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Repository Citation

Griffith, K. (2020). The Impact of Exercise of Mental Health. Wright State University. Dayton, Ohio.

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The impact of access to exercise on mental health

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Population and Public Health

Scholarship in Medicine Final Report

Abstract

Objective: Researchers have long recognized the positive association between exercise and mental health. With such a large proportion of the United States population being affected by mental illness, it is more important now than ever, to establish ways to improve the mental health of the country. The aim of this study is to evaluate the mental health of areas with differing levels of access to exercise, specifically Ohio and West Virginia, and begin making connections and associations about locations with similar data.

Methods: Data used in this study was gathered by the County Health Rankings and Roadmaps program (CHR&R). The data provided for the number of mentally unhealthy days was reported from surveys while the data associated with access to exercise opportunities was calculated based on distance to opportunities, with greater distance allowance for more rural areas. Utilizing SPSS statistics software, compiled data was statistically analyzed via paired and unpaired t-tests as well as Pearson correlation.

Results: Analysis indicated that both access to exercise opportunities and mentally unhealthy days were significantly different between Ohio and West Virginia. Further, a negative correlation was found indicating that in West Virginia for 2020, as access to exercise opportunities increases, the number of reported mentally unhealthy days decreases. No correlation was found

between these two variables in Ohio for 2020. Likely, differences seen between states are attributable to population size and/or geographical location.

Introduction/Literature Review

The World Health Organization describes mental health as a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to contribute to his or her community¹. Unfortunately, this state is disrupted for 1 in 5 people in the United States each year². These mentally unhealthy individuals may not only experience low self-esteem and trouble maintaining relationships, but also have a higher risk of both infectious and non-infectious diseases³. Specifically, in those with severe mental illness, there is a significantly higher risk of cardiovascular disease risk factors such as obesity, hyperglycemia, and metabolic syndrome⁴.

In 2018, 19.1% of the United States, or 46.7 million people, experienced mental illness⁵. Such a large portion of the population being affected by mental illness comes with a large financial burden⁵. Mental disorders have experienced a 5.6% increase of growth in spending between the years 1996 and 2013. In 1996, mental health disorders were a distant second to heart conditions in regard to healthcare spending in the US. By 2013, healthcare costs associated with mental health disorders surpassed that of heart conditions by more than \$13 billion⁵.

The benefits of physical activity have long been utilized in both the treatment and prevention of health conditions. Exercise promotes several physical effects that help to prevent chronic diseases such as diabetes, obesity, and hypertension, but it has also been shown to reduce the risk of mental health conditions, specifically anxiety and depression³. Further, exercise has been found to reduce negative symptoms and cognitive deficits in schizophrenia⁴.

Several studies have observed the relationship between exercise and mental health. Adbollahi et al. showed that exercise in conjunction with cognitive behavioral therapy can reduce depressive symptoms and suicidal ideation⁶. Further, a cross-sectional study done by Chekroud et al. demonstrated that those who exercised had roughly 43% fewer mentally unhealthy days than those who did not⁷. While incorporating exercise into daily life seems like an easy, cost efficient way to manage both physical and mental health, that is not always the case. There are a multitude of barriers that can hinder an individual's ability to partake in exercise, one of these being access to exercise opportunities. A study completed by Anne Roubal and colleagues found access to exercise opportunities varies widely throughout the country, specifically, the Northeast region of the United States was shown to have the most access to exercise opportunities while the Southeast had the least⁸.

While the relationship between mental health and exercise has been established, as well as the access of exercise opportunities here in the United States, there is minimal literature on the relationship between the mental health of an area and that area's access to exercise opportunities. By beginning to establish this relationship, we create a framework for future researchers to look at the same variables within different areas of the country or world. Once a clear or significant relationship is discovered, plans of improvement can be implemented, such as creating more exercise opportunities in areas where the lack thereof is found to negatively correlate with the mental health of that area.

Research Questions

RQ1: What is the difference in the average number of mentally unhealthy days during the years 2016 and 2020 in Ohio?

RQ2: What is the difference in access to exercise in Ohio during the years 2016 and 2020?

RQ3: What is the difference in the average number of mentally unhealthy days between West Virginia and Ohio in 2020?

RQ4: What is the difference in access to exercise between West Virginia and Ohio in 2020?

RQ5: What is the relationship between access to exercise and mentally unhealthy days in West Virginia in 2020?

RQ6: What is the relationship between access to exercise and mentally unhealthy days in Ohio in 2020?

Methods

Context/Protocol

The variables utilized in this study include access to exercise opportunities and the number of poor mental health days. All data used in this study was gathered by the County Health Rankings and Roadmaps program (CHR&R). Access to exercise opportunities is a measure of the percent of individuals that live within a certain distance of exercise opportunities. Exercise opportunities are defined as recreational facilities or parks. Distance from the exercise opportunity was specific for different environments. Those that reside in a census block are considered to have access if they live within a half mile. Those that reside in urban census blocks are considered to have access within one mile and those in a rural census block are described as having access if they are within 3 miles of an exercise opportunity.

Poor mental health days are reported as an average. Data for this variable was gathered via survey in which people reported the average number of mentally unhealthy days in the last 30

days. As health outcomes become poorer with age, the CHR&R program reported age adjusted estimates. Due to smaller populations and thus smaller sample sizes in certain areas of each state, statistical modeling was utilized to obtain the most reliable estimates.

Data Collection

As all data was previously collected by the CHR&R program, no further data collection will be required. Data retrieved from the CHR&R program was exported into excel to better allow for statistical analysis. All data available for variables used in Ohio and West Virginia were included in data analysis. There were no exclusion criteria.

Data Analysis

While utilizing the SPSS statistics software, several different quantitative tests will be run to compare data sets as well as define any correlation between them. The two variables involved in these tests are the percent of access to exercise and average number of poor mental health days in Ohio and/or West Virginia in the years 2016 and/or 2020. For research questions 1 and 4, an independent samples t-test will be run. Further, paired t-tests will be performed for research questions 2 and 3. Then a Pearson correlation will be carried out to determine the relationship between the variables in research questions 5 and 6.

Results

When looking at Ohio counties between the years 2016 and 2020 and comparing the average mentally unhealthy days reported (RQ1), we found the days reported increased significantly from 4.05 days in 2016 to 4.40 days in 2020 ($t = 20.953, p < .001$) (Table 1).

Table 1: Mentally Unhealthy Days in Ohio

Year	N	Mean	SD
2016	88	4.05	.029
2020	88	4.40 ^a	.033

Abbreviation: SD, Standard Deviation

^astatistically significantly different from 2016 ($p < .001$)

The percent with access to exercise opportunities of the same Ohio counties in 2016 and 2020 (RQ2) showed there was no significant change from 68.19% in 2016 to 67.76% in 2020 ($t = .383, p < 0.703$) (Table 2).

Table 2: Access to Exercise Opportunities in Ohio

Year	N	Mean	SD
2016	88	68.19%	17.43%
2020	88	67.76%	19.08%

Abbreviation: SD, Standard Deviation

The number of reported mentally unhealthy days in 2020 (RQ3) were significantly different between West Virginia (5.38) and Ohio (4.39) counties ($t = 17.82, p < 0.001$) (Table 3).

Table 3: Mentally Unhealthy Days Between Two States

State	N	Mean	SD
West Virginia	55	5.38	.333
Ohio	88	4.39	.314

Abbreviation: SD, Standard Deviation

Further, the percent of citizens with access to exercise opportunities in 2020 (RQ4) was also significantly different between West Virginia (53.95%) and Ohio (67.73%) counties ($t = -3.90, p < 0.001$) (Table 4).

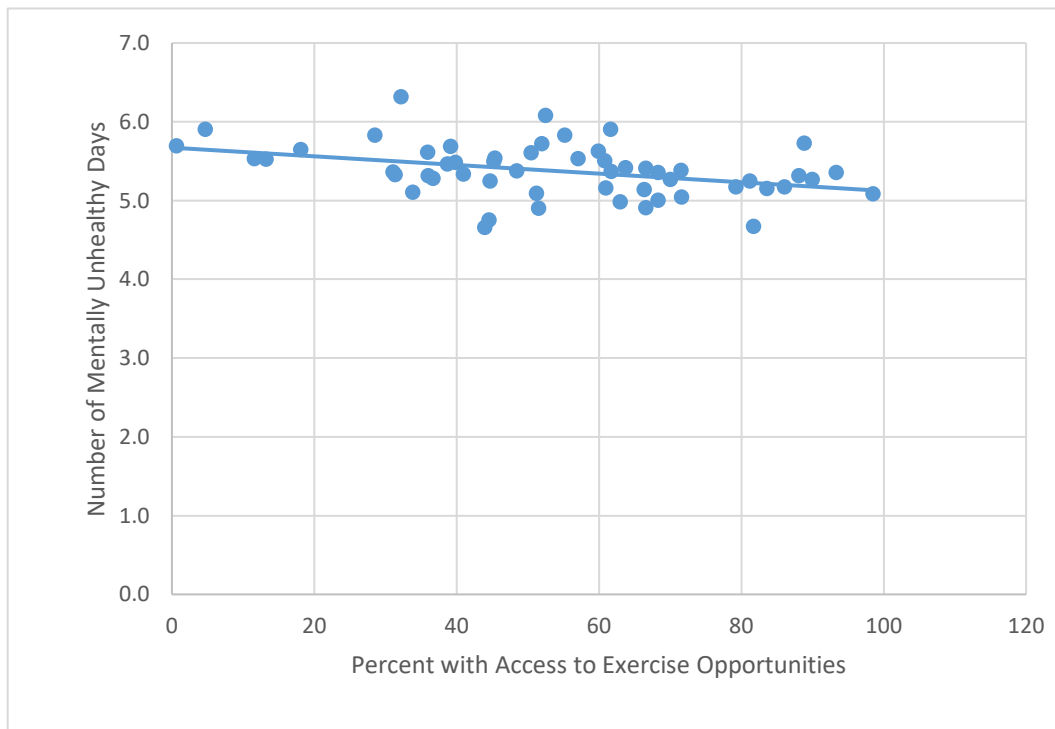
Table 4: Percent with Access to Exercise Opportunities Between Two States

State	N	Mean	SD
West Virginia	55	53.95%	22.88%
Ohio	88	67.73%	19.08%

Abbreviation: SD, Standard Deviation

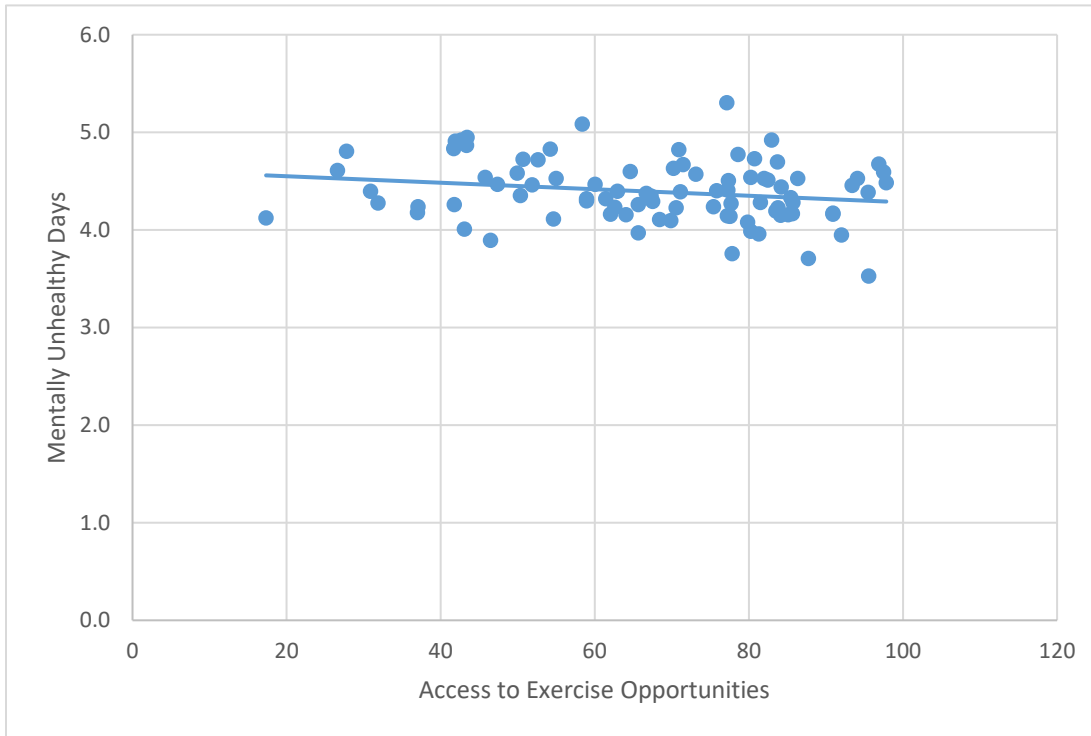
While analyzing how access to exercise opportunities correlates with the number of reported mentally unhealthy days in West Virginia in 2020 (RQ5), a Pearson correlation revealed a small but significant negative correlation ($r = -.377, p = .005$) indicating that as access to exercise opportunities increases, reported number of mentally unhealthy days decrease (Figure 1).

Figure 1: Correlation Between Access to Exercise Opportunities and Mentally Unhealthy Days in West Virginia 2020



To investigate of how access to exercise opportunities correlates with the number of reported mentally unhealthy days in Ohio 2020 (RQ6), a Pearson correlation indicated there was no significant correlation between the two ($r = -.203, p = .058$).

Figure 2: Correlation Between Access to Exercise Opportunities and Mentally Unhealthy Days in Ohio 2020



Discussion

This study has shown that there may be a worthwhile association between access to exercise opportunities and the number of reported mentally unhealthy days. Further, this association may also be related to geographical area and population. While Ohio saw a significant increase in mentally unhealthy days from 2016 to 2020, it did not also see a statistically significant change in access to exercise opportunities. When comparing both Ohio's access to exercise opportunities and reported number of mentally unhealthy days in 2020 to that of the same variables in West Virginia, it was found that both were significantly different between states. There are several factors at play that could have the ability to demonstrate such difference between states and even just within Ohio itself over the years, the biggest of these being population growth.

Despite the fact that population growth in the United States has slowed down, it is still increasing with each year. However, this growth is not evenly distributed and while most states

see an increase in population, a handful of states actually see a decrease. From 2018 to 2019, forty states, including Ohio, saw an increase in population. In that same time frame, ten states were found to have population decreases, West Virginia among them⁹.

Although results showed a significant increase in the number of mentally unhealthy days in Ohio over the past 4 years, there was not a significant correlation between the growth in mentally unhealthy days and the change in access to exercise opportunities. The opposite was true for West Virginia. A Pearson correlation indicated there was a small but significant negative correlation between access to exercise opportunities and number of mentally unhealthy days in West Virginia 2020. The correlation indicated that as access to exercise opportunities increased, the number of reported mentally unhealthy days decreased. Again, the difference in these states is likely a result of population size and geographical location. A similar study looking at the relationship between number of reported mentally unhealthy days and diet in Appalachian college students demonstrated that 36.7% of students faced food insecurity, even while on campus¹⁰. This, along with the fact that Ohio, while roughly 70% larger than West Virginia, has nearly eleven times the population, helps to answer the question of why West Virginia experiences a significant correlation between access to exercise and mentally unhealthy days and Ohio does not⁹.

When looking at figures 1 and 2, it is apparent that despite Ohio not have a statistically significant correlation between variables, its plot follows a similar trajectory of that of West Virginia. The obvious visual difference between the two plots is the greater distribution of data points seen in the figure for West Virginia. Again, this indicates population and geographical area are likely contributors. When reviewing data points on the plot of West Virginia, it is discovered that one of the larger reports of mentally unhealthy days was in McDowell County

whereas Monongalia had the lowest reported number of mentally unhealthy days. The difference in size of these counties is roughly 170 square miles, with McDowell being larger. Yet, the population of Monongalia is nearly six times that of McDowell^{11,12}. With its rural landscapes and significantly smaller populations, West Virginia citizens experience a much higher risk for lacking access to things like healthcare, nutritious food, and of course, exercise opportunities¹⁰. These findings help to highlight the state wide, and possibly even nationwide, need for more resources, specifically exercise opportunities, in less populated, rural areas.

Conclusion

This paper provides the first look into the relationship between access to exercise and mentally unhealthy days. One crucial finding in this study is that access to exercise and consequently mentally unhealthy days, are likely associated with geographical location and/or population size. However, a limitation to this study is that only data from Ohio and West Virginia was utilized. Further, as some of the county populations are very small, the data for number of mentally unhealthy days had to be obtained via statistical modeling. While this could help yield more reliable estimates, it is also possible that some data is more based on the statistical model itself than the actual survey responses. Yet, a strength in the data collection of this variable is that it is age-adjusted. As age is a non-modifiable risk factor and associated with poorer health outcomes, age adjustment allows for better comparison despite counties having age structures that differ.

A few limitations are associated with data collection of access to exercise opportunities. One of these being that it is difficult to truly include all exercise opportunities. Things such as sidewalks, shopping malls, and school gymnasiums may offer exercise opportunities, but these were not included in the definition of recreational facilities and thus not included in data

collection. Another limitation is defining access. While citizens may be close in proximity to certain opportunities, there may still be other barriers to access, such as cost.

Moving forward, it would be beneficial to review the data from several other states, specifically different regions of the United States. As it is still unclear whether access to exercise opportunities and consequently mentally unhealthy days are associated with geographical location, population, or a combination of the two, it would be beneficial to expand this study. Once enough data regarding the relationship between these two variables has been gathered, current associations can be strengthened, and/or new associations can be made that help local, state, and federal governments implement policies that improve the mental health of their citizens.

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