



Chronic Disease and Minimum Wage: Disparities in Diagnosis among Black and Hispanic Workers

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ABSTRACT

Introduction: While the positive correlation between earnings and health outcomes is well-established, little is known about the relationship between minimum wages and health. Even though some counties and municipalities set minimum wages above the federally mandated level, the impact of these higher wages on the health of low wage workers is not clear.

Methods: Using the 2019 Selected Metropolitan/Micropolitan Area Risk Trends of the Behavioural Risk Factor Surveillance System this study examines the relationship between the number of chronic disease diagnoses and county-level minimum wages. Since insurance benefits, employment, and chronic disease outcomes are interdependent, and individual health endowments are unobserved, a structural equation modelling framework is used to model complex relationships between the county-level minimum wages and individual health, employment status, insurance, and chronic disease outcomes.

Results: Even after controlling for employment, insurance, and age, results indicate higher minimum wages are associated with fewer chronic disease diagnoses. Findings are robust to various model specifications and distributional assumptions. Likely a reflection of their higher chronic disease burden and increased likelihood earning low wage, the impact of wage on chronic disease is greater for Hispanic and African American workers than Whites.

Conclusion: Among historically oppressed populations, increases in the federally mandated minimum could improve chronic disease outcomes. Policy makers and labour advocates should consider health-related justifications in their efforts to lobby for higher federal, state, and local minimum wages.

Keywords: Chronic disease; Minimum wage; Health disparities; Diagnosis

INTRODUCTION

While the positive correlation between earnings and health outcomes is well-established, little is known about the relationship between minimum wages and health outcomes. In the United States, the minimum wage was created with passage of the Fair Labour Standards Act (FLSA) and defined as the lowest hourly amount that an employee could be paid for their labour. Though some counties and municipalities in the United States (US) set minimum wages above the federally mandated level, the influence of these higher wages on the health of low wage workers is not clear.

The Affordable Care Act mandated that employers with 50 or more full-time employees must provide health insurance to 95% of their full-time employees or pay a penalty (equal to \$ 3,860 per employee per year in 2020). If workers are healthy, health coverage cost an employer roughly \$ 3,000 annually. However, if the worker has 1 chronic condition, the cost increases to an average of \$ 10,000. 7 chronic diseases-cancer, diabetes, hypertension, stroke, heart disease, pulmonary conditions, and mental illness-have a total impact on the economy of \$ 1.3 trillion annually. Of this amount, \$ 1.1 trillion represents the cost of lost productivity (Milken Institute Study: Chronic Disease Costs U.S. Economy More Than \$ 1 Trillion Annually | Keeping

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The Affordable Care Act increased the number of individuals with access to health insurance and higher minimum wages increase an individual's overall income. These two factors may have the potential to help workers to either avoid developing or effectively manage chronic conditions. However, the relationship between individual health, minimum wages, insurance, and chronic conditions has not been well-defined. Among a nationally representative sample of US workers, this study utilizes county and state level variation in the minimum wage to examine the relationship between chronic conditions and local-level minimum wages.

Background

While the relationship between income and health has been well established—higher income is associated with improved health and better health outcomes—the relationship between the minimum wage and individual health outcomes remains unclear [1-5]. Minimum wage increases have the potential to not only increase wages for low-wage workers, but also to reduce their employment prospects. Some studies have shown that higher minimum wages are associated with improved health outcomes including (1) lower suicide rates, (2) cardiovascular disease, and (3) diabetes [6-12]. The directionality of findings, however, depends both on the specific subgroup analyzed and whether the analysis sample included both employed and unemployed workers [6,7,9,13-15]. Positive health outcomes are observed among experienced, employed workers while negative health outcomes are observed among those who are unemployed or out of the labor force [16].

Results investigating the relationship between both obesity and mental health have been mixed. Studies examining the association between higher minimum wages and obesity have shown that higher minimum wages are associated with both higher and lower obesity prevalence [6,9]. Similarly, research shows associations between the minimum wage and both positive and negative mental health outcomes [17,18]. Further studies are needed to determine why outcomes may vary.

In addition to employment status, minimum wage changes may also have a differential impact on women or workers from historically marginalized groups who are more likely to be low wage earners and earn hourly compensation. Whether these groups actually benefit from minimum wage changes, however, has not yet been determined [19,20]. As age advances, the likelihood of fair or poor health, psychological distress, obesity, and diabetes is higher for Blacks and Hispanics than Whites (National Center for Health Statistics (US), 2017). While women have a higher likelihood of obesity and psychological distress, men are more likely to develop diabetes (National Centre for Health Statistics (US), 2017).

While studies have shown that the net health effects from minimum wage changes are small, the long-term contribution of wages on health cannot be overlooked [21-24]. Thus far, published evidence has remained mixed on how minimum wage may affect health. In general, findings have shown higher minimum wage and health outcome improvements are related [6-10]. The relationship between health outcomes, health disparities, and minimum wage have not been thoroughly ex-

plored or definably established. Therefore, the motivation of this study was to assess the relationships more thoroughly between health, disparities, and minimum wage. Three primary determinants of health-access to healthcare, environmental exposures, and health behaviour—are fundamentally driven by income. This study will examine the relationship between micro-level variations in the minimum wage and the prevalence and age of onset of 13 major chronic conditions. Coupling data from a nationally representative sample of US workers with an investigator curated database of county-level minimum wages, this study assesses the association between minimum wage and diagnosis of 13 chronic conditions—cancer, Chronic Obstructive Pulmonary Disease (COPD), kidney disease, diabetes, asthma, stroke, obesity, arthritis, depression, angina, heart attack, hypertension, and hyperlipidemia.

The Study

Aims: A unique coupling of county and individual level data from 2019, this study examined the relationship between the number of chronic disease diagnoses and county-level minimum wage.

Design: To examine the relationship between chronic disease diagnoses and county-level minimum wages, accounting for the endogeneity of health and employment status, this study applied structural equation modelling (SEM) to 2019 cross-sectional data.

Sample: The analysis sample included all individuals in the 2019 Behavioral Risk Factor Surveillance Survey (BRFSS) between the ages of 18 and 64.

Data

Data: Data for this study was combined from two primary sources—Economic Policy Institute (EPI) Minimum Wage Tracker and the 2019 BRFSS.

BRFSS Data: The BRFSS is a state-based telephone surveys of more than 400,000 respondents representing the non-institutionalized, adult population with a landline or cellular phone [25]. BRFSS contains information on individual health-related behaviors, health conditions, and use of health services. BRFSS, however, is based on self-reported information and cannot be validated with medical records [26]. BRFSS also collects data on emerging health issues like vaccine shortages, influenza, localized health information, public health conditions, local health responses, and use of local resources for health needs.

The Center for Disease Control and Prevention (CDC) analyzes BRFSS data for metropolitan and micro-politan statistical areas (MMSAs), to provide localized health information that can help public health practitioners to 1) identify local emerging health problems, 2) plan, 3) evaluate local responses, and 4) efficiently allocate resources to specific needs. The Selected Metropolitan/Micropolitan Area Risk Trends of BRFSS (SMART BRFSS) uses BRFSS data to provide prevalence rates for selected conditions and behaviors for cities and their surrounding counties both small and large residential areas.

The Office of Management and Budget defines the MMSAs given that they contain “population nucleus...having a high degree of economic and social integration” [27,28]. The SMART BRFSS

data set was produced by adding new raking weights designed to correspond to the 2019 population estimates for each eligible MMSA. Typically, BRFSS data are used to produce state-level estimates; however, for the SMART project, BRFSS data were used to produce small area-level estimates for MMSAs. To identify respondent county and MMSA, a county of residence name was collected from the respondent during the telephone interview. The name of the county was used to determine the corresponding American National Standards Institute county code; this code was retained as a variable in the data set and used to assign an MMSA. If a county was missing from a landline or cell phone data record, a county was imputed using a systematic imputations process. The full BRFSS is weighted using an iterative proportional fitting methodology that permits the introduction of additional demographic characteristics that more accurately match sample distributions to known demographic characteristics. Raking adjusts the estimates using the margins (raking control variables). The raking method iteratively applies a proportional adjustment to the weights of the cases that belong to the same category of the margin until a convergence to within a target percentage difference is achieved. To generate the MMSA weights in the SMART BRFSS, additional raking to 5 margins is applied to the BRFSS raked data set at the MMSA level.

EPI State/County minimum wages: 30 states and D.C. have increased their minimum wage to be higher than the federal minimum wage. Furthermore, 45 localities have adopted a minimum wage that is higher than their state minimum wage. Monthly, the Economic Policy Institute updates their Minimum Wage Tracker (EPI, 2021). This resource indicates state level minimum wages for 1) standard and tipped workers, 2) states whose wage is annually indexed for inflation, 3) states with no minimum wage, and 4) localities with minimum wages that differ from the state minimum wage. The 2019 EPI Tracker was used to identify which state and local minimum wages varied from the federal level and the identified state/county variations were found using Department of Labour archive of state minimum wage laws.

Data integration: SMART BRFSS provides MMSA codes for all survey respondents. To integrate information from 2019 SMART BRFSS with the 2019 EPI minimum wages, corresponding Federal Information Processing System (FIPS) and MMSA codes were determined using the 2019 Social Security Administration to FIPS Core-Based Statistical Area and MMSA County Crosswalk published by the National Bureau of Economic Research. This allowed for the connection of MMSA codes to county FIPS codes. Some MMSAs correspond to more than 1 county FIPS code, however, since the SMART BRFSS has a probability-weighted, stratified sampling framework, each respondent can only be included once for the MMSA weighting scheme to be valid. In these instances, respondents will be assigned to the county in which their MMSA of residence has the largest geographical representation.

Outcome variables: The total number of chronic diagnoses was derived from Section 6 of the BRFSS questionnaire which captures information on individuals' chronic diagnoses. Non-skin cancer, COPD, kidney disease, diabetes, asthma, stroke, obesity, arthritis, depression, angina, heart attack, hypertension, and hyperlipidemia were the only chronic conditions

included in this section. However, these conditions constitute those most common and costly health conditions in the US. The BRFSS only captures condition diagnosis rather than condition severity. Since most chronic conditions can vary widely in severity and individuals with very mild conditions are not comparable to those with very severe conditions, this analysis elected to utilize a count variable representing an individual's total number of chronic diagnoses. Used in other studies of population health, the number of chronic conditions provides an indication of an individual's overall health, cost of health-care, and level of functionality and independence [29].

Demographic characteristics: Sex (female), marital status (married), number of children in the household, age, race (Black), and ethnicity (Hispanic) are included as covariates in the analysis.

Health, employment, insurance, education: Four binary variables are created from the BRFSS data. First, an educational indicator is created for respondents who report having education equal to or above completion of a high school degree or equivalent. Next, an employment status indicator is created for respondents who report being either employed for wages or self-employed. Those who report being out of work as well as homemakers, students, and retirees are not considered to be employed. Similarly, a health coverage indicator is created for respondents who, at the time of the survey, report having any type of health coverage. Lastly, respondents who reported having excellent, very good or good health are considered healthy and those who report fair or poor general health are considered not healthy.

Household income: Respondents classify their annual household income from all sources into 1 of 5 categories: 1) Less than \$ 15,000 2) \$ 15,000 to less than \$ 25,000 3) \$ 25,000 to less than \$ 35,000 4) \$ 35,000 to less than \$ 50,000 and 5) \$ 50,000 or more. A binary indicator for "low income" was created from categories 1 and 2 to represent income below \$ 25,000. A binary indicator for "high income" was created from category 5 to represent income above \$ 50,000. Income groups 3 and 4 were considered "Middle Income" and used as the reference category.

Theoretical framework: We hypothesized workers who lived in lower minimum wage areas would experience an increased negative health outcome and for marginalized groups, an increase in health disparities. The relationship between work, health, health insurance, and wages is complex, multidimensional, and continually evolving. Not only do employees rely on employers as their providers of health insurance, but employers also rely on healthy employees for business operations [30]. It is rational to assume that healthy workers would be more productive and active members of the labour force while workers with poor health would be less productive and may choose to discontinue their labour market participation. Being less productive or leaving the labour force may be a choice out of the individual's control. Since chronic conditions indicate poor health outcomes, workers with multiple chronic conditions could be less productive as a result. Poorly managed or severe chronic conditions can prevent individuals from entering the workforce. However, for most American workers, the likelihood of being diagnosed with a chronic condition is dependent on

access to healthcare, which is contingent upon having health insurance. Worker characteristics such as age, build, and health status not only effect their willingness to work but also their productivity while at work and their ability to perform work-related duties [31]. Furthermore, those diagnosed with chronic conditions rate their health as worse, are less likely to be satisfied at work, and are less likely to work if given an alternative compared to those without chronic diagnoses [31-33]. The attributes that affect a worker's productivity may be the result of personal behavioural and modifiable lifestyle choices, such as smoking, as well as the current and previous economic, social, and environmental conditions in which they live, work, learn, and age. Health diagnoses, the decision to work, and the provision of health benefits, may also be influenced by the provision of social safety net benefits or spousal/household circumstances. Minimum wage changes impact both employers and employees. Higher minimum wages may encourage individuals to enter the labour market or increase their current level of labour force participation while higher minimum wages may discourage employers from hiring additional workers due to their higher marginal cost. **Figure 1** depicts one characterization of the relationship between chronic conditions, employment, health, and insurance. This simplistic rendering outlines the key elements and one interpretation of their interrelationships.

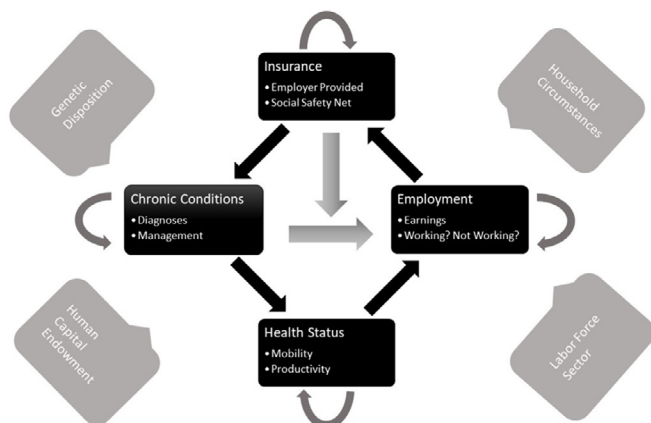


Figure 1: Study Framework

Ethical considerations: US government national survey data, such as the BRFSS is funded by the CDC. Participation in BRFSS is voluntary and individuals are not compensated for their participation. BRFSS has no individually identifiable information and does not qualify as human subjects research as defined by the Department of Health and Human Services. Data users are required to accurately report results, use provided population and/or group weights, and acknowledge the CDC in their publication or related research (Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System Survey Questionnaire, 2022).

Analysis

To examine the relationship between chronic disease diagnoses and county-level minimum wages, two types of analysis were conducted. First, descriptive statistics examined the heterogeneity within the sample and statistically significant differences within and between groups. Second, given that insurance, chronic diagnoses, employment, and general health status are

all measured with a degree of error, the hypothesized relationship between these interrelated factors is estimated using nonlinear SEM which allows for multiple endogenous variables within the system. SEM incorporates ideas from regression estimation, path-analysis, and factor analysis to enable the estimation of models that reflect hypotheses based on complex theory [34].

Assuming that the number of chronic conditions, employment, health, and insurance are endogenous while age, education, race, and the minimum wage are exogenous, the appropriate model specification was identified through an iterative process. In this process, a matrix of all possible combinations of exogenous and endogenous covariates was created. Each combination was estimated comparing the chi-square statistic and Root Mean Square Error of Approximation (RMSEA) across all specifications. Each estimation enhanced our understanding of this complex framework as we endeavored to examine the associations between minimum wage changes and chronic conditions [35]. Finally, the specification presented in Equation 1 was identified as the best fit model. All data analysis was done in R. SEM used the nlqsolv and lavaan packages.

(Equation1) *ChronicConditions*

$$= \beta_1 + \beta_2 \text{Age} + \beta_3 \text{Health} + \beta_4 \text{MinWage} + \beta_5 \text{Hispanic} + \beta_6 \text{Black} \\ + \beta_7 \text{Hispanic} * \text{MinWage} + \beta_8 \text{Black} * \text{MinWage} + 1.\text{Res}_1$$

$$\text{Employment} = \beta_9 + \beta_{10} \text{Age} + \beta_{11} \text{HighSchool} + \beta_{12} \text{ChronicConditions} + \beta_{13} \text{Hispanic} + \beta_{14} \text{Black} + 1.\text{Res}_2$$

$$\text{Insurance} = \beta_{15} + \beta_{16} \text{Age} + \beta_{17} \text{Employment} + \beta_{18} \text{Married} + 1.\text{Res}_3$$

$$\text{Health} = \beta_{19} + \beta_{20} \text{Age} + \beta_{21} \text{ChronicConditions} + 1.\text{Res}_4$$

Since research has shown a strong relationship between household income and individual health, it is important to consider socioeconomic status in studies examining population health [36,37]. However, including both educational and income covariates in the regression model could introduce potential multicollinearity given the strong correlation between education and income [38]. Therefore, the system was first estimated without inclusion of income indicators (Equation 1) and re-estimated to include indicators of high- and low-income earners (Equation 2).

(Equation2) *ChronicConditions*

$$= \beta_1 + \beta_2 \text{Age} + \beta_3 \text{Health} + \beta_4 \text{MinWage} + \beta_5 \text{Hispanic} + \beta_6 \text{Black} \\ + \beta_7 \text{Hispanic} * \text{MinWage} + \beta_8 \text{Black} * \text{MinWage} + \beta_9 \text{HighIncome} \\ + \beta_{10} \text{LowIncome} + 1.\text{Res}_1$$

$$\text{Employment} = \beta_{11} + \beta_{12} \text{Age} + \beta_{13} \text{HighSchool} + \beta_{14} \text{ChronicConditions} + \beta_{15} \text{Hispanic} \\ + \beta_{16} \text{Black} + 1.\text{Res}_2$$

$$\text{Insurance} = \beta_{17} + \beta_{18} \text{Age} + \beta_{19} \text{Employment} + \beta_{20} \text{Married} + \beta_{21} \text{HighIncome} \\ + \beta_{22} \text{LowIncome} + 1.\text{Res}_3$$

$$\text{Health} = \beta_{23} + \beta_{24} \text{Age} + \beta_{25} \text{ChronicConditions} + 1.\text{Res}_4$$

Sensitivity Analysis

Since a count variable indicating the total number of chronic

diagnoses is unable to account for differences in severity, complications, or other associated health concerns, we performed two additional sensitivity analyses to test the robustness of the regression results [39]. First, the count of chronic diagnoses in Equation 2 was replaced with a binary indicator which equalled zero for those with no chronic diagnoses and one for those with at least one chronic diagnosis. This specification tested for differential minimum wage relationships between those with and without chronic diagnoses. Second, the relationship between minimum wages and heart attack, diabetes, obesity, stroke, and heart disease. These conditions were selected since they are widely regarded as the costliest to treat among the working-age population [40-42]. We acknowledge that these additional analyses do not replace the inclusion of condition severity in the existing model, but consistency between results found in these analyses and the original specification would support the findings.

Validity, Reliability, and Rigor

To ensure the reliability and consistency of the results presented, the outcome distributions of the outcome variables were tested to ensure appropriate distributional assumptions were met. Measurement stability within the sample was validated and empirical results were tested and retested against sample subsets to validate consistency of findings.

Table 1: Sample and subgroup descriptive statistics and statistical differentials

	Full Sample					Black			Hispanic			Test of Significant Black Differential		Test of Significant Hispanic Differential	
	N	Mean	Std Dev	Min	Max	Mean Values						F Stat	P-Value	F Stat	P-Value
						N	Mean	Std Dev	N	Mean	Std Dev				
Chronic Conditions Count	138528	1.93	1.71	0	13	15745	2.15	1.8	19510	1.69	1.61	1.13	<0.0001	1.14	<0.0001
Min Age at Chronic Diagnosis	111586	44.62	13.15	1	65	13295	43.73	12.93	15047	40.22	12.68	1.04	0.0044	1.07	<0.0001
Age	138528	44.15	13.5	18	64	15745	43.82	13.37	19510	39.67	12.96	1.02	0.0746	1.07	<0.0001
Minimum Wage 2019	138527	9.36	1.3	7.25	16	15745	9.18	1.29	19509	9.16	1.41	1.02	0.2125	1.21	0.2301
						Frequency Values						Chi-Square	P-Value	Chi-Square	P-Value
Employed	138528	70%	0	0	0	15745	65%	0	19510	65%	0				
Has Health Insurance	135219	88%	0	0	0	15361	85%	0	19203	71%	0	114.46	<0.0001	5899.5	<0.0001
Good Health	138270	84%	0	0	0	15705	80%	0	19468	75%	0	223.83	<0.0001	1289.1	<0.0001
HS Education or Above	138528	93%	0	0	0	15745	92%	0	19510	76%	0	8.3333	0.0039	9841.2	<0.0001
Female	138528	52%	0	0	0	15745	58%	0	19510	54%	0	2.2257	0.1101	1.5687	0.4022
Married ≥ 1	138528	51%	0	0	0	15745	32%	0	19510	41%	0	2572.4	<0.0001	809.26	<0.0001
Chronic Diagnosis	111601	81%	0	0	0	13298	84%	0	15054	77%	0	172.23	<0.0001	167.79	<0.0001

RESULTS

Descriptive Statistics

Table 1 provides mean values for continuous and discrete variables and frequencies for categorical variables. Full sample values are provided in addition to those for the Black and Hispanic subgroups who comprise 11% and 14% of the sample, respectively (unweighted). Respondents are between 18 and 64 years old with an average age of 44 (SD=13.50). Blacks and Hispanics are slightly younger (Blacks: 43.82, SD=13.37; Hispanic: 39.67, SD=12.96) and these differences are statistically significant (Blacks: F=1.02, p=0.0746; Hispanics: F=1.07, p<0.001). A little over half of the sample is female (52%) and the average individual in the sample has (1) 2 chronic diagnoses (SD=1.71) and (2) was diagnosed with the first at age 45 (SD=13.15). Blacks, on average, have more chronic diagnoses (2.15, SD=1.80) and were first diagnosed at younger ages (43.73, SD=12.93)-both differences in age (F=1.04, p=0.0044) and diagnoses (F=1.13, p<0.001) are statistically significant. Hispanics, on the other hand, have fewer chronic diagnoses (1.69, SD=1.61), but received their first chronic diagnoses at age 40 (SD=12.68)-both statistically significant (Diagnoses: F=1.14, p<0.001; Age at diagnosis: F=1.07, p<0.001).

Angina	3223	2%	0	0	0	396	3%	0	441	2%	0	2.7749	0.0958	0.4391	0.5075
Heart Attack	3616	3%	0	0	0	466	3%	0	476	2%	0	8.5328	0.0035	2.6004	0.1068
Stroke	3260	2%	0	0	0	639	4%	0	388	2%	0	224.73	<0.0001	13.142	0.0003
Obesity	83598	60%	0	0	0	10528	67%	0	11745	60%	0	315.41	<0.0001	0.2064	0.6496
Diabetes	11716	8%	0	0	0	2044	13%	0	1869	10%	0	469.18	<0.0001	37.437	<0.0001
Low Income	10136	9%	0	0	0	1880	15%	0	3085	20%	0	608.33	<0.0001	2674.8	<0.0001
Middle Income	36974	32%	0	0	0	5612	43%	0	8118	51%	0	876.88	<0.0001	3217.4	<0.0001
High Income	68740	59%	0	0	0	5454	42%	0	4564	29%	0	1788.4	<0.0001	6985.2	<0.0001
Black	138528	11%	0	0	0	0	0	0	0	0	0	0	0	0	0
Hispanic	138528	14%	0	0	0	0	0	0	0	0	0	0	0	0	0

About 70% of the sample is employed, with significantly lower percentages of Blacks (65%; $\chi^2=223.95$, $p<0.001$) and Hispanics (65%; $\chi^2=329.09$, $p<0.001$) reporting employment at the time of the survey. While 88% of the sample has health insurance, and 84% report being in good or excellent health, only 85% ($\chi^2=114.46$, $p<0.001$) of Blacks and 71% ($\chi^2=5899.50$, $p<0.001$) of Hispanics are insured with 80% ($\chi^2=223.83$, $p<0.001$) of Blacks and 75% ($\chi^2=1289.11$, $p<0.001$) of Hispanics reporting their health as good. The majority of respondents have a high school education (93%) and 76% ($\chi^2=9841.21$, $p<0.001$) of Hispanics have achieved education beyond high school. Finally, 51% of those surveyed were married, however, this representation is slightly lower for Blacks (32%; $\chi^2=2572.42$, $p<0.001$) and Hispanics (41%; $\chi^2=809.26$, $p<0.001$). Only 9% of the full sample is low income, compared to 15% of Blacks ($\chi^2=608.33$, $p<0.0001$) and 20% of Hispanics ($\chi^2=2674.77$, $p<0.0001$). However, only 42% and 29% of Black and Hispanics, respectively, have income above \$ 50,000 ($\chi^2=1788.36$, $p<0.0001$; Hispanic $\chi^2=6985.25$, $p<0.0001$). In 2019, county level minimum wages ranged from \$ 7.25 to \$ 16.00 per hour with a national average minimum wage value of \$ 9.36 (SD=1.30). County level wages were slightly lower for Blacks (\$ 9.18, SD=1.29) and Hispanics (\$ 9.16, SD=1.41) though these differences were not statistically significant ($F=1.02$, $p=0.2125$; $F=1.21$, $p=0.2301$).

Structural Equation Model Equation 1

Table 2 lists SEM estimation results from Equation 1. Model RMSEA (0.0881, $p=0.139$) suggests a reasonable approximate fit. The number of chronic conditions is positively correlated with age ($\beta=0.3924$, $SE=0.0022$) and insurance ($\beta=0.0426$, $SE=0.0026$) suggesting that the number of chronic diagnoses

increases by 0.4 each year and that the likelihood of having insurance goes up each year. Both Blacks (0.0402, 0.0168) and Hispanics ($\beta=0.0685$, $SE=0.0180$) have comparatively more chronic conditions than other racial and ethnic groups, but these magnitudes are very small. The negative association between minimum wage and chronic conditions indicates that higher minimum wages are correlated with lower average number of chronic diagnoses ($\beta=-0.0013$, $SE=0.0029$). This value suggests that if the minimum wage increases by \$ 1, the average number of chronic diagnoses would fall by 0.0013. Racial and ethnic minimum wage interaction terms indicate the effect of minimum wage variations on Blacks and Hispanics relative to other racial groups. In other words, these terms quantify the additional change in the number of chronic diagnoses experienced by these subgroups relative to other population groups. Blacks ($\beta=-0.0168$, $SE=0.0180$) and Hispanics ($\beta=-0.0343$, $SE=0.0168$) have even larger reductions in the number of chronic conditions. If the minimum wage increases by \$ 1, the average number of chronic diagnoses among Blacks and Hispanics would both fall by 0.02 on average. Employment is positively associated with educational levels equal to or above high school graduation ($\beta=0.1004$, $SE=0.0027$) and older ages ($\beta=0.0157$, $SE=0.0029$). These results show that those with higher education are 1.1 (or roughly 10%) and those at older ages are 1.02 (or 2%) times more likely to be employed. However, Blacks ($\beta=-0.0324$, $SE=0.0026$) and Hispanics ($\beta=-0.0375$, $SE=0.0028$) are 3% and 4% comparatively less likely to be employed than other racial and ethnic groups. Interestingly, the number of chronic conditions is negatively related to the relative likelihood of employment ($\beta=-0.2244$, $SE=0.0028$) suggesting that relative likelihood of employment declines as chronic diagnoses increase.

Table 2: SEM estimation chronic diagnoses, minimum wage, health, and insurance

Chi-Square		23355		P-Value		0	
Root mean square error of approximation (RMSEA)		0.088		P-value RM-SEA ≤ 0.05		0.139	
	Estimate	Std Err	t-Stat	P-Value	CI _{lower}	CI _{upper}	
	Intercept	-0.288	0.0234	-12.31	0	-0.334	-0.242
	Age	0.3924	0.0022	174.45	0	0.388	0.3968
	Insured	0.0426	0.0026	16.589	0	0.0375	0.0476
Chronic Conditions	Minimum Wage	-0.001	0.0029	-4.401	0.0466	-0.07	-0.005
	Hispanic	0.0402	0.0168	2.3915	0.0168	0.0072	0.0731
	Black	0.0685	0.018	3.8049	0.0001	0.0332	0.1038
	Black* Minimum Wage	-0.017	0.018	-6.933	0.0351	-0.052	-0.002
	Hispanic* Minimum Wage	-0.034	0.0168	-2.049	0.0405	-0.067	-0.002

	Intercept	1.4205	0.0146	97.004	0	1.3918	1.4492
	Education ≥ HS	0.1004	0.0027	36.832	0	0.0951	0.1057
Employed	Chronic Conditions	-0.224	0.0028	-79.49	0	-0.23	-0.219
	Age	0.0157	0.0029	5.4225	0	0.01	0.0214
	Black	-0.032	0.0026	-12.25	0	-0.038	-0.027
	Hispanic	-0.038	0.0028	-13.52	0	-0.043	-0.032
Insured	Intercept	2.2365	0.0119	187.81	0	2.2132	2.2599
	Age	0.0873	0.0028	31.386	0	0.0818	0.0927
	Employed	0.05	0.0028	18.129	0	0.0446	0.0554
	Married	0.0993	0.0028	35.844	0	0.0938	0.1047
Health	Intercept	2.6321	0.0093	282.54	0	2.6139	2.6504
	Age	0.0404	0.0027	14.901	0	0.0351	0.0457
	Chronic Conditions	-0.416	0.0025	-166	0	-0.421	-0.411

Note: Indicates statistically significant $\alpha=0.05$

Similarly, the relatively likelihood of being insured is positively associated with age ($\beta=0.0873$, $SE=0.0028$) suggesting that older individuals are 10% more likely than younger individuals to have health insurance. Most likely due to the provision of employer provided health benefits, individuals who are employed are relatively more likely to have health insurance than those who are not working or out of the labour force. Finally, married respondents ($\beta=0.0993$, $SE=0.0028$) have a 1.1 times higher likelihood of being insured that those who are not married. Finally, the relative likelihood of reporting good or excellent health is higher among individuals at older ages ($\beta=0.0404$, $SE=0.0027$), but relatively lower among those with higher number of chronic diagnoses ($\beta=-0.4161$, 0.0025). The relationships between the endogenous factors-chronic diagnoses, health, insurance, and employment-and the exogenous characteristics-age, race, ethnicity, marital status, and minimum wages-are outlined in Figure 2. While the direction and magnitude of these associations is not easily interpreted using this diagram, it provides evidence of the complexity of these interrelated factors and the multiple associations between them and individual characteristics. This figure indicates that simply increasing 1 factor or changing 1 individual characteristic is not guaranteed to change individual outcomes given numerous associations and influences acting simultaneously.

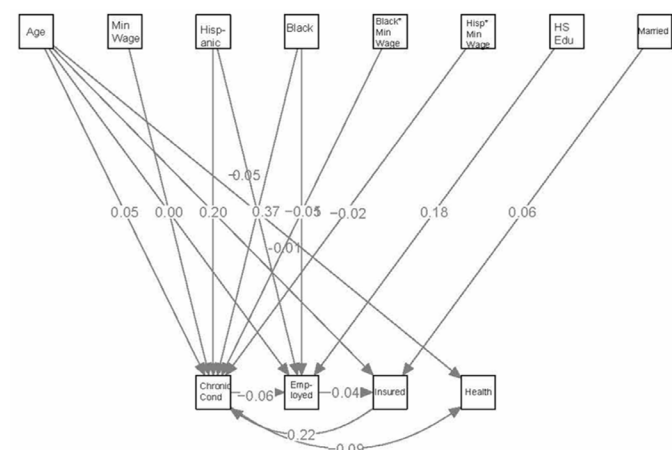


Figure 2: Vector Relationship for Total Chronic Diagnoses

Structural Equation Model Equation 2

Table 3 lists SEM estimation results from Equation 2 which adds indicators of high and low income to the previous model (Figure 3). Individuals earning high income have fewer chron-

ic diagnoses ($\beta=-0.178$, 0.003) and those earning low income have more chronic diagnoses ($\beta=0.093$, 0.003) compared to middle income earners. When income indicators are included, neither the coefficient for Hispanic nor the minimum wage are significant in the model of chronic conditions. Therefore, Hispanics ($\beta=-0.061$, 0.018) do not, on average, have a significantly different number of chronic conditions that the rest of the sample and the average number of chronic conditions does not vary between areas having different minimum wage levels ($\beta=-0.004$, 0.003). However, Blacks ($\beta=0.014$, 0.019) do have a higher average number of chronic diagnoses than other racial and ethnic groups. The interaction effect between the minimum wage and Black ($\beta=-0.090$, 0.002) remains significant and indicates that Blacks who live in areas with higher minimum wage levels have a lower number of chronic diagnoses compared to Blacks living in other areas. Therefore, a \$ 1 increase in the minimum wage corresponds to 0.1 fewer chronic diagnoses among Blacks. Income is also significantly related to the likelihood of having insurance. Individuals earning higher income ($\beta=0.227$, 0.003) are 25% more like to have insurance while those earning low income ($\beta=-0.028$, 0.003) are 3% less likely to have insurance compared to middle income earners.

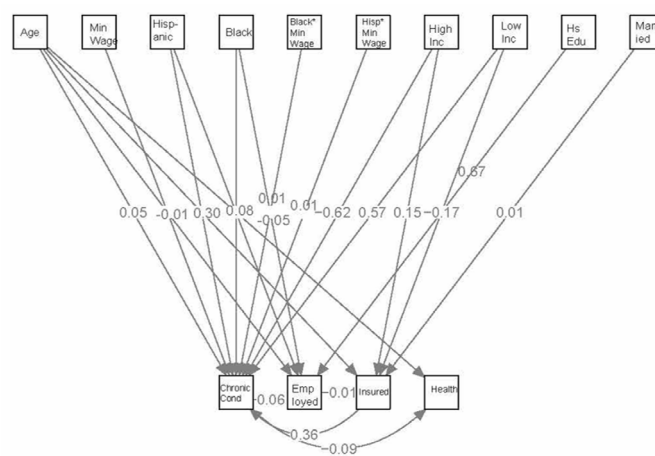


Figure 3: Vector Relationship for Total Chronic Diagnoses with Income Indicators

Sensitivity Analysis

Table 4 lists the SEM estimation using a binary indicator of chronic diagnoses. Results show that on average, minimum wages ($\beta=0.000$, 0.003) are not significantly related to the likelihood of having at least one chronic diagnosis. However, as

seen in the estimation of Equations 1 and 2, the effects among Blacks are significant. Compared to other racial and ethnic groups, Blacks ($\beta=0.029, 0.021$) are 1.03 times more likely to be diagnosed with a chronic condition. However, this likelihood is reduced among Blacks living in areas with higher minimum wages ($\beta=0.010, 0.021$). Results from models of the relationship between minimum wages and heart attack, diabetes, obesity, stroke, and heart disease are listed in Appendix (Tables

5-9). These results show that, on average, differences in the minimum wage levels do not have a significant impact on the likelihood of heart attack, heart disease, stroke, obesity, or diabetes diagnosis. However, they do show that among Blacks the relative likelihood of diagnosis is slightly lower in areas with a relatively higher minimum wage (Heart Attack 4.6%; Heart Disease 1.6%; Stroke 1.5%; Obesity 0.40%; Diabetes 0.20%).

Table 3: Full SEM estimation chronic diagnoses, minimum wage, health, and insurance

Chi-Square			92142	P-Value		0	
Root mean square error of approximation (RMSEA)			0.101	P-value RM-SEA \leq 0.05	0	Full	
	Estimate	Std Err	t-Stat	P-Value	CIlower	CIupper	
Chronic Conditions	Intercept	-0.132	0.025	-5.253	0	-0.181	-0.082
	Age	0.399	0.002	168.24	0	0.394	0.403
	Insured	0.067	0.003	23.873	0	0.061	0.072
	Minimum Wage	-0.004	0.003	-1.358	0.174	-0.01	0.002
	Hispanic	-0.061	0.018	-0.343	0.41	-0.095	-0.026
	Black	0.014	0.019	7.424	0.001	0.002	0.051
	Black* Minimum Wage	-0.09	0.002	-4.76	0.001	-0.698	-0.001
	Hispanic* Minimum Wage	0.019	0.018	1.054	0.292	-0.016	0.053
	High Income	-0.178	0.003	-60.25	0	-0.184	-0.172
	Low Income	0.093	0.003	32.807	0	0.088	0.099
Employed	Intercept	1.577	0.017	94.21	0	1.544	1.61
	Education \geq HS	0.088	0.003	29.712	0	0.082	0.094
	Chronic Conditions	-0.229	0.003	-74.73	0	-0.235	-0.223
	Age	-0.001	0.003	-0.167	0.867	-0.007	0.006
	Black	-0.034	0.003	-11.89	0	-0.04	-0.028
Insured	Hispanic	-0.038	0.003	-12.61	0	-0.044	-0.032
	Intercept	2.28	0.014	168.45	0	2.253	2.307
	Age	0.077	0.003	26.11	0	0.071	0.083
	Employed	-0.013	0.003	-4.459	0	-0.019	-0.007
	Married	0.018	0.003	5.628	0	0.012	0.024
Health	High Income	0.227	0.003	71.79	0	0.221	0.233
	Low Income	-0.028	0.003	-9.164	0	-0.034	-0.022
	Intercept	2.694	0.01	260.3	0	2.674	2.715
	Age	0.039	0.003	13.309	0	0.033	0.045
Chronic Conditions	-0.421	0.003	-155.2	0	-0.426	-0.415	

Note: Indicates statistically significant $\alpha=0.05$

Table 4: SEM estimation binary chronic diagnosis indicator, minimum wage, health, and insurance

Chi-Square			58264	P-Value		0	
Root mean square error of approximation (RMSEA)			0.113	P-value RMSEA \leq 0.05	0	Full	
	Estimate	Std Err	t-Stat	P-Value	CIlower	CIupper	
Chronic Conditions	Intercept	1.286	0.028	46.49	0	1.232	1.341
	Age	0.243	0.003	87.35	0	0.238	0.248
	Insured	0.034	0.003	11.28	0	0.028	0.039
	Minimum Wage	0	0.003	0.145	0.885	-0.006	0.007
	Hispanic	0.025	0.019	1.306	0.191	-0.013	0.063
	Black	0.029	0.021	3.199	0.002	0.012	0.069
	Black* Minimum Wage	-0.01	0.021	-4.071	0.016	-0.051	-0.005
	Hispanic* Minimum Wage	-0.022	0.019	-1.13	0.258	-0.059	0.016
	High Income	-0.045	0.003	-13.91	0	-0.052	-0.039
	Low Income	0.011	0.003	3.639	0	0.005	0.017

Employed	Intercept	1.582	0.018	89.88	0	1.547	1.616
	Education ≥ HS	0.101	0.003	33.44	0	0.095	0.107
	Chronic Conditions	-0.014	0.003	-4.542	0	-0.02	-0.008
	Age	-0.087	0.003	-28.86	0	-0.093	-0.081
	Black	-0.045	0.003	-15.48	0	-0.051	-0.04
	Hispanic	-0.035	0.003	-11.46	0	-0.041	-0.029
Insured	Intercept	2.306	0.013	171.1	0	2.28	2.332
	Age	0.075	0.003	25.54	0	0.069	0.081
	Employed	-0.029	0.003	-10.22	0	-0.035	-0.024
	Married	0.018	0.003	5.653	0	0.012	0.024
	High Income	0.23	0.003	73.08	0	0.224	0.237
	Low Income	-0.032	0.003	-10.41	0	-0.038	-0.026
Health	Intercept	2.927	0.011	258.5	0	2.905	2.95
	Age	-0.098	0.003	-32.74	0	-0.104	-0.092
	Chronic Conditions	-0.123	0.003	-41.13	0	-0.128	-0.117

Table 5: SEM estimation heart attack diagnosis, minimum wage, health, and insurance

Chi-Square		55095.3		P-Value		0	
Root mean square error of approximation (RMSEA)		0.111		P-value RM-SEA ≤ 0.05		0 Full	
	Estimate	Std Err	t-Stat	P-Value	Cllower	Clupper	
Heart Attack	Intercept	-0.169	0.028	-6.095	0	-0.223	-0.115
	Age	0.126	0.003	43.181	0	0.121	0.132
	Insured	0.004	0.003	1.296	0.195	-0.002	0.01
	Minimum Wage	-0.001	0.003	-0.365	0.715	-0.008	0.005
	Hispanic	-0.017	0.02	-0.868	0.386	-0.055	0.021
	Black	0.053	0.021	2.52	0.012	0.012	0.095
	Black* Minimum Wage	-0.047	0.021	-2.267	0.023	-0.088	-0.036
	Hispanic* Minimum Wage	0.003	0.02	0.147	0.883	-0.035	0.041
	High Income	-0.083	0.003	-24.956	0	-0.089	-0.076
	Low Income	0.053	0.003	16.882	0	0.047	0.059
	Intercept	1.564	0.017	91.683	0	1.531	1.597
	Education ≥ HS	0.095	0.003	31.651	0	0.089	0.101
Employed	Heart Attack	-0.095	0.003	-32.325	0	-0.1	-0.089
	Age	-0.079	0.003	-26.88	0	-0.085	-0.073
	Black	-0.045	0.003	-15.49	0	-0.051	-0.039
	Hispanic	-0.036	0.003	-11.629	0	-0.042	-0.03
	Intercept	2.306	0.013	171.083	0	2.28	2.333
	Age	0.075	0.003	25.531	0	0.069	0.081
Insured	Employed	-0.029	0.003	-10.209	0	-0.035	-0.024
	Married	0.018	0.003	5.654	0	0.012	0.024
	High Income	0.23	0.003	73.071	0	0.224	0.237
	Low Income	-0.032	0.003	-10.425	0	-0.038	-0.026
	Intercept	2.721	0.011	250.876	0	2.7	2.742
	Age	-0.107	0.003	-36.963	0	-0.113	-0.101
Health	Heart Attack	-0.168	0.003	-58.535	0	-0.174	-0.163

Note: Indicates statistically significant $\alpha=0.05$

Table 6: SEM estimation heart disease diagnosis, minimum wage, health, and insurance

Chi-Square		54633.2		P-Value		0	
Root mean square error of approximation (RMSEA)		0.111		P-value RM-SEA ≤ 0.05		Full	
	Estimate	Std Err	t-Stat	P-Value	Cllower	Clupper	
Heart Disease	Intercept	-0.226	0.028	-8.135	0	-0.28	-0.171
	Age	0.127	0.003	43.477	0	0.122	0.133
	Insured	0.012	0.003	3.935	0	0.006	0.018
	Minimum Wage	-0.001	0.003	-0.321	0.748	-0.008	0.006
	Hispanic	0.093	0.02	4.725	0	0.054	0.131
	Black	-0.022	0.021	-1.027	0.304	-0.063	0.02
	Black* Minimum Wage	-0.016	0.021	-4.742	0.046	-0.058	-0.014
	Hispanic* Minimum Wage	-0.099	0.02	-0.506	0.712	-0.137	-0.061
	High Income	-0.068	0.003	-20.449	0	-0.074	-0.061
	Low Income	0.049	0.003	15.602	0	0.043	0.056
Employed	Intercept	1.553	0.017	90.982	0	1.519	1.586
	Education ≥ HS	0.098	0.003	32.438	0	0.092	0.103
	Heart Disease	-0.092	0.003	-31.447	0	-0.098	-0.086
	Age	-0.079	0.003	-26.857	0	-0.085	-0.073
	Black	-0.045	0.003	-15.574	0	-0.051	-0.04
	Hispanic	-0.035	0.003	-11.319	0	-0.041	-0.029
Insured	Intercept	2.305	0.013	170.964	0	2.278	2.331
	Age	0.075	0.003	25.562	0	0.069	0.081
	Employed	-0.029	0.003	-9.936	0	-0.034	-0.023
	Married	0.018	0.003	5.652	0	0.012	0.024
	High Income	0.23	0.003	73.016	0	0.224	0.236
	Low Income	-0.032	0.003	-10.359	0	-0.038	-0.026
Health	Intercept	2.72	0.011	250.463	0	2.699	2.742
	Age	-0.108	0.003	-37.147	0	-0.113	-0.102
	Heart Disease	-0.16	0.003	-55.4	0	-0.165	-0.154

Note: Indicates statistically significant α=0.05

Table 7: SEM estimation stroke diagnosis, minimum wage, health, and insurance

Chi-Square		34855		P-Value		0	
Root mean square error of approximation (RMSEA)		0.11		P-value RM-SEA ≤ 0.05		Full	
	Estimate	Std Err	t-Stat	P-Value	Cllower	Clupper	
Stroke	Intercept	-0.146	0.028	-5.246	0	-0.2	-0.091
	Age	0.108	0.003	36.848	0	0.103	0.114
	Insured	0.019	0.003	6.375	0	0.013	0.025
	Minimum Wage	-0.004	0.003	-1.059	0.29	-0.01	0.003
	Hispanic	-0.027	0.02	-1.378	0.168	-0.065	0.011
	Black	0.008	0.021	3.733	0.047	0.003	0.049
	Black* Minimum Wage	-0.015	0.021	-7.154	0.047	-0.056	-0.006
	Hispanic* Minimum Wage	0.011	0.02	0.584	0.559	-0.027	0.05
	High Income	-0.089	0.003	-26.798	0	-0.095	-0.082
	Low Income	0.05	0.003	15.721	0	0.044	0.056
Employed	Intercept	1.56	0.017	91.599	0	1.527	1.593
	Education ≥ HS	0.096	0.003	32.059	0	0.09	0.102
	Stroke	-0.107	0.003	-36.793	0	-0.113	-0.101
	Age	-0.079	0.003	-27.048	0	-0.085	-0.074
	Black	-0.042	0.003	-14.401	0	-0.048	-0.036
	Hispanic	-0.035	0.003	-11.61	0	-0.041	-0.029
Insured	Intercept	2.303	0.013	170.794	0	2.277	2.33
	Age	0.075	0.003	25.599	0	0.069	0.081
	Employed	-0.027	0.003	-9.546	0	-0.033	-0.022
	Married	0.018	0.003	5.65	0	0.012	0.024
	High Income	0.23	0.003	72.931	0	0.224	0.236
	Low Income	-0.032	0.003	-10.276	0	-0.038	-0.026

Health	Intercept	2.731	0.011	251.971	0	2.71	2.753
	Age	-0.111	0.003	-38.457	0	-0.117	-0.105
	Stroke	-0.155	0.003	-53.888	0	-0.161	-0.15

Note: Indicates statistically significant $\alpha=0.05$

Table 8: SEM estimation obesity diagnosis, minimum wage, health, and insurance

		Chi-Square	53651.6		P-Value		0
		Root mean square error of approximation (RMSEA)		0.144	P-value RM-SEA ≤ 0.05	0	Full
		Estimate	Std Err	t-Stat	P-Value	Clower	Clupper
Obesity	Intercept	0.706	0.028	25.35	0	0.651	0.761
	Age	0.162	0.003	55.808	0	0.156	0.168
	Insured	0.024	0.003	7.977	0	0.018	0.03
	Minimum Wage	-0.001	0.003	-0.361	0.718	-0.008	0.005
	Hispanic	0.04	0.02	2.034	0.042	0.001	0.078
	Black	0.067	0.021	3.223	0.001	0.026	0.108
	Black* Minimum Wage	-0.004	0.021	-2.128	0.038	-0.045	-0.002
	Hispanic* Minimum Wage	-0.002	0.019	-0.121	0.904	-0.041	0.036
	High Income	-0.003	0.003	-0.766	0.444	-0.009	0.004
	Low Income	-0.018	0.003	-5.725	0	-0.024	-0.012
Employed	Intercept	1.535	0.017	88.939	0	1.501	1.569
	Education \geq HS	0.1	0.003	33.186	0	0.094	0.106
	Obesity	0.043	0.003	14.485	0	0.037	0.049
	Age	-0.098	0.003	-32.915	0	-0.104	-0.092
	Black	-0.049	0.003	-16.595	0	-0.054	-0.043
	Hispanic	-0.037	0.003	-12.017	0	-0.043	-0.031
Insured	Intercept	2.309	0.013	171.34	0	2.282	2.335
	Age	0.075	0.003	25.478	0	0.069	0.081
	Employed	-0.031	0.003	-10.788	0	-0.037	-0.025
	Married	0.018	0.003	5.655	0	0.012	0.024
	High Income	0.231	0.003	73.197	0	0.225	0.237
Health	Low Income	-0.033	0.003	-10.539	0	-0.039	-0.027
	Intercept	2.809	0.011	254.079	0	2.788	2.831
	Age	-0.118	0.003	-40.136	0	-0.124	-0.112
	Obesity	-0.059	0.003	-20.053	0	-0.065	-0.054

Note: Indicates statistically significant $\alpha=0.05$

Table 9: SEM estimation diabetes diagnosis, minimum wage, health, and insurance

		Chi-Square	33948		P-Value		0
		Root mean square error of approximation (RMSEA)		0.109	P-value RM-SEA ≤ 0.05	0	Full
		Estimate	Std Err	t-Stat	P-Value	Clower	Clupper
Diabetes	Intercept	-0.413	0.027	-15.241	0	-0.467	-0.36
	Age	0.22	0.003	78.343	0	0.214	0.225
	Insured	0.032	0.003	10.712	0	0.026	0.038
	Minimum Wage	-0.003	0.003	-0.963	0.335	-0.01	0.003
	Hispanic	-0.013	0.019	-0.697	0.486	-0.051	0.024
	Black	0.047	0.021	2.276	0.023	0.006	0.087
	Black* Minimum Wage	-0.002	0.021	-2.11	0.019	-0.038	-0.001
	Hispanic* Minimum Wage	0.038	0.019	0.988	0.469	0.001	0.076
	High Income	-0.103	0.003	-31.696	0	-0.109	-0.096
	Low Income	0.043	0.003	13.958	0	0.037	0.049
Employed	Intercept	1.53	0.017	89.554	0	1.497	1.564
	Education \geq HS	0.097	0.003	32.122	0	0.091	0.102
	Diabetes	-0.11	0.003	-37.056	0	-0.116	-0.104
	Age	-0.067	0.003	-22.217	0	-0.073	-0.061
	Black	-0.039	0.003	-13.301	0	-0.045	-0.033
	Hispanic	-0.031	0.003	-10.064	0	-0.037	-0.025

	Intercept	2.304	0.013	170.714	0	2.278	2.331
	Age	0.075	0.003	25.563	0	0.069	0.081
Insured	Employed	-0.026	0.003	-9.063	0	-0.032	-0.02
	Married	0.018	0.003	5.631	0	0.012	0.024
	High Income	0.23	0.003	72.825	0	0.224	0.236
	Low Income	-0.031	0.003	-10.173	0	-0.038	-0.025
	Intercept	2.674	0.011	246.024	0	2.653	2.695
Health	Age	-0.08	0.003	-27.395	0	-0.086	-0.074
	Diabetes	-0.226	0.003	-79.246	0	-0.232	-0.221

Note: Indicates statistically significant $\alpha=0.05$

DISCUSSION

The Federal minimum wage was established to serve as a floor below which wages for non-tipped workers could not fall. This ensured that workers would be paid a “fair wage for honest work” [43]. However, given inflationary pressures within the economy and a stagnant political system failing to increase wages since 2009, the federal minimal wage is not adequate to maintain a minimum standard of living [44]. Although the amount of the federal minimum wage has changed over the years by both political parties, the most recent change came in 2009, and today, the wage remains at \$ 7.25 per hour. The laws that established the federal minimum wage gave states and localities the ability to establish a minimum wage that is above the federal wage. At this time, 29 states, D.C., and multiple localities have opted to increase minimum wage. Unfortunately, many states in the southern United States—such as Alabama, Georgia, Tennessee, Texas, and Louisiana—have opted for no increase to the minimum wage or have a minimum wage that is lower than the current federal wage. This is noteworthy because these states, located in what is often known as the Stroke Belt, Cancer Belt, or Diabetes Belt, experience worse health outcomes and health disparities compared to other parts of the country. Higher income overall has been associated with improved health outcomes [1-5]. Individuals with higher income typically have better access to high quality health care. In our study, we used the outcomes of (1) number of chronic conditions diagnosed and (2) age at first chronic disease diagnosis to quantify the influence of minimum wage on chronic disease outcomes in Whites, Blacks, and Hispanics.

Findings from our study demonstrate, in a nationwide sample, when compared to Whites, Blacks are diagnosed with more chronic diseases and are diagnosed with chronic disease at an earlier age. This supports earlier findings [45]. Although Hispanic individuals were diagnosed with fewer chronic diseases compared to Whites and Blacks, the age at first diagnoses was lower than for Whites or Blacks [46,47]. At the intersection of chronic conditions, wage, and employment, Blacks and Hispanics reported lower levels of employment compared to Whites. This has also been consistently reported over time [48]. Employment Status of the Civilian Population by Race, Sex, and Age, 2022. Additionally, county level minimum wages were slightly lower for Blacks and Hispanics though this did not reach statistical significance. One reason to consider for this finding is the states that have high populations of Black and Hispanic individuals are also the states, typically in the South-Eastern United States, that maintain the federal minimum wage of \$ 7.85. At the time of publication, most of these states did not have plans to increase minimum wage, therefore, in the future

when more states enact higher minimum wages, additional exploration of this finding is warranted. Chronic disease, employment rate, insurance status, and good health were explored. While some findings were expected, such as a decline in good health as individual’s age, others were novel. These novel findings add to existing correlational literature. For example, although the rate of chronic disease increased with older age and for Blacks, findings suggest the rates of chronic disease declined when these individuals reside in counties with a higher minimum wage and had insurance. Furthermore, for both Blacks and Hispanics, the rates of chronic disease were even further reduced when living in a county with a higher minimum wage. Because an increase in both minimum wage and insurance coverage potentially reduces the gap in chronic disease diagnoses for Blacks and Hispanics, an increase in minimum wage should be considered in states with significant health disparities in minority populations. States in the southern United States, where minimum wage remains the lowest, should consider the connection between wages and chronic disease when making state level policy changes in minimum wage.

Results suggest that Blacks, Hispanics, and those with more diagnosed chronic diseases are less likely to be employed. Because in the United States insurance status is often tied to employment status, lower rates of employment potentially exclude some of the most vulnerable populations from acquiring insurance. This is especially problematic in states that did not pass the Affordable Care Act’s Medicaid expansion—the majority of which are located in the South-Eastern United States. Additionally, when the age at first diagnosis of a chronic disease is lower, the likelihood of employment decreases. For both Black and Hispanic populations, are 1st diagnosed with a chronic disease at a lower age when compared to Whites, the potential decrease in employment only serves to both further marginalize these vulnerable populations through decreased earnings and reduced opportunities for insurance coverage. Individuals who live in an area with a higher minimum wage are more likely to be diagnosed with a chronic disease later, and there is no difference in this later age at diagnosis between ethnic subgroups. Therefore, chronic diseases, access to healthcare, and health awareness are related and cannot be separated from earnings [47,49,50]. This also has mortality and productivity implications when you examine minimum wage heterogeneity across the US [51-53].

LIMITATIONS

Limitations should be considered when interpreting the results of this study. For analysis, minimum wage data was used at the county level and not at the census tract level. This was a retrospective secondary analysis; therefore, data was limited to

what was available in each of the selected databases. The hourly minimum wage in each county was used in this estimation. However, this information does not capture all types of minimum wage variations or all type of workers. For example, some states set minimum wage levels for tipped, agricultural, seasonal, or workers in particular industries whereas other states may exempt them from minimum wage laws entirely. Only individual-level and minimum wage data from 2019 was used for the model estimation. Use of a single year of data limits the scope of the results in several ways. The results only indicate associations and cannot be used to infer causality. Additionally, the role of various mediating and moderating factors cannot be explicitly defined in a cross-sectional study. The study does not account for other area-level factors that are relevant to health, including community resources, economic conditions, and local-area health infrastructure. Finally, because the data is cross-sectional, we cannot analyse trends in health status, minimum wage, insurance, and employment status over time. Cross sectional data only allows us to characterize the association between these characteristics and makes attribution of causality impossible.

CONCLUSION

In conclusion, findings suggest Blacks and Hispanics, who live in counties with a minimum wage that is higher than the federal minimum wage, are diagnosed with their first chronic disease later in life. Both employment status and insurance status influence this finding. Further research that compares regions of the country, such as those states in the Southeast with low minimum wage and fewer health safety nets to states who have a higher minimum wage and health safety nets, is needed. Policy makers and labour advocates should consider health-related justifications in their efforts to lobby for higher federal, state, and local minimum wages and healthcare expansions.

AVAILABILITY OF DATA AND MATERIALS

This study utilizes the Behavioural Risk Factor Surveillance System (BRFSS). Centres for Disease Control and Prevention (CDC). Behavioural Risk Factor Surveillance System Survey Questionnaire. Atlanta, Georgia: U.S. Department of Health and Human Services, Centres for Disease Control and Prevention, 2019. Data can be found at <https://www.cdc.gov/brfss/questionnaires/index.htm>

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AUTHORS CONTRIBUTION

M.J. performed data work and empirical analyses. L.J. and M.J. drafted the manuscript. L.J. contributed to the writing, interpretation, and contextualization of findings. All authors reviewed and edited the manuscript.

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CONFLICT OF INTEREST

The authors have no competing interests to disclose.

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