Diabetes and Public Housing

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Abstract

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Chair of the Supervisory Committee: Clarence Spigner

Health Services

“Here is my abstract”

Table of Contents

List of Figures

Figure Number Page

List of Tables

1 Background and Significance

1.1 Public Housing

Housing is widely awknowledged as an important social determinant of health(???). Health outcomes driven by housing are mediated by housing quality, safety, stability and affordability(???). There have been well established links between housing quality and morbidity from mental disorders, injuries infectious diseases, and chronic diseases(???).

While there is a growing body of evidence associating substandard housing with poor health outcomes, the relationship between public housing and health is minimaly explored. Public housing provides decent and safe rental housing for eligible populations including low-income families, the elderly, and persons

with disabilities (HUD, n.d.). Relevant studies have shown that public housing residents have worse health outcomes than other city residents (??? and (???)). Even less understood is the relationship between subsidized public housing and 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, 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 insuffient or when the body becomes resistant to the effects of insulin. Type II diabetes is largely attributed to lifestyle factors including obesity and physical activity levels. Gestational diabetes is the least common type and occurs during pregnancy. The prevalance of type II diabetes are much higher than type I. In the US, type II and type I diabetes accounted for approximately 91% and 6% of all diagnosesd diabetes cases (???).

Diabetes is a serious chronic disease condition without a medical cure. However 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. Additionally, other determinants of health have been recognized to impact diabetes management, namely healthcare access, cultural and social support, economic stability and built environments (???). Housing instability and food insecurity in particular have been shown to reduce diabetes management self-efficacy in low income adults (???).

While there are numerous published literature on the association between substandard housing and chronic conditions like diabetes, there are few studies that 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.

2

Methods

2.1 Study Setting and Study Design

The current study investigates whether public housing is asociated 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 (???).

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 recieving 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 overall number of participants derived from the DASHH dataset totaled 585,372.

2.3.1 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 [Source]. Housing assitance 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 - subisidized 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 partipants 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 housing assistance was given a 1 for PHA status.

2.3.2 Outcome Variable

The outcome variable for this study was diabetes status.This was defined using the Centers for Medicare and Medicaid Services (CMS) Chonic Conditions Warehouse (CCW) algorithm [Source]. 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[Source]. 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 alogrithm were coded a 0 and those that met the criteria were coded as 1 for diabetes status.

2.3.3 Potenetial 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 partipants 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 partipants 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 (Divers et al., 2020 & CDC (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 distribition (???). 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 appropriate for this study because logistic reregression analyses allows for measuring the association of an effect towards a binomial response variable by combining multiple variables to avoid confounding (???).

Two models were used to determine the odds ratios (OR) and coresponding 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 including age, race and ethnicity and gender variables. In addition, models were fit to determine the odds ratio of diabetes status for each of the public housing authority. Similarly, the unadjusted model and the adjusted

model that included age, race and ethinicity and gender variables were used to determine the association for the second analysis. Findings were statistical significant if the estimates did not cross the the confidence intervals and p-values were below <0.05 cutoff. 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. The majority, 89.5% did not have any public housing assitance 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 definiton of diabetes and the rest, 90.1% were not considered to have diabetes. Additionally, the population age distribution were different bewtween PHA status, the non-PHA category had an older population with a median of age of 62 and a mean age of 50 compared to the PHA

population with a median and mean age of 34 and 35.7 respectively.

3.2 Public Housing and Diabetes

For the primary analysis, the assocation between diabetes status and public housing assistance, the crude model showed that the odds ratio of having diabetes was 1.34 fold greater for those with public housing assistance (table 2). In the adjusted model, PHA residents were 94% more likely to meet the definition of diabetes compared to those that were non-PHA residents.

Table 3.2: Association between PHA Status and Diabetes

Housing Status	Model 1	Model 2
Non-PHA	Referent	Referent
PHA	1.34 (CI: 1.31-1.38)	1.94 (CI: 1.88-1.99)

3.3 Public Housing Authorities and Diabetes

In the second analysis, the association between diabetes status and the specific public housing authorities, the crude model showed that the odds of meeting the definiton of diabetes were 1.28 times greater among KCHA residents and 1.42 times greater among SHA residents. The adjusted model revealed that among KCHA residents the odds of meeting the definition of diabetes were 2.16 times higher and 1.70 for SHA residents compared to non-PHA residents.

Table 3.3: Association between the Public Housing Authorities and Diabetes

Status	Model 1	Model 2
Non-PHA	Referent	Referent

Status	Model 1	Model 2
KCHA	1.28 (CI: 1.24-1.33)	2.16 (CI: 2.09-2.25)
SHA	1.42 (CI: 1.38-1.48)	1.70 (CI: 1.64-1.77)

Table 3.1: Population Demographics

Characteristics	KCHA	SHA	Combined PHA	Non-PHA
	N=34,514 (5.9%)	N=27,044 (4.6%)	N=60,919 (10.4%)	N=523,814 (89.5%)
Age				
<5	6.6%	6.1%	6.4%	5.5%
5-9	12.0%	10.2%	11.2%	7.0%
10-17	19.5%	14.9%	17.5%	9.8%
18-29	12.5%	9.9%	11.3%	8.3%
30-49	21.0%	19.3%	20.3%	11.2%
50-64	15.3%	19.9%	17.4%	9.4%
65-74	6.8%	11.5%	8.9%	28.0%
75+	6.1%	7.9%	7.0%	20.6%
Median	39.1 years	29.0 years	34.0 years	62.0 years
Mean	33.3 years	38.7 years	35.7 years	50.0 years
Race and Ethnicity				
American Indian or Alaska Native	0.8%	1.4%	1.0%	0.8%
Asian	5.5%	11.7%	8.3%	6.9%
Asian Pacific Islander	0.1%	0.2%	0.2%	3.5%
Black/African American	36.9%	44.9%	40.2%	7.9%
Latino	3.8%	2.8%	3.4%	6.5%
Multiple	15.5%	10.2%	13.2%	8.0%
Native Hawaiian or Pacific Islander	2.3%	1.9%	2.1%	2.4%
Other	0.0%	0.0%	0.0%	0.8%
White	30.1%	22.3%	26.8%	56.1%
Unknown	5.0%	4.5%	4.8%	6.9%
Gender				
Female	58.6%	53.5%	56.3%	52.4%
Male	40.6%	45.7%	42.9%	47.2%
Multiple	0.8%	0.8%	0.8%	0.4%

Note:
Percentages may not add up to 100 because of missing data

Discussion

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3.4 Discussion

Findings from this study indicate that public housing assistance was associated with diabetes status. Even after adjusting for potentially confounders (age, gender, race and ethinicity) the effect of public housing on diabetes status were increased.

The reduced risk of RA observed in our study, in relation to duration of breast feeding, is similar to some (Karlson, 2004; Pikwer, 2009; Adab, 2014; Brun, 1995; Orellana, 2017), but not other studies (Brennan, 1994; Berglin, 2010), that also observed that breastfeeding was associated with a lower risk of RA. Karlson et al. reported an inverse association between duration of breastfeeding and risk of RA among female nurses in the Nurses' Health Study; they reported that the adjusted risk of RA for women who breastfed for 24 months or longer was 0.5 (95% CI: 0.3-0.8) compared to females that did not breastfeed (Karlson, 2004). Similarly, in a Swedish study, Pikwer et al. concluded that the risk of developing RA may be reduced by a long history of breastfeeding; they reported that the ORs for the risk of RA associated with breastfeeding for 13 months or longer and for 1 to 12 months, compared to no history of breastfeeding, were 0.46 (95% CI: 0.24-0.91) and 0.74 (95% CI 0.45-1.20), respectively (Pikwer, 2009). Among Chinese women, Adab et al. reported that longer duration of breastfeeding may be associated with a decreased risk

of RA; for those who breastfed for 36 months or longer, compared with women who never breastfed, the adjusted OR was 0.54 (95% CI 0.29-1.01) (Adab, 2014). Brun et al., in a population-based study, reported an association between decreased mortality from RA and the total time of lactation; they reported a mortality rate ratio of 0.49 (95% CI: 0.28-0.85) for those with total lactation of 30 months or greater compared to those who had zero months of lactation 9(Brun, 1995). Orellana et al. reported a potential inverse association between breastfeeding length and ACPA-Positive RA; women who breastfed for 7-12 months had an OR of 0.91 (95% CI: 0.72-1.15) and women who breastfed for 13 months or longer 0.74 (95%CI: 0.59-0.93) compared to those who breastfed for 6 months or less and adjusted for age and residential area, p-value trend = 0.0086 (Orellana, 2017). However, they reported that the association was not statistically significant when adjusted for age, residential area, smoking, and alcohol consumption (Orellana, 2017).

3.5 Limitations

there are serveral limitations to note. First, there was the huge reduction in the eligible population. People who met the definition of diabetes in this population for this study was significantly reduced from approximately 43,000 to 13,600 after applying the inclusion criteria, a 69% decrease. Other potentially significant data could be gleamed from those missing in the diabetes group among this population.

Another limitation is that this study does not provide the prevalence of diabetes due to the inherent characteristic of claims data. The population captured in the study were only those that sought health care services for diabetes related outcomes. People who may have had diabetes but were asymptomatic or those who had been previously diagnosed with diabetes but did not seek care within the time frame of meeting the definition of diabetes were not captured in the study.

Despite the limitations, this study contributes to our understanding of poverty and diabetes self-management the findings are generalizable to low-income, racially and ethnically diverse populations with diabetes who obtain health care in safety-net health settings

A

Appendix

Colophon

This document is set in EB Garamond, Source Code Pro and Lato. The body text is set at 11pt with *EBGaramond*(3).

It was written in R Markdown and *LaTeX*, and rendered into PDF using huskydown and bookdown.

This document was typeset using the XeTeX typesetting system, and the University of Washington Thesis class class created by Jim Fox. Under the hood, the University of Washington Thesis LaTeX template is used to ensure that documents conform precisely to submission standards. Other elements of the document formatting source code have been taken from the Latex, Knitr, and RMarkdown templates for UC Berkeley's graduate thesis, and Dissertate: a LaTeX dissertation template to support the production and typesetting of a PhD dissertation at Harvard, Princeton, and NYU

The source files for this thesis, along with all the data files, have been organised into an R package, xxx, which is available at `https://github.com/xxx/xxx`. A hard copy of the thesis can be found in the University of Washington library.

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