

## Does Living Location Impact on the Prevalence of Type 2 Diabetes Mellitus in Australia: A Literature Review

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### Abstract

Type 2 diabetes mellitus (T2DM) is a major cause of mortality and morbidity in Australia. Several environmental characteristics are associated with the physical and mental wellbeing, and these factors are hypothesized to influence on T2DM risk. This study aimed to investigate the impact of living location on the risk of developing T2DM. Mapping the hotspots for type 2 diabetes, and identify the common features for high-risk areas and re-allocating resources and health facilities. The sample population is extracted from the Medicare Australia database, and apply ArcGIS software to visualize the data and obtain the geographical patterns of diabetic patients in Australia. Analyze of clustering and compare hot spots with cold spots locations, the environmental indicators applied in the study include safe neighborhood, physical activity environment, walkability, and green space.

**Keywords:** Type 2 Diabetes, Geographical Information Systems, Environmental Characteristics

### Introduction

Type 2 diabetes mellitus is defined as a chronic disorder that impairs the ability to produce insulin, which is a hormone that transfers glucose into energy [1, 2]. Referring to the World Health Organization, the global prevalence rate for diabetes among adults rose from 1980 (4.7%) to 2014 (8.5%). In 2016, approximately 1.6 million people died from diabetes, and the disease can have a severe impact on the quality of life [3]. Diabetes might lead to several complications, including heart disease, kidney and nerve damage, and stroke. Each year, the government spends a huge amount on preventing and treatment of diabetes and this figure is expected to escalate. Therefore, the burden of diabetes has increased rapidly worldwide and cause serious health issues.

Throughout the study of geographic location, we can locate the hotspots for type 2 diabetes and identify common features for high-risk areas. Re-allocating resources and health facilities to ensure that local pharmacies and hospitals are equipped with a sufficient amount of diabetes medications and insulin therapy. And diabetic patients have adequate access to the health service. The purpose of this paper is to review existing research on the association between type 2 diabetes and environmental determinants. And highlight the findings and directions for further research.

### Literature Review

The geographical patterns of diabetic patients can be visualized and analyzed using ArcGIS software [4]. Mohez et al. conduct a case study in Western Australia to identify the geographical location of

patients with diabetes; the clinical data is extracted from general practice in Australia. The study finds out that patients with T2DM are clustered around two specific locations, age and other environmental factors may also contribute to the observed geographical patterns.

The prevalence rate of type 2 diabetes is associated with biological, environmental, and behavior risk exposures [5]. Various environmental factors can influence an individual's health outcomes. Environmental changes have a positive influence on behaviour and physical factors, for example, promoting physical activity and lowering the obese rate [6]. The measurement of environmental characteristics including, safe neighborhood, access to physical activity resources, walkability, and availability to natural resources [7].

### Neighborhood Environment

Previous literature demonstrated that neighborhood environments could impact an individual's health condition. In this paper, three aspects of the neighborhood characteristics are considered, including safety, access to physical activity resources, and walkability [8]. Mair et al. use information from the "Multi-Ethnic Study of Atherosclerosis" to study the association between neighborhood cohesion and mental health. The reduction of violence in the neighborhood is linked to positive health outcomes, for example, less depression and mortality. The paper discovers that neighborhoods with more university graduated and higher household income will experience less violence and stress, and reduce the risk of having mental health issues.

Katie et al. investigate the influence of physical activity and food access on weight-related health [4]. The biracial cohort study concludes that residential location can affect the individual dietary behaviors and the body mass index. In populated regions, people with more access to natural food stores while less access to convenience stores tend to have a healthy food intake [9]. These environmental exposures shape the lifestyle and dietary behaviors and help residents to control the daily calorie intake and reduce the risk of developing T2DM.

Residents living in areas that are supportive of walking have a greater chance to do exercise, which leads to a decreased risk of being obese or overweight [10-12]. Paquet et al. state that 1 standard deviation increment to walkability index will decrease the risk of having T2DM by 12 percent, whereas places with a low walkable environment are linked with greater risk of developing T2DM. The common limitation of neighborhood study is that it only measures the environment within the residence area. But, ignore other activity spaces where people spend a considerable amount of time, for example, school and workplace.

### Green Space

The impact of parks and other green spaces on health outcomes has been increasingly viewed by researchers and policymakers [13]. A cross-sectional study discovers that individuals living in greener neighborhoods are associated with reduced stress levels and less risk of having type 2 diabetes [14, 15]. Astell-Burt et al. randomly selected 26072 people aged above 45 years in New South Wales and the health status is based on a self-reported survey. The green space data is collected from the Australian Bureau of Statistics Meshblock and applied the geographic information system to visualize the data. The study concludes that the risk of being diagnosed with type 2 diabetes is lower with greener surroundings, especially for neighborhoods with 41 to 60% of urban green space.

### Conclusions

Patients with diabetes seem to cluster in specific locations, and environmental characteristics can be seen as an influential factor for health outcomes. Safety neighborhoods, availability to physical activity resources, and walkable environment tend to lower the risk of obesity. Residents live in regions with green surroundings are less likely to be diagnosed with T2DM. However, most studies use self-reported data, which contains information bias. As some participants might be living with undiagnosed diabetes. To minimize bias, data can be collected from local hospitals or the Medicare Australia database. Previous studies on neighborhood environment normally focused on specific regions, and it might contain selection and confounding bias. The collected data can be sample-specific, to make comparisons across studies, we can use the index to generalize the factors. For example, the walkability index and healthy star ratings for food intake. The study design on green space is cross-sectional; hence, the causality between changes in greenbelt and health status might be ignored.

Mohez et al. point out the connection between geographic location and patients with T2DM, but it does not analyze the general features

of the hotspots. Further research can compare places with a large proportion of diabetic patients and analyze common features. The association between the neighborhood environment and mental health has been confirmed in the previous study. In my research, I would investigate if this relationship applies to the prevalence of type 2 diabetes. Although the connection between environmental factors and health outcomes has been addressed separately in published articles. Future studies can combine the environmental characteristics, including physical activity resources and green space to identify the key determinant for type 2 diabetes and interactions between influential factors. Besides, having an adequate amount of fresh food intake, and being physically active are useful methods to prevent or delay diabetes, proximity to physical activity resources and supermarkets also play a role in preventing T2DM. The walkability and distance to the green area can be analyzed using GIS-based measures, and identify the minimum level of environmental factors required to prevent T2DM.

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