



**Master of Public Health  
Epidemiology- MPH746  
Study Design Project**

---

**Prevalence of childhood obesity in Lancaster, PA: A cross-sectional study**

---

**Emily Weaver**



#### **Part IV: Abstract (Max 250 words)**

The prevalence of childhood obesity and its association with physical activity will be measured in Lancaster County, Pennsylvania through a cross-sectional study. Exposure (physical activity) measurements will be recorded with a survey given with beginning of school year paperwork or sent through the mail to those not attending school. The outcome (weight) will be measured either in school or through home visits. The prevalence of childhood obesity and odds ratio as it relates to level of physical activity will be useful in public health to understand healthier lifestyles for children, eventually leading to healthier adults.

#### **Part I: Background & Objectives**

Childhood obesity is a persistent problem within the United States, has adverse outcomes during childhood, and are amplified when carried into adulthood. During 2017-2018 for children aged 2-19 years, the prevalence of obesity was 19.3% effecting roughly 14.4 million children (Center for Disease Control and Prevention [CDC], 2021). The prevalence of childhood obesity in kindergarten is 5.4% and decreased to 1.7% between fifth and eighth grade (Cunningham, et al., 2014). Overweight 5-year-olds were four times as likely to become obese compared to a normal weight child (Cunningham, et al., 2014). Obesity in children also takes into consideration socioeconomic status. The prevalence among the lowest income group was 18.9%, 19.9% in the middle group, and 10.9% in the highest group (CDC, 2021). Children with obesity are at more risk of developing high blood pressure and high cholesterol, which are risk factors for cardiovascular disease (CDC, 2021). They are also more likely to have impaired glucose tolerance, insulin resistance, type 2 diabetes, breathing problems, joint problems, musculoskeletal discomfort, fatty liver disease, gallstones, and gastro-esophageal reflux (CDC, 2021). There are also psychological and social problems associated with childhood obesity such as anxiety, depression, low self-esteem, low quality of life, and bullying (CDC, 2021). Children who have obesity are more likely to become adults who are obese. Adulthood obesity is associated with even more risk of heart disease, type 2 diabetes, and cancer (CDC, 2021). Risk factors tend to be more severe when obesity begins during childhood. It is difficult to measure disability due to disease (DALY) in children since the outcomes are observed in adulthood. However, since it is known that obese children and adolescents are more likely to become obese adults, it is worthy to note that in 2015 there were 4.0 million deaths and 120 DALYs due to excess body mass index (Tran et al., 2019). Adults who are obese at age 40 can expect to die 3-6 years earlier than those who are not obese, roughly similar to someone who smokes (Childhood Obesity Foundation, 2021). From an economic standpoint, childhood obesity can cost \$19,000 per child during their lifetime for additional doctor visits, medications, and other medical costs (Finkelstein et al., 2014). However, this cost does not account for loss in productivity once they become working adults. In a Swedish cohort study, it was found that of those who were obese in their childhood, 1 in 4 had obesity recorded as a cause of death (Lindberg et al., 2020).

#### **Objectives:**

#### **This study aims to:**

- 1) Measure prevalence of childhood obesity and risk factors in Lancaster County, Pennsylvania.

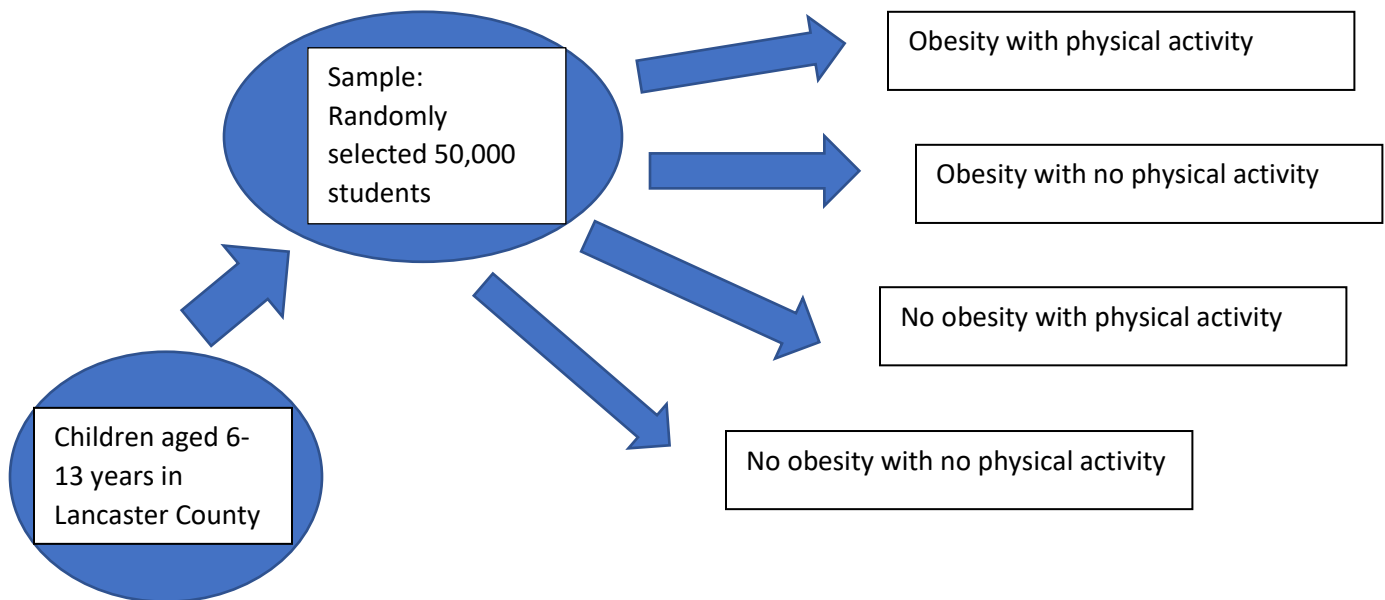
- 2) Investigate the association of childhood obesity with physical activity and in Lancaster County, Pennsylvania

## Part II: Methods

### Study design:

I chose to study the prevalence of childhood obesity in Lancaster, PA through a cross-sectional study design. This study will investigate the association of physical activity serving as the exposure and childhood obesity being the outcome. Cross-sectional studies are useful for studying common diseases **with long duration**, such as childhood obesity. This study design will also allow investigation on multiple exposures that lead to the outcome of childhood obesity, or potentially more outcomes if needed. It is also a relatively cost effective and easy study to do since the outcomes and exposures are measured at one point in time. In addition, it allows the researcher to calculate prevalence. Prevalence will give an indication of if childhood obesity is an active problem in Lancaster County school aged children. I chose not to pursue a cohort study due to time, effort, and money restraints as well as risking higher non-response and drop out participants. I chose not to pursue a case-control study due to wanting to measure prevalence and they are better suited for rare diseases. I did not want to do a randomized control trial because I am not looking how to experiment with childhood obesity, I do not have proposed new treatment. Finally, an ecological study did not make sense as they do not provide strong evidence between exposure and outcome.

Prevalence of childhood obesity and the association with physical activity.



**Study participants:**

The study population will be children aged 6-13 years in Lancaster County schools, including public, private, homeschool, and online programs. The study participants will be randomly selected from each school's database for enrollment. The researcher will randomly select 50,000 children aged 6-13 to gather sufficient data on the age range.

**Data collection**

The outcome will be measured by participants being weighed in school for those that attend school. To minimize nonresponse, home visits will be performed for those not attending school. The same exact scale will be used for all participants. BMI will be calculated and categorized under CDC guidelines to determine if the child is overweight or obese. Overweight is between the 85<sup>th</sup> and 95<sup>th</sup> percentile and obese is considered the 95<sup>th</sup> percentile or greater.

Exposure measurements will be recorded through a questionnaire given with beginning of school year paperwork or sent through the mail to those not attending school. The questions will be given on physical activity type, how many minutes per day, how strenuous the activity is, etc. The survey will consist of multiple-choice questions formatted in a range of responses of least to greatest for each category. This portion will likely be completed by the child's parent since the study is focused on children.

In order to be considered a confounder, the variable must have a relationship with both the outcome and exposure and is not on the causal-pathway of the relationship between the exposure and the outcome. Some confounding variables of concern are child's stress, socioeconomic factors, parent's education level, and diet. Measurement of these factors could take place on the survey given.

Restriction or stratified analysis could be used to adjust for confounding factors

**Possible sources of errors**

Selection bias should be minimized due to obtaining the sample from school enrollment databases since all children are required to go to school, regardless of the educational format. **Non-response could also serve as a selection bias as it could create an unrepresentative sample of the population. The researchers will attempt to minimize non-response by sending the questionnaire home with the rest of beginning of school year paperwork, hopefully making it more convenient to complete.** Measurement bias may be observed in responder bias in how they answer the survey questions. The questions should be framed as detailed as possible to minimize confusion in answering questions. **Since physical activity is difficult to measure,** bias may be encountered in the participants perception of their child's physical activity level compared to their actual actions; this would be misclassification. Parents may answer questions regarding to the confounding variables untruthfully as well. Although there were steps taken to minimize nonresponse for this study, there will always be some refusal to participate. There may also be misclassification on obesity performed by the research team.

**Time frame**

I assume it will take roughly 9 months to complete all questionnaires, gather data, and organize it to draw conclusions. The study will be beginning at the start of school (roughly end of August) and hopefully be concluding by May.

**Ethical consideration**

Obesity is considered a medical condition and all participation and responses will be kept confidential. In order to reduce exposure, each study participant will be assigned an identification number and have all personal information removed from study documents. Anything including personal information such as completed surveys or consent forms will be kept in a locked file cabinet or safe computer folders. The study will not be conducted until ethical approval is obtained from an Institutional Review Board.

**Part III: Proposed findings and their possible impact**

The disease frequency of childhood obesity will be measured by prevalence. The measure of association of childhood obesity with physical activity level will be calculated with odds ratio.

Prevalence is measured by taking the number of cases present in the population at a specific time divided by the number of persons in the population at that specific time. Odds ratio will be calculated by first creating a 2x2 table summarizing the results into four categories: obesity with physical activity (A), no obesity with physical activity (B), obesity with no physical activity (C), and no obesity with no physical activity (D). Next, the researchers will multiply  $A \times D$  divided by  $C \times B$ , yielding the odds ratio.

As mentioned previously, confounding variables of concern are child's stress, socioeconomic factors, parent's education level, and diet. Stratified analysis could be used in this cross-sectional study to adjust for confounding factors. The researchers could stratify by any of the variables of concern mentioned above. For example, if wanting to stratify by socioeconomic status, the researchers could separate the study participants into high, middle, and low statuses. Analyzing the data when stratified could give indication if socioeconomic status has an effect on childhood obesity. Restriction could also be used to control for confounding. For example, the researches could exclude children who have higher stress from the study.

Impacts of finding the prevalence of childhood obesity could lead to organizations, schools, and communities to adopt more active lifestyles. Collecting and analyzing data on childhood obesity may lend an impactful public health change in the future health and habits of children, eventually leading to a healthier population of adults. This cross-sectional study is also designed in a way to further study risk factors associated with childhood obesity.



## References

Center for Disease Control and Prevention (CDC). (2021). *Overweight and Obesity*. <https://www.cdc.gov/obesity/data/childhood.html>. Accessed October 4, 2021.

Childhood Obesity Foundation. (2021). What are the Complications of Childhood Obesity? <https://childhoodobesityfoundation.ca/what-is-childhood-obesity/complications-childhood-obesity/>. Accessed October 5, 2021.

Cunningham, S. A., Kramer, M. R., Venkat Narayan, K. M. (2014). Incidence of Childhood Obesity in the United States. *The New England Journal of Medicine*. 370: 403-411. DOI: 10.1056/NEJMoa1309753. Accessed October 4, 2021.

Finkelstein, Eric., Malhotra, Rahul., Graham, W. C. K. (2014). Over a Lifetime, Childhood Obesity Costs \$19,000 Per Child. *Duke Global Health Institute*. <https://globalhealth.duke.edu/news/over-lifetime-childhood-obesity-costs-19000-child>. Accessed October 5, 2021.

Lindberg, Linda., Danielsson, Pernilla., Persson, Martina., et al. (2020). Association of childhood obesity with risk of early all-cause and cause-specific mortality: A Swedish prospective cohort study. *Plos Medicine*. DOI: 10.1371/journal.pmed.1003078

Tran, B. X., Dang, K. A., Le, H. T. et al. (2019). Global Evolution of Obesity Research in Children and Youths: Setting Priorities for Interventions and Policies. *Obesity Facts*. 12: 137-149. DOI: 10.1159/000497121. Accessed October 5, 2021.