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2024

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William Bohne

Anthony Onochie

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Weight Health in the Modern Lens: Investigating the Intersectionality of Obesity

William Bohne and Anthony Onochie

Abstract

Purpose

The purpose of this study is to investigate the relationship between these social determinants of health and obesity to provide a better understanding of geographical differences in obesity rates.

Methods

All data was collected using countyhealthrankings.org. The variables that were studied included access to exercise, food insecurity, and life expectancy due to previous literature demonstrating probable association between these variables and the prevalence of obesity.

Results

Statistically significant increase in number of adults with obesity from 2016 to 2022 (32% to 37%). Statistically significant weak, negative correlation between access to exercise and obesity ($r=-.306$). Statistically significant weak, negative correlation between adult obesity rates and food environment index ($r=-.388$). Statistically significant moderate, negative correlation between life expectancy and adult obesity ($r=-.522$)

Conclusion

With an increase in obesity rates in Ohio from 2016 to 2022 and a clear correlation with decreased life expectancy, there continues to be an urgent need to address the “obesity epidemic” not only in Ohio counties, but nationwide, by taking a closer look at the variables associated with obesity.

Introduction

Obesity is known to be a multifactorial pathology that results in a multitude of adverse health conditions. Research has shown that obesity can be caused by genetic predisposition, environmental factors, lifestyle habits and choice, or a combination of all these factors.¹ Similarly, social determinants of health have become a point of interest lately in medicine because we now know how important these factors are to an individual’s health. Many different social determinants of health have been identified, and some are easier to track and obtain data on than others.

Much of the discourse surrounding obesity seeks to find out what factors significantly influence obesity, as a better understanding of these factors would play a role in combating this health condition. One of such factors is socioeconomics. It is well documented that the impact of a person or a community’s economic activity can affect the quality of life that can be attained. This phenomenon is also applicable to this in-depth assessment of obesity. A niche

socioeconomic facet that this paper investigates is the food environment index. This variable combines the two measures of food access, namely: 1) the percentage of a given population that are low-income earners and have limited access to grocery stores, and 2) the percentage of a given population that lack access to a reliable food source.

Public databases such as countyhealthrankings.org have made accessing data about social determinants of health quick, cheap, and easy. Mechanistic relationships between obesity and specifically access to quality food and exercise have been described in the literature.^{2,3} The purpose of this paper is to investigate the relationship between these social determinants of health and obesity to provide a better understanding of geographical differences in obesity rates.

Methods

Data Collection

All data was collected using countyhealthrankings.org. The variables that were studied included access to exercise, food insecurity, and life expectancy due to previous literature demonstrating probable association between these variables and the prevalence of obesity.¹⁻⁵ Food insecurity data was collected using the Map to Meal Gap. Access to exercise data was collected using ArcGIS Business Analyst and Living Atlas of the World; YMCA; US Census TIGER/Line Shapefile. Life expectancy data was determined using the National Center of Health Statistics - Mortality Files. Finally, obesity data was collected using “multilevel regression and poststratification (MRP) is performed for small-area estimation that links BRFSS data with high spatial resolution population demographic and socioeconomic data from the Census’ American Community Survey (ACS)”

Variables

Obesity: Defined as the percentage of the adult population aged 18 and above that report a body mass index (BMI) greater than or equal to 30 kg/m² (age-adjusted).

Life Expectancy: Defined as the average number of years a person can expect to live.

Food insecurity: Defined as the percentage of the population who lack adequate access to food.

Access to exercise: For the scope of this study, access to exercise is defined as the percentage of the population with adequate access to locations for physical activity.

Inclusion/exclusion

All 88 Ohio counties were included in the data pool.

Data Analysis

This study compares the rates of obesity and with access to exercise, food insecurity, and life expectancy for each county in Ohio. Two regression analyses were performed to determine if the presence of food deserts serves as an accurate predictor of obesity, and to determine if obesity serves as an accurate predictor of life expectancy. A correlation test was also performed to compare lack of exercise opportunities and rates of obesity. Finally, the prevalence of obesity in Ohio from 2016 was compared to the prevalence of obesity in 2022 using a paired T-test.

Results

Our comparison between the percentage of adults with obesity between 2016 and 2022 showed a significant difference in the percentage of adults with obesity between 2016 (mean=32.072) and 2022 (mean=35.572) ($t=-19.318$, $p <.001$) (Table 1). Paired t-test

Table 1: Percentage of Adults with Obesity

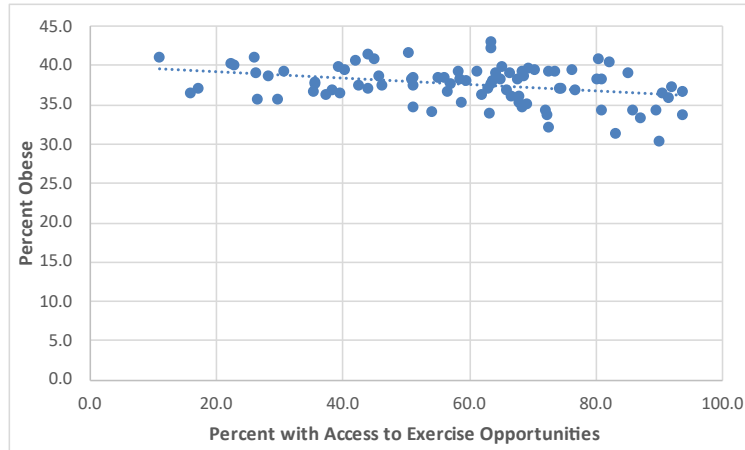
Year	n	mean	SD
2016	88	32.072	2.768
2022	88	37.572*	2.412

Abbreviation: SD, standard deviation

*Statistically significant difference

Our next research question explored how the percent of people with access to exercise opportunities correlates with the percent of obese adults in Ohio in 2022 (RQ1), a Spearman correlation suggested that there was a weak but significant negative correlation ($r=-.306$, $p<0.004$), which indicates that as the percent of people with access to exercise opportunities increase, the percent of obese adults decrease. (Figure 1).

Figure 1: Correlation Between People with Access to Exercise Opportunities and Percent of Obese Adults in Ohio in 2022



A Spearman correlation showing a weak but significant correlation ($r = -.306$, $p < 0.004$) where, as the percent of people with access to exercise opportunities increase, the percent of obese adults decrease.

For two of our research questions, we chose to do regression analyses. Our first regression investigated the relationship between adult obesity and food environment index in Ohio in 2022. Utilizing a simple linear regression, the best fitting model presented a statistically significant, weak, negative correlation between adult obesity rates and food environment index ($F_{1,86} = 15.256$, $p < 0.001$), accounting for 15.1% of the variance in our data. The sole contributor to the model was the Food environment index ($B = -1.315$, $t = -3.906$, $p < 0.001$)

Our second regression compared life expectancy and adults with obesity. We found a statistically significant, moderate, negative correlation between life expectancy and adult obesity ($r = -.522$, $p < 0.001$). Similarly, using a simple linear regression, the best fitting model was significant ($F_{1,86} = 32.165$, $p < 0.001$), accounting for 32.2% of the variance in our data.

Discussion

The results of this study show an alarming increase in the percentage of adults with obesity by 5% from 2016 to 2022. There are a plethora of theories as to why this increase occurred, but the overall cause can be simplified to *an increase in caloric intake and a decrease in physical activity*.⁴ The increase in popularity of food delivery services as well as the increasing number of “work from home” positions after the COVID-19 epidemic may be contributing to the two underlying factors of the obesity epidemic and further research addressing these factors is warranted.

Due to the known association between lack of exercise and obesity, this study investigated the relationship between these two variables in Ohio.³ The results show a weak, negative correlation between access to exercise and obesity, meaning that lack of access to exercise does have at least a small impact on rates of obesity. However, there are limitations to using “access to exercise opportunities” as a reliable indicator of exercise status. For example, many people exercise at home, go on walks in their community, and participate in other “exercise” activities that don't require the use of an actual exercise facility. This may skew the data by including people in the “lack of access” category who still exercise and are therefore less likely to be obese.

There was a slightly larger, negative correlation between food environment index and obesity. The broad definition and operationalization of “food environment index” limits the impact of this variable. Although previous research has shown that excessive caloric intake is a major factor in obesity, because an individual does not have access to healthy foods does not mean that they will inherently consume more calories.² Further research into the relationship between food environment index and caloric intake should be performed, and the resulting data could be used to more accurately predict the relationship between food environment index and obesity.

The strongest correlation in this study was a moderate, negative correlation between life expectancy and obesity, suggesting that obesity can be used as a predictor of life expectancy in population studies. The exact mechanisms of how obesity contributes to decreased life expectancy include hypertension, diabetes, and lipid disorders.⁵ The causative relationship between obesity and life expectancy has been identified in numerous studies but was included in this study looking specifically at county-wide data in Ohio to see if it matched national and global trends.⁵

There are several limitations to this study. From a research design perspective, using county-level, aggregate data can lead to overlooking the geographic reasons for certain data. There are multiple cities in a county, and some of these cities may have drastically different data for certain variables, but these differences will be missed when using county-level data. Future research can extrapolate the same data used in this study to investigate inter-country relationships in Ohio. Additionally, the cross-sectional nature of this study makes it difficult to draw conclusions about correlations because the data only pertains to one point in time. Further longitudinal studies should be performed to solidify cause and effect relationships between the studied variables.

Conclusion

Obesity is a multivariate health epidemic that is on the rise in the United States.⁴ Research has shown that decreased caloric expenditure and increased caloric intake lies at the root of the problem, but the geographic and socioeconomic factors involved in obesity have yet to be solidified.¹ There are a plethora of variables stated in the literature that are implicated in obesity, and the results of this study showed the strongest negative correlation between obesity and life expectancy. There is also a weak, negative correlation between obesity and both food environment index and access to exercise. With an increase in obesity rates in Ohio from 2016 to 2022 and a clear correlation with decreased life expectancy, there continues to be an urgent need to address the “obesity epidemic” not only in Ohio counties, but nationwide.

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