Diabetes and Public Housing

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Abstract

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“Here is my abstract”

Table of Contents

Page

List of Figures

List of Tables

Table Number Page

1

Background and Significance

1.1 Public Housing

Housing is widely acknowledged as an important social determinant of health (Thomson, Thomas, Sellstrom, & Petticrew, 2013). Health outcomes driven by housing are mediated by housing quality, safety, stability, and affordability (Taylor, 2018). There are well established links between housing quality and morbidity ranging from mental disorders, injuries, infectious diseases, and chronic diseases (Krieger & Higgins, 2002). There is a growing body of evidence associating substandard housing with poor health outcomes, but the relationship between public housing and health is minimally explored. Public housing provides decent and safe subsidized rental housing for eligible populations including low-income fami-

lies, the elderly, and persons with disabilities (HUD, 2020). However, relevant studies have shown that public housing residents have worse health outcomes than other city residents (Digenis-Bury, Brooks, Chen, Ostrem, & Horsburgh, 2008 ; Manjarrez, Popkin, & Guernsey, 2007). Even less understood is how public housing assistance impacts chronic health conditions like diabetes.

1.2 Diabetes

Diabetes is a chronic disease that is characterized by an inability of the body to maintain a healthy blood glucose level, this can cause a variety of symptoms that affect multiple systems in the body and can lead to potentially life-threatening complications. The key regulator hormone of glucose is insulin and it is produced in the pancreas. The absence or malfunction of insulin leads to elevated blood glucose levels called hyperglycemia. When insulin hormone is missing or ineffective the disease is called Diabetes Mellitus and this condition has multiple types.

1.2.1 Diabetes Variants

The most common diabetes variants include type I diabetes mellitus, type II diabetes mellitus, and gestational diabetes. Type I diabetes is usually caused by genetic factors triggering an autoimmune reaction that results in the destruction of insulin producing cells in the pancreas. Also known as Juvenile Diabetes, the type I classification is typically diagnosed relatively early in life during childhood or early adulthood. Whereas Type II diabetes develops when the body can still produce insulin however the amount is insufficient or when the body becomes resistant to the effects of insulin. Type II diabetes is largely attributed to lifestyle factors. Gestational diabetes is the least common type and occurs during pregnancy. The prevalence of type II diabetes are much higher than type I. In the US, type II and type I diabetes account for approximately 91% and 6% of all diagnosed diabetes cases (Bullard et al., 2018).

Diabetes is a serious chronic condition without a medical cure. The treatment for diabetes involves disease prevention and management. Medical treatment of diabetes primarily consists of exogenous insulin replacement or use of medications that stimulate the pancreas to produce endogenous insulin. Without

adequate blood control, diabetes can lead to increased risk of other conditions including vision loss, heart disease, stroke, kidney failure, nerve damage, amputation, and even premature death.

1.3 Problem Definition

Disease management for type II diabetics focuses on lifestyle modification such as diet control and increased physical activity. The goal is to promote weight loss and reduce excess fat that subsequently reduces insulin resistance and enhances disease control. However, other determinants of health have been recognized to impact the effectiveness of diabetes management, namely healthcare access, cultural and social support, economic stability and built environments (Clark, 2014). Housing instability and food insecurity in particular have been shown to reduce diabetes management self-efficacy in low income adults (Vijayaraghavan, Jacobs, Seligman, & Fernandez, 2011).

Again, while there are numerous published literature on the association between substandard housing and health outcomes, few studies specifically examine the relationship between public housing and diabetes. For this reason, the current study aimed to explore this public health issue within a local context in King County, WA.

In the effort to decrease the gap of knowledge between the junction of public housing and health, Public Health Seattle and King County (PHSKC) formed a unique partnership with King County Housing Authority (KCHA), Seattle Housing Authority (SHA) enabling data to be shared across sectors with the intention of informing and measuring future interventions that would improve the health of the county residents. This research aims to use the provided data to contribute to the literature on the association between public housing and diabetes among Medicaid and Medicare patients. The findings of the study could help identify where resources for diabetes prevention and management might be more effective.

2

Methods

2.1 Study Setting and Study Design

The current study investigates whether public housing is associated with risk of diabetes status among King County, WA residents who were enrolled in Medicare and Medicaid. This study uses a descriptive cross-sectional design. The cross-sectional design is appropriate because it allows for an estimate of a dichotomous disease outcome at a particular point in time (Greenland & Morgenstern, 1988).

The analysis of this study was conducted on a dataset compiled from the King County *Data Across Sectors for Housing and Health (DASHH)* partnership. The findings from the original initial study have previously been reported (Public Health - Seattle & King County, 2018).

2.2 Data Sources

In an effort to reduce fragmented data siloes across different sectors, the DASHH partnership was formed in 2016 between Public Health - Seattle and King County , and two public housing authories, King County Housing Authority and Seattle Housing Authority. The primary objectives for DASHH were to join health and housing administrative data together to inform and measure future interventions, relating to policy, outreach, and program evaluation that would improve the health of King County residents, as well as to disseminate actionable data with key health and housing stakeholders.

The housing data provided by both KCHA and SHA originated from the US Department of Housing and Urban Development (HUD). This data source contained elements that included demographic information and period of enrollment for families and individuals. Claims and enrollment for Medicaid and Medicare data were from Washington Health Care Authority (HCA) which was provided to PHSKC. Enrollment data contained information on who was receiving Medicaid and Medicare benefits. Claims data provided elements such as diagnosis codes that were used to identify acute events and chronic conditions. All these data sources were linked together by a unique identifier ID.

2.3 Study Population

The study population were participants that were enrolled in either Medicare or Medicaid programs. Further eligibility for study participation included King County, Washington residency and at least 11 months of Medicare or Medicaid coverage in 2017. The minimum coverage restriction provides a more accurate representation of participants with full Medicaid and Medicare insurance benefits. The overall number of participants derived from the DASHH dataset totaled 585,372. ### Exposure Variable The exposure variable for this study was public housing assistance status. This was extracted from the HUD-50058 form which was provided by the PHAs. The HUD-50058 form provides information on families that participate in public housing or Section 8 rental subsidy programs (HUD, 2020). Housing assistance is separated into 3 main types:

- Housing Choice Vouchers - vouchers provided to recipients to rent units on the private housing market
- Public housing properties and units - subsidized housing managed by PHAs
- Project-based vouchers - subsidized housing units not managed by PHAs

Responses on the HUD-50058 form were combined into a composite public housing binary variable. Study participants that were not enrolled in any of the listed housing assistance programs were coded as 0 for PHA status. Whereas those responses that contained any of the 3 types of housing assistance was given a 1 for PHA status.

2.3.1 Outcome Variable

The outcome variable for this study was diabetes status. This was defined using the Centers for Medicare and Medicaid Services (CMS) Chronic Conditions Warehouse (CCW) algorithm (Centers for Medicare and Medicaid Services, 2020). According to the CCW, a participant meets the criteria if they have at least 1 inpatient, skilled nursing facility, home health agency visit or 2 hospital outpatient or carrier claims with diabetes diagnoses codes as outlined by the chronic conditions reference list within the last 2 years(Centers for Medicare and Medicaid Services, 2020). This definition does not specify diabetes variant but instead accounts for any type diabetes diagnoses. The diabetes status outcome variable was dichotomous, given a 0 or 1. Those that did not meet the CCW algorithm were coded a 0 and those that met the criteria were coded as 1 for diabetes status.

2.3.2 Potential Confounders

Potential confounders were identified based on literature review. This study considers age, race and ethnicity and gender as potential confounding variables. Each of these variables were selected due to the increased baseline risk for participants to be either in public housing or have diabetes. It is known that diabetes is an age-related disease, with a higher risk for older populations (Selvin & Parrinello, 2013). Age was presented as a discrete variable for the participants age in 2017. Similarly, according to CDC data,

racial minority groups may be differentially at risk for both type 1 and type 2 diabetes compared to their white counterparts (CDC, 2020; Divers et al., 2020). Race and ethnicity variable was defined categorically and included: American Indians/Alaska Natives, Asian, Asian Pacific Islander, Black/African American, Latino, Multiple, Native Hawaiian and Pacific Islander, Other, Unknown, and White. Gender was selected because both psychosocial and biological factors are responsible for sex and gender diabetes risk differences (Kautzky-Willer, Harreiter, & Pacini, 2016). Gender was grouped categorically and included: Female, Male, and Multiple.

2.4 Analyses

As is common in epidemiological and health services research, demographic characteristics were presented to describe the population distribution (Hayes-Larson, Kezios, Mooney, & Lovasi, 2019). Descriptive analyses were first used to list the percentages for each of the demographic categorical variables. (See table 1). The demographics table is arranged by PHA status, this included: KCHA, SHA, combined PHA and non-PHA. Although the discrete variable for age was used in the statistical analyses, age was reported categorically in the descriptive analyses for a simpler layout. Mean and median age were also shown for each category.

For the statistical analyses, logistic regression models were fitted to assess the risk of diabetes status in relation to public housing assistance status. This analysis is well-suited for this study because logistic regression analyses allows for measuring the association of an effect towards a binomial response variable by combining multiple variables to avoid confounding (Sperandei, 2014). Given the binary outcome variable of diabetes status, logistic regression is an appropriate choice.

There were two main statistical analyses were performed in this study, the relationship between public housing and diabetes as well as the relationship between the specific public housing authorities and diabetes. Two models were used to determine the odds ratios (OR) and corresponding 95% confidence intervals for the association between public housing assistance and diabetes status. The models used were the unadjusted model, without any other variables included in the analysis and the adjusted model includ-

ing age, race and ethnicity and gender variables. In addition, these models were also fit to determine the odds ratio of diabetes status in relation to public housing authority. Similarly, the unadjusted model and the adjusted model that included age, race and ethnicity and gender variables were used to determine the association for the second analysis. Findings were statistically significant if the estimates did not cross the confidence intervals and p-values were below <0.05 threshold. Analyses were conducted using R version 3.6.0.

3

Results

3.1 Descriptive Statistics

Among the study participants, the proportion of people that were in the PHA category was 10.4% and of that, 5.9% were with KCHA and 4.6% with SHA (See Table ??). The majority of the study participants, 89.5% did not have any public housing assistance in 2017. Descriptive analysis revealed that PHA population had a greater proportion of people meeting the definition of diabetes at 12.7% compared to the non-PHA group with 9.6%. Overall, 9.9% were considered to meet the definition of diabetes and the rest, 90.1% were not considered to have diabetes.

Additionally, the population age distribution were different between PHA status, the non-PHA category