate: When anxiety is the outcome variable, depression status is added as a covariate, and vice versa, to adjust for the high co-occurring conditions and isolate the independent relationship of each of these conditions with obesity[115] (Health Resources and Services Administration & U.S. Census Bureau, 2024).

Assumptions

The focus of the present study is determined by using a country-wide cross-sectional secondary data (NSCH 2022-2023) in investigating the relationship between childhood obesity[116] and anxiety/depression in U.S. children between the ages of 10 and 17 years, using gender and urbanicity as modifying factors. It was calculated that the age range of 10-17 was the time of development[117] when body image concerns, peer social comparison and anxiety disorders are clinically salient and measurable by parent report,[118] and when the psychiatric burden of obesity-related stigma is most acute.

The particular emphasis on gender and urbanicity as two moderators, as opposed to a wider range of potential moderators, was done to fill the gap in the literature that had been identified and due to the parsimony of analysis. The reason why the NSCH dataset was chosen is due to the availability of the most comprehensive and rigorously methodologically representative nationally representative data on child health in the U.S., with validated parent-reported mental health diagnoses, measured or reported anthropometric data to classify by BMI, and key demographic variables.

The cross-sectional design limits external validity of the study because it does not permit drawing causal conclusions, and the use of secondary data limits the researcher to collecting the variables that were not measured in the NSCH. The scope of the population will be non-institutionalized, civilian U.S. children aged 10-17 years old with no missing data on significant variables. Results are not to be extended to younger children (under 10), adults and other populations outside the United States. Other theoretical models, like the cognitive behavioral model of anxiety or the biopsychosocial model, were also taken into consideration, but not taken as the dominant theoretical framework, because the SEM provides the best correspondence to multilevel moderators of interest.

Scope and Delimitations

This research has a number of possible contributions to the existing knowledge in the sphere of the epidemiology of public health and pediatrics. To begin with, it builds up on the existing literature of the obesity-anxiety relationship by simultaneously testing the moderating impact of gender and urbanicity on one another using a nationally representative sample in the U.S. Previous research has typically studied these moderators independently or in study sample that is not based in the U.S., which presents a gap in the epidemiological literature

that this study fills directly (Papadimitriou et al., 2025). Second, survey-weighted logistic regression with interaction terms is a methodologically sound way of moderation testing, which could be used as the template in future epidemiological studies involving complex survey data.

For practice and policy, the findings of the study will be useful as actionable evidence to distinguish the sub-groups of children (e.g., rural girls and urban boys) that are the most burdened with co-occurring obesity and anxiety problems. This fact is of direct importance in relation to health services provided in schools, pediatric primary care providers and community-based organizations involved in obesity prevention and mental health promotion. Among the policy implications, there is the possibility to support focused funding distributions both in rural mental health infrastructure and pediatric health programming that is gender-sensitive.

This study can be useful on several ecological levels in order to positively change the situation. Individually, the high-risk subgroups can be identified early, and anxious obese children can be intervened in such cases. At a communal level, the data can inform the formulation of a culturally and geographically specific community health intervention. The existence of the moderation effect differences, in turn, justifies equity-based public health policy responses to the combination of geographic and gender-based health disparities in childhood, at the policy level. The research therefore helps in the greater purpose of health research, which is to minimize health disparities and enhance wellbeing among all children irrespective of their places of residence or sex.

Limitations

This research has several limitations associated with the quantitative, cross-sectional research design and secondary NSCH data. First, the internal validity

is constrained, as it is impossible to determine causal relations between childhood obesity[132] and anxiety; only associations can be investigated. Use of parent-reported data generates the risk of measurement error, which interferes with construct validity, especially in subjective variables like anxiety and depression. The country-representative NSCH data increases the external validity, but the results might not apply beyond the U.S. groups or other cultural backgrounds. Potential methodological weaknesses include omitted-variable bias. Even though the major covariates, such as socioeconomic[8] status, gender, and parental mental health, are covered, other factors of interest (e.g., diet quality, physical activity, or genetic predisposition) might not be adequately captured. Obesity and anxiety are likely to be affected by confounding variables that may be used to distort observed relationships. Parental responses may be influenced by biases, including social desirability bias and recall bias. To address the problems, the research will utilize[133] statistical controls and multivariate regression methods to minimize confounding effects[133]. Also, it enhances reliability and consistency by using a large, standardized dataset. Although it is impossible to remove their limitations, attentive choice of variables, powerful analytical techniques, and transparent reporting will contribute to their reduction and enhance the credibility of results.

Significance

The proposed study makes valuable contributions to knowledge in the field of public health by advancing understanding of the links between childhood obesity[134] and anxiety within a thorough analytical framework. By incorporating moderating factors such as gender and urbanicity, the study will be grounded in the existing literature and consistent with the Social Ecological Model, which emphasizes multi-level[66] determinants of health outcomes. This study will be of value to the literature by filling gaps in understanding how contextual and

demographic factors affect the obesity-mental health relationship. Practically and policy-wise, the findings can be used to design specific interventions that could help prevent the occurrence of obesity[135] and anxiety in children. In particular, classifying high-risk subgroups by gender or geographic location can assist[136] healthcare providers, educators, and policymakers in developing[136] more precise[136] prevention programs. Evidence-based decision-making can be facilitated by insights from nationally representative NSCH data at both the community and national levels. The study's implications for positive social change are also evident; it will provide the opportunity to identify vulnerable groups at the earliest stage and involve them in combined strategies for physical and mental treatment. Combined treatment for obesity[137] and anxiety can enhance overall child welfare, reduce long-term health inequalities, and promote healthier developmental processes. These contributions do not override the study's scope and focus on the practical implications of enhancing child health outcomes.

Summary and Conclusions

The literature has shown that there is a strong relationship between childhood obesity[138] and poor mental health, specifically, anxiety and depression. The most important themes are the importance of psychosocial factors, including body esteem and teasing, and demographic factors, including gender, socioeconomic status, and urbanicity. Empirical research based on big data, such as the NSCH, justifies the application of[139] quantitative techniques to test these relationships. Nevertheless, the results can be contradictory, especially regarding the power and stability of the positive correlation between anxiety and obesity[140]. Although there is a lot of information on the overall association between obesity[141] and mental health, there is less on the interaction among multiple moderating factors. The available literature tends to investigate either gender or urbanicity

separately, and there are gaps in models that address both. Also, the mechanism of causality is unclear because most designs are cross-sectional. The current paper also fills these discrepancies by investigating the relationship between childhood obesity[142] and anxiety, and also considering the factors of gender and urbanicity as moderators. The method extends existing information by offering more detailed insight into the interplay among these variables in a nationally representative sample. The results will guide future studies and interventions. At this point, it is relevant to move to Section 2, which describes the methodological approach used to examine these relationships, including the research design, data sources, and analytical strategies.

Section 2: Research Design and Data Collection

Introduction

In the section, a detailed description of the research design, data source, sampling methods, variable definitions, and data analysis approaches was provided for this quantitative study, which relied on secondary data and employed a cross-sectional analysis. This[143] is to ensure methodological rigor and transparency capable of surmounting the challenge of reproducibility and enabling critical analysis of the study findings. All the choices made regarding the methods are explained by compliance with the research questions, the theoretical framework, and the specifics of the NSCH data. This part will further be subdivided into the following subsections: research design and rationale; setting and sample; instrumentation; data collection procedures; variable definitions; data analysis plan; ethical considerations; and limitations.

Research Design and Rationale

Secondary data analysis is conducted using a quantitative, cross-sectional design in this research. The quantitative design is appropriate because the research questions are developed to test a statistical relationship and to assess the moderate impact of operationally measured variables through inferential statistical analysis. A cross-sectional design is appropriate because all the data needed are gathered at a single point in time using the NSCH, which is specifically designed to support population-level association research in childhood health. Even though it is impossible to cause anything with the help of the cross-sectional data, they are very suitable to support the prevalence-based association testing, which constitutes the principal analytic target of the present study, and have been actively employed in the former literature on childhood obesity[144] and mental health (Crouch et al., 2023; Foster et al., 2020; Papadimitriou et al., 2025)[16]. The 2022-2023 NSCH can be used as a publicly available, high-quality, nationally representative dataset because it is properly designed and used in a secondary data analysis. Secondary analysis will not only address the logistical, financial, and ethical constraints of primary data collection.[145] Still, it will also provide a far wider sample than would be possible in a primary data collection. As a particular source of[147] data, the NSCH has been used in the literature on childhood obesity[146] and rural-urban health (Crouch et al., 2023; Foster et al., 2020)[16], which makes it reasonable to assume[147] it is relevant to the research questions.

Methodology

The study sample included U.S. children aged 10-17 years who were not in institutions and were sampled in the 2022-2023 National Survey of Children's Health (Data Resource Center for Child and Adolescent Health [DRC], 2024). The NSCH sample comprises over 50,000 children nationwide, and an estimated sub-sample of more than 15,000 after applying these inclusion criteria. The

initial data set used a complicated[148] sampling method involving probability sampling to select addresses via list-assisted dialing with random digits,[148] ensuring national representativeness. Such a methodology indicates a stratified and clustered sample design that improves coverage of the population and its geographic areas. The information was obtained from parent- or caregiver-reported surveys conducted by federal agencies, which ensured homogeneous collection practices. This study included participants with full information on obesity[149] status, anxiety/depression diagnosis, gender, urbanicity, and the most important covariates. The exclusion criteria were the absence of or unrealistic BMI data and age less than 10-17 years, as the data is already de-identified and only requires user registration. The federal control and prior peer-reviewed use lend it credibility. Power analysis with G*Power (Faul et al., 2007)[16] indicated that a sample size of 400 was the minimum required; the available sample size was strong in terms of statistical power[150] and thus suitable for this study.

Sampling procedures used by original[151] creators of the data set.

The NSCH uses a complex, probability-based sampling design to be nationally representative.[152] In particular, it employs address-based sampling (ABS) with stratified random sampling, which allows covering both landline and non-landline households. Households are randomly selected from a national address frame, and one child per household is selected. This[153] is a stratified, cluster sampling plan that enhances coverage in areas and demographic classes. Structured questionnaires were used to collect data from parents or caregivers, administered online or by mail. This study will have inclusion criteria as children aged 10-17 with full data on BMI, anxiety, depression, gender and urbanicity. The exclusion criteria involve the implausibility of BMI and key variables. Data Resource Centre makes the dataset publicly available, and

registration is required. It does not require any special permission as it is de-identified. NSCH is a federally funded survey with high reliability and validity, and it has been extensively used in peer-reviewed studies, demonstrating high data quality. This data is perfect because it has a large, nationally representative sample and includes the variables. A priori power analysis conducted using G*Power (Faul et al., 2007)[16] with α = .05, power = .80, and a small-to-medium effect size (OR = 1.5) indicated a minimum required sample of approximately 400 participants. Because the NSCH dataset contains a substantially larger nationally representative sample, the available sample exceeds the minimum requirement needed to ensure adequate statistical power.

Operationalization

The Health Resources and Services Administration (HRSA) Maternal and Child Health Bureau and the National Centre[154] for Health Statistics (NCHS) of the CDC administered the 2022-2023 NSCH. The sampling frame was based on all non-institutionalized children living in the United States who were between the ages[155] of 17 years.[155] The sampling method used was a list-assisted random-digit-dial telephone sampling technique, supplemented by address-based sampling to increase coverage among households without landline telephones, resulting in a nationally representative sample. The present study will include the following inclusion criteria: (1) children aged between 10 and 17 years; (2) full data on BMI CLASS (obesity[156] status); (3) full data on parent-reported anxiety and depression diagnosis; (4) full data on gender (sex), urbanicity, and at least 80% complete data on covariates. The exclusion criteria will be as follows: (1) children between 0-9 and 18 and above years; (2) data on primary independent or dependent variables will be missing; (3) implausible BMI values given by NSCH data quality flags. The NSCH data is publicly accessible on the Data

Resource Centre on Child and Adolescent Health (DRC) at childhealthdata.org. There is no need for any special permits or institutional agreements to access the public-use dataset, since it is de-identified and released by the federal agency. The public-use file does not require a formal data use agreement, but the researcher must be registered in the DRC portal to access and download the dataset.

Data Analysis Plan

IBM SPSS Statistics Version 29 was used to analyses[157] the data. The first step in data cleaning involved verifying missing data, outliers, and implausible BMI records using NSCH data quality flags. The cases with large amounts of missing data were dropped, and minor missingness was addressed using list wise[158] deletion. Survey weights were applied to make it national. This study answered two research questions aiming to determine relationships between obesity[159] and anxiety/depression, and the moderators were gender and urbanicity. Hypotheses were tested using logistic regression analyses, since the outcomes were binary. The effect was moderated by including interaction terms (obesity[160] x gender[162], obesity[161] x urbanicity[162]). The main assumptions were that the observations were independent, there was no multicollinearity, and the logit was linear with respect to continuous predictors. It tested them using variance inflation factors, correlation matrices, and the Box-Tidwell procedures. If assumptions were not met, transformations or large standard errors were to be considered. Where appropriate, comparisons were handled using conservative significance levels. The introduction of covariates was informed by previous literature that stated that they confounded the effect. The interpretation was done through odds ratios, 95% confidence intervals, and p-values. A = 0.05 was set as the statistical significance level. This type of analysis can be used to conduct a strong study of association and free-play effects in the dataset.

Threats to Validity

External validity can be compromised by using U.S.-based NSCH data, which limits the applicability of these results to other nations or cultures. But in the United States, it is enhanced by national representativeness (Crouch et al., 2023; Foster et al., 2020)[16]. The level of testing reactivity is low because data was gathered without any reference to this research.

The threats to internal validity are[164] a cross-sectional design, which restricts[164] the ability to draw causes[164] and introduces a[164] possibility of reverse causation between anxiety and obesity[163] (Kokka et al., 2023)[16]. Probability sampling helps to reduce selection bias, but residual confounding can still exist. Parent-reported measures are also a source of instrumentation threats, as they can lead to reporting errors (Foster et al., 2020)[16]. The issues of construct validity are associated with the fact that single-item measures of anxiety and depression are used, which may be restrictive in the depth of measurement (Galler et al., 2024)[16]. Multicollinearity or model misspecification may also compromise the statistical conclusion validity; the diagnostic tests were performed to mitigate these threats.

The study addressed these threats by including established variables, adjusting for major confounders, and using appropriate statistical methods (Forster et al., 2023)[25][16]. Where necessary, sensitivity analyses were done. Although limitations are inescapable in some respects, the validity and reliability of findings can be improved through a critical approach to methodological design and analytical rigor.

Ethical Procedures

The federal government issues the 2022-2023 NSCH public-use dataset in a de-identified form. The public-use file does not contain any personally identifiable information (PII). Not all records are publicly published without first

being depersonalized (removal of direct identifiers (names, addresses, Social Security numbers, and specific geographic identifiers below the state level) from the records). The NCHS and HRSA conducted de-identification before releasing the data, which is in line with the federal privacy protections under the Privacy Act and the Confidential Information Protection and Statistical Efficiency Act (CIPSEA). Since the dataset that is used by the researcher[165] does not contain any PII, there is no possibility of re-identifying individual participants. The data storage and data security measures in this study are: downloaded NSCH dataset will be stored on a password-protected computer that is only accessible to the principal researcher, all data analysis files will be encrypted, no raw data file will be shared with unauthorized persons, and a minimum of five years of data will be kept after the study is completed as per Walden University IRB policy before data is deleted. The data files in the NSCH are accessible to any registered user of the DRC,[166] and are not confidential; however, the researcher will treat the downloaded files as confidential research data in line with good research practice. Two important ethical issues apply to this study.

To begin with, since the secondary data used in this research are based on a federal government survey, there is no face-to-face interaction with human respondents. Nevertheless, a valuable ethical implication is the sound stewardship of data, which entails child health information. Although the data are de-identified, the researcher will still have the ethical responsibility to avoid re-identifying individual participants and to use the data in accordance with the purpose of this study. This[167] shall be addressed through close adherence to the NSCH data use terms and Walden University IRB protocols. Second, the research investigates the possibly sensitive health issues (obesity,[169] anxiety, and depression) in children, which raises the question of how the results can be

applied in a stigmatizing manner. To reduce the risk of contributing to weight-based or mental health stigmatization, the researcher will ensure that all dissemination of findings is expressed in[170] non-stigmatizing, person-first language and that the findings are[170] presented in[170] a framework of public health equity.

NSCH data is completely de-identified before being publicly released, and thus no personally identifiable information (PII) (e.g.[171] names, addresses, precise geographic locations) is contained. Federal agencies deleted identifiers prior to[1] release to ensure adherence to privacy legislation, including CIPSEA. Thus, the researcher does not identify any participant information in the dataset. The data would be stored on an encrypted, password-protected computer accessible only by the researcher to ensure confidentiality. There is no file sharing on a public platform, and reporting is only done in aggregate. Information will be stored safely for 5 years and then permanently destroyed in accordance with institutional policies. Two important ethical questions are taken into account. First, data misuse or re-identification risk, despite the data being de-identified, is addressed by adhering to stringent policies governing the ethical use of data and by making no effort to identify individuals. Second, there is the risk of stigmatization of obese and mentally ill children. It is tackled through the application of person-first, non-stigmatizing on-stigmatizing[173] language and the presentation of findings in the context of a broader public health discussion, rather than as an individual responsibility. In general, ethical standards are maintained through safe data management, responsible reporting, and adherence to institutional and federal research regulations.

Summary

The study adopted a quantitative and cross-sectional design, where secondary data were utilized through the 2022-2023 NSCH to test the correlation between

childhood obesity[174] and anxiety/depression. The sample of children aged 10-17 used in the study is nationally representative, which provides a strong basis for analyzing the situation. To achieve consistency and validity, standardized NSCH measures were used to operationalize variables, and a rigorous data analysis plan was implemented, including logistic regression and moderation analyses to examine relationships and interaction effects. The major covariates were selected based on previous studies, and the statistical assumptions were thoroughly examined to ensure correct outcomes. The methodological[175] controls and diagnostic testing were utilized[175] to overcome[175] potential threats to validity. The use of de-identified data, safe storage procedures, and responsible reporting were considered ethical priorities. All ethical considerations were followed in the study, which ensured[176] confidentiality, reduced[176] risk, yielded[176] relevant results that could be generalized to the entire population, and mitigated[176] limitations. The research strategy supports the study's purpose and research questions, providing a clear structure for investigating the relationship between obesity[177] and mental health. The second section presents the results of the statistical analysis, including both descriptive and hypothesis-testing results.

Section 3: Presentation of the Results and Findings

Section 4: Application to Professional Practice and Implications for Social Change

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Appendix A: Title of Appendix

Field Product #1: Policy Brief Memo

Title:

Addressing Childhood Obesity and Anxiety in U.S. Youth: A Dual-Risk Public Health Priority

Introduction

Childhood obesity[189] and anxiety are critical and interrelated public health concerns in the United States. Evidence from national datasets such as the National Survey of Children's Health (NSCH) shows that obesity[190] is significantly associated with increased risk of anxiety and depression among children aged 10–17.

Scope of the Problem

Approximately 20% of U.S. children are obese, with increasing prevalence of mental health disorders (Crouch et al., 2023; Contreras et al., 2021)[16]. Rural children and specific gender groups face disproportionate risks due to structural and social inequities (Foster et al., 2020)[16].

Current Approaches

Current interventions often address obesity[191] and mental health separately. School nutrition and physical activity programs exist but lack integrated mental health screening (Forster[25] et al., 2023)[16].

Proposed Policy

Implement integrated screening programs combining[192] BMI and mental health assessment[192] in pediatric and school settings. Expand rural mental health services and develop gender-sensitive interventions.

Major Constituencies

Public health agencies, pediatric providers, schools, policymakers, and community organizations.

Conclusion

Integrated and equity-focused policies are essential to reduce the dual burden of obesity[193] and anxiety in children.

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Field Product #2: Community Health Intervention Plan

Integrated Childhood Wellness Program: Addressing Obesity and Mental Health

Problem Definition

Childhood obesity[194] is significantly associated with anxiety and depression, particularly among rural and vulnerable populations (Beltran-Garrayo et al., 2023; Kokka et al., 2023)[16].

Goal Setting

Reduce obesity[195] prevalence

Improve early mental health detection

Increase access to care

Target Population

Children aged 10–17, especially:

Rural populations

Low socioeconomic[8] groups

High-risk gender subgroups

Intervention Strategies

Integrated screening (BMI + mental health)

School-based health education

Counseling services

Community engagement programs

Implementation Plan

Partner with schools and health departments

Train providers

Use mobile clinics in rural areas

Evaluation Plan

Pre/post health outcomes

Participation rates

Reduction in anxiety/depression

References

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DrPH Field Product #3: Visual Representation of Intervention Framework

SEM Level

Intervention Component

Delivery Mode

Responsible Party

Success Indicator

Microsystem

(Individual)

Physical activity sessions & nutrition education

School-based workshops (weekly)

School nurses, PE teachers

10% BMI z-score reduction at 24 months

Microsystem

(Individual)

CBT skills groups (gender-specific)

Small group, bi-weekly

Licensed counselors

15% GAD-7 score reduction

Mesosystem

(Family)

Parent/caregiver education

Monthly workshops & take-home materials

CHWs, school counselors

25% increase in parent knowledge

Exosystem

(School/Community)

School counselor training in integrated screening

Professional development[196] workshops

Public health program coordinator

100% of counselors trained

Macrosystem

(Policy)

Community advocacy for rural health equity

Policy briefs, community forums

DrPH candidates, administrators

Policy brief delivered to health[197] department

Note. CHW = Community Health Worker; CBT = Cognitive Behavioral Therapy; GAD-7 = Generalized Anxiety Disorder-7; SEM = Social Ecological Model (Bronfenbrenner, 1979)[16]. Delivery modes and indicators are subject to adaptation based on community needs assessment findings[198].

DrPH Field Product #4: Community Fact Sheet

 Key Facts About Childhood Obesity in the U.S.

1.	Mph ,	Improper formatting	Correctness
2.	~~last~~ → Last	Confused words	Correctness
3.	the term	Determiner use (a/an/the/this, etc.)	Correctness
4.	, you	Incorrect punctuation	Correctness
5.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
6.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
7.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
8.	*socioeconomic; socio-economic; Socioeconomic*	Text inconsistencies	Correctness
9.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
10.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
11.	*This*	Intricate text	Clarity
12.	*This*	Intricate text	Clarity
13.	~~SocialChange~~ → Social Change	Misspelled words	Correctness
14.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
15.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide

16.	*(Contreras et al., 2021; Crouch et al., 2023); (Contreras et al., 2021; Forster et al., 2023); (Crouch et al., 2023; Foster et al., 2020); (Crouch et al., 2023); (Beltran-Garrayo et al., 2023; Galler et al., 2024; Kokka et al., 2023); (Beltran-Garrayo et al., 2024; Forster et al., 2023); (Foster et...*	Citation style options	Correctness
17.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
18.	~~a antecedent~~ → an antecedent	Determiner use (a/an/the/this, etc.)	Correctness
19.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
20.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
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23.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
24.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
25.	*Forster; Förster*	Text inconsistencies	Correctness
26.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
27.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
28.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide

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34.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
35.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
36.	*Likewise, parental mental health has been identified as a significant contextual variable, differentially predicting obesity risk among children across rural and urban environments and income groups (Foster et al., 2020), underscoring the relevance of considering family and environmental context in...*	Paragraph can be improved	Clarity
37.	*Regardless of this accumulating evidence, there is an identifiable gap in the literature.*	Paragraph can be improved	Clarity
38.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
39.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
40.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide

41.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
42.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
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44.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
45.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
46.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
47.	~~study that tests~~ → analysis of	Paragraph can be improved	Clarity
48.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
49.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
50.	~~BMICLASS~~ → BMI CLASS	Misspelled words	Correctness
51.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
52.	framework,	Incorrect punctuation	Correctness
53.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
54.	~~will~~	Incorrect verb forms	Correctness
55.	~~intervention~~ → interventions	Incorrect noun number	Correctness
56.	combined,	Incorrect punctuation	Correctness

57.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
58.	obesity,	Incorrect punctuation	Correctness
59.	an alternative	Determiner use (a/an/the/this, etc.)	Correctness
60.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
61.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
62.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
63.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
64.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
65.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
66.	*multi-level; multilevel*	Text inconsistencies	Correctness
67.	~~development~~ → Development	Custom suggestions with replacements	Style guide
68.	~~development~~ → Development	Custom suggestions with replacements	Style guide
69.	),	Incorrect punctuation	Correctness
70.	*These propositions lead directly to the study's analytic approach, in which gender is treated as an individual-level moderator, urbanicity as a community-level moderator, and how the two interact to strengthen or weaken the obesity-anxiety relationship.*	Paragraph can be improved	Clarity

71.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
72.	*Its relevance to this paper is especially high, since the NSCH data focus on variables representing a variety of ecological levels, such as individual (gender, age, weight status), family (parental education, household income, parental mental health), and community (urbanicity, geographic region).*	Paragraph can be improved	Clarity
73.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
74.	~~development~~ → Development	Custom suggestions with replacements	Style guide
75.	*Besides the SEM, the study has a conceptual foundation in the emerging literature on psychosocial mechanisms underlying the relationship between childhood obesity and mental health.*	Paragraph can be improved	Clarity
76.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
77.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
78.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
79.	~~development~~ → Development	Custom suggestions with replacements	Style guide
80.	*The research questions will aim to test the hypothesis that these theoretically hypothesized moderation effects are supported by empirical evidence from the U.S. nationally representative NSCH data.*	Paragraph can be improved	Clarity
81.	study.	Closing punctuation	Correctness

82.	~~is used to collect~~ → collects	Paragraph can be improved	Clarity
83.	~~bio statistical~~ → biostatistical	Misspelled words	Correctness
84.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
85.	unachievable.	Closing punctuation	Correctness
86.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
87.	*Each model will incorporate the following covariates (depression or anxiety as a cross-control, age, race/ethnicity, socioeconomic status) and will be adjusted using NSCH survey weights to make them nationally representative.*	Paragraph can be improved	Clarity
88.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
89.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
90.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
91.	~~development~~ → Development	Custom suggestions with replacements	Style guide
92.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
93.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
94.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide

95.	*Using the NSCH data to test the hypothesis that parental mental health was a differentiating factor for child obesity across rural and urban settings and income status, Foster et al. (2020) utilized a multilevel analysis framework based on SEM concepts.*	Paragraph can be improved	Clarity
96.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
97.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
98.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
99.	a greater	Determiner use (a/an/the/this, etc.)	Correctness
100.	*They are theorized to be more intense and to have greater impact with respect to the child's gender and geographic location.*	Paragraph can be improved	Clarity
101.	~~have a negative impact on~~ → hurt, harm	Wordy sentences	Clarity
102.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
103.	~~have a negative effect on~~ → hurt, harm	Wordy sentences	Clarity
104.	in a	Wrong or missing prepositions	Correctness
105.	*The use of this conceptual framework in previous studies has been a similar manner.*	Paragraph can be improved	Clarity
106.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide

107.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
108.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
109.	the dependent	Determiner use (a/an/the/this, etc.)	Correctness
110.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
111.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
112.	*In the NSCH, this is obtained through the variable BMICLASS that classifies children as underweight, healthy, overweight and obese with reference to parent-reported height and weight (Health Resources and Services Administration & U.S. Census Bureau, 2024).*	Paragraph can be improved	Clarity
113.	*This*	Intricate text	Clarity
114.	*Age (Covariate): This is the age of the child in years when the survey is filled, but in this case, it is limited to children between the ages of 10 and 17 years.*	Paragraph can be improved	Clarity
115.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
116.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
117.	~~development~~ → Development	Custom suggestions with replacements	Style guide
118.	report,	Incorrect punctuation	Correctness

119.	*The particular emphasis on gender and urbanicity as two moderators, as opposed to a wider range of potential moderators, was done to fill the gap in the literature that had been identified and due to the parsimony of analysis.*	Paragraph can be improved	Clarity
120.	*The reason why the NSCH dataset was chosen is due to the availability of the most comprehensive and rigorously methodologically representative nationally representative data on child health in the U.S., with validated parent-reported mental health diagnoses, measured or reported anthropometric data...*	Paragraph can be improved	Clarity
121.	*The cross-sectional design limits external validity of the study because it does not permit drawing causal conclusions, and the use of secondary data limits the researcher to collecting the variables that were not measured in the NSCH.*	Paragraph can be improved	Clarity
122.	*The scope of the population will be non-institutionalized, civilian U.S. children aged 10-17 years old with no missing data on significant variables.*	Paragraph can be improved	Clarity
123.	*Other theoretical models, like the cognitive behavioral model of anxiety or the biopsychosocial model, were also taken into consideration, but not taken as the dominant theoretical framework, because the SEM provides the best correspondence to multilevel moderators of interest.*	Paragraph can be improved	Clarity
124.	*This research has a number of possible contributions to the existing knowledge in the sphere of the epidemiology of public health and pediatrics.*	Paragraph can be improved	Clarity

125.	*Second, survey-weighted logistic regression with interaction terms is a methodologically sound way of moderation testing, which could be used as the template in future epidemiological studies involving complex survey data.*	Paragraph can be improved	Clarity
126.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
127.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
128.	*Among the policy implications, there is the possibility to support focused funding distributions both in rural mental health infrastructure and pediatric health programming that is gender-sensitive.*	Paragraph can be improved	Clarity
129.	*This study can be useful on several ecological levels in order to positively change the situation.*	Paragraph can be improved	Clarity
130.	*The existence of the moderation effect differences, in turn, justifies equity-based public health policy responses to the combination of geographic and gender-based health disparities in childhood, at the policy level.*	Paragraph can be improved	Clarity
131.	*The research therefore helps in the greater purpose of health research, which is to minimize health disparities and enhance wellbeing among all children irrespective of their places of residence or sex.*	Paragraph can be improved	Clarity
132.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
133.	*To address the problems, the research will utilize statistical controls and multivariate regression methods to minimize confounding effects.*	Paragraph can be improved	Clarity

134.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
135.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
136.	*In particular, classifying high-risk subgroups by gender or geographic location can assist healthcare providers, educators, and policymakers in developing more precise prevention programs.*	Paragraph can be improved	Clarity
137.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
138.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
139.	provides justification for applying	Paragraph can be improved	Clarity
140.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
141.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
142.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
143.	*This*	Intricate text	Clarity
144.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
145.	, but will also address the logistical, financial, and ethical constraints of secondary data analysis.	Paragraph can be improved	Clarity
146.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide

147.	*As a particular source of data, the NSCH has been used in the literature on childhood obesity and rural-urban health (Crouch et al., 2023; Foster et al., 2020), which makes it reasonable to assume it is relevant to the research questions.*	Paragraph can be improved	Clarity
148.	*The initial data set used a complicated sampling method involving probability sampling to select addresses via list-assisted dialing with random digits, ensuring national representativeness.*	Paragraph can be improved	Clarity
149.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
150.	sufficiently powerful	Paragraph can be improved	Clarity
151.	the original	Determiner use (a/an/the/this, etc.)	Correctness
152.	ensure national representativeness	Paragraph can be improved	Clarity
153.	*This*	Intricate text	Clarity
154.	~~Centre~~ → Center	Misspelled words	Correctness
155.	*The sampling frame was based on all non-institutionalized children living in the United States who were between the ages of 17 years.*	Paragraph can be improved	Clarity
156.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
157.	~~analyses~~ → analyze	Incorrect verb forms	Correctness
158.	~~list wise~~ → listwise	Misspelled words	Correctness
159.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide

160.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
161.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
162.	*The effect was moderated by including interaction terms (obesity x gender, obesity x urbanicity).*	Paragraph can be improved	Clarity
163.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
164.	*The threats to internal validity are a cross-sectional design, which restricts the ability to draw causes and introduces a possibility of reverse causation between anxiety and obesity (Kokka et al., 2023).*	Paragraph can be improved	Clarity
165.	*Since the dataset that is used by the researcher does not contain any PII, there is no possibility of re-identifying individual participants.*	Passive voice misuse	Clarity
166.	~~user of the DRC,~~ → DRC user	Paragraph can be improved	Clarity
167.	*This*	Intricate text	Clarity
168.	by adhering closely	Paragraph can be improved	Clarity
169.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
170.	*To reduce the risk of contributing to weight-based or mental health stigmatization, the researcher will ensure that all dissemination of findings is expressed in non-stigmatizing, person-first language and that the findings are presented in a framework of public health equity.*	Paragraph can be improved	Clarity
171.	e.g.,	Incorrect punctuation	Correctness

172.	~~prior to~~ → before	Wordy sentences	Clarity
173.	~~on-stigmatizing~~	Incorrect phrasing	Correctness
174.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
175.	*The methodological controls and diagnostic testing were utilized to overcome potential threats to validity.*	Paragraph can be improved	Clarity
176.	*All ethical considerations were followed in the study, which ensured confidentiality, reduced risk, yielded relevant results that could be generalized to the entire population, and mitigated limitations.*	Paragraph can be improved	Clarity
177.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
178.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
179.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
180.	~~development~~ → Development	Custom suggestions with replacements	Style guide
181.	~~development~~ → Development	Custom suggestions with replacements	Style guide
182.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
183.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
184.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide

185.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
186.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
187.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
188.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
189.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
190.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
191.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
192.	*Implement integrated screening programs combining BMI and mental health assessment in pediatric and school settings.*	Paragraph can be improved	Clarity
193.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
194.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
195.	~~obesity~~ → Obesity	Custom suggestions with replacements	Style guide
196.	~~development~~ → Development	Custom suggestions with replacements	Style guide
197.	the health	Determiner use (a/an/the/this, etc.)	Correctness

198.	*Delivery modes and indicators are subject to adaptation based on community needs assessment findings.*	Paragraph can be improved	Clarity