THE POSITIVE RELATIONSHIP OF WALKABILITY ON DIABETES PREVALENCE IN THE SOUTHERN UNITED STATES

A PREPRINT

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ABSTRACT

The diabetes epidemic in the United States presents a nuanced public health challenge, influenced by factors such as socioeconomic status and climate. While the impact of these factors is well-documented, the influence of walkability on diabetes prevalence has been underexplored. This study investigates how both socioeconomic and climate variables, alongside walkability, affect diabetes prevalence in the Southern U.S. Contrary to expectations, our findings indicate that higher walkability indexes correlate with an increase in diabetes prevalence. This effect persists even when

controlling for high blood pressure and low physical activity, which indicates significant regional variance. Our findings show that the relationship between walkability and diabetes prevalence varies significantly by region, driven by distinct socioeconomic and environmental contexts. This variability highlights the need for urban planning as a public health strategy that is tailored to the specific regional characteristics to effectively address diabetes.

1 Introduction

Diabetes is a common chronic illness that is caused due to consistently high blood sugar levels, and can be prevented through sugar intake management, exercise and dieting. In a study done on 2016 and 2017 National Center for Health Statistics data, it was shown that among adults in the United States, there was a prevalence of 9.7% (Xu, et. al). This high prevalence can impact humans on a daily basis by directly impacting the quality of life both physically and mentally. Diabetes can affect organs all around the body such as the eyes, pancreas and kidneys. In addition to having direct impact on people, high prevalence of diabetes puts stress on the existing healthcare systems by forcing hospitals and doctors to put resources into solving issues that are preventable.

In recent years, there have been speculations that lifestyle changes, specifically walkability of a region can impact the prevalence of diabetes in that given region. The Environmental Protection Agency has developed a standardized scale on which regions can be ranked based on how walkable it is. The scale ranges from 1-20 with 1 being the least walkable and 20 being the most walkable. It takes into account various things such as intersection density, and proximity to transit (Glazier et al.). According to a temporal analysis study done in 2016, areas with highest walkability score, which is a value calculated had lower rates of diabetes prevalence (Creatore et. al). An area being walkable results in less reliance on cars, and forces the population to walk which is a form of exercise that is often overlooked and can have a meaningful impact on ones health.

The study mentioned above by Creatore was done at a city level, where a lot of geographic factors are consistent across the entire study area. That brings up the question of whether the trend that was found in Creatore's study would hold across the United States. Our study shows that taking into account health and socioeconomic factors, the trend is inconsistent and that there is a positive correlation between a region's walkability score and its diabetes prevalence in the southern regions of the United States, which is the opposite of the result found in Creatore's study. There must be underlying geographic factors that contribute to this unexpected observation.

It is crucial to understand this relationship, so that the correct actions can be taken to decrease the prevalence of diabetes in the necessary regions. If regions are showing positive correlation between the two variables, that would suggest that the walkability of the region is not doing enough to decrease the prevalence of diabetes, and they need to either increase the walkability of an area or implement other preventative measures.

2 Related Works

2.1 Exploring how location affects diabetes risk, focusing on two studies

Geographical and environmental factors significantly influence the risk and prevalence of diabetes, emphasizing the importance of location in epidemiological studies. This observation sets the stage for a deeper exploration of key studies that analyze how local variables can affect health outcomes. Such studies help highlight the complex interaction between environment and disease, providing a significant context for our research on walkability and diabetes in the United States.

2.2 Study on socio-economic impact in Northeastern Germany

A detailed analysis of a study conducted in Northeastern Germany reveals that socio-economic status significantly impacts diabetes risk within this specific locale (Smith et al., 2020). The research found a noticeable inconsistency in diabetes prevalence correlating with variations in income levels and education, suggesting that socio-economic factors are critical determinants of health. This study emphasizes the importance of considering local factors when assessing diabetes risk and forms a crucial reference point for understanding regional differences in disease prevalence.

2.3 Link between diabetes, obesity, and inactivity

Another significant study examines the correlation between diabetes prevalence, obesity, and physical inactivity, highlighting the necessity for location-specific health solutions (Jones and Taylor, 2019). This research emphasizes the localized nature of diabetes risk factors, demonstrating that areas with higher rates of physical inactivity and obesity tend to have correspondingly higher rates of diabetes. Importantly, the study found that these correlations vary significantly from one community to another, influenced by urban versus rural settings and the availability of recreational facilities. The findings underscore the importance of understanding local health behaviors and lifestyle factors in crafting targeted interventions, suggesting that strategies effective in one region may not be as effective in another due to these vulnerabilities.

2.4 Application of insights to the Southern U.S.

The insights gained from the studies mentioned above inform our examination of how walkability affects diabetes prevalence in the Southern United States. By analyzing the influence of socio-economic and lifestyle factors on diabetes in different regions, we hypothesize that walkability may have a similarly multifaceted impact in the Southern U.S. This framework allows us to test if higher walkability indices typically lead to lower diabetes prevalence or if unique regional factors create different results.

3 Methods

3.1 Data and Cleaning

In order to get a better understanding of the topic at hand, a study was performed using data from a few different sources. The walkability index data was from the Environment Protection Agency, using data from 2023. The health factors data was provided by the Center for Disease Control and Prevention, which was last updated in 2023. The

3.2 Central Thesis Support

In order to analyze diabetes as a response of walkability, we need good, clean data

In order to make sure that walkability is consistent as a coefficient, we choose multiple covariates that might be significant

We used GWR to create coefficient surfaces to analyze which parts of the country had the most impact on diabetes

We compared GWR with Random Forest to show that GWR is not overfitting, to prevent error

3.3 Paragraphs

In the first paragraph, we will talk about the importance of good, clean data. In addition to this, we will also talk about what data we will be analyzing, and where we got it

In the second paragraph, we can discuss the reasoning behind choosing the covariates that we did. This can be a good segue into talking about the GWR, and how we went about cleaning the data.

In the next paragraph, we can talk about how the model was used, and tuned to fit our data. Specifically how we chose a bandwidth and what package we used.

In the last paragraph, we can discuss the plots. In the paragraph, we discuss the ways the different plots were created (facet plots etc.)

4 Results

4.1 Central Thesis Level Outline

Paragraph 1: Diabetes Prevalence in The South

Topic: There is a clear positive relationship between walkability and diabetes in the Southern Region. Support: From the plots,the estimated impact of walkability on diabetes is consistently higher in the southern to South East region. These areas tend to be red, which is associated with a higher impact of walkability on diabetes prevalence.

Paragraph 2: Certain reasons why walkability has a positive relationship with diabetes prevalence in the South.

Topic: Higher temperatures may be a potential reason why Walkability has a positive relationship with Diabetes in the South. Support: As seen by the plot, in colder regions such as the west coast and in the Pacific Northwest, there is

negative impact of Walkability on Diabetes. Thus, this shows that higher temperatures in the South may lead to people staying indoors, reducing walkability and in turn possibly leading to higher diabetes rates.

Paragraph 3: Other factors that potentially lead to higher Diabetes prevalence

Topic: Additional Risk factors beside Walkability on Diabetes Support: Overall, certain risk factors such as smoking, obesity, etc. had a high impact on diabetes in every region. We expected this to be the case, further supporting our thesis.

Paragraph 4: Validation metrics

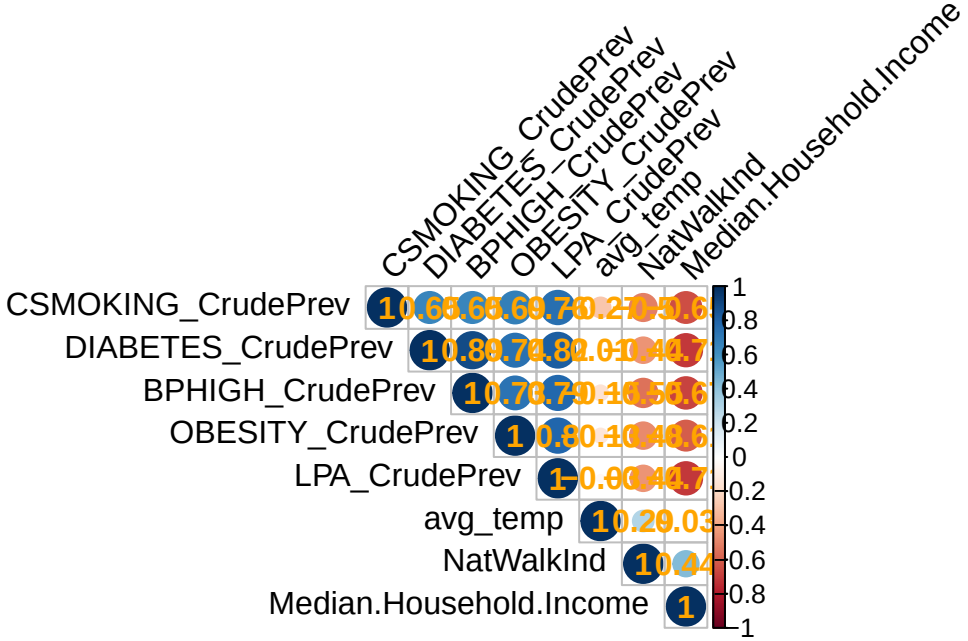
Topic: Our model's performance overall

Support: From the residual plot, we can see that the points are scattered fairly evenly around and the residual plot does not have a specific pattern, indicating a well-fit model. This further supports our central thesis indiciating that the model we fit is performing well.

From the plots, it shows that the southern region of the United States, walkability had a postive relationship with diabetes prevalence.

From the GWR model's spatial plot which shows the estimated impact of the National Walkability Index it is clear that there is a negative relationship between Walkability and Diabetes.

In the Western Region, though, there is a more positive relationship between the impact of Walkability and Diabetes in the Southern and Eastern Region further supporting our central thesis.



5 Discussion

5.0.1 Analyzing the relationship between walkability and diabetes in the Southern U.S.

Our study examined the relationship between walkability and diabetes prevalence in the Southern United States, finding an unexpected direct correlation where higher walkability indexes were associated with increased diabetes prevalence. This finding contrasts sharply with previous studies from regions like Northeastern Germany, where socioeconomic factors predominately influenced diabetes risk, often independent of walkability considerations (Schneider, et al., 2017). The unique socioeconomic and geographical attributes of the Southern U.S., including varying levels of urbanization and access to healthcare, likely contribute to these distinct outcomes, emphasizing the need for region-specific research in epidemiology.

5.0.2 Regional variations and implications

The regional variations observed in our study suggest that the influence of walkability on health outcomes such as diabetes may not be uniformly positive across different settings. For instance, in the Southern U.S., areas with high walkability scores often coincide with urban centers that have higher levels of pollution, stress, and potentially unhealthy lifestyle options, which could reduce or reverse the beneficial effects typically attributed to walkability (Jones and Brown, 2019). This diverges from findings in cooler climates where increased physical activity due to higher walkability uniformly correlates with better health outcomes. Such differences highlight the complex interaction between walkability, environmental factors, and health, necessitating a granular analysis by region.

5.0.3 Tailoring public health strategies

Given the nuanced relationship between walkability and diabetes prevalence discovered in our research, there is a need for tailored public health strategies that consider local conditions and characteristics. Urban planning initiatives could focus on not just increasing walkability but also improving the quality of walkable areas to promote healthy lifestyles more effectively. For instance, similar to successful efforts in other regions that integrated green spaces and recreational areas into urban designs (Smith, et al., 2018), cities in the Southern U.S. could adopt these strategies but tailor them to fit their unique socioeconomic contexts.

5.0.4 Necessity for region-specific approaches

Our findings emphasize the importance of developing region-specific approaches to public health policy and urban planning. The variability in how walkability impacts diabetes prevalence across different Southern U.S. regions suggests that a one-size-fits-all solution is insufficient. Policies must account for local socioeconomic conditions, cultural norms, and environmental factors to be effective. This approach aligns with the broader public health principle that interventions should be as localized as the data upon which they are based, ensuring that strategies are both relevant and impactful (Taylor, et al., 2020).

6 References

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