Voting and Health: An Exploratory Analysis of the Relationship Between Voter Participation and County-Level Health Using a Pooled Cross-Sectional Time-Series Design in Two States (Oregon and Texas)

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A Dissertation Submitted to:

The Faculty of
The Milken Institute School of Public Health
of The George Washington University in Partial fulfillment of the requirements
for the degree of Doctor of Public Health

May 19, 2024

Dissertation Directed by

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The Milken Institute School of Public Health of The George Washington University certifies that Gnora Ruth Gumanow Mahs has passed the Final Examination for the degree of Doctor of Public Health as of March 27, 2024. This is the final and approved form of the dissertation.

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Acknowledgements

The author wishes to acknowledge her committee members and readers for supporting and mentoring her along her academic journey. She wishes to acknowledge her husband for feeding her during late night courses, walking the dog on long writing days, and for being a pillar of support throughout this journey. Finally, she wishes to acknowledge her parents for instilling a love of learning, teaching her to ask questions about the status quo, and showing her the importance of democracy and community organizing.

Abstract of Dissertation

Voting and Health: An Exploratory Analysis of the Relationship Between Voter Participation and County-Level Health Using a Pooled Cross-Sectional Time-Series Design in Two States (Oregon and Texas)

There has been a growing interest in the relationship between voter participation, representative democracy, and community health. Previous research has shown that there is a relationship between electoral policies and overall health at the state level, county levels of COVID case and mortality rates, Black infant mortality, and health insurance access. However, there has yet to be a pooled-cross sectional time-series study that examines the relationship between voter participation and several measures of community health within a single state policy context. This exploratory research expands the current knowledge and understanding of the relationship between voter participation and health in two states (Oregon and Texas) by using pooled cross-sectional time-series analysis at the county level. Using data from Behavioral Risk Factor Surveillance System, Election Administration and Voting Survey, and the American Community Survey, this dissertation aims to answer the following primary research question: Are voter participation rates associated with county level health outcomes, health behaviors, and healthcare access over time and across counties when controlling for insurance, race, income, education, housing tenure, housing quality, and population density in Oregon and Texas?

Results indicated that voter participation is related to health insurance access in Oregon and in Texas voter participation was associated with better health (fewer poor health days, fewer poor mental health days, fewer adults that smoke, and fewer uninsured

adults) even when controlling for race, income, education, homeownership, housing quality, population density, and time in a county fixed effects model. While these findings are exploratory, it adds to the current literature and understanding on the relationship between voting and health. Future work should focus on additional measures of community power, electoral administration and resources, alternative community segmentations, and the role electoral and health policy plays in this critical relationship.

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Outcomes, Voter Participation, And Control Variables At The County Level Using

County Fixed Effects Linear Regression.

Chapter 1: Introduction

There has been a growing interest in the relationship between voter participation, representative democracy, and community health. In 2023, Healthy People 2030, which sets the nation's goals for a healthy country every decade, added "increase the proportion of voting-age citizens who vote" as a core objective (Office of Disease Prevention and Health Promotion, 2023). Similarly, County Health Rankings & Roadmaps (CHRR) published their 2023 findings report with a focus on civic participation and infrastructure while adding voter participation to their list of county-level social context measures (County Health Rankings & Roadmaps, 2023*)*. Complimenting CHRR, America's Health Rankings added voter participation as a measure in their data dashboard (America's Health Rankings, n.d.). Even more so, health professional organizations, such as the American Public Health Association (2022), the American Medical Association (2022), the Society for Public Health Education (2022), and the American College of Physicians (2023), have focused policy statements that recognize promoting civic and voter participation as a path to advancing health equity.

Since the mid-1900s, only about half of all eligible voters have cast a ballot in most presidential elections, even in elections where there has been higher than normal turnout more than a third of Americans have not voted (Keyssar, 2009). Given the substantial evidence that the right to vote cannot be equally exercised (Anderson, 2019), and a newer body of evidence suggests that voting is associated with health outcomes and disparities (Nelson et al., 2019), it is important for public health to recognize and explore the role democracy has in creating the conditions for population health.

Recent research has focused on the relationship between voting and health at varying ecological levels (individual, community, nations). At the individual level, research has focused on how health is a resource needed to participate, (i.e. you have to be healthy enough to vote so healthier people vote) (Nelson et al., 2019; Kim et al., 2015). At the community level, research has been focused on how the voting process is associated with health outcomes. Researchers at the University of Northern Illinois developed the Cost of Voting Index (COVI) which ranks states across a number of policies that make it easier or harder to vote. These policies include early voting options, online voter registration availability, absentee voting rules, and more (Schraufnagel & Pomante, 2020). Public health researchers have used the COVI to better understand how electoral policies and systems are related to health outcomes ranging from self-reported health (Schraufnagel, 2023) to COVID-19 case and mortality (Pabayo et al., 2022). These findings suggest that voting policies that make it easier to vote are associated with higher levels of self-reported good health (Schraufnagel, 2023), and lower rates of cases and mortality from COVID-19, respectively (Pabayo et al., 2022). Additionally, Pacheco and LaCombe (2022) examined the relationship between democratic institutions, including voter participation and electoral policies, and health outcomes such as infant mortality and life expectancy. Their findings suggest that institutions that promote political accountability (including making it easier to register and vote) are associated with lower infant mortality across states. These studies have predominantly focused on the state-level policy context, however, more research can be done to explore the relationship at the county level. This dissertation examines the relationship between voter participation

and county level population health while controlling for multiple demographic characteristics and social conditions.

Each Paper explores the county-level context in a distinct state. Paper 1 is focused on Oregon which is the easiest state to vote according to the COVI (Schraufnagel & Pomante, 2020), and Paper 2 is focused on Texas which is the hardest state to vote according to the same index (Ibid). Voter participation in both papers used was measured using the county level voting data from the Election Administration and Voting Survey (EAVS; U.S. Election Assistance Commission, n.d.) and population estimates from the American Community Survey (ACS; US. Census Bureau, n.d.). To measure health outcomes, Paper 1 used the Oregon Health Authority's state Behavioral Risk Factor Surveillance System (BRFSS) and Paper 2 used County Health Rankings and Reports (CHRR) to measure county health and health behaviors in Texas. More information on each manuscript's data use is included in the Methods section.

Health Inequities, The Social Determinants of Health, and Power in the United States

Public health has focused on social and environmental factors that contribute to health outcomes since the early stages of the field. For example, public health mitigated the cholera epidemic through improved plumbing conditions at the population level. These interventions included the creation of government provided water purification systems and infrastructure funding for sewer and drainage systems (Tulchinsky, 2018). Public health practitioners have continued to focus on social conditions and population level interventions, such as access to affordable housing, education, economic resources, and social support (U.S. Department of Health and Human Services, Office of Disease

Prevention and Health Promotion, n.d.; University of Wisconsin Population Health Institute, 2014).

These non-clinical social conditions are unevenly distributed among various populations— in part due to racism, classism, ableism, and other forms of historical and cultural oppression— leading to pervasive health disparities across the country which are oftentimes governed by political decisions (Graham, 2004). Therefore in order to address these disparities, research and public health practice must focus on the social processes underlying this inequitable distribution of resources and power (Ibid). For example, historical and pervasive disparities exist in access to stable affordable housing across racial and ethnic groups (Coleman, 2022). This disparity is rooted in decades of racially discriminatory housing practices and policies. In fact, federal housing policies championed by Franklin Roosevelt offered families government backed mortgages to only white households. This intentionally left Black people and other communities of color out of home-ownership programs as Black neighborhoods were seen as a financial risk to the federal government (Gross, 2017). The Federal Housing Administration (FHA), established in 1934, enshrined government sponsored segregation by refusing to insure mortgages in Black neighborhoods. Additionally, the FHA subsidized builders who produced subdivisions had to agree not to sell homes to Black people— these practices are commonly known as redlining (Ibid). The effects of redlining alone have had a persistent negative impact on communities of color. Redlining has contributed to racial segregation, economic inequality, and health disparities. Research published in Environmental Justice in 2020 found associations between redlined neighborhoods and higher rates of cancer, asthma, and poor mental health (Nardone et al., 2020). These

findings highlight how policies that created inequities in non-clinical social conditions led to and continue to widen inequities in health outcomes.

Non-clinical social conditions are shaped and determined by political decision making (such as legislative policy changes, ballot measures, funding referendums, executive orders, etc) and the policymaking process (Givens et al., 2018). To continue with the previous example, access to affordable housing is determined by the types of zoning policies enacted, funding for low-income housing programs, enforcement mechanisms for anti-discrimination policies, etc (Schuetz 2020; 42 USC Ch. 45: FAIR HOUSING, 1988). While housing status at the individual level is considered a condition for health, the availability of safe and accessible housing is determined at the political level. These policies are determined either directly by voters when they are referred to the ballot, or by elected officials who are voted into office and meant to represent the interests of the community. When voter access is skewed to favor certain people, the policymaking process is skewed to serve the interests of those who have access over those who do not. In this example, if homeowners are more represented in the electorate, housing policies might not fully represent the interests of renters. In fact, research shows that homeowners do participate in elections more than renters which has impacted local zoning policies (Hall et al., 2022). Additionally, elected officials can change policies that impact voter access (Brennan Center for Justice, 2022) which can in turn continue this feedback loop where community needs are not fully represented by the electorate which in turn impacts the policies that are meant to serve the community.

Possible Mechanisms for the Relationship Between Voting and Health

Political Power and Legislative Influence

A prominent theory for how voting may be associated with health outcomes is that voting is one form of power that one can use to influence policy decisions. People vote directly on budgets and ballot measures that affect health, such as Medicaid expansion (KFF, 2019), reproductive health care (New York Times, 2022), and environmental investments (Menon & Galst, 2022; National Conference of State Legislatures, n.d.). Voting also indirectly influences policy through electing officials who pass laws that impact health and social conditions. When electoral policies allow for more people to have a say in democratic decisions, governing bodies become more responsive to their needs. In fact, historical research shows that when women gained the right to vote, legislators became more responsive to women's interests which led to reductions in child mortality rates (Miller, 2008; Weber, 2023). Similarly, the Voting Rights Act of 1965 outlawed racially discriminatory electoral policies like poll taxes, literacy tests, and good character clauses (Anderson, 2019). The impact of this groundbreaking piece of legislation was huge increases in voter participation for Black Americans (Anderson, 2019) which in turn has been shown to have improved Black infant mortality rates (Rushovich et al., 2024). These two powerful historical examples illustrate how when communities are able to participate in the electoral process they are able to influence policy decisions that shape community health.

Voting Strengthens Social Cohesion

An additional possible pathway for how voter participation is associated with health is through building and reinforcing social cohesion. Social cohesion is the strength of relationships and solidarity within a community (U.S. Department of Health and Human Services, 2020). Evidence has shown that social cohesion is a mitigating factor when people are at risk of poor health (Chuang et al., 2013). Social cohesion has been linked to community resiliency and individual mental health when facing natural disasters (Ludin et al., 2019; Greene et al, 2023).

Health is Needed for Participation

At the individual level, health is needed to vote. One must be healthy enough, mentally and physically, to navigate the voting process. In fact, most of the research on the relationship between voting and health at the individual level examines how health status is associated with voter participation. Across numerous studies, having better health is associated with a higher likelihood of voter participation (Nelson et al., 2019). Recent research has shown a correlation between voting abstention at the individual level and poor health even after controlling for socio-demographic factors (Ojeda, 2015). Most of this research focuses on individual voting behaviors and individual health factors with less of a focus on community-level participation and health outcomes.

Context for Understanding Oregon's Electoral Processes

To fully discuss the inter-state relationship between voting and health, it is important to understand the policy context for electoral processes in each state. Oregon

has been a leader when it comes to innovative policies that make elections more accessible for their eligible population. Between the mid-80s to the late-90s Oregon transitioned their elections from in-person voting to all mail-ballots (Multnomah County, 2020). Mail elections in Oregon enable voters to cast their ballots on their own schedules since ballots are sent to registered voters 21 days before the election and voters can return their ballot through the mail or any drop box within the state, even if it is outside of their county of residence (Multnomah County, 2011). More recently, Oregon has passed policies to add pre-paid postage to the mail-ballot return envelopes (Oregonian, 2019), and extended the period for which ballots can be received by the elections office (Bureau, 2022).

Oregon is not just a leader for implementing processes for voters to easily return their ballots but has also implemented policies that make it easier for voters to register ahead of elections. In 2015, Oregon passed the country's first Automatic Voter Registration (AVR) program. AVR enabled the Department of Motor Vehicles (DMV) to register eligible voters through backend data sharing when they provided sufficient documentation necessary for voter registration (*Automatic Voter Registration*, 2024). When an individual visits the DMV and has an interaction that provides evidence of eligibility to vote— citizenship, residency, and age— the DMV shares their voter registration data with the Secretary of State's election database. If that individual is determined to be eligible to vote, they are sent a postcard notifying them of their eligibility and giving them an opportunity to opt-out of registering or to choose a political party through return of the same postcard. If they do not return the postcard opting-out of

voter registration, they are automatically added to the list of registered voters and sent a ballot in the next election they are eligible for (Ibid).

Oregon experienced a drastic increase in voter registration after the policy was implemented— over 225,000 new voters were registered in the first year of the program. Considering the voting eligible population of Oregon was 2.91 million, the new registrants account for 7.7% of the eligible population of the state (Oregon Secretary of State, n.d.-b). According to a report by McElwee et al. (2017), 44% of voters registered through the AVR program voted in 2016 and 95% of people automatically registered were first-time voters in 2016. The program increased voter registration rates for communities of color and young voters. Only 6% of non-AVR voters were people of color in 2016 compared to 11% of first-time voters and 15 percent of all voters registered by the program. Similarly, 37% of first-time voters registered by AVR were young voters (age 18-29) while only 13 percent of non-AVR voters were young voters. Given the success, it is not surprising that other states have followed in Oregon's footsteps. According to the National Conference of State Legislatures (2022) twenty-three states have enacted similar voter registration programs, and some have attempted to expand AVR to other government agencies like the public health department (such as when individuals sign up for Medicaid or purchase insurance on the individual marketplaces) and offices of fish and wildlife (who issue hunting and fishing licenses). In 2017, Oregon further expanded voter registration by allowing 16- and 17-year-olds to pre-register, including via AVR, so that a ballot is mailed to the voter in the first election they are eligible— when they turn 18 (National Conference of State Legislatures, 2023). These

policies enable Oregon to consistently have some of the highest voter participation rates across the country (McDonald, n.d.).

While Oregon's electoral laws are relatively advanced, they still have a few policies on the books that create barriers to voting. While voters can update their registration online, the state does not allow voters to newly register online without printing and mailing in their paperwork (Oregon Secretary of State, n.d.). This means that voters must register either through the DMV's AVR system or via a paper registration form. Additionally, the state does not have election-day or same-day voter registration and instead new voters who wish to cast a ballot must be registered to vote 21 days before the election (Ibid)— a policy that dates back to the 1980s (Radnovich, 2022). This policy may hinder the eligible population's ability to fully participate in elections and may widen participation disparities. Given Oregon's track record when it comes to inclusive electoral policies, the state is a great case study for how voter participation within a state that promotes inclusive policies is associated with health and if these policies assure electoral representation and subsequently better health for historically disenfranchised communities or if the electoral political landscapes continue to reinforce disparities.

Context for Understanding Texas' Electoral Processes

Where Oregon is an example of expansive and inclusive elections, Texas is, and has been, an example of restrictive policies and practices. Texas was previously covered by the Voting Rights Act Preclearance Clause due to having a history of implementing racially discriminatory election laws. Only 24 hours after the Supreme Court's Decision

on Shelby v. Holder— a case brought forward by Shelby County, Texas— Texas implemented an incredibly strict voter identification policy (The Brennan Center for Justice, 2022). Texas has enacted a long list of restrictive voter policies. For example, to vote-by-mail, voters must have an acceptable excuse, such as having a documented absence during election day or having documented proof of disability (Pérez, 2021). If a voter is able to get an absentee ballot they must pay for their own postage. Early voting is also limited as early vote locations have limited hours and are explicitly banned from offering 24-hour drop-boxes (Ibid). Voting options are also frequently limited; for example, during the 2020 election one of the most diverse counties in the state, Harris County, only had one early voting center for voters to use ahead of Election Day. If a ballot signature is rejected, voters have no avenue for correcting the defect after Election Day (Ibid). Voter registration in Texas is also an onerous process with limits to online voter registration and those who assist voters in the registration process must be deputized by the state elections department. Texas also recently passed a law that would punish election officials if they do not aggressively purge voter rolls— the state already has a reputation for sloppy purges that disenfranchise eligible voters. The state also bans election officials from sending out vote-by-mail applications and encouraging voters to apply for absentee ballots (Ibid).

Texas is ranked 50th out of 50 states on the Cost of Voting Index (COVI), a tool used to rank all US states and their voting policies from easiest state to vote in (1) to hardest state to vote in (50) (Schraufnagel & Pomante, 2020). The COVI takes into consideration a number of state policies that either make it easier or harder for eligible citizens to cast their ballots. Policies considered in the COVI include but are not limited

to polling location times, early voting periods, absentee voting options, and voter registration options. Texas is ranked 50th due to their incredibly restrictive electoral policies that make it more difficult to cast a ballot for Texas voters than voters in any other state (Ibid). Given this political context, Texas is an important state context to consider when examining how a restrictive electoral policy climate is associated with community health.

Chapter 2: Literature Review

When examining the relationship between voter participation and population health it is first important to be grounded in the literature in order to understand what gaps in the evidence need to be studied further. While there is copious amounts of literature on the evidence between health conditions and voter participation that illustrates how healthier people and communities are more likely to vote (Nelson et al., 2019; Kim et al., 2015; Blakely, 2001), evidence on the relationship between voting policy and population health is still developing. This literature review focuses only on the existing evidence of how voting and electoral policy is associated with aggregate population health. This section discusses the current literature landscape in relation to voter participation and health at the aggregate community level.

The Cost of Voting Index (COVI; Schraufnagel & Pomante, 2020) has recently become a focus of researchers aiming to better understand how election policies at the state level are associated with population health. In 2021, Healthy Democracy Healthy People released the Health & Democracy Index (Hunter et al., 2021) which uses the COVI to measure voter access and 12 public health measures from America's Health Rankings to illustrate the relationship between voter access and population health across all 50 states. They found that states with better access to voting and had better health outcomes like state overall health, self-rated health and mental health, premature mortality, and chronic disease. The project also found that states with higher voter participation had smaller infant mortality disparities than states with less voter participation. While the Health & Democracy Index is not peer-reviewed, it is a seminal

piece of evidence that has inspired more recent research and the recognition of voter access as a non-clinical social condition for health (Pabayo et al., 2022; Society for Public Health Education, 2022; American Public Health Association, 2022; Bajaj, 2022). Considering the Health & Democracy Index was not peer reviewed it also contains a few major limitations: the research did not compare across race/ethnicity, only income and education were controlled for in the models, and there were no published reports of statistical inference such as the regression models used or p-values to indicate the strength of the relationship displayed (Hunter et al., 2021).

In 2023, Schraufnagle examined the relationship between the COVI and state health across presidential elections between 1996-2020 and found a consistent relationship between state electoral policies and America's Health Rankings composite indicator of state health and that as COVI scores changed over time there were corresponding changes in state health scores. This study further shows that state electoral policies are associated with state health, however, the study did not use additional control measures beyond what is already controlled for in both the COVI and America's Health Rankings composite state health score.

In 2021, researchers Pabayo, Liu, Grinshteyn, Cook, & Muennig found that individuals targeted by voting restrictions— people with lower incomes, racial minorities, and young people— were also less likely to have health insurance in states with more restrictive electoral policies. Conversely the study found that those who were wealthier, white, or older, were no more likely to be uninsured regardless of voting restrictions. The study used the COVI to measure electoral restrictions and individual responses to the 2017 Behavioral Risk factor Surveillance System to measure individual health insurance

access. This study was limited by not including a temporal element to examine electoral restrictions and insurance access making it hard to understand the causal pathway for this relationship. Additionally, the study did not explore the mechanism behind this relationship to understand why electoral policy is related to health insurance access.

In 2022, researchers Pabayo, Grinshteyn, Steele et al., explored the association between state voting policies, and COVID-19 case and mortality rates at the county level. This study used the New York Times' Github COVID-19 database, County Health Rankings, and the COVI to illustrate that the relative restrictiveness of electoral policies in a state was predictive of county COVID-19 case and mortality rates from January 2020 to March 2021. Additionally, the researchers found that lower income communities experienced a larger burden of the pandemic and faced more barriers to voting than higher income communities. The study controlled for a wide range of factors such as county Trump vote share, median income, age, and proportion of the county that is rural. However, the study does still have a few key limitations, case and mortality rates were not available by race which limited analysis of racial differences and the study only examined one time-point which limited the ability to test specific mechanisms of the relationship— the researchers could not test if voting leads to better health or if better health leads to increased voter participation. This research underscores the relationship between voter access and community health outcomes while highlighting the need to examine the relationship using multiple time periods.

Researchers Drs. Pacheco and LaCombe (2022) investigated the role of state institutions and population health. They defined two categories of state institutions, those that promote political accountability and those that promote checks and balances.

Institutions that promote political accountability were defined as those that hold elected officials accountable such as campaign finance laws, laws that make it easier to register and vote during elections, laws that make it easier for citizens to communicate their preferences like ballot initiatives and referenda, and staffing, pay, and resources that enable legislators to learn about the conditions in their districts. Institutions that enable a system of checks and balances were defined as consensus-oriented institutions like the level of professionalism of state legislatures which either enables or hinders the body's ability to propose, pass, and enact new legislation without external influences. Laws that enable strong bodies of government in the executive and legislative branches are thought to increase the institutions' ability to enact laws that are responsive to community needs and aligned with community values. The study used a Bayesian exploratory factor analysis on state institutional and electoral data from 1975 to 2016 to identify the strength of these two institutional types across all 50 states and their relationship with infant mortality rates (1995-2016), life expectancy (1975-2016), and midlife all-cause mortality (1999-2016). The study found that states with institutions that promote political accountability are associated with lower infant mortality rates than states with institutions that do not promote political accountability. Similarly, states with institutions that promote checks and balances are associated with longer life expectancy than states with institutions that do not promote checks and balances. The researchers suggested future studies examine how democratic institutions relate to health inequities within states and across demographic characteristics and future research should look at less generalized measures of population health. While voter access is not a central focus of this paper, the

findings showed that political accountability, which included several indicators of voter access, was associated with population health at the state level.

Recently, Rushovich et al., (2024) published a difference-in-difference study on the impact of the Voting Rights Act of 1965 (VRA) on Black infant mortality and Black versus white infant mortality. This study makes the strongest causal argument that voting rights have a direct impact on health and racial equity. The counties covered by the preclearance clause of the VRA experienced an 11.4% on average decrease in Black infant deaths beyond those experienced by counties not covered by the VRA. Additionally, the study found that there were 20% fewer Black infant deaths than would have been expected in the absence of the VRA. However, the VRA did not impact white infant death rates. The study was limited by the assumption that the underlying population did not change across the study period (1965-2021) but was controlled for using population counts as a variable. The study was also limited by the accuracy of infant death records which have been shown to be undercounted for Black infants and rural and impoverished areas. This study shows that the VRA produced improvements in social, political, and economic conditions for Black Americans and underscores the importance of better understanding how contemporary changes to electoral policies are related to health and racial equity.

Gaps in Evidence

The body of evidence focused on how voting and electoral policies are related to population health is relatively new but growing rapidly. There are several opportunities to examine and explore this relationship more deeply so that public health practitioners can

be confident in their assertions that voter access is important for population health and equity. All the research cited above has focused primarily on state-level analyses. While electoral policies are oftentimes determined at the state-level, there can be wide variance across the state when it comes to voter participation rates. For example, According to County Health Rankings' (n.d.) new voter participation metric, the state level voter turnout in Oregon was 76.4% in 2020, however, Malheur County had a voter turnout rate of just 56.4% while Wallowa County had a rate of 90.2%. This dissertation addresses this limitation of the current literature by examining how county-level voter participation and health outcomes are related in a single state and using two contrasting examples of state voter access landscapes to get a clearer picture of how voting is associated with population health. Additionally, as posed by Pabayo et al. (2021) both papers used four time points to further strengthen the understanding of how voter access is related to population health. Like the Health & Democracy Index, this dissertation also utilizes a wide variety of population health and health behavior measures to widely inform public health practice.

Contributions

This dissertation advances the understanding of the relationship between voting and health in a few ways and aims to inform further analysis. Many previous studies have looked primarily at either cross-sectional data from one time-period, or individual level data. Additionally, studies have focused on one or targeted health outcomes. This dissertation expands the current knowledge and understanding by using pooled cross-sectional time-series analyses at the county level to explore the relationship between

voter participation and health. This study also examined multiple health outcomes and behaviors which allows for a broader understanding of how different health outcomes are related to voter participation. Each study focused on a single state as contrasting examples of state electoral policy climates. This dissertation aids in the understanding of how voter participation is associated with various health outcomes at the county-level.

Additionally, the dissertation has significant policy implications as democracy reform continues to be a hotly contested issue at the state and federal level. This dissertation adds an example of how social conditions, health, and voter access are interconnected within contrasting state examples.

Chapter 3: Methods

Overall Approach

This dissertation project used quantitative methods to explore the relationship between county-level voter participation (as a measure of community power) and health, while controlling for racial and ethnic composition, income, education, homeownership, and housing quality within two states selected to represent contrasting electoral policy landscapes. Both papers utilized pooled cross-sectional time series design over an eight-year period using counties as the study "participants" with voter participation as the independent variables, county-level health measures as the dependent variable, and percent uninsured, percent of the population that identifies as non-Hispanic Black, percent of the population that identifies as Hispanic, median income, percent of housing units occupied by the homeowner, percent of units with housing quality concerns, educational attainment, and population density as control variables.

Public health research focuses on complex upstream social and environmental conditions for healthy communities; however, the current published literature focuses on short-term individual-level research outcomes most of the time (Rutter et al., 2017). Research that focuses on systems level change, like structural barriers (or aids) to civic and voter participation, relies on evaluating the impact of policy-change using quasi-experimental and/or cross-sectional designs as traditional experimental designs like randomized control trials are generally impractical or unethical to conduct (Ibid). Given these practical and ethical considerations, this dissertation project utilizes a cross-sectional design that measures county-level voter participation rates and health outcomes

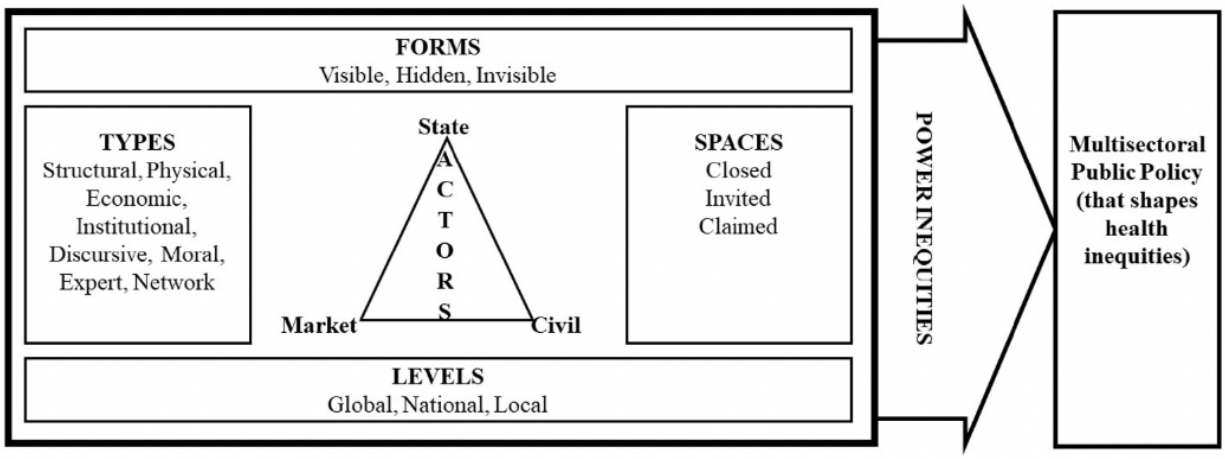
without directly manipulating any variables and does not focus on any individual level data. Beyond the ethical rationale, the selected methodology is also beneficial because using pooled cross-sectional time series data allows exploration of variation both across counties in a single state and across time. Additionally, understanding community levels of voter participation as one output or expression of community power requires examining the relationship between voter participation and community health beyond individual participation. Further detail on each paper's specific methodology, data collection, and analysis can be found in their individual sections later in this chapter.

Conceptual Framework

While the narrative from history has illustrated how power is tied to both voting and inequities it is important to have a firm understanding of the mechanisms for which power is manifested and how differences in community power— which can be understood as the level of control a community has over policy, social norms, and systems of governance— influence health outcomes. To better understand power for the purpose of empirical research, this dissertation used the "*Health Equity Power Framework*" by Sharon Friel et al., (2021) using voter participation as an expression of community power.

The Health Equity Power Framework (HEPF) was informed by qualitative interviews with government, industry and civil society actors across policy case studies covering a multitude of disciplines. The researchers were able to put together a framework that combines multiple community organizing frameworks of power for a more complete perspective.

Figure 1. Health Equity Power Framework



The HEPF illustrates that there are many different types of power (structural, institutional, economic, expert, etc.) that manifest in different ways. Power also takes three distinct forms— Visible where interests are identifiable such as in public meetings or formal decision-making processes; Hidden which refers to the backstage decision making that happens behind closed doors in meetings that have barriers to participation; and Invisible which manifests through dominant ideologies, norms, and values. The framework also suggests that power appears in three different types of spaces— Closed where elite groups of actors make decisions without consultation; Invited which is still controlled by elite actors (they set the agenda, take the meeting minutes, and reflect their agenda) but parties with mutual interests are included in discussions; and Claimed which are spaces created by less powerful actors through lobbying and power building activities. The framework also describes three different types of actors: State (i.e., government), Market (i.e., economic forces), and Civil (i.e., people).

Using this model, it is easy to fully understand the forces that drive power, how power manifests, and what inflection points advocacy campaigns and policy programs can target to create change. Within the HEPF model, voter participation is a clear measure of visible power used by civil actors in invited spaces. However, it is important to note that the electoral process is governed by all the types of power in political decision-making (hidden and invisible). Voting is also a form of structural power that can influence economic, physical, and institutional power, as the outcomes of elections often dictate policy choices that impact these types of power. Therefore, it is important to note that while this dissertation measures voter participation to examine how visible power of a community is associated with county level health, other forms of power inequity still govern the voter experience and health outcomes.

Aims and Research Questions

This dissertation addresses current gaps in the understanding of the relationship between voting and health by examining associations between voter participation, race, social capital, social conditions, and community health in Oregon and Texas. These studies examined how changes (over time and across counties) in voter participation in both Oregon and Texas is associated with county health while controlling for health insurance status, race and ethnicity, social capital, social conditions, and population density. Specifically, this dissertation aims to address the following research questions:

- Are voter participation rates associated with county level health outcomes, health behaviors, and healthcare access over time and across counties when controlling

for insurance, race, income, education, housing tenure, housing quality, and population density in Oregon and Texas?

- Is the relationship between voter participation rates and county level health outcomes, health behaviors, and health insurance access mediated by race, income, education, housing tenure, and housing quality in Oregon and Texas?

Hypotheses

To illustrate the hypothesized relationships between the independent variables, dependent variables, and control variables including the direction of these relationships, a table that shows each of the dependent variables' hypothesized relationship to the independent and control variables is included in the Appendix (Appendix 1). The main hypotheses are described below:

- Increases in voter participation in Oregon (both across counties and over time) are associated with lower rates of chronic health conditions, lower rates of diagnosed depression, higher rates of people reporting good or better health, lower rates of adults that smoke, higher percent of adults that are physically active, and lower rates of people that are uninsured.
- Increases in voter participation in Texas (both across counties and over time) will be associated with fewer poor mental health days, fewer poor health days, lower rates of adults that smoke, lower rates of physical inactivity, and lower rates of adults that are uninsured.

- Counties with higher voter participation rates in Oregon and Texas will have a smaller proportion of their population that identifies as non-Hispanic Black and/or Hispanic, higher median incomes, a higher rate of the population that has a high school diploma, a higher rate of homeownership, and a lower share of housing units that lack facilities.

Justification for Dependent Variables

Much of the research focused on the relationship between voting and health at the community level has used self-reported health as the primary dependent variable. While self-reported health is a good measure of health and wellbeing, this measure provides little detail beyond who is reporting good or bad health. Additionally, self-reported estimates of health may be impacted by response bias towards better health (Rosenman et al. 2011). In an effort to expand the understanding about the relationship between community health and voter participation, these studies use multiple health measures that meet the following criteria:

1. The measure is important to the practice of improving public health;
2. The measure has known policy interventions to improve outcomes; and
3. There is evidence of the relationship between the health measure and voter participation.

Evidence is provided below that shows how each of the selected dependent variables meets the above criteria for inclusion in the study.

Chronic Health Conditions

According to the Centers for Disease Control and Prevention (CDC), six in ten adults have at least one chronic condition, defined as conditions that last one year or more and require ongoing medical attention and/or limited daily activities. Many chronic conditions are leading causes of death in the United States, such as heart disease, cancer, and diabetes. Additionally, most of the nation's health expenditures are used to address chronic conditions, making them a pressing issue for public health and medical practitioners alike (Centers for Disease Control and Prevention (CDC), 2022).

Chronic conditions are a downstream health outcome that are influenced by numerous social and behavior factors. However, there are also several policy interventions that have been shown to lower chronic disease prevalence that may be influenced by voter participation, such as improving access to health care through expanded Medicaid eligibility; improving screening programs for early detection and treatment; investing in community health workers and other allied health professionals; etc., (CDC, 2019).

Research at the individual level has shown that people with heart disease and disability have lower rates of voting than individuals without these conditions, however, that same research found that people with cancer often higher rates of voting than those who do not have cancer, illustrating that there is a complex relationship between chronic health conditions and voter participation (Gollust & Rahn, 2008). However, research has not explored if or how prevalence of chronic conditions are associated with voter participation at the community level.

Mental Health

Mental health is a growing concern for public health practitioners, 22% of adults in the United States were estimated to have experienced mental health issues in 2021 (National Institute of Mental Health, 2023). According to a national survey conducted by CNN and KFF, a majority of people in the United States believe that the country is experiencing a mental health crisis (Lopes et al., 2024). In fact, the same survey found that half of all adults say that they or a family member have experienced a mental health crisis and these crises have had ripple effects for the mental health of their family units (Ibid). Research at the individual level has also found that voting is associated with better future mental health outcomes for adolescents (Ballard et al. 2018).

Mental health is also a growing concern for policy makers and there are several policy options that aim to improve community mental health. Policies that expand mental health screenings, fund and establish programs that aim to reduce distress through targeted population interventions, and increase the capacity of the mental health care system are all effective strategies to promote mental wellbeing (Veldhuis et al., 2021).

Self-Reported Health

Self-reported health is the most commonly used proxy for measuring health in studies that aim to understand how voter participation is associated with health outcomes (Ballard et al., 2018; Schraufnagel, 2023). Self-reported health indicates a person's perceived wellbeing. The measure is thought of as a reliable measure for general

wellbeing and has been shown to be related to mortality (Lorem et al., 2020), need for physician services (Miilunpalo et al., 1997), and other clinically measured health statuses (Garrity et al., 1978). Self-reported health is also a good measure of health-related quality of life at the population level (University of Wisconsin Population Health Institute, n.d.-a).

Given that self-reported health is a general measure of health and wellbeing for individuals and populations, many policies that aim to address health outcomes or the social determinants of health can have an impact on overall health. Policies that make investments in disease prevention, promote health, and address the social needs of the population (such as income, education, housing, employment, transportation, environment, and neighborhood conditions) can help improve the overall health and wellbeing of communities (Rosenthal, 2022).

Smoking

Tobacco use and smoking behavior has been a topic of growing concern for public health over the last several decades. Cigarette smoking is the leading cause of death in the United States, causing more than 480,000 deaths each year (National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health, 2014). Smoking is associated with multiple chronic conditions such as lung cancer, chronic obstructive pulmonary disease, strokes, and asthma (Ibid; CDC 2010).

Many policy interventions can decrease smoking behavior, having lasting impact on the overall health of the population and chronic disease prevalence. Policies like tobacco taxes (Sharbaugh et al., 2018), increasing age limits (National Academies of

Science Engineering and Medicine, 2015), and funding for cessation programs (Farrelly et al., 2008) have shown to be effective in reducing smoking behaviors.

Research at the individual level has shown that people who smoke are less likely to vote (Albright et al., 2016). However, there has not been much community level research into whether voting, and access to voting is associated with decreases in smoking behavior.

Physical Activity

Increasing physical activity is an important public health indicator. Physical activity is associated with fitness, bone health, attention, academic performance, lower blood pressure, mental health, and reductions to arthritis (Community Preventive Services Task Force, 2023). Just over a quarter of adults in the United States are physically inactive (CDC, 2020).

Policies that aim to increase physical activity can range from individually focused programs like school-based programs to those that focus on the built design of neighborhoods. Environmental policies that regulate and improve road safety for biking and walking can increase physical activity by providing safe active commutes to and from work (Roundtable on Obesity Solutions et al., 2015).

Insurance Access

Insurance access is an important indicator of health care access. People with health insurance are more able to access primary care services, get needed treatment for

acute and traumatic conditions, and continue getting care for chronic illnesses. Similarly, being uninsured has been associated with adverse health outcomes (Hoffman & Paradise, 2008).

One of the most impactful policies to improve health insurance access in the United States was the implementation of the Affordable Care Act which not only banned excluding those with pre-existing conditions from gaining insurance, but also allowed states to expand Medicaid coverage to single adults (124 Stat. 119 - Patient Protection and Affordable Care Act, 2010). Oregon was one of the first states to expand Medicaid coverage through legislative action, and many states have considered ballot measures to expand their programs (Oregon Health and Sciences University, 2018). However, some states have yet to expand Medicaid coverage, including Texas (KFF, 2024).

Since insurance access is a good indicator of healthcare access it was used as a dependent variable in this study. However, since many of the other dependent variables may be impacted by insurance access (since having health insurance can both improve health and give people access to diagnoses), insurance access was used as a control variable in models not using insurance access as the dependent variable.

Justification for Control Variables

Electoral power can shape other forms of power through policy making and governing processes and can also be influenced by these other forms of power that make it either easier or harder for people to vote. It is important for this dissertation to include measures of social conditions as a means of measuring possible moderating forms of power.

Race

Considering the racialized history of voting rights across the U.S. and immense body of research related to health inequities for Black and Hispanic communities, it is important to understand if counties with a higher concentration of Black and/or Hispanic people have a lower rate of voter turnout and if counties with a higher concentration of Black and/or Hispanic people have worsened health outcomes. As discussed in earlier chapters, Black and Hispanic voters have been continually disenfranchised from political decision making, both in political obstacles that target Black voters (poll taxes, understanding clauses, etc.) and in laws that continually make it difficult for Black and Hispanic people to run and hold political positions (Anderson, 2019). This purposeful exclusion and diminishment of political power has enabled policymakers to pass laws that further racialize health outcomes. Examining how the relationship between health and voting is moderated by race is important to seeing the larger picture of power as a determinant of health. States that were previously covered by the preclearance clause in the Voting Rights Act, like Texas, have passed policies that make it harder to vote and specifically target communities of color, it is important to understand how race is related to the model of voter access and health (Brennan Center for Justice, 2018). Additionally, While Oregon is a relatively white state (U.S. Census Bureau, n.d.), it is still important to understand if its electoral policies support participation across racial demographics. If the percent non-Hispanic Black population and the percent Hispanic population is a moderator variable in this study, it indicates that state voting policies in Oregon and

Texas are impacting the Black and Hispanic communities inequitably which in turn has impacted health.

Income and Education

Evidence suggests that socioeconomic status including income and educational attainment are both related to voter access and health inequities (Blakely et al., 2001). Inequalities in voter participation based on income leads to unequal electoral power and assures that the interests of wealthier communities are better represented in policy decisions which can have an impact on both policies related to the SDoH and health care access (Hill & Leighley, 1992). Similarly, inequities in educational attainment and voter participation leads to further unequal representation (Blakely et al., 2001). If those with lower income or lower educational attainment are underrepresented in political decision making processes, their unique personal interests, like investments in social safety nets, might be under-invested which could hinder access to health (Ibid).

Homeownership and Housing Quality

Housing tenure (own vs. rent) and housing quality are tied to political power. Homeowners are more likely to vote and have their interests represented politically and homeowners tend to be healthier than renters. Having homeowners' interests better represented in political decisions can hinder the development of affordable quality housing and the passing of renters protections (Jiang, 2018). There is also evidence that suggests housing tenure is related to health outcomes and health equity (Mehdipanah,

2017). Some research also suggests that the quality of housing and the value of homes are important variables to consider when examining the relationship between housing and health (Gibson, 2011). When it comes to voting and political participation, homeowners are more likely to be involved in political decision making because of their own self-interests in their community (Jiang, 2018) and renters also face more barriers to voting because they move more frequently than homeowners (Squire & Wolffinger, 1987). When people move they must update their address on their voter registration in order to vote in subsequent elections— not being registered is the primary reason people don't vote (Ibid). Additionally, research from County Health Rankings and Reports suggests that communities that are more civically engaged have healthier housing options (University of Wisconsin's Population Health Institute, 2023).

Population Density

Given that both states used in this dissertation have large rural populations with a handful of metropolitan areas, there is likely large variation in population density across counties. Studies show that population density is related to health outcomes (Greenberg & Schneider, 2023). Additionally, research has demonstrated that voter participation is related to population density (Preuss, 1981). Therefore it is important to control for population density in the final multivariate models.

Year

These studies both use data across multiple years. While the fixed effects approach controls for county based differences, the model does not control for time-based confounding factors. It is well documented that voter participation depends on the type of election (presidential vs. midterms) (DeSilver, 2014). Since this study uses data from both presidential and midterm elections, it is important to control for year differences in the multivariate models.

Lagged Dependent Variable

Since both studies use a cross-sectional time series approach to measuring the relationship between voting and health, multivariate models include a lagged dependent variable to control for possible autocorrelation (Beck & Katz, 1995).

Sampling Frame

All counties in Oregon (n=36) and Texas (n=254) were the units of analysis included in the study. Some counties (OR: n=3; TX n=10) have missing values for health and elections related data. Additionally some health measures combine small counties to ensure the survey sample size is large enough to glean generalizable results, however, this means the county data from one survey does not always align with another. For example: in Oregon Gilliam, Sherman, and Wasco counties are combined in the BRFSS reports but not in the EAVS, making it difficult to combine data across surveys. When counties are combined or when a county is missing a data point, no data was be reported for the county.

Data

This study utilized four distinct publicly available population level data sources. In Paper 1, the study included health data from four time periods (2010-2013, 2012-2015, 2014-2017, 2015-2019) from Oregon Health Authority's published Oregon Behavioral Risk Factor Surveillance System's (BRFSS) prevalence data. Paper 2 used County Health Rankings & Roadmaps health outcome data. Both studies used data from the Election Administration and Voting Survey from four time (2012, 2014, 2016, & 2018) to measure the total votes counted in each election year; Both papers used American Community Survey 5-year estimate data to measure population size to standardize the elections data so they are comparable across counties and to measure of race, income, educational attainment, homeownership, and housing conditions.

More information on each data source is provided below. Additionally, a table for both manuscripts' variables used and variable descriptions, the data sources, and the literature supporting the use of the variable is included in Table 1 below.

Table 1. Variables of Interest, Data Sources, and Supporting Literature

Variables		OR: Data Sources	OR: Variable Description	TX: Data Source	TX Variable Description	Literature Supporting Use
Independent Variable	Voter Participation	EAVS & ACS	% of eligible population that voted in presidential election	EAVS & ACS	% of eligible population that voted in presidential election	Pabayo R, Grinshteyn E, Steele B, Cook DM, Muennig P, Liu SY (2022) The relationship between voting restrictions and COVID-19 case and mortality rates between US counties. PLoS ONE 17(6): e0267738. https://doi.org/10.1371/journal.pone.0267738 Nelson C, Sloan J, Chandra A. Examining Civic Engagement Links to Health: Findings from the Literature and Implications for a Culture of Health. RAND Corporation; 2019. Pacheco J, LaCombe S. The Link between Democratic Institutions and Population Health in the American States. *Journal of Health Politics, Policy and Law*.

						Published online May 6, 2022. doi:https://doi.org/10.1215/03616878-9978103 Schraufnagel S. Voting Restrictions and Public Health: An Analysis of State Variation 1996–2020. *State and Local Government Review*. Published online October 10, 2023. doi:https://doi.org/10.1177/0160323x231202421
Dependent Variables	Chronic Health Conditions	Oregon BRFSS	% of adults with one or more chronic health conditions	Not Included	Not Included	Sund R, Lahtinen H, Wass H, Mattila M, Martikainen P. How voter turnout varies between different chronic conditions? A population-based register study. Journal of Epidemiology and Community Health. 2016;71(5):475-479. doi:https://doi.org/10.1136/jech-2016-208314
	Mental Health	Oregon BRFSS	% of adults who have been diagnosed with depression	County Health Rankings & Roadmaps	Average number of self-reported poor mental health days	Wray-Lake L, Shubert J, Lin L, Starr LR. Examining associations between civic engagement and depressive symptoms from adolescence to young adulthood in a national U.S. sample. Applied Developmental Science. 2017;23(2):119-131. doi:https://doi.org/10.1080/10888691.2017.1326825
	Self-rated health	Oregon BRFSS	% of adults who report good or better overall health	County Health Rankings & Roadmaps	Average number of self-reported poor physical health days	Hunter D, Ayers J, Barba Brown J. Health & Democracy Index. democracyindex.hdhp.us. Published August 2021. Accessed November 3, 2022. https://democracyindex.hdhp.us/
	Smoking	Oregon BRFSS	% of adults who use tobacco products	County Health Rankings & Roadmaps	% of adults who report smoking cigarettes	Albright K, Hood N, Ma M, Levinson AH. Smoking and (Not) Voting: The Negative Relationship Between a Health-Risk Behavior and Political Participation in Colorado. Nicotine & Tobacco Research. 2015;18(3):371-376. doi:https://doi.org/10.1093/ntr/ntv098
	Physical activity	Oregon BRFSS	% of adults that get the CDC recommended hours of physical activity	County Health Rankings & Roadmaps	% of adults that report no physical activity	Ballard, Parissa J., et al. "Impacts of Adolescent and Young Adult Civic Engagement on Health and Socioeconomic Status in Adulthood." Child Development, vol. 90, no. 4, 2019, pp. 1138–54, https://doi.org/10.1111/cdev.12998.
Control Variables	Race and Ethnicity	ACS 5 Year Estimate	% of population that identifies as Non-Hispanic Black & % of population that identifies as Hispanic	ACS 5 Year Estimate	% of population that identifies as Non-Hispanic Black & % of population that identifies as Hispanic	Anderson, C. (2019) "One: A History of Disenfranchisement," in One person, no vote: How voter suppression is destroying our democracy. New York, NY: Bloomsbury Publishing. The Brennan Center for Justice, The Effects of Shelby County v. Holder. Retrieved September 5, 2022, from https://www.brennancenter.org/our-work/policy-solutions/effects-shelby-county-v-holder
	Income	ACS 5 Year Estimate	County median income	ACS 5 Year Estimate	County median income	Blakely TA, Kennedy BP, Kawachi I. Socioeconomic inequality in voting participation and self-rated health. Am J Public Health. 2001;91(1):99-104. doi:10.2105/ajph.91.1.99 Hill KQ, Leighley JE. The Policy Consequences of Class Bias in State Electorates. American Journal of Political Science. 1992;36(2):351. doi:https://doi.org/10.2307/2111481

Education	ACS 5 Year Estimate	% of population older than 25 with at least a high school diploma	ACS 5 Year Estimate	% of population older than 25 with at least a high school diploma	Blakely TA, Kennedy BP, Kawachi I. Socioeconomic inequality in voting participation and self-rated health. Am J Public Health. 2001;91(1):99-104. doi:10.2105/ajph.91.1.99 Telfair, Joseph, and Terri L. Shelton. "Educational attainment as a social determinant of health." North Carolina medical journal 73.5 (2012): 358-365.
Housing Tenure	ACS 5 Year Estimate	% of units occupied by homeowners	ACS 5 Year Estimate	% of units occupied by homeowners	Jiang B. Homeownership and voter turnout in u.s. local elections. Journal of Housing Economics. 2018;41:168-183. doi:https://doi.org/10.1016/j.jhe.2018.06.006 Mehdipanah R, Schulz AJ, Israel BA, et al. Neighborhood Context, Homeownership and Home Value: An Ecological Analysis of Implications for Health. Int J Environ Res Public Health. 2017;14(10):1098. Published 2017 Sep 22. doi:10.3390/ijerph14101098 Jiang B. Homeownership and voter turnout in u.s. local elections. Journal of Housing Economics. 2018;41:168-183. doi:https://doi.org/10.1016/j.jhe.2018.06.006
Housing Quality	ACS 5 Year Estimate	% of units that lack plumbing facilities, kitchen facilities, and/or telephone service	ACS 5 Year Estimate	% of units that lack plumbing facilities, kitchen facilities, and/or telephone service	Gibson M, Petticrew M, Bambra C, Sowden AJ, Wright KE, Whitehead M. Housing and health inequalities: a synthesis of systematic reviews of interventions aimed at different pathways linking housing and health. Health Place. 2011;17(1):175-184. doi:10.1016/j.healthplace.2010.09.011
Population Density	ACS 5 Year Estimate and Census Geography Estimates	People per square mile	ACS 5 Year Estimate and Census Geography Estimates	People per square mile	Preuss GG. The Effects of Density and Urban Residence on Voter Turnout. *Population and Environment*. 1981;4(4):246-265. Accessed February 4, 2024. http://www.jstor.org/stable/27502946 Greenberg M, Schneider D. Population density: What does it really mean in geographical health studies? *Health & Place*. 2023;81:103001. doi:https://doi.org/10.1016/j.healthplace.2023.103001
Year	N/A	Year of Observation	N/A	Year of Observation	DeSilver D. Voter turnout always drops off for midterm elections, but why? Pew Research Center. Published 2014. https://www.pewresearch.org/short-reads/2014/07/24/voter-turnout-always-drops-off-for-midterm-elections-but-why

Health Data

This dissertation analyzed the association between voter participation and county level health outcomes using Oregon and Texas as contrasting examples. Paper 1 used BRFSS county prevalence data from OHA as primary dependent variables to measure the

association between voting and health outcomes and behaviors. OHA provides county estimates from the Oregon administered BRFSS to the public as estimated percentages of adults who fit into a range of health behaviors and conditions. All variables from the OHA dashboard are age-adjusted. OHA's dashboard provides estimates on numerous health issues for counties in Oregon for years 2010-2013, 2012-2015, 2014-2017, and 2015-2019. OHA's dashboard uses data collected exclusively from BRFSS. The health variables selected for Paper 1 include:

- the percent of adults with one or more chronic health conditions;
- the percent of adults with a diagnosis of depression;
- the percent of adults that reported having "good" or better health;
- the percent of adults that reported using tobacco products; and
- the percent of adults that reported getting the CDC's recommended level of physical activity.

Paper 2 analyzed the relationship between indicators of voter access and county health in Texas and used County Health Rankings & Roadmaps (CHRR) data to measure county level community health outcomes. CHRR is developed and maintained by the University of Wisconsin Population Health Institute and provides measures for health and social determinants of health in almost every county in all 50 states (University of Wisconsin Population Health Institute, 2022). CHRR utilizes and synthesizes data from the BRFSS, American Community Survey (ACS), Census, and other federal government data sources in order to rank each county on an ordinal scale from worst overall health to best overall health. Additionally, they provide county estimates on a range of health

outcomes and behaviors (Ibid). The health variables from CHRR used for Paper 2 include:

- Average poor physical health days;
- Average poor mental health days;
- The percent of adults that smoke; and
- The percent of adults that report no physical activity

It is important to note that the data sources from the CHRR for the health and health behaviors included in this study were offset by a number of years such that the reports on physical health and mental health in the 2020 dataset uses data from 2017 and the 2016 dataset uses data from 2015. In order to ensure that the health data matches with the treatment timeline of the policies included in the dissertation, data was used based on the year of the original data collection, not the CHRR year it was reported. Details on data years matching is displayed in Table 2.

Both papers used the percent of the county that reports being uninsured in the American Community Survey as a dependent variable. More information about the ACS is included in subsequent paragraphs.

Both health data sources (OHA & CHRR) rely on BRFSS data as the original source of data. BRFSS is a cross-sectional survey instrument run by the Centers for Disease Control and Prevention (CDC). BRFSS is a phone survey that collects data regarding adult health-related risk behaviors, chronic health conditions, and use of preventative services (Oregon Health Authority, n.d.). State health departments use telephone call centers or universities to administer BRFSS surveys continuously throughout the year using random digit dialing techniques on both landlines and cell

phones. One key limitation of BRFSS is that reports for race or ethnicities are limited in states with largely white populations like Oregon (86.2% of the population identifies as white; United States Census Bureau, n.d.). Finally, another limitation is that not every county has reported outcomes on every metric of interest which limits the internal validity of the study due to potential non-response bias (Oregon Health Authority, n.d.).

The Election Administration and Voting Survey

Both Manuscripts used data from the Election Administration and Voting Survey (EAVS) to measure voter participation at the county level. The Election Assistance Commission, created under The Help America Vote Act (HAVA) in 2002, collects a report after every federal election from state and county elections officials on voter registration; uniformed and overseas voters; early, absentee, and provisional voting; voting equipment; and poll workers, polling places, and precincts (The Election Assistance Commission, n.d.). The data is gathered from all 50 states, the District of Columbia and four territories. Since the data is collected directly from the government agencies responsible for conducting elections, as opposed to self-reported data from voter surveys, it is the most accurate depiction of elections available to the public at the county level. Data is available for even numbered years from 2010 to 2022. Both papers used data from election years between 2012 and 2018 (Ibid).

Since the public estimates reported by BRFSS and EAVS do not include demographic data it was not possible to extrapolate if different sub-populations within a county, such as the voter participation rate of a specific racial or ethnic group, are associated with health or health disparities. Instead the selected controls for race, income,

education, homeownership, and housing quality, was used as a proxy for understanding how county social capital and conditions are related to the overall model of voter participation and health.

American Community Survey

In order to incorporate measures of race, social capital, and social conditions, both papers used the American Community Survey's (ACS) 5-year estimates. The ACS is administered by the U.S. Census Bureau and is an ongoing survey that provides yearly information on the population of the U.S. at the county, state, and federal level (US Census Bureau, 2019).

Population Standardization Data and Methodology:

To standardize voter participation, as a measure of voter access, this dissertation used the EAVS variable for total ballots counted across all counties in Oregon and Texas. However, the EAVS only collects raw counts that must be standardized into population rates in order to compare across counties. The ACS's Citizen Voting Age Population Estimates (CVAP) were used to convert the EAVS county counts into population rates (such as ratio of votes cast to population eligible). This population standardization methodology is recommended in the data documentation for the EAVS (United States Election Assistance Commission, 2020). To ensure that the estimates do not undercount young voters who become eligible within the 5-year survey span, these population rates utilized CVAP estimates from the year of interest as the final year of the survey estimate, such that the 2016 population estimate came from the estimate published in 2016 and

spans from 2011-2016. These rates were recalculated for every even numbered year included in the study period to ensure that they account for changes to the population like unexpected growth (United States Census Bureau, n.d.-a).

Control Variables Data

1. *Data Used to estimate Health Insurance Access*

This dissertation used ACS 5-year estimates of the percent of the county population that was uninsured. The uninsured rate estimates were used such that the year of interest is the mid-point in the 5-year estimate range, for example the 2016 population estimate came from the estimate published in 2018 and spans from 2013-2018.

2. *Data Used to Control for Racial Demographics*

This dissertation used ACS 5-year estimates of the percent of the county population that identifies as non-Hispanic Black and Hispanic. These racial population estimates were used such that the year of interest is the mid-point in the 5-year estimate range, for example the 2016 population estimate came from the estimate published in 2018 and spans from 2013-2018. One key limitation of this data is that the racial demographic data used only accounts for those who identify as either non-Hispanic Black or Hispanic, but does not include estimates of those who reported being Hispanic and Black or other categories of two or more racial identities.

3. *Income and Education Moderating Variables Data*

To control for the difference in income across counties, the ACS 5-year estimates for median household income was used. To control for educational attainment, ACS 5-

year estimates of the percent of population over 25 that has at least completed high school or the equivalent (ie. GED). These income and education estimates were used such that the year of interest is the mid-point in the 5-year estimate range, such that the 2016 population estimate came from the estimate published in 2018 and spans from 2013-2018.

4. Housing Moderating Variables Data

The percent of owner-occupied housing units in each county and the percent of occupied units that lacked complete plumbing facilities, kitchen facilities, and/or telephone service were treated as control variables for the purpose of this study. The ACS 5-year estimates include county estimates of the percent of owner occupied units and an estimate number of units that lacked plumbing, kitchen, and/or telephone service which was summed and then combined with total occupied units in the county was used to estimate the percent of homeowners in the county to estimate the proportion of occupied units that lacked proper facilities. Similarly to the other ACS variables used, midpoint in the 5-year estimate range was used as the estimate for each time period.

5. Population Density

The population density for each county was used as a control variable in both papers. County population size estimates from the ACS were used along with the county geographic area estimates from the US Census Bureau to calculate population density in units of people per square mile (United States Census Bureau, 2023).

Table 2. Data Matching Years

Year	EAVS Data Year	CVAP Estimate	Oregon BRFSS Data Years	CHR Data Years	CHR Report Year	ACS Data Years
2012	2012	2007-2012	2010-2013	2006-2012	2014	2009-2014
2014	2014	2009-2014	2012-2015	2014	2016	2011-2016
2016	2016	2011-2016	2014-2017	2016	2018	2013-2018
2018	2018	2013-2018	2015-2019	2018	2021	2015-2020

Analysis

The key variables of interest and the literature that justifies their use are listed above in Table 1. The dependent variables of interest for this dissertation were measures of county health and health behaviors in Oregon (Paper 1) and Texas (Paper 2). While some of the health outcomes vary across the two papers, the overall model and approach to data analysis are consistent across both papers and are therefore described together.

Both papers utilized multiple fixed-effects multivariate regression models using pooled cross-sectional time-series data from 2012 to 2018. Using a pooled cross-sectional time-series design allowed for comparison of cross-sectional variables over time while controlling for time and county invariant characteristics within the state. All of the variables used in this analysis are continuous variables. The studies report several descriptive statistics including, the state mean for each variable and standard deviation for each time point. The health measures are age-adjusted which aids in the comparison of the outcomes across counties with varying median ages.

A table showing how the data was matched across the study period is included in the appendix (Table 2). All statistical regressions were run using STATA 16 software with an acceptable statistical inference level set at 0.05 which is consistent with most research standards.

Additionally, to get an initial understanding of how the dependent variables are related with voter participation, unadjusted bivariate linear regressions were used. Multivariate fixed-effects models were used to measure the relationship between voter participation and each dependent variable while controlling for a lagged dependent variable to control for autocorrelation, the uninsured rate (if it was not the primary dependent variable), racial demographics, income, education, homeownership, housing quality, population density, and time. Several robustness checks were used to determine the most appropriate multivariate model for each of the dependent variables.

Robustness Checks

Distribution of Variables

All variables were visualized using histograms to ensure the variables in the models were all normally distributed (Appendix 4- 17 for Paper 1; Appendix 34 - 46 for Paper 2). The percent of the population that identified as non-Hispanic Black and Hispanic, along with population density were not normally distributed for both Paper 1 and Paper 2. To ensure the data used for each of the following analyses does not

contradict core assumptions of linear regression, these three variables were converted using the natural log of the variable.

Multicollinearity

To test for collinearity between the independent variables a correlation table was used (Appendix 3 for Paper 1; Appendix 33 for Paper 2). To test the degree to which variables selected for each model are related to each other, a Variance Inflation Factor was calculated for each model. The VIF scores for each variable in each model is included in the final results tables. Both the correlation tables and the VIF scores indicated high levels of collinearity within the multivariate models, however, variables were not removed due the theoretical rationale for each independent variable discussed in the methods section requires keeping each of the variables in the final models.

Internal Consistency

To test the internal consistency of the health variables and explore the possibility of creating a composite "health" variable, a Crohnbach's Alpha test was conducted. To combine variables into a single composite health variable, an alpha coefficient of 0.70 or above was used as a cutoff.

Endogeneity

To ensure the proper multivariate regression model was selected, the Durbin-Wu-Hausman test was conducted for each of the multivariate models. Based on the findings from this test the model was run using fixed effects or random effects regression models.

If the null-hypothesis of the Durbin-Wu-Hausman test was rejected, meaning that the county-level effects are correlated, the model used a fixed effects model. If the test failed to reject the null-hypothesis, the model used a random effects model.

Heteroskedasticity

One of the primary assumptions required to conduct any linear regression is that of homoscedasticity, where variance of the residuals are constant. To ensure the variance of the residuals is constant across all levels of the main multivariate models, and determine if the use of weights is needed to correct for heteroskedasticity, residuals and linear values for the multivariate models were predicted and then graphed on a scatter plot. If the residuals displayed signs of heteroskedasticity, population weights were used to control for this violation of the assumptions required for linear regression.

Distribution of Standard Error

Additionally, one of the key assumptions of linear regression models is that the residual error is distributed normally. To check the distribution of error, the residuals of each model were plotted using a symmetry plot.

Chapter 4: Results

Paper 1. Oregon

Descriptive Statistics

Table 3 shows the mean (M) and standard deviation (SD) for each variable included in this analysis over time. Mean voter participation was relatively stable over time with rates in 2012, 2016, and 2018 being in the mid-sixties (64.81%; 69.56; and 63.69% respectively), however, in 2014 voter participation was slightly lower at 54.56%. Similarly there was low variation in county voter participation with standard deviations all being around 6%. Health outcomes were also relatively stable across time, means varied by a few percentage points, and standard deviations showed low levels of deviation from the mean at each time period.

Variables used to control for county racial differences (non-Hispanic Black and Hispanic) were similarly stable across time, however, standard deviations were larger than the mean, suggesting that there is large variation in the racial makeup of counties at each time period. Median income increased every year starting at $45,071.08 in 2012 and ending at $56,923.72 in 2018. High school completion and percent of housing units occupied by the owner were both relatively stable across time with low variation between counties at a single time period. Both housing quality and population density were relatively stable across time, however, both measures indicated large variation between counties with standard deviations for housing quality being about a quarter of the mean, standard deviations for population density being about three times the size of the mean.

While the descriptive statistics suggest that there is little variation across time and between counties for most of the measures included in this analysis, it is important to run bivariate models to better understand if any of these measures help explain the small variation between counties and across time.

Table 3. Oregon Descriptive Statistics for variables used in the pooled cross-sectional time series analysis

Variables	2012		2014		2016		2018	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Voter Participation	64.81%	6.68%	54.56%	6.05%	69.56%	5.78%	63.69%	6.67%
Chronic Health Conditions	52.97%	5.71%	54.32%	6.14%	54.12%	4.92%	54.10%	5.50%
Depression	23.63%	4.22%	24.75%	4.00%	24.74%	4.97%	25.72%	4.64%
Good Health	82.42%	5.07%	80.97%	4.77%	81.99%	4.31%	81.21%	4.38%
Smoking	19.64%	5.96%	19.10%	5.94%	19.08%	5.33%	18.06%	4.64%
Physical Activity	25.13%	7.70%	24.31%	9.50%	21.65%	5.33%	22.78%	5.60%
Uninsured	15.14%	2.36%	11.17%	2.26%	7.80%	1.50%	11.01%	4.17%
Non-Hispanic Black	0.67%	0.87%	0.73%	0.84	0.74%	0.87%	0.71%	0.88%
Hispanic	11.11%	8.42%	11.46%	8.64%	11.94%	8.76%	12.34%	8.85%
Median Income	$45,071.08	$7,692.46	$46,481.14	$8,701.51	$51,121.89	$9,785.54	$56,923.72	$10,688.15
High School Completion	88.26%	3.88%	88.64%	4.23%	88.89%	4.00%	89.93%	3.86%
Owner Occupied Units	65.14%	4.27%	64.69%	4.41%	65.57%	4.75%	67.41%	5.51%
Units with Quality Concerns	4.54%	1.37%	4.58%	1.41%	4.22%	1.22%	3.57%	0.89%
Population Density	113.25	311.25	115.99	319.97	119.08	328.78	121.51	333.9

Bivariate Relationships

To further explore the relationship between the dependent variables and voter participation, unadjusted linear regressions were used. Appendix 2 shows t-statistic, p-value, and number of observations from each of these unadjusted linear regressions. Voter participation was positively associated with good health, negatively associated with adult smoking rates, and negatively associated with adults that were uninsured. Voter participation was not associated with chronic health conditions, depression, or physical activity. Given the theoretical framework and justification for each of the dependent variables, it is still important to include multivariate models with each of the dependent variables in the final analysis.

Robustness Tests

To determine the most appropriate statistical test for the main multivariate models, several robustness tests were performed.

Internal Consistency

To test the internal consistency of the health variables and explore the possibility of creating a composite "health" variable, a Crohnbach's Alpha test was conducted using chronic conditions, depression, good health, smoking, physical activity and uninsured rates. To combine variables into a single composite health variable, an alpha coefficient of 0.70 or above was used as a cutoff. The alpha coefficient for this test was 0.601 indicating that these variables are not appropriate for a combined composite score. An additional test was completed dropping the uninsured rate from the test and similarly the alpha coefficient was 0.64 indicating that a combined variable would not be appropriate.

Another Crohnbach's Alpha was calculated dropping the health behavior variables (smoking and physical activity) and the alpha coefficient was 0.55 which was not sufficient to justify a combined variable.

Crohnbach's Alpha was also used to determine the internal consistency between the control variables and the alpha coefficient using all control variables was 0.035 indicating that a combined variable for the controls was not appropriate. Additional combinations of the control variables were tested for internal consistency including: high school completion and median income (alpha = 0.0002), homeownership and housing quality (alpha = 0.0002), median income and homeownership (alpha = 0.0003), and the percent of the population identifying as non-Hispanic Black and Hispanic (alpha = 0.042). Each of these additional tests indicate that combined variables are not appropriate for the multivariate models in this study.

Collinearity of Independent Variables

A correlation table was created to test the collinearity between the independent variables included in the multivariate models (Appendix 3). The correlation table shows a high level of collinearity between all of the independent variables with strong correlations between almost all of the independent variables. While collinearity may complicate findings from multivariate analysis and some suggest removing collinear variables when possible, the theoretical rationale for each independent variable discussed in the methods section requires keeping each of the variables in the final models.

Endogeneity

To ensure the proper multivariate regression model was selected, the Durbin-Wu-Hausman test was conducted for each of the statistically significant multivariate models discussed above. Results from the Durbin-Wu-Hausman test showed that all models were endogenous and therefore fixed-effects regression models were most appropriate.

Heteroskedasticity

To ensure the variance of the residuals is constant across all levels of the main multivariate models, and determine if the use of weights is needed to correct for heteroskedasticity, residuals and linear values for the multivariate models were predicted and then graphed on a scatter plots (Appendices 18-25). The models that used chronic conditions and physical activity as the dependent variables showed some levels of heteroskedasticity and population weights were used for these final models.

Distribution of Standard Error

Additionally, one of the key assumptions of linear regression models is that the residual error is distributed normally. To check the distribution of error, the residuals of each model were plotted using a symmetry plot. The symmetry plots (Appendices 26-31) of the residuals from each of the multivariate models with chronic conditions, depression, smoking, physical activity and uninsured rates as dependent variables showed signs of non-normal distribution of error. These findings further suggest that additional testing and modeling is needed to fully understand these multivariate relationships.

Multivariate Regression Model

Six multivariate models (Table 4) were used to explore the relationship between voter participation and health outcomes while controlling several factors. Most of the multivariate regressions between voter participation, health variables, and controls did not confirm that there is an association between voting and health even when controlling for other community conditions.

The fixed-effects model using chronic conditions, depression, good health, smoking, and physical activity as the dependent variables showed that voter participation was not associated with these dependent variables when the control variables were held constant. However, there were still and handful of notable results from these models

Table 4. Oregon Multivariate Models Of The Relationship Between Health Outcomes, Voter Participation, And Control Variables At The County Level Using County Fixed Effects Linear Regression.

	Model 1 (Chronic Health Conditions (%))[b]			Model 2 (Depression (%))[c]			Model 3 (Good Health (%)[d]			Model 4 (Smoking (%))[e]			Model 5 (Physical Activity (%))[f]			Model 6 (Uninsured (%))[g]		
Variables	Coeff.	St. Error	VIF	Coeff.	St. Error	VIF	Coeff.	St. Error	VIF	Coeff.	St. Error	VIF	Coeff.	St. Error	VIF	Coeff.	St. Error	VIF
Voter Participation	-3.98	25.29	279.46	-11.33	8.16	101.2	2.5	8.18	98.25	-3.78	8.19	97.79	-30.75	35.72	73770	-32.18***	3.99	91.7
Lagged Dependent Variable[a]	-0.033	0.34	394.14	0.19	0.14	45.98	-0.3	0.13	608.51	0.051	0.15	28.79	0.46*	0.18	7930	-0.26	0.26	19.93
Uninsured	0.65	0.43	55.97	-0.15	0.19	18.7	-0.04	0.19	18.4	-0.22	0.2	20.28	-0.29	0.79	20945			
Non-Hispanic Black	-8.86	4.7	449.31	-1.44	1.39	146.85	-3.08*	1.36	146.83	1.72	1.6	148.08	5.13	4.65	371944	0.41	0.71	119.41
Hispanic	-3.18	55.38	256.77	13.53	13.71	95.78	-17.06	13.15	94.22	-7.4	18.52	95.58	15.85	56.66	75420	-5.42	4.98	91.76
Median Income	-0.0002	0.0004	175.67	0.00004	0.0002	120.66	0.0003	0.0002	104.85	0.00002	0.0002	137.47	0.0008	0.001	87221	-0.0002	0.0001	106.18
High School Completion	-2.21	1.16	7356.81	-0.47	0.6	2754.68	-0.97	0.55	2997.88	-0.15	0.6	2682.55	4.23*	1.59	4.16E+06	-0.48	0.36	2773.53
Owner-Occupied Units	0.39	0.78	813.78	0.16	0.28	452.58	0.48	0.26	468.32	0.32	0.29	522.68	-1.09	0.8	511804	0.26	0.18	431.73
Units with Quality Concerns	260.06*	104.48	41.98	35.85	50.89	19.98	1.47	47.98	19.12	62.71	50.79	20.13	118.57	140.6	19698	-50.86	30.18	17.07
Population Density	104.1	63.49	15.57	-16.54	29.73	17.73	-90.94**	27.76	15.75	-49.43	30.87	22.17	83.19	70.99	46522	33.84	18.39	13.87
Year	-0.23	2.21	8219.64	0.4	0.78	2646.35	0.55	0.76	2759.16	0.52	0.9	2702.67	-4.4	3.46	3.17E+06	0.6	0.59	3032.52
N Obs.		95			95			95			93			78			102	
Groups		32			32			32			32			28			35	
R^2_{within}		0.756			0.165			0.3598			0.2237			0.9899			0.5915	

$R^2_{between}$	0.0009	0.0864	0.0714	0.0044	0.0886	0.0685
$R^2_{overall}$	0.0002	0.0617	0.0552	0.0119	0.0492	0.0235

* = p<0.05; **= p< 0.01; *** = p< 0.001

a = lagged dependent variables were used to control for expected autocorrelation, or the relationship between the dependent health outcome variable and previous health outcomes. It is an expression of health 2 years prior in the model and corresponds with the dependent variable of each model.

b = The lagged dependent variable for model 1 is chronic conditions to account for the level of chronic conditions that existed prior to the contemporary relationship between voting and chronic conditions.

c = The lagged dependent variable for model 2 is depression to account for the level of depression that existed prior to the contemporary relationship between voting and depression.

d = The lagged dependent variable for model 3 is good health to account for the level of good health that existed prior to the contemporary relationship between voting and good health.

e = The lagged dependent variable for model 4 is smoking to account for the level of smoking that existed prior to the contemporary relationship between voting and smoking.

f = The lagged dependent variable for model 5 is physical activity to account for the level of physical activity that existed prior to the contemporary relationship between voting and physical activity.

g = The lagged dependent variable for model 6 is uninsured adults to account for the level of uninsured adults that existed prior to the contemporary relationship between voting and uninsured adults.

Model 1 Chronic Conditions

The model using chronic conditions as the dependent variable (model 1) showed that county voter participation rates were not associated with county rates of chronic conditions when all other variables were held constant. Additionally, most of the controls were not associated with county rates of chronic conditions. However, counties with higher housing quality concerns were more likely to have higher rates of chronic conditions (model 1; Coefficient = 260.06) when all other variables were held constant. Model 1 did a good job overall predicting variation across time ($R^2_{within} = 0.756$), which may be due to little variation between the dependent and independent variables during the study period. However, model 1 did not do a good job of explaining the variation between counties ($R^2_{between} = 0.0009$) or overall ($R^2_{overall} = 0.0002$). Additionally, all of the variables in the model showed high levels of collinearity with VIFs between 15 and 8220 which suggests additional analysis may be needed to fully measure this relationship.

Model 2 Depression

The model using depression as the dependent variable (model 2) showed that county levels of voter participation were not associated with county rates of depression. Similarly none of the other control variables were associated with depression when all other variables were held constant. However, the model overall did a decent job of predicting variation across time, between counties, and overall ($R^2_{within} = 0.165$; $R^2_{between} = 0.0864$**;** $R^2_{overall} = 0.0617$). Additionally, all of the variables in the model showed high levels of collinearity with VIFs between 17 and 2755 which suggests additional analysis may be needed to fully measure this relationship.

Model 3 Good Health

Similar to the previous models, the model using good health as the dependent variable (model 3) showed that county voter participation rates were not associated with good health. Most of the control variables were not associated with good health when all other variables were held constant. However, model 3 showed that counties with more people per square mile were more likely to have lower rates of good health (Coefficient = -90.94) when all other variables were held constant. The model overall did a decent job of predicting variation across time, between counties, and overall ($R^2_{within} = 0.3598$; $R^2_{between} = 0.0714$**;** $R^2_{overall} = 0.0552$). Additionally, all of the variables in the model showed high levels of collinearity with VIFs between 15 and 3000 which suggests additional analysis may be needed to fully measure this relationship.

Model 4 Smoking

The model using smoking as the dependent variable (model 4) showed that county voter participation rates were not associated with county adult smoking rates when all other variables were held constant. The additional control variables were also not associated with county adult smoking rates when all other variables were held constant. Model 4 did a good job predicting variation across time ($R^2_{within} = 0.2237$) but did not do a good job predicting variation between counties or variation overall ($R^2_{between} = 0.0044$**;** $R^2_{overall} = 0.0119$). Additionally, all of the variables in the model showed high levels of collinearity with VIFs between 20 and 2705 which suggests additional analysis may be needed to fully measure this relationship.

Model 5 Physical Activity

The model using physical activity as the dependent variable (model 5) showed that county voter participation rates were not associated with county level physical activity rates when all other variables were held constant. Additionally, the control variables were not associated with physical activity levels when all other variables were held constant. Model 5 did a good job predicting variation across time ($R^2_{within} = 0.9899$) and a modest job predicting variation between counties and overall ($R^2_{between} = 0.0886$**;** $R^2_{overall} = 0.0492$). Additionally, all of the variables in the model showed high levels of collinearity with VIFs between 20,900 and 4.16E+06 which suggests additional analysis may be needed to fully measure this relationship.

Model 6 Health Insurance Access (uninsured)

The model using the percent of adults that were uninsured as the dependent variable (model 6) showed counties voter participation rates were associated with the proportion of the adult population that were uninsured when all other variables were held constant. A 1% voter participation was associated with a 30.75% decrease in the percent of the population that was uninsured when all other variables were held constant ($p < 0.001$). The control variables were not associated with county proportions of uninsured adults. Model 6 did a good job predicting the variation across time, a modest job predicting variation between counties, and a poor job predicting variation overall ($R^2_{within} = 0.5915$; $R^2_{between} = 0.0685$**;** $R^2_{overall} = 0.0235$). While this model does confirm the hypothesis that insurance access is associated with voter participation, the model did have high levels of collinearity with VIFs ranging from 13 to 3033 and therefore further modeling may be necessary to fully understand this relationship.

Paper 2. Texas

Descriptive Statistics

Table 5 shows the mean (M), standard deviation (SD) for each variable included in this analysis across time. Voter participation in Texas during presidential election years (2012 and 2016) was in the low 50s with a standard deviation that accounts for 20% the size of the mean which indicates that voter participation across the state has a moderate spread of variation. Voter participation in 2014 was the lowest rate during the study period of 31.47% with a standard deviation of 9.54% or about a third the size of the mean.

Table 5. Texas descriptive statistics for variables used in the pooled cross-sectional time series analysis

	2012		2014		2016		2018	
Variables	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Voter Participation	51.15%	9.84%	31.47%	9.54%	54.09%	10.62%	46.43%	10.40%
Poor Mental Health Days	3.36	1.01	3.20	0.25	3.64	0.23	4.54	0.31
Poor Physical Health Days	4.04	1.13	3.63	0.50	3.81	0.44	4.44	0.48
Smoking	21.73%	7.69%	15.61%	1.81%	15.62%	1.68%	18.98%	2.34%
Physical Inactivity	27.64%	1.55%	28.02%	2.73%	27.29%	2.90%	25.43%	4.96%
Uninsured	21.35%	4.97%	19.37%	4.74%	17.38%	4.60%	17.40%	5.11%
Non-Hispanic Black	6.44%	6.68%	6.34%	6.70%	6.34%	6.60%	6.24%	6.59%
Hispanic	33.31%	22.99%	34.00%	23.16%	34.83%	23.27%	35.29	23.40%
Median Income	$46,352.92	$10,586.02	$48,039.81	$11,225.86	$51,465.12	$12,327.48	$54,348.12	$13,140.66
High School Completion	78.93%	7.95%	79.47%	8.12%	81.74%	8.23%	81.82%	8.51%
Owner Occupied Units	81.85%	8.07%	71.17%	8.11%	71.52%	8.31%	71.97%	9.46%

Units with Quality Concerns	4.31%	2.11%	4.41%	2.03%	3.70%	2.00%	3.55%	2.00%
Population Density	108.63	318.77	112.18	330.3	116.05	342.79	119.43	351.89

Texas counties had about 3 to 5 days of poor health and poor mental health on average and 2018 had the highest number of poor health and mental health days compared to the other years included in the study. Smoking rates started at 21.75% (SD = 7.69%) in 2012 and fell to 15.6% for both 2014 and 2016 but rose again in 2018 to 18.98% (SD 2.34%). The percent of adults that got no physical activity stayed between 25-28% with relatively low variation at each time point. The uninsured rate in Texas dropped from 21.35% in 2012 to 19.37% in 2014 and to 17.4% in 2016 and 2018 the variation from the mean for each year was between 20-30% of the mean. This suggests that there was moderate difference between counties during that time period.

The percent of the population that identified as non-Hispanic Black and Hispanic stayed stable over the study period with about 6% of the population identifying as non-Hispanic Black and 33-35% of the population identifying as Hispanic. Both racial populations indicated high levels of variation between counties at each time period with standard deviations that were close to 66%-100% of the size of the mean. Median income steadily increased throughout the study period starting at about $46,000 in 2012 and ending at about $54,000 in 2018. Each year income had moderate variation between counties with standard deviations accounting for about 25% of the size of the mean. High school completion rates were relatively stable in Texas during the study period ranging from 78.93% in 2012 to 81.82% in 2018. High school completion rates also had low variation across counties with standard deviations accounting for about 10% of the mean. Homeownership rates (the percent of units occupied by owners) was at a high of 81.85%

in 2012 but dropped to 71% in 2014 and stayed at that same level for the remainder of the study period. Similar to high school completion, homeownership had low levels of variation across counties during each time period with standard deviations accounting for about 10% of the size of the mean. The percent of housing units with quality concerns stayed relatively stable between 4.31% and 3.55% and the variation between counties was high with standard deviations accounting for about 50% the size of the mean. Population density was also relatively stable across time with the mean being about 108-120 people per square mile. However, there was large variation in population density across counties with standard deviations accounting for about 3 times the size of the mean.

Bivariate Relationships

To further explore the relationship between the dependent variables and voter participation an unadjusted linear regression was used, Appendix 32 shows the t-statistic, p-values, and number of observations from these tests. Voter participation was positively associated with poor mental health days, negatively associated with physical inactivity, and negatively associated with the percent of the population that was uninsured. Voter participation was not associated with poor health days or smoking in bivariate unadjusted linear regressions. However, given the theoretical framework and justification for each of the dependent variables, it was still important to include multivariate models with each of the dependent variables in the final analysis.

Robustness Tests

To determine the most appropriate statistical test for the main multivariate models, several robustness tests were performed.

Internal Consistency

To test the internal consistency of the health variables and explore the possibility of creating a composite "health" variable, a Cronbach's Alpha test was conducted using poor mental health days, poor health days, percent smoking, percent no physical activity, and percent uninsured. To combine variables into a single composite health variable, an alpha coefficient of 0.70 or above was used as a cutoff. The alpha coefficient for this test was 0.1731 indicating that these variables are not appropriate for a combined composite score. An additional test was completed using poor mental health days, poor physical health days, and the percent smoking rate and similarly the alpha coefficient was 0.4049 indicating that a combined variable would not be appropriate. Similarly Cronbach's Alpha was used to determine the internal consistency between the control variables and the alpha coefficient using all control variables was 0.0020 indicating that a combined variable for the controls was not appropriate. Additional combinations of the control variables were tested for internal consistency including: high school completion and median income (alpha = 0.0013), homeownership and housing quality (alpha< 0.0000), median income and homeownership (alpha = 0.0003), and the percent of the population identifying as non-Hispanic Black and Hispanic (alpha = 0.3385). Each of these additional tests indicate that combined variables are not appropriate for the multivariate models in this study.

Collinearity of Independent Variables

A correlation table was created to test the collinearity between the independent variables included in the multivariate models (Appendix 33). The correlation table shows a high level of

collinearity between all of the independent variables with strong correlations between almost all of the independent variables. While collinearity may complicate findings from multivariate analysis and some suggest removing collinear variables when possible, the theoretical rationale for each independent variable discussed in the methods section requires keeping each of the variables in the final models.

Endogeneity

To ensure the proper multivariate regression model was selected, the Durbin-Wu-Hausman test was conducted for each of the multivariate models. Results from each test confirmed that fix-effects regression models were appropriate to use in all but one of the models. The model that used physical inactivity as the dependent variable indicated random effects to be more appropriate.

Heteroskedasticity

To ensure the variance of the residuals is constant across all levels of the main multivariate models, and determine if the use of weights is needed to correct for heteroskedasticity, residuals and linear values for the multivariate models were predicted and then graphed on a scatter plot. All of the multivariate models in the study showed signs of heteroskedasticity. Therefore each of the final regression models were run using weights that were inversely proportional to the variance to ensure the models' variances were homoskedastic. However, population weights are not allowed in random effects models so the model that used physical inactivity as the dependent variable employed robust standard errors as a way to control for heteroskedasticity. Appendices 47 through 56 show the unweighted and then weighted scatter plots used to visualize heteroskedasticity. Additionally, after using population weights for the

model using uninsured as the dependent variable, the model was still heteroskedastic (Appendices 55-56). These findings indicate that further statistical testing may be needed to better understand these two models.

Distribution of Standard Error

Additionally, one of the key assumptions of linear regression models is that the residual error is distributed normally. To check the distribution of error, the residuals of each model were plotted using a symmetry plot. The symmetry plots of the residuals (Appendices 57 - 61) from each of the statistically significant multivariate models (poor mental health days, poor physical health days, smoking, and uninsured rate) showed straight lines indicating that the error terms of each model were normally distributed, further confirming that linear regression is appropriate for this study.

Multivariate Regression Models

Multivariate fixed-effects regressions between voter participation, health variables, and controls further confirmed that there is an association between voting and health even when controlling for other community conditions. Each model is displayed in Table 19 and shows the slope (coefficient) and significance level, standard error, and variance inflation factor (VIF). Additionally, Table 19 includes the number of observations and groups (counties) for each model, and the coefficient of determination (R^2) which measures the proportion of the variance in the dependent variable that is explained by the independent and control variables. R^2's were included for across time in a single county (within), between counties at a single time-point (between), and overall.

Table 6. Texas Multivariate Models Of The Relationship Between Health Outcomes, Voter Participation, And Control Variables At The County Level Using County Fixed Effects Linear Regression.

	Model 1 (Poor Mental Health Days)[b]			Model 2 (Poor Physical Health Days)[c]			Model 3 (Smoking (%))[d]			Model 4 (Physical Inactivity (%))[e]			Model 5 (Uninsured (%))[f]		
Variables	Coeff.	St. Error	VIF	Coeff.	St. Error	VIF	Coeff.	St. Error	VIF	Coeff.	St. Error	VIF	Coeff.	St. Error	VIF
Voter Participation	-1.83***	0.16	285.45	-2.43***	0.21	171.56	-11.61***	1.28	102.28	-2.04	6.43	194.71	-5.32*	2.08	125.9
Lagged Dependent Variable[a]	-0.062	0.047	648.42	-0.22***	0.028	298.4	0.061	0.029	54.69	0.329*	0.133	5397.81	0.355	0.209	531.26
Uninsured (%)	-0.001	0.011	449.42	0.41***	0.009	329.44	0.15	0.08	356.68	-0.783*	0.383	1769.45			
Non-Hispanic Black (%)	0.149	0.127	118.66	0.62	0.241	36.88	-0.106	0.246	7.71	1.229	2.302	515.84	-1.419	1.707	8.2
Hispanic (%)	-0.064	2.16	5050.94	-8.03***	1.87	727.8	32.07***	8.13	884.75	-13.88	7.36	9858.4	25.87**	8.54	1248.77
Median Income	0.00001	0.00001	3337.36	-0.00001	0.00001	1008.63	0.0001	0.0001	149.44	0.0005**	0.0001	3100.26	0.00004	0.00008	640.85
High School Completion	0.006	0.011	11830.7	0.065**	0.019	5076.18	-0.064	0.119	9779.43	-0.815**	0.257	42777.11	0.102	0.106	3452.83
Owner-Occupied Units	0.001	0.009	1567.85	-0.055***	0.019	2355.25	-0.172	0.089	2551.14	0.575	0.463	17193.46	-0.004	0.143	3113.9
% Units with Quality Concerns	0.38	2.75	237.22	4.89**	1.4	28.44	23.01	21.22	69.78	36.18	23.59	444.71	-16.83	20.83	166.82
Population Density	-2.34*	1.16	7315.06	-2.69	2.42	3736.53	-28.14**	9.29	1796.95	21.76	33.27	9495.85	-9.77	7.1	164.75
Year	0.42***	0.02	11481.57	0.44***	0.034	5184.04	1.6***	0.328	13533.1	-0.855***	0.16	1323.83	-0.606*	0.241	13823.85
N Observations	515			545			525			653			653		
Groups	237			237			235			251			241		
R^2_{within}	0.9994			0.9816			0.9926			0.9187			0.9915		
$R^2_{between}$	0.2381			0.0095			0.0574			0.0015			0.2322		
$R^2_{overall}$	0.1485			0.0004			0.0424			0.0001			0.1915		

* = p<0.05; **= p< 0.01; *** = p< 0.001

a = lagged dependent variables were used to control for expected autocorrelation, or the relationship between the dependent health outcome variable and previous health outcomes. It is an expression of health 2 years prior in the model and corresponds with the dependent variable of each model.
b = The lagged dependent variable for model 1 is poor mental health days to account for the level of poor mental health days that existed prior to the contemporary relationship between voting and poor mental health days.
c = The lagged dependent variable for model 2 is poor health days to account for the level of poor health days that existed prior to the contemporary relationship between voting and poor health days.
d = The lagged dependent variable for model 3 is smoking to account for the level of smoking that existed prior to the contemporary relationship between voting and smoking.
e = The lagged dependent variable for model 5 is physical inactivity to account for the level of physical inactivity that existed prior to the contemporary relationship between voting and physical inactivity.
f = The lagged dependent variable for model 6 is uninsured adults to account for the level of uninsured adults that existed prior to the contemporary relationship between voting and uninsured adults.

Model 1 Poor Mental Health Days

County voter participation rates were associated with average poor mental health days (model 1) when all other variables were held constant. A 1% increase in county voter participation rates was associated with an average 1.83 day decrease in county poor mental health days when all other variables were held constant. Additionally, counties with higher average poor mental health days were more likely to have fewer people per square mile (coefficient = -2.34) and poor mental health was higher in later years of the study (coefficient = 0.42) when all other variables were held constant. Model 1 did a good job explaining the variation in poor mental health days across time and a modest job explaining the variation in poor mental health days between counties and overall (R^2_{within} = 0.9994; $R^2_{between}$ = 0.2381; $R^2_{overall}$ = 0.1485). This model rejects the null hypothesis that voter participation is not related to poor mental health days when all other variables are held constant, however, the model did have high levels of collinearity with VIFs ranging from 118-11,481 suggesting that additional modeling may be needed to fully explore this relationship. The multivariate model also switched directionality from the bivariate model of poor mental health days and voter participation.

Model 2 Poor Physical Health Days

County voter participation rates were associated with poor physical health days (model 2). A 1% increase in county voter participation rates were associated with an average 2.43 day decrease in poor physical health days when all other variables were held constant. Additionally, counties with higher average poor physical health days were more likely to have higher rates of adults without insurance (coefficient = 0.41), smaller Hispanic populations (coefficient = -8.03), more adults that have completed high school (coefficient = -0.065), fewer housing units occupied

by the owner (coefficient = -0.055), more housing units with quality concerns (coefficient = 4.89), and was associated with later years in the study (coefficient = -0.44) when all other variables were held constant. Model 2 did a good job of explaining the variation in poor health days across time but did a bad job explaining the variation between counties or overall (R^2_{within} = 0.9816; $R^2_{between}$ = 0.0095**;** $R^2_{overall}$ = 0.0004). This model rejects the null hypothesis that voter participation is not related to poor physical health days when all other variables are held constant, however, the model did have high levels of collinearity with VIFs ranging from 28-5,184 suggesting that additional modeling may be needed to fully explore this relationship. Further analysis should also be conducted because the bivariate model showed no relationship between voter participation and poor health days.

Model 3 Smoking

County voter participation rates were associated with the rate of adults that smoke (model 3). A 1% increase in county voter participation rates were associated with an average 11.61% decrease in adult smoking rates when all other variables were held constant. Counties with larger Hispanic populations (coefficient = 32.07), smaller population densities (coefficient = -28.14), and later years of the study (coefficient = 1.6) were associated with higher rates of adults that smoke when all other variables were held constant. Model 3 did a good job of explaining the variation in poor health days across time but did a bad job explaining the variation between counties or overall (R^2_{within} = 0.9926; $R^2_{between}$ = 0.0574**;** $R^2_{overall}$ = 0.0424). This model rejects the null hypothesis that voter participation is not related to smoking when all other variables are held constant, however, the model did have high levels of collinearity with VIFs ranging from 54-13,533 suggesting that additional modeling may be needed to fully explore this relationship.

Further analysis should also be conducted because the bivariate model showed no relationship between voter participation and adult smoking rates.

Model 4 Physical Inactivity

County voter participation rates were not associated with physical inactivity (model 4) when all other variables were held constant. However, counties with lower rates of adults that lacked insurance (coefficient = -0.783), higher median incomes (coefficient = 0.0005), lower proportion of adults that completed high school (coefficient = -0.815), and earlier years in the study period (coefficient = -0.855) were associated with higher levels of physical inactivity when controlling for all other variables in the model. Model 4 did a good job of explaining the variation in poor health days across time but did a bad job explaining the variation between counties or overall (R^2_{within} = 0.9187; $R^2_{between}$ = 0.0015**;** $R^2_{overall}$ = 0.0001). This model fails to reject the null hypothesis that voter participation is not related to physical inactivity when all other variables are held constant and the model did have high levels of collinearity with VIFs ranging from 194-9,858 suggesting that additional modeling may be needed to fully explore this relationship.

Model 5 Health Insurance Access (uninsured adults)

County voter participation rates were associated with county levels of adults that were uninsured (model 5) when all other variables were held constant. A 1% increase in county voter participation was associated with a 5.32% decrease in adults that were uninsured. Counties with larger Hispanic populations (coefficient = 25.87) had higher rates of adults without health insurance when all other variables were held constant and later years in the study were associated with decreases in the uninsured rate (coefficient = -0.606) when controlling for all other

variables. Overall, model 5 did a good job explaining variance in county levels of adults without health insurance across time and did a moderate job explaining the variance between counties and overall ($R^2_{within} = 0.9915$; $R^2_{between} = 0.2322$**;** $R^2_{overall} = 0.1915$). This model rejects the null hypothesis that the percent of uninsured adults is not related to voter participation, however, the model did have high levels of collinearity with VIFs ranging from 8-13,823 suggesting that additional modeling may be needed to fully explore this relationship.

Chapter 5: Discussion

Overall Findings

This exploratory study aimed to better understand if voter participation at the county level was associated with aggregate health outcomes using a cross-sectional time-series approach. Previous literature has shown a connection between policies that govern the electoral process, like the Voting Rights Act of 1965 (Rushovich et al., 2024) or overall state electoral policies (Schraufnagel, 2023), and health outcomes. Previous literature has primarily focused at the state level (Ibid), used historical data (Rushovich et al., 2024), and/or only used a single time period (Pabayo et al., 2022). This exploratory study expanded the current evidence base by using more recent data, using a time-series approach spanning 4 election cycles, and examining the relationship at the county level within one state political context. Taken together, these exploratory analyses show that the state context that governs county-level voter participation can have implications for population health outcomes.

While this dissertation was exploratory, both studies found that voter participation was associated with health insurance access. These findings underscore previous findings from Pabayo et al. (2021) and suggest that voter participation is an important input of community power associated with increased health insurance access. Further research should examine how voter participation and voting policies are associated with policies that aim to increase health insurance access like expanding Medicaid eligibility rules. Additionally, further studies should explore changes in specific electoral policies and their association with health insurance access using methodologies that more closely approximate a causal assertion, like a difference-in-difference design.

Conversely, both studies found that there was no relationship between voter participation and physical activity (or inactivity) in the multivariate models. Paper 2 did find a significant relationship between voter participation and physical inactivity in the bivariate models but once controls were added the relationship became insignificant. This could indicate that there are other factors that better explain the variation in physical activity levels or could be due to the relatively small amount of variation in physical activity levels across counties and time in both papers. Neither study looked at the changes in policies that would impact physical activity levels during the study period in Oregon and Texas or how voting could have shaped said policies. It is also possible that there was not enough time in the study to see changes suggested in the theoretical framework— voter participation is suggested to influence public policy decisions that then lead to changes in health outcomes. These changes may take a longer time than the study allowed and further study could explore both changes in policy that impact physical activity levels and their relationship with voter participation and electoral policies.

The studies' findings also differed in important ways. While Paper one did not show a significant relationship between voter participation and most health outcomes (chronic conditions, depression, smoking, and physical activity), Paper 2 showed a significant relationship between voter participation and most of the health outcomes (poor mental health days, poor physical health days, and adult smoking). These differences are important given the electoral policy contexts of each state. Oregon (Paper 1) was selected as a state example for this exploratory dissertation because it is an example of a state that has inclusive electoral voter policies. It is ranked as the easiest state to vote in according to the Cost of Voting Index (Schraufnagel & Pomante, 2020) and the state has automatic voter registration (National Conference of State Legislatures, 2024) and all mail elections (Multnomah County, 2020) to

name just a couple of the state policies that make it easier to vote in Oregon. This is further illustrated by the lack of variance in county-level voter participation rates. This context further supports that policies that make it easier to vote are an important context for voter participation rates, and it is possible that the lack of variance found in Paper 1 led to a lack of a statistical relationship between voter participation and health outcomes. This phenomenon is often referred to as the "ceiling effect" where data is skewed to the top of the possible spectrum. Since Oregon's voter participation rates and health outcomes were generally stable throughout the study period and between counties it may be difficult to find a statistical relationship. Texas (Paper 2) was selected as a contrasting state example because it is ranked as the hardest state to vote in (Schraufnagel & Pomante, 2020), was previously covered by the Preclearance Clause in the VRA (The Brennan Center for Justice, 2022), and there is documented evidence of electoral reforms in the state that make it harder to vote, such as limiting absentee voting, strict voter ID requirements, and bans on online voter registration (Pérez, 2021). In this state context there is a statistical relationship between voter participation and health. Taken together, these studies suggest that states should consider improving voter participation rates, by shifting policies to make elections more accessible, inclusive, and representative, to support community health improvements. However, since the papers used different health measures, this comparison should be taken with caution.

These studies focused on a single state, to help control for differences in political context that exist between states. However, several studies have used controls for state policy to look at the relationship between electoral policy, voter participation, and health outcomes. Since Paper 1 showed no relationship between voter participation and health outcomes and Paper 2 showed an almost consistent relationship between voter participation and health outcomes, further

examination of how this relationship changes based on state level differences using the entire country and consistent health measures could aid in the understanding of how voter participation in varying contexts of state policy is related to health outcomes. This county-level national research has been done to show electoral policies were associated with county-level insurance access (Pabayo et al., 2021) and county-levels of COVID case and mortality rates (Pabayo et al., 2022). However additional research could expand on this work by including a time-series approach and additional measures of population health and/or health policy.

Paper 1 Oregon

While health outcomes and health behaviors were not related to voter participation at the county level in Oregon between 2012 and 2018, voter participation was related to health insurance access. This is an important finding for health policy researchers and advocates aiming to increase health insurance access. Within the context of the Health Equity Power Framework (Friel et al., 2021), this finding suggests that voter participation is a form of community power that can inform health policies aiming to improve insurance access. This is further backed up by research showing that states with more barriers to voting are more likely to have inequities in health insurance access (Pabayo et al., 2021).

While the findings showing that counties with higher voter participation rates had lower rates of uninsured adults were promising, it is important to discuss the limitations of this study. These findings showing no relationship between voter participation and health outcomes could be due to the relatively low level of variance between counties and across time for both the independent and dependent variables. While considering the exact mechanism for the relationship between voter participation and health outcomes was not part of this study, it is

important to remember that Oregon is a leading state for voting and health policy. If all of the counties have statistically the same access to voting and health resources, there is little to measure in terms of statistical relationships.

It is also important to note that the models used in Paper 1 did not do a good job explaining the variance in the dependent variables between counties or overall. Some of the models did a modest to good job explaining the variation in the dependent variable over time, however this could be because both the independent and dependent variables seemed to be relatively stable across time. Additionally, it is important to note that there were high levels of collinearity between independent variables which skews results toward the null hypothesis. The model using the percent of adults without health insurance as the dependent variable (model 6), violated the linear regression assumption of normal distribution of error and therefore results should be used cautiously. When residual error is not distributed normally, linear regression models may become biased and produce invalid results. Therefore the results of Model 6 should be taken very cautiously as the results could be biased in either direction and further statistical modeling should further explore the relationship between voter participation and health insurance access.

It is also important to examine the health outcome variables that were used and question if they are the most appropriate measures of health outcomes or if others may have different results. Oregon BRFSS does not include general measures of mental health, like self-reported overall mental health or average poor mental health days, and so this study relied on rates of diagnosed depression which may be limited by one's ability to get a diagnosis. Diagnosed depression also does not account for other mental health issues that would be included in a more generalized measure of mental health. Similarly, chronic health conditions, while an important

health outcome, may not be a sensitive enough measure of health for the model used. Chronic conditions require a long period of intervention and treatment (Maresova, et al., 2019) and many policies aiming to reduce chronic disease prevalence focus on preventive measures. Given the theoretical framework suggests that voter participation informs health policy, it is possible that the study period did not account for the time needed to see changes in chronic disease prevalence. Exploration of the relationship between voter participation and health should further explore additional measures of health and try to incorporate different health related surveys that may have more sensitive and/or reliable results.

It is important to remember that Oregon has been a leader when it comes to innovative policies that make elections more accessible for their eligible population. Oregon has all mail elections (Multnomah County, 2020), pre-paid postage on ballots (Oregonian, 2019), and automatic voter registration programs (Oregon Secretary of State, n.d.-b). These policies make it easier for eligible voters to register and cast their ballots during elections which is reflected in the relatively high rates of voter participation that are stable across time and between counties. Similarly, during the study period Oregon expanded Medicaid eligibility (Lyons et al., 2014) which could account for the decrease in adults that were uninsured during the study period.

Paper 2 Texas

The null hypothesis, that voter participation was not related to health outcomes, was rejected in all but one of the models included in Paper 2, demonstrating the county level voter participation was associated with health outcomes, health behaviors, and health insurance access when controlling for racial demographics, county social and capital conditions, population density, time, and unmeasured county differences. The findings in Texas confirmed the findings

of previous research focused on the relationship between voter participation and health outcomes, suggesting that voter participation is associated with better health (fewer poor mental health days, fewer poor physical health days, fewer adults that reported smoking, and fewer adults that lacked health insurance) when all other variables were held constant (Nelson et al., 2019; Pabayo et al., 2022; Schraufnagel, 2023; Pacheco & LaCombe, 2022).

While the full mechanism of how voting is associated with health outcomes was not explored. It is important to remember the electoral policy context in Texas makes it harder for eligible voters to cast a ballot, especially eligible voters from marginalized communities. For example, Texas was previously covered by the Voting Rights Act Preclearance Clause due to having a history of implementing racially discriminatory election laws. Only 24 hours after the Supreme Court's Decision on Shelby v. Holder— a case brought forward by Shelby County, Texas— Texas implemented an incredibly strict voter identification policy (The Brennan Center for Justice, 2022). Given this history, it is not surprising voter participation was associated with all control variables in bivariate regressions which paired with the findings from the multivariate models further underscores the importance of promoting inclusive and representative voter participation.

Limitations

Limitations in Analytical Models

All models included in this dissertation showed a few notable limitations in their analytical approach. All models had high levels of collinearity which can skew findings toward the null hypothesis. While this dissertation focused on the association between voter

participation and health, both studies did not correct for temporality of the independent and dependent variable. Both the independent and dependent variable data was collected on overlapping timelines which makes it impossible to assert that voter participation leads to better health or vice versa. Further research should explore the use of methodologies that aim to strengthen the understanding of the temporality of this important relationship.

Limitations Related to Data Used

All health variables, besides health insurance access, came from BRFSS between 2010-2018. In 2016, BRFSS added the use of cell phone numbers to their survey methodology which limits the ability to compare data from the survey across years selected for this dissertation. Additionally, prior to 2016 BRFSS provided data with county-level estimates that were modeled from seven years of responses and changed to provided one year modeled estimates after 2016. Additionally, one key limitation of BRFSS is that reports for race or ethnicities are limited in states with largely white populations like Oregon (86.2% of the population identifies as white) (United States Census Bureau, n.d.-b).

All of the data used in this dissertation is aggregated at the county level, and it is therefore impossible to understand how individual behavior and health outcomes are related to the model. Similarly, none of the data used was disaggregated by measures shown to be important to both health and voter participation such as race, income, education. Future research should explore how differences in voter participation of specific groups are also associated with health differences within those groups. For example, future studies could explore if disparities in voter participation for non-Hispanic Black people are associated with health disparities of non-Hispanic Black people.

Theoretical Limitations

This dissertation project had a few key theoretical limitations that will be important to explore in future research. This study did not include any measurement of political systems or electoral policy which makes it impossible to understand how voter participation is or is not influencing health policy, and if those health policies are truly improving health outcomes. In fact, Schraufnagle (2023), Pabayo et. al (2022), and Pacheco & LaCombe (2022) used a measures of voting policy to understand how voter access is related to health outcomes. Additional analysis should focus on the relationship between voter participation and policy outcomes and/or the relationship between health outcomes and health related ballot initiatives.

The theoretical pathway for the relationship between voting and health in the Health Equity Power Framework (Friel et al., 2021) suggest that voter participation as a measure of power would be associated with health outcomes because it allows for governing bodies to be representative and/or responsive to community needs. However, this study did not have a focus on policy change or policy impact. Instead this dissertation focused on the input of voter participation as a measure of community power on the ultimate outcome of health. Future work should look at the relationship between voter participation and the implementation of health policies that support health and racial equity. Additionally, future research should look at the relationship between policies that moderate community power, such as electoral policies, and their relationship to health equity.

This study did not include additional measures of community power, like legislative representation, community inputs into policy decisions, or the representativeness of legislative districts. In fact, this dissertation project focused on the relationship at the county level, but a more appropriate geographic measure could be legislative districts or precincts. Since many

articles focused on the relationship between voter participation and health have focused on additional institutional measures of power such as work mentioned from Pacheco and LaCombe (2022). These institutional measures and additional alignment with geographies related to electoral power may be critical to further understanding how voter participation is related to health outcomes. Future research should look more closely at the relationship between additional measures of power, representation, and health outcomes.

Contributions to Current Literature

These exploratory findings advance the understanding of the relationship between voting and health in a few ways and informs further analysis. Many previous studies have looked primarily at either cross sectional data from one time period, or individual level data. Additionally studies have focused on one or targeted health outcomes. This dissertation expanded the current knowledge and understanding by using a pooled cross-sectional time-series approach to explore the relationship between voter participation and health. This study also examined multiple health outcomes and behaviors which allowed for a broader understanding of how different health outcomes are related to voter participation. Each study included in this dissertation focused on a single state as contrasting examples of state electoral policy climates which naturally controlled for state-level policy differences that occur in nationally focused studies. This dissertation aided in the understanding of how voter participation is associated with various health outcomes at the county-level.

Additionally, these studies have significant policy implications as democracy reform continues to be a hotly contested issue at the state and federal level. This dissertation adds further research showing that voter participation is connected to health outcomes and health insurance

access and underscores the importance of a robust participatory democracy for the health and wellbeing of communities.

Conclusion

The relationship between voter participation and health continues to be important to understanding the relationship between community power and health. This exploratory dissertation showed that there is an association between voter participation and health at the county level in Texas and showed an association between voter participation and health insurance access in both Oregon and Texas. Future research should explore additional methodologies to limit measurement and modeling limitations such as collinearity, temporality, and distribution of error. Additionally, future research should explore using other health related survey data that can be disaggregated by race, income, education and important measures of social capital and conditions. While further study is necessary, voter participation remains an important upstream factor for health.

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Appendices

Appendix 1. Hypothesis Table

Independent Variable	IV Direction	Dependent Variable	DV Direction	Race Variable	Direction	Race Variable	Direction	Income	Direction	Education	Direction	Housing Tenure	Direction	Housing Quality Issues	Direction
Voter Participation	Higher	Chronic Health Conditions	Lower	non-Hispanic Black	Lower	Hispanic	Lower	Median Income	Higher	HS Degree	Higher	Home-owners	Higher	Lacking facilities	Lower
Voter Participation	Higher	Mental Health (depression and poor mental health days)	Lower	non-Hispanic Black	Lower	Hispanic	Lower	Median Income	Higher	HS Degree	Higher	Home-owners	Higher	Lacking facilities	Lower
Voter Participation	Higher	Self-rated health (poor health days) (TX)	Lower	non-Hispanic Black	Lower	Hispanic	Lower	Median Income	Higher	HS Degree	Higher	Home-owners	Higher	Lacking facilities	Lower
Voter Participation	Higher	Self-rated health (good or better health) (OR)	Higher	non-Hispanic Black	Lower	Hispanic	Lower	Median Income	Higher	HS Degree	Higher	Home-owners	Higher	Lacking facilities	Lower
Voter Participation	Higher	Smoking	Lower	non-Hispanic Black	Lower	Hispanic	Lower	Median Income	Higher	HS Degree	Higher	Home-owners	Higher	Lacking facilities	Lower
Voter Participation	Higher	Physical activity (get CDC recommended) (OR)	Higher	non-Hispanic Black	Lower	Hispanic	Lower	Median Income	Higher	HS Degree	Higher	Home-owners	Higher	Lacking facilities	Lower
Voter Participation	Higher	Physical activity (no physical activity)(TX)	Lower	non-Hispanic Black	Lower	Hispanic	Lower	Median Income	Higher	HS Degree	Higher	Home-owners	Higher	Lacking facilities	Lower
Voter Participation	Higher	Uninsured	Lower	non-Hispanic Black	Lower	Hispanic	Lower	Median Income	Higher	HS Degree	Higher	Home-owners	Higher	Lacking facilities	Lower

Appendix 2. Bivariate Unadjusted Linear Regressions Between Voter Participation and Dependent Variables in Oregon

Dependent Variables	t	p	N
Chronic Health Conditions	-1.31	0.191	130
Depression	-1.17	0.245	129
Good Health	5.8***	<0.001	130
Smoking Rate	-2.71**	0.008	129
Physical Activity	1.01	0.314	113
Uninsured	-3.49***	0.00	144

* = p<0.05;

**= p< 0.01;

*** = p< 0.001

Appendix 3. Correlation Table of Independent Variables in Oregon

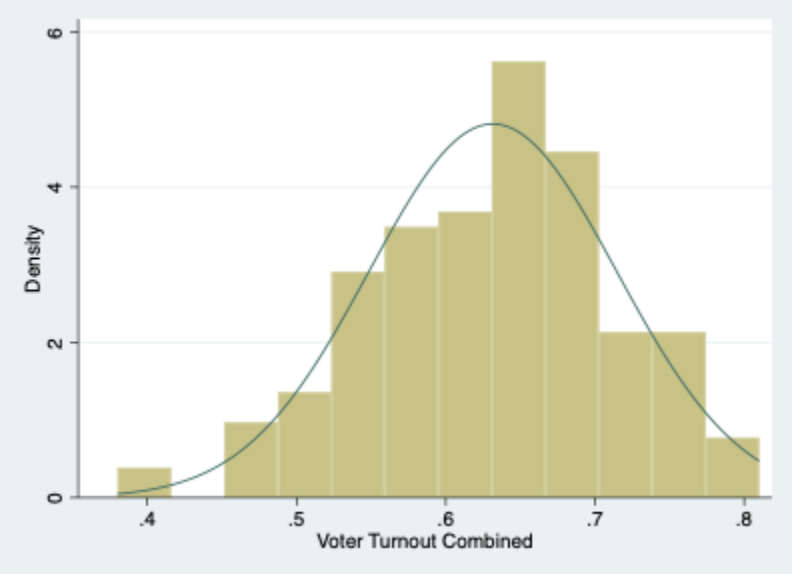
Variable r p	Voter Participation	Uninsured	% Black	% Hispanic	Median Income	High School Completion	Home-ownership	Housing Quality	Population Density	Year
Voter Participation	1									
Uninsured (%)	-0.2814***	1								
Non-Hispanic Black (%)	-0.1009	-0.156	1							
Hispanic (%)	-0.3767***	0.2409**	0.2162*	1						
Median Income	0.2229**	-0.2674**	0.3682***	0.3385***	1					
High School Completion	0.4304***	-0.3852***	0.1467	-0.6985***	0.1597	1				
Owner-Occupied Units	0.2127*	-0.1503	-0.5243***	-0.3251***	-0.0847	-0.0005	1			
% Units with Quality Concerns	-0.1793*	0.1285	-0.0794	-0.1385	-0.4544***	-0.1645	-0.1518	1		
Population Density	-0.0324	-0.0885	0.5542***	0.3299***	0.6780***	0.1866*	-0.4408	-0.2620**	1	1
Year	0.158	-0.4682***	0.0672	0.0794	0.4380***	0.1473	0.1791*	-0.2821***	0.0087	1

* = p<0.05

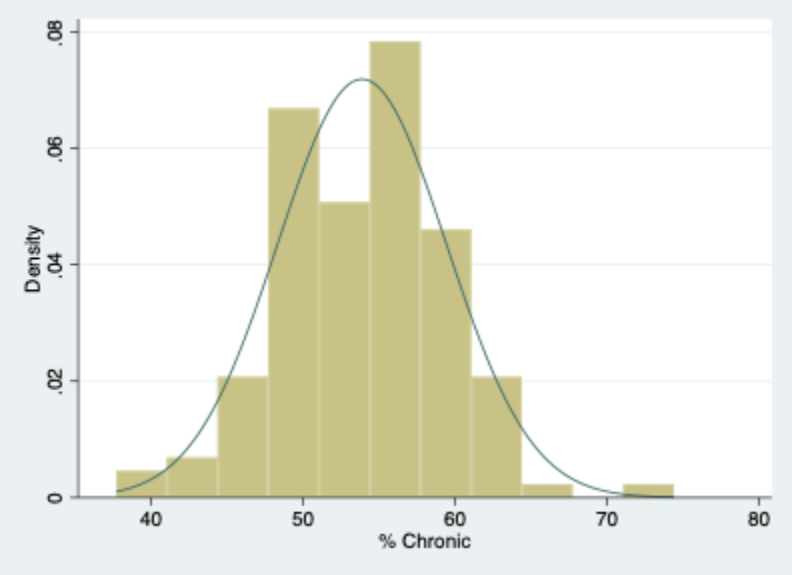
**= p< 0.01

*** = p< 0.001

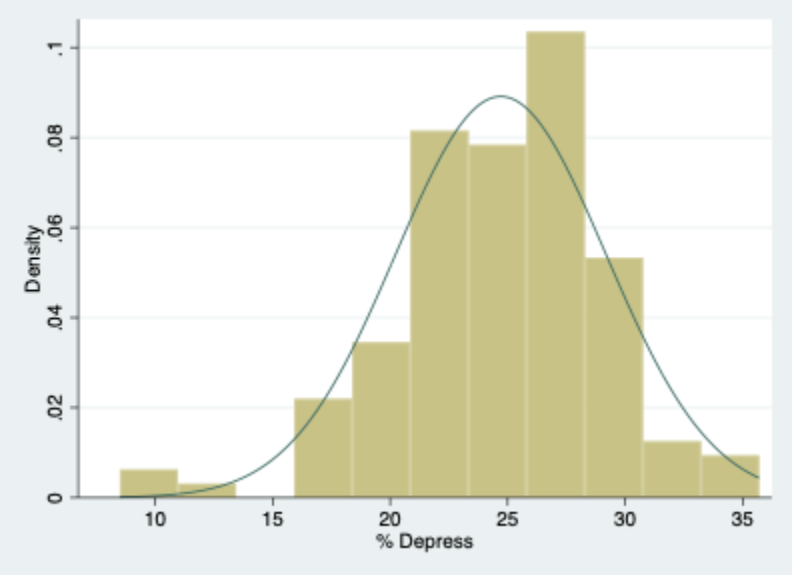
Appendix 4. Distribution Of Voter Participation in Oregon



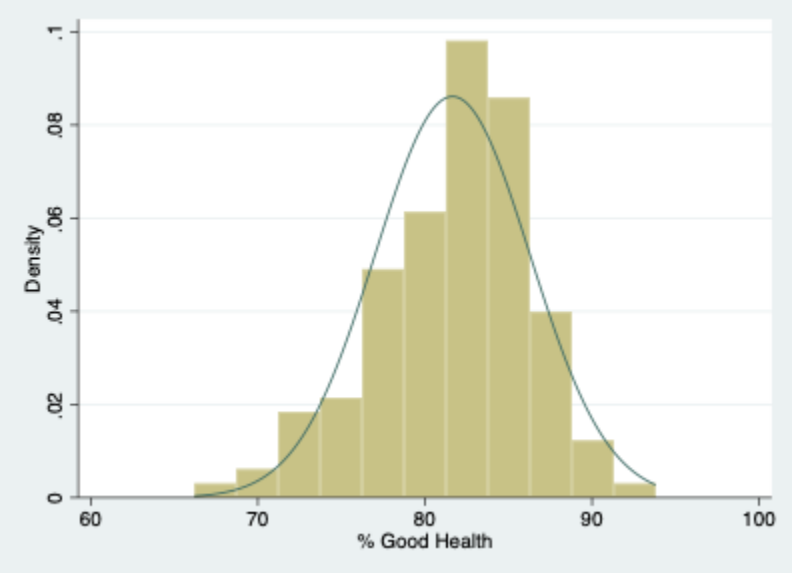
Appendix 5. Distribution of Chronic Conditions *in Oregon*



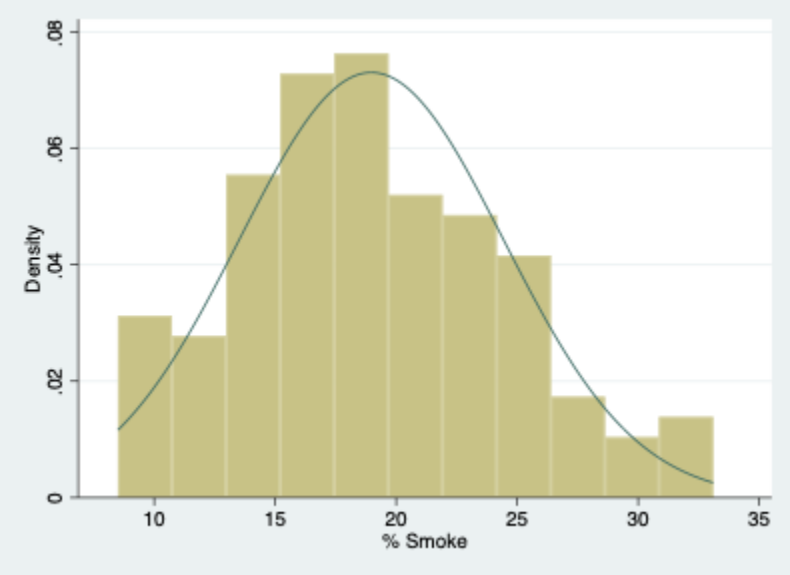
Appendix 6. Distribution Of Depression in Oregon



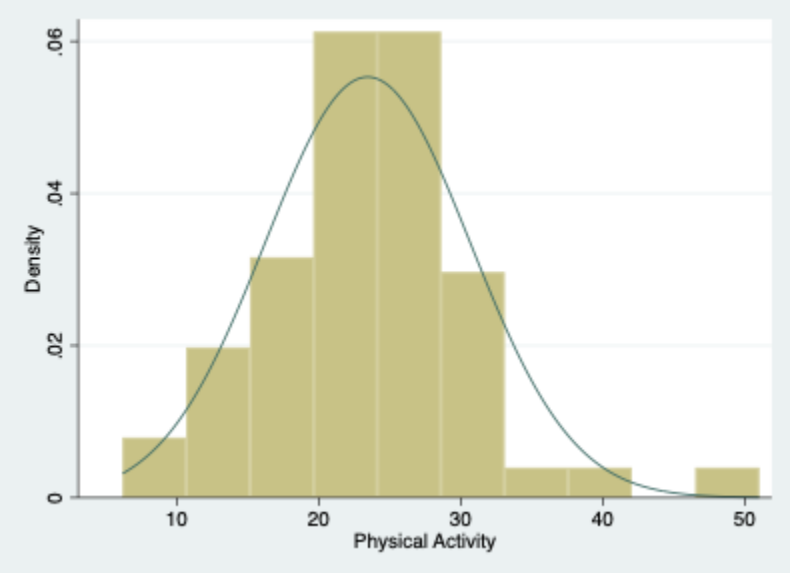
Appendix 7. Distribution Of Good Health in Oregon



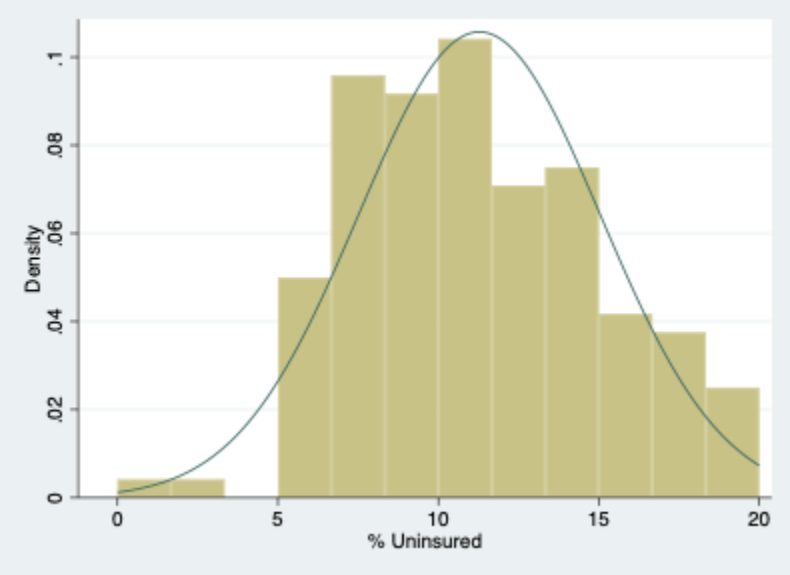
Appendix 8. Distribution Of Adults That Smoke in Oregon



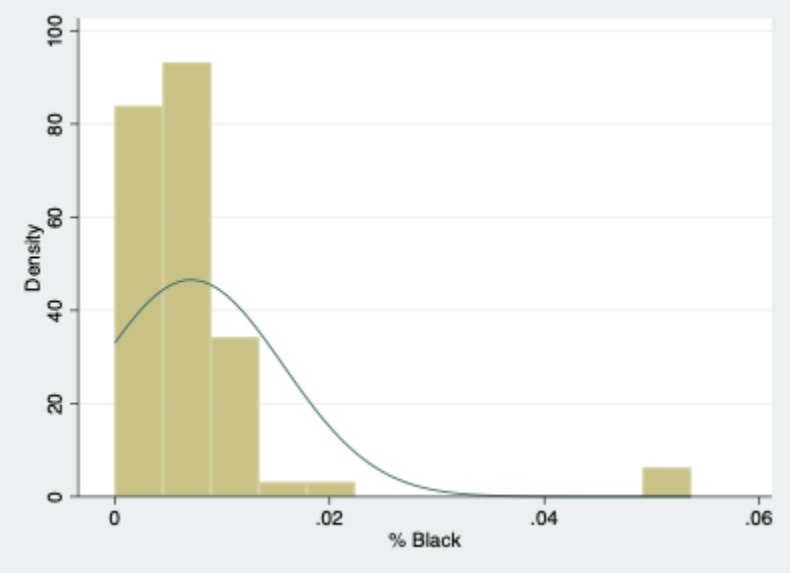
Appendix 9. Distribution Of Physical Activity in Oregon



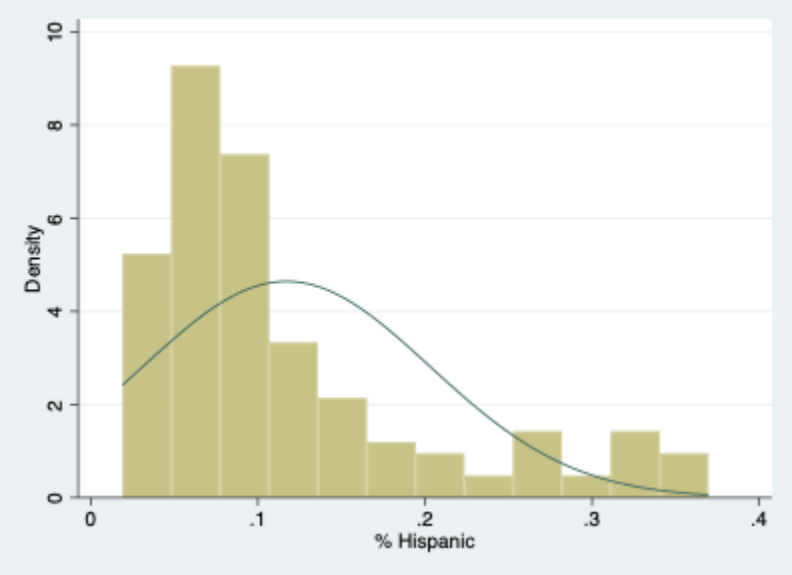
Appendix 10. Distribution Of Uninsured in Oregon



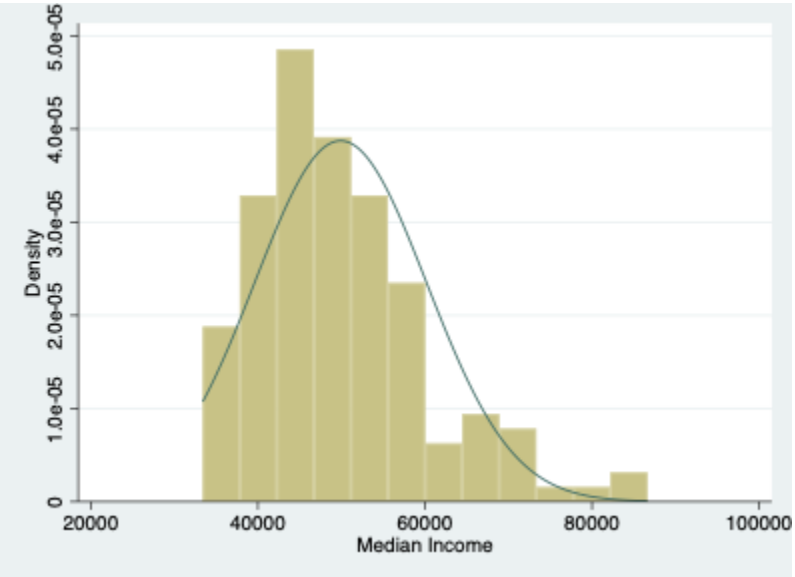
Appendix 11. Distribution Of Percent Of Population That Identifies As Non-Hispanic Black in Oregon



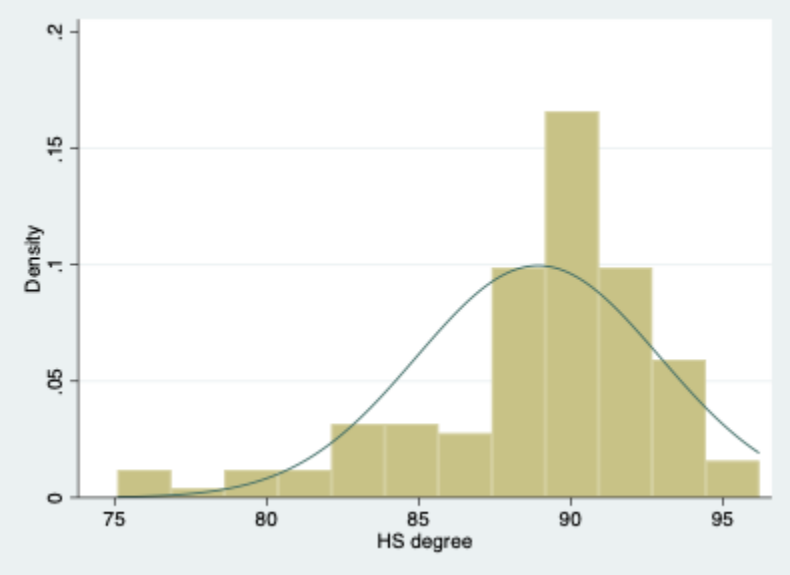
Appendix 12. Distribution Of Percent Of Population That Identifies As Hispanic in Oregon



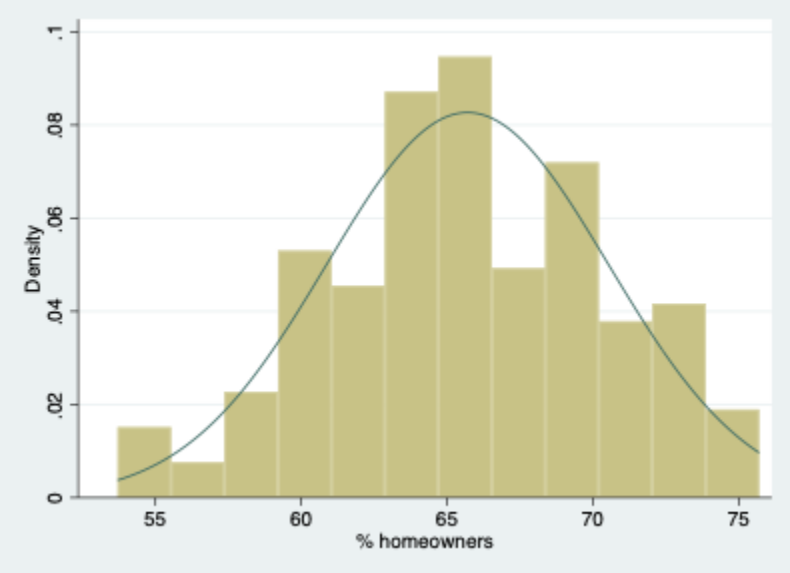
Appendix 13. Distribution Of Median Income in Oregon



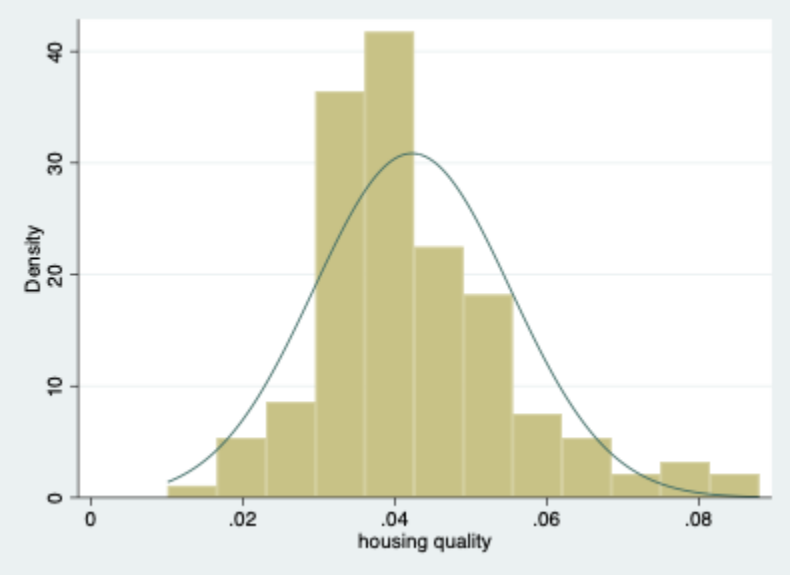
Appendix 14. Distribution Of Percent Of High School Completion in Oregon



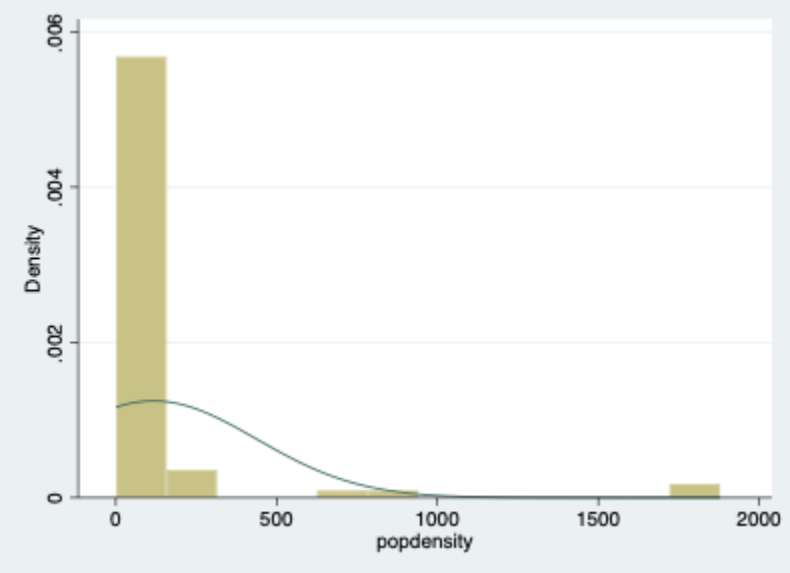
Appendix 15. Distribution Of Percent Of Housing Units Occupied By Owners in Oregon



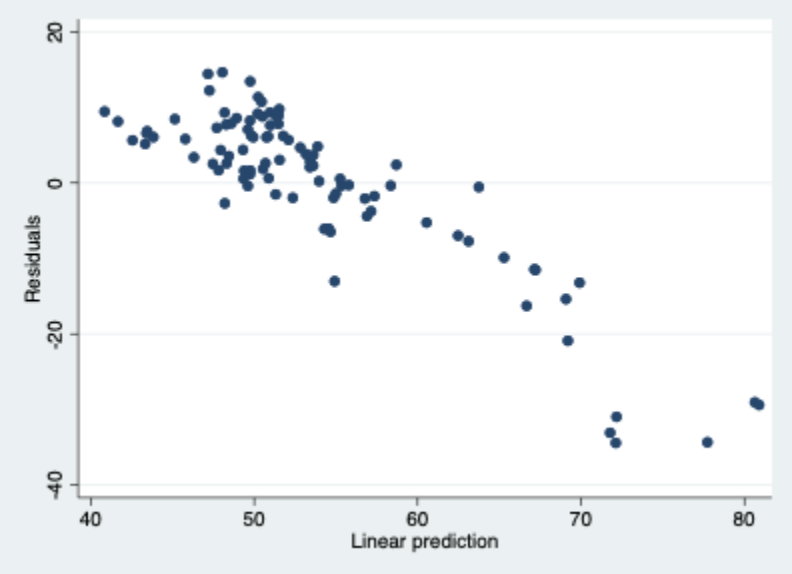
Appendix 16. Distribution Of Percent Of Housing Units With Quality Concerns in Oregon



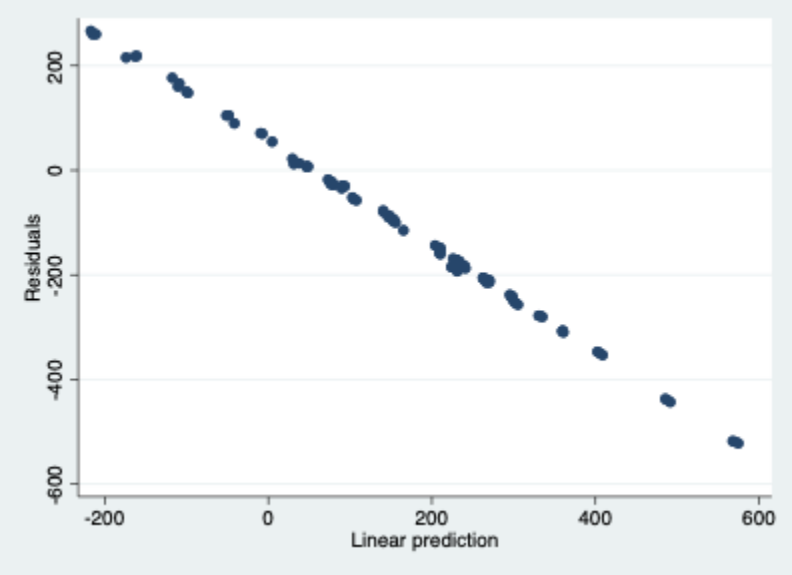
Appendix 17. Distribution Of Population Density in Oregon



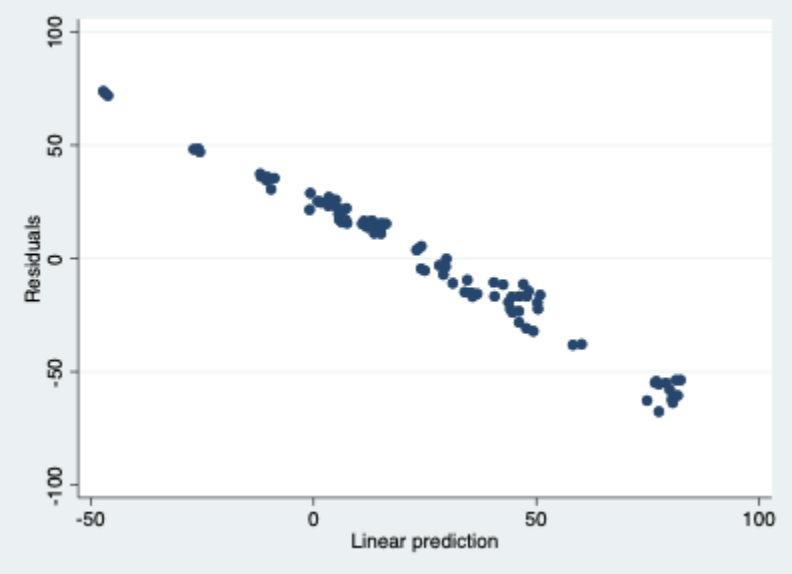
Appendix 18. Unweighted Test For Heteroskedasticity For Model Using Chronic Conditions As Dependent Variable in Oregon



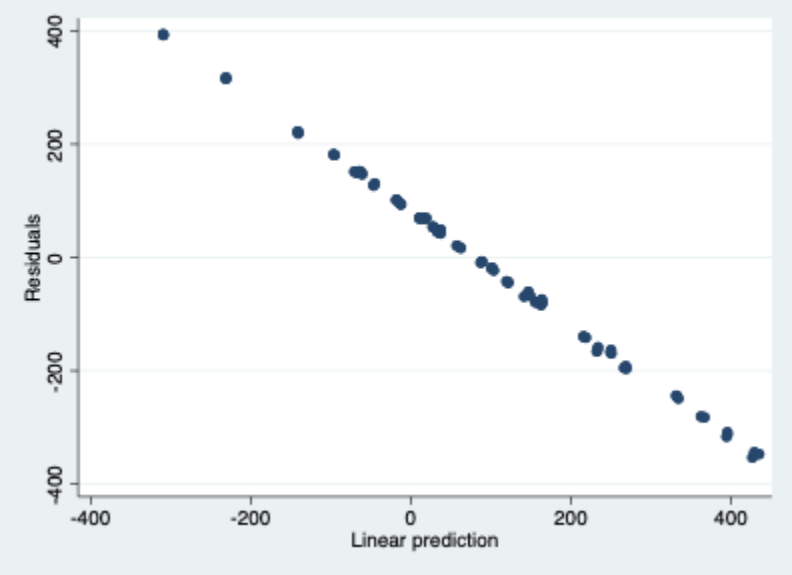
Appendix 19. Weighted Test For Heteroskedasticity For Model Using Chronic Conditions As Dependent Variable in Oregon



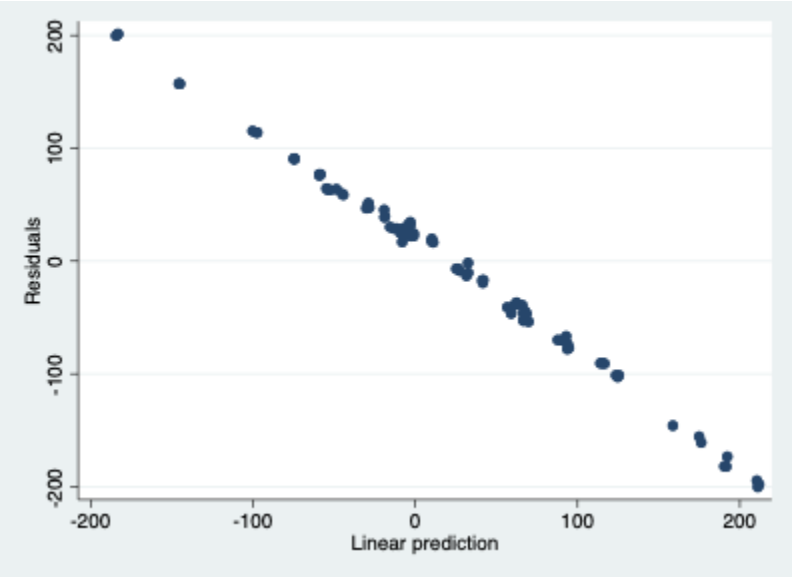
Appendix 20. Unweighted Test For Heteroskedasticity For Model Using Depression As Dependent Variable in Oregon



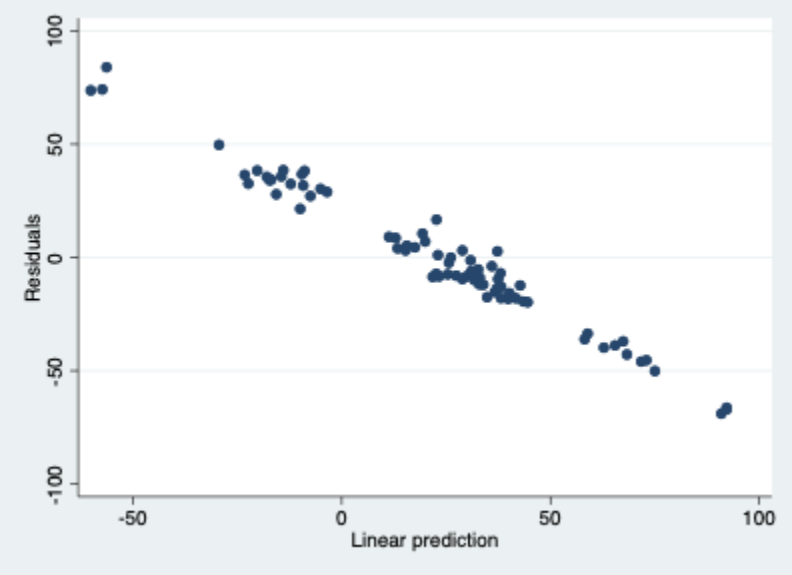
Appendix 21. Unweighted Test For Heteroskedasticity For Model Using Good Health As Dependent Variable in Oregon



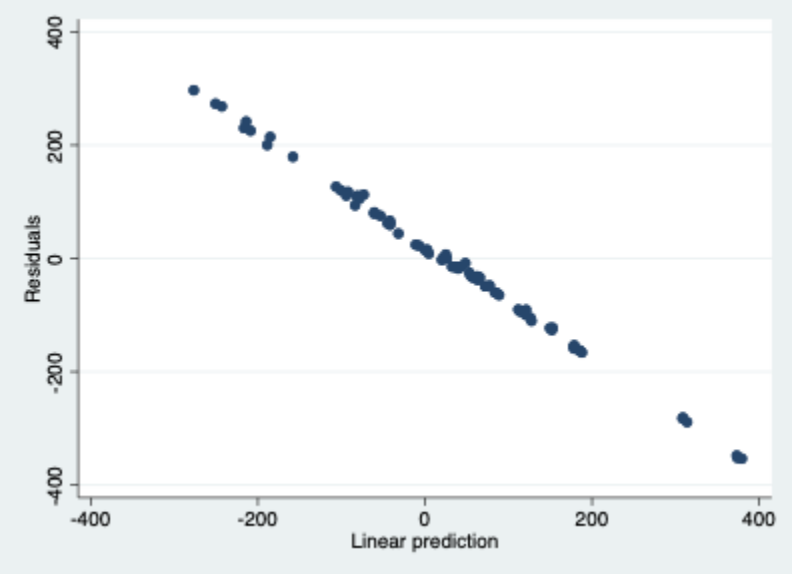
Appendix 22. Unweighted Test For Heteroskedasticity For Model Using Smoking As Dependent Variable in Oregon



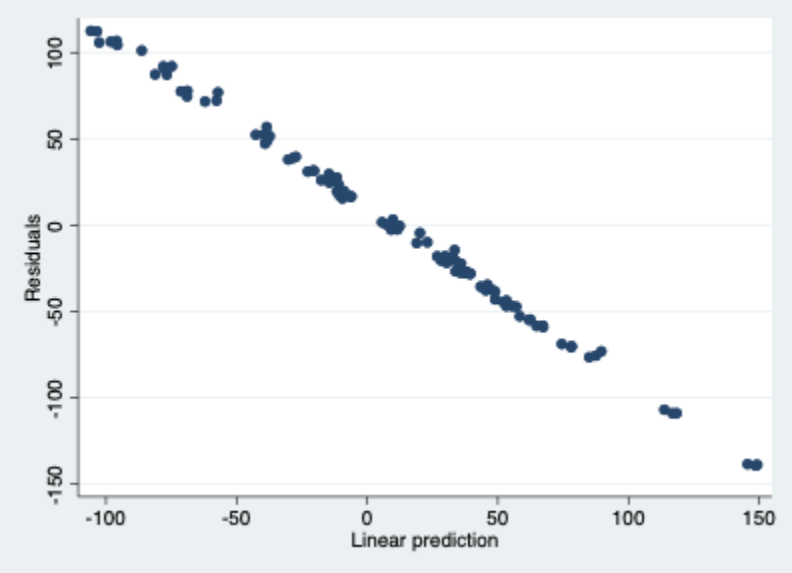
Appendix 23. Unweighted Test For Heteroskedasticity For Model Using Physical Activity As Dependent Variable in Oregon



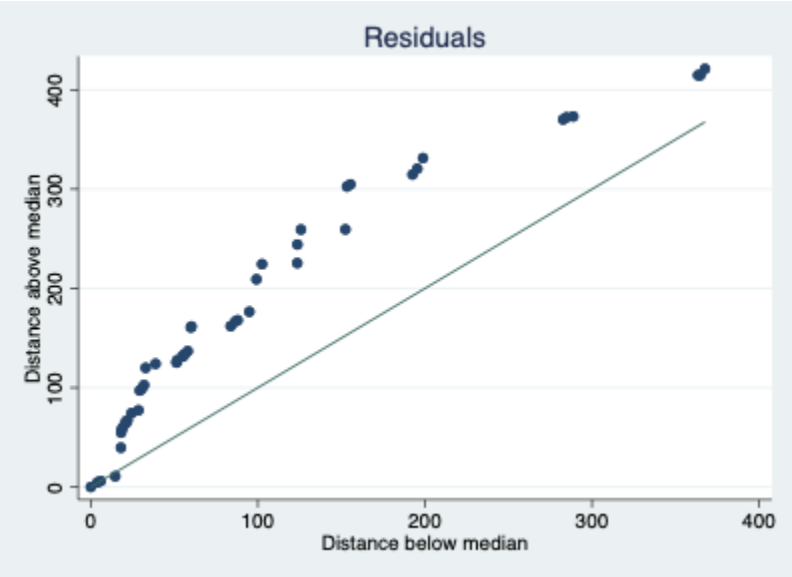
Appendix 24. Weighted Test For Heteroskedasticity For Model Using Physical Activity As Dependent Variable in Oregon



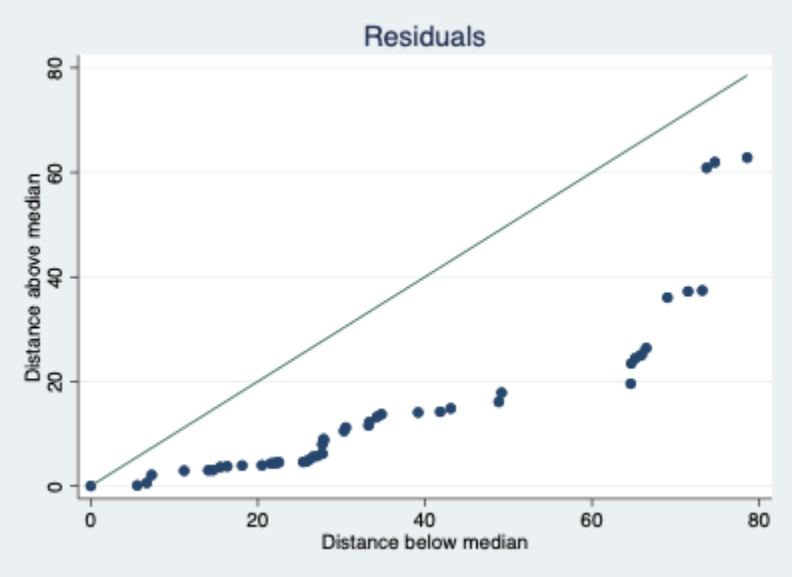
Appendix 25. Unweighted Test For Heteroskedasticity For Model Using Uninsured Rate As Dependent Variable in Oregon



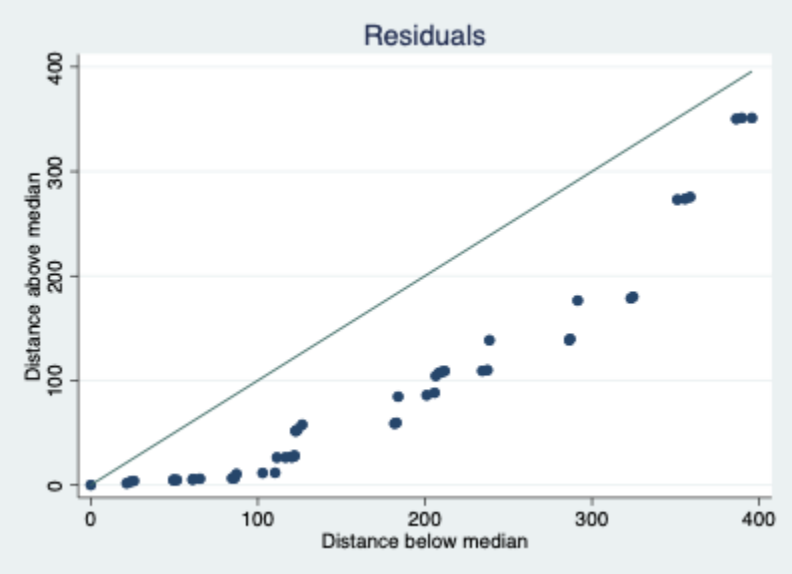
Appendix 26. Distribution Of Error For Model Using Chronic Conditions as Dependent Variable in Oregon



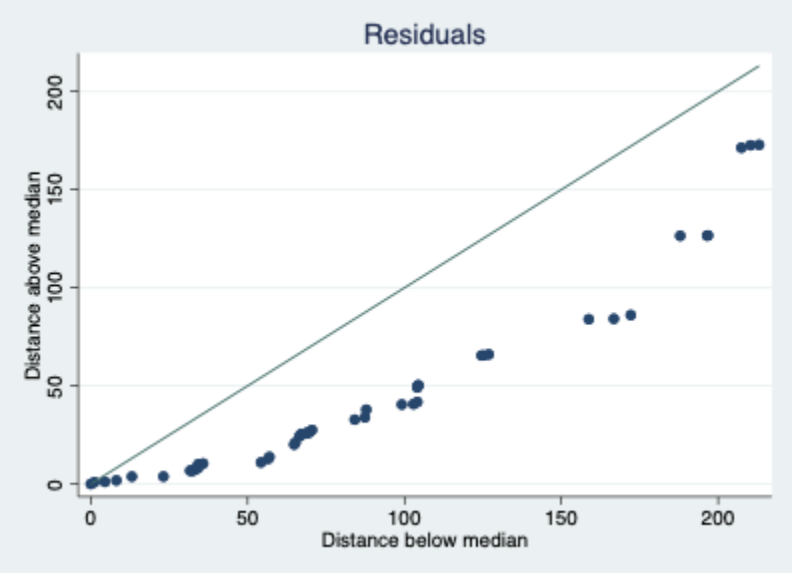
Appendix 27. Distribution Of Error For Model Using Depression as Dependent Variable in Oregon



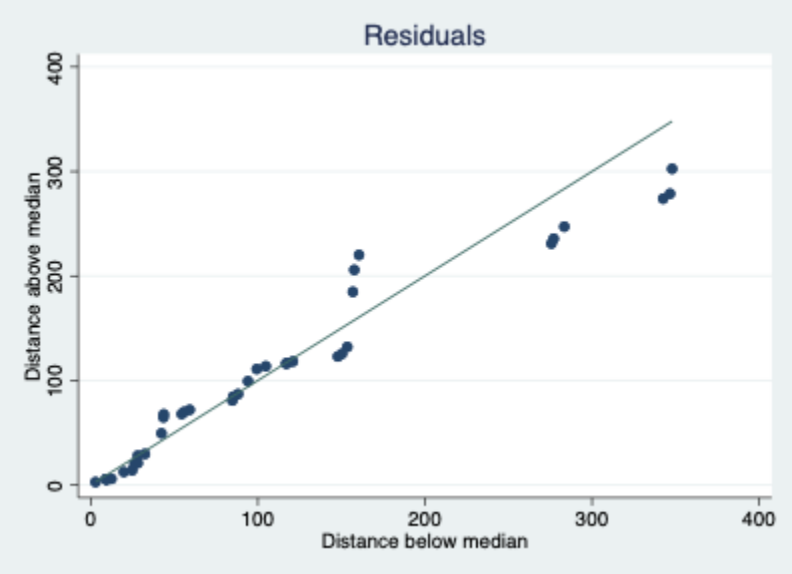
Appendix 28. Distribution Of Error For Model Using Good Health as Dependent Variable in Oregon



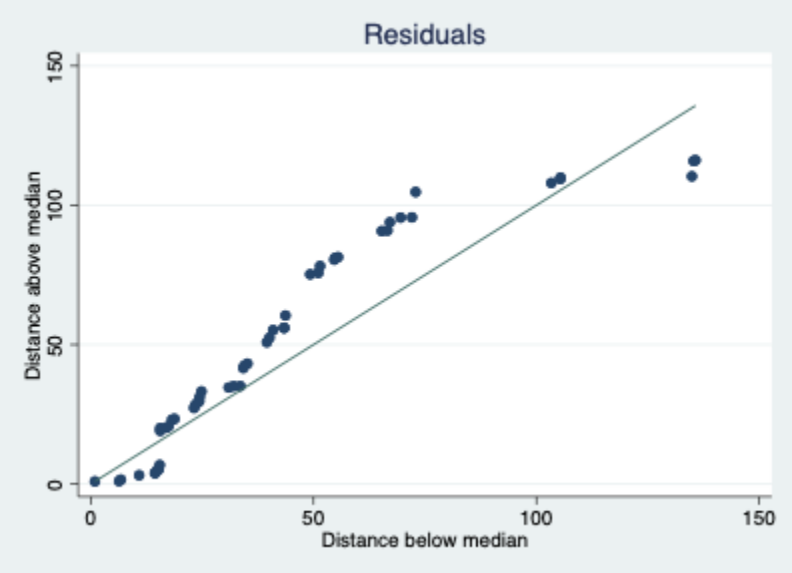
Appendix 29. Distribution Of Error For Model Using Percent Of Smoking as Dependent Variable in Oregon



Appendix 30. Distribution Of Error For Model Using Physical Activity as Dependent Variable in Oregon



Appendix 31. Distribution of Error for Model Using Percent of Population That Was Uninsured as Dependent Variable in Oregon



Appendix 32. Bivariate relationship between voter participation and health variables in Texas

Dependent Variables	t	p	N
Poor Mental Health Days	4.87***	<0.001	782
Poor Physical Health Days	-1.52	0.128	814
Smoking Rate	-0.28	0.776	789
No Physical Activity	-2.86**	0.004	941
Uninsured	-5.36***	<0.001	941

* = p<0.05;

**= p< 0.01;

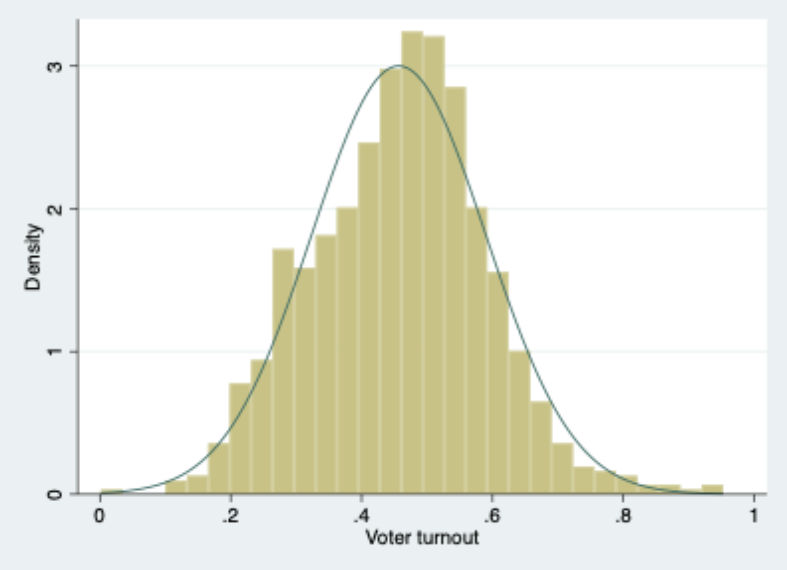
*** = p< 0.001

Appendix 33. Correlation Table of Independent Variables in Texas

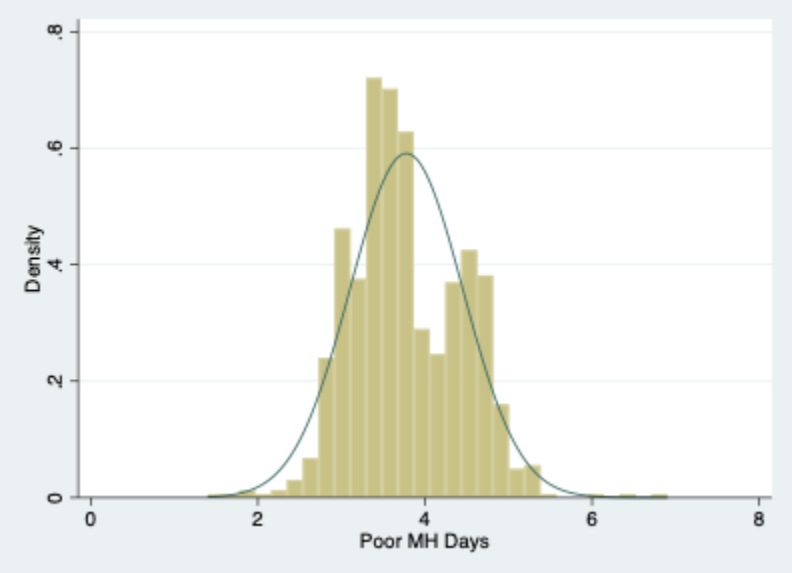
Variable r p	Voter Participation	Uninsured	% Black	% Hispanic	Median Income	High School Completion	Homeownership	Housing Quality	Population Density	Year
Voter Participation	1									
Uninsured (%)	-0.1722***	1								
Non-Hispanic Black (%)	-0.1648***	-0.3042***	1							
Hispanic (%)	-0.1958***	0.4363***	-0.3505***	1						
Median Income	0.2287***	-0.4998***	0.0935**	-0.1231***	1					
High School Completion	0.2590***	-0.6722***	0.2863***	-0.6610***	0.4964***	1				
Owner-Occupied Units	0.1340***	-0.1355***	-0.1781***	-0.3077***	0.0983**	0.1678***	1			
% Units with Quality Concerns	-0.2104***	0.2057***	-0.0508	0.1235***	-0.2672***	-0.2148***	0.0039	1		
Population Density	-0.2261***	-0.1544***	0.4485***	-0.1037***	0.3361***	0.2902***	-0.1501***	0.0016	1	
Year	0.0543	-0.3022***	0.0011	0.0467	0.2504***	0.1475***	0.0094	-0.1617***	0.0053	1

* = p<0.05;
**= p< 0.01;
*** = p< 0.001

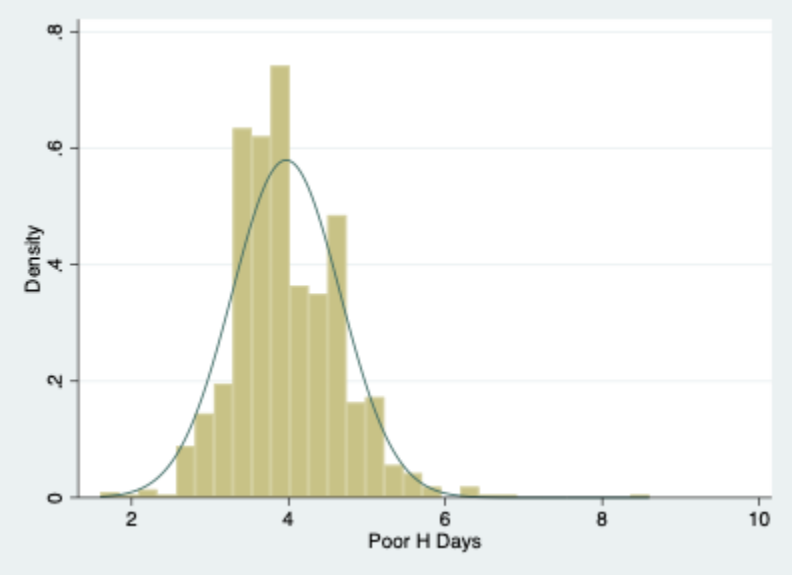
Appendix 34. Distribution Of Voter Participation in Texas



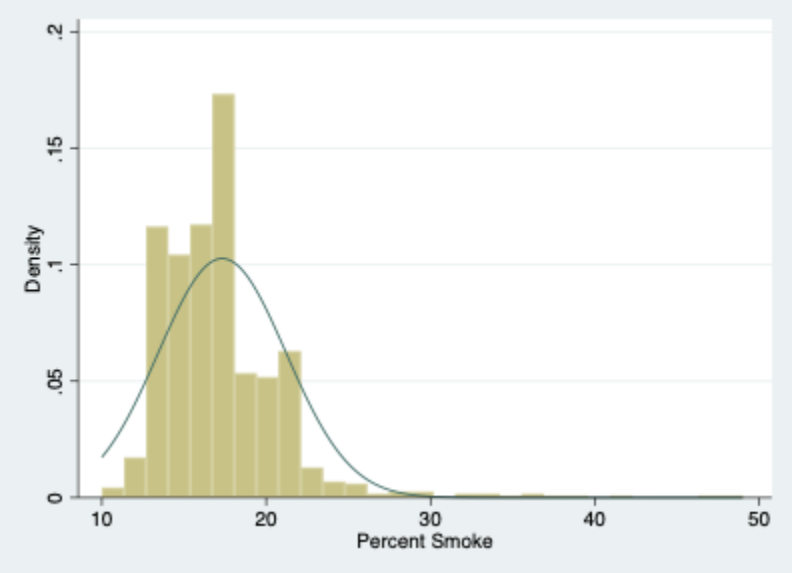
Appendix 35. Distribution Of Poor Mental Health Days in Texas



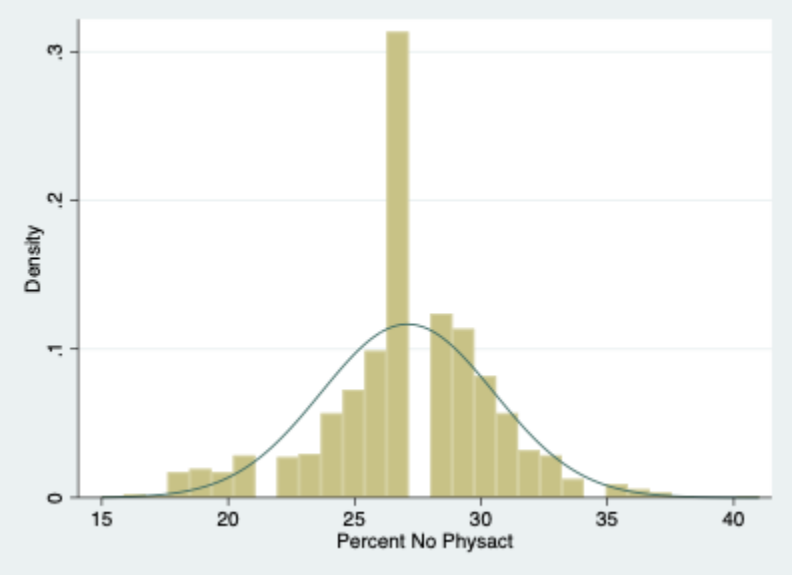
Appendix 36. Distribution Of Poor Physical Health Days in Texas



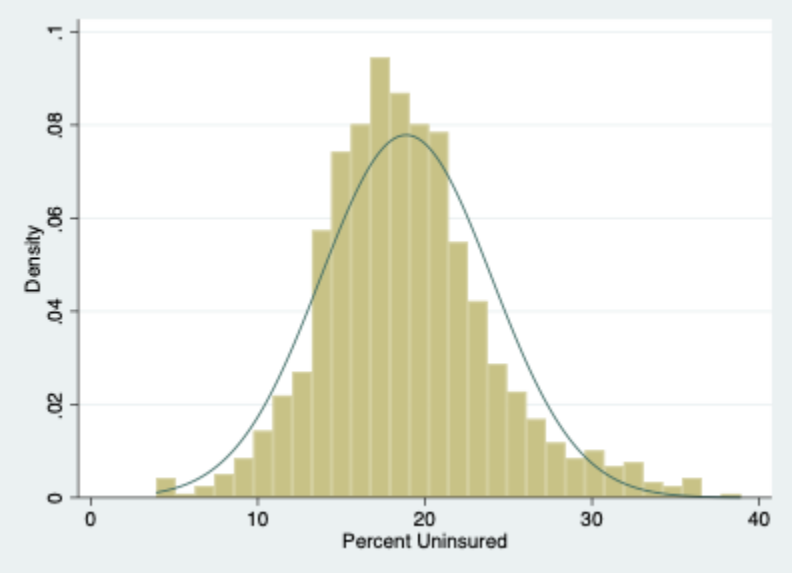
Appendix 37. Distribution Of Adults That Smoke in Texas



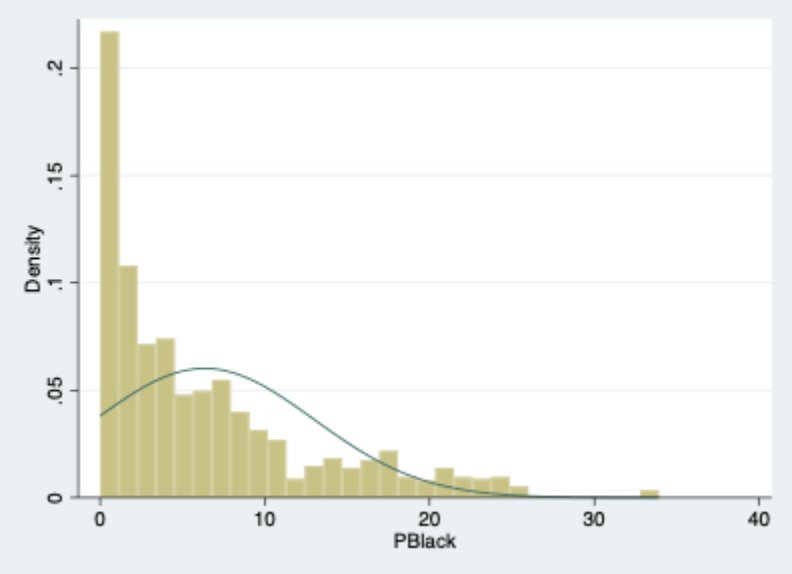
Appendix 38. Distribution Of Physical Inactivity in Texas



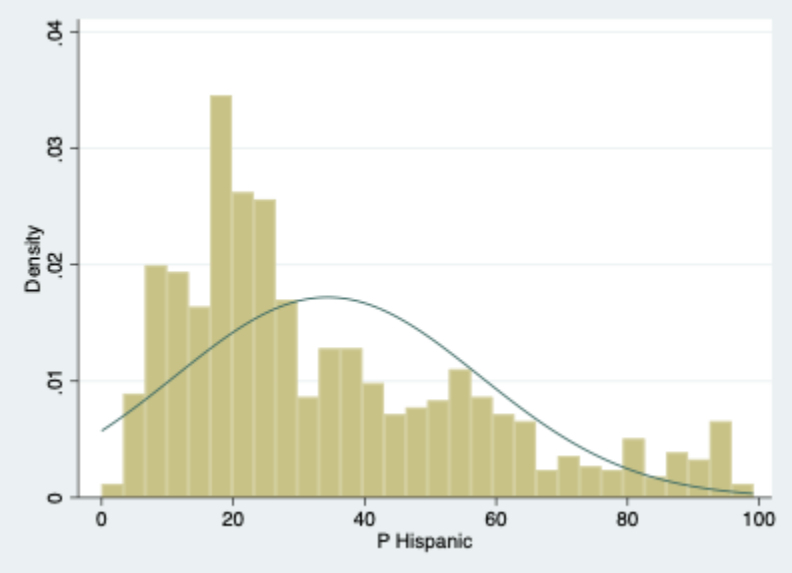
Appendix 39. Distribution Of Uninsured in Texas



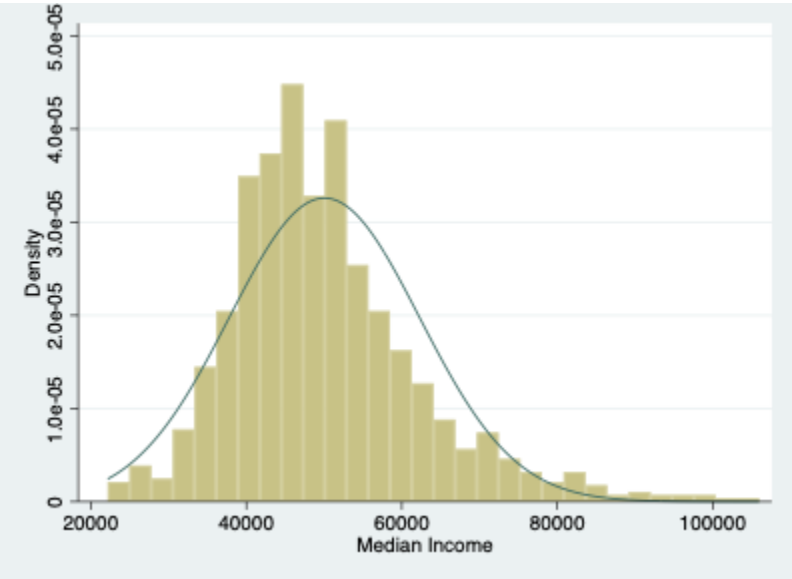
Appendix 40. Distribution Of Percent Of Population That Identifies As Non-Hispanic Black in Texas



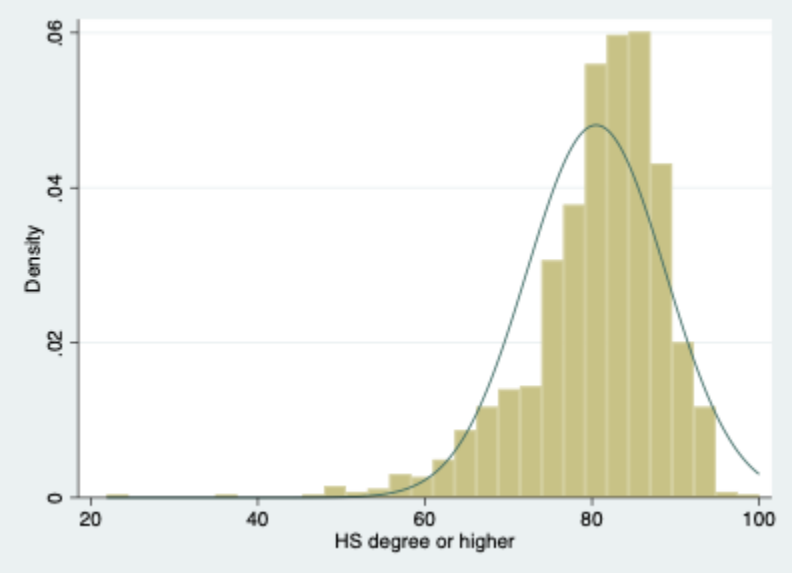
Appendix 41. Distribution Of Percent Of Population That Identifies As Hispanic in Texas



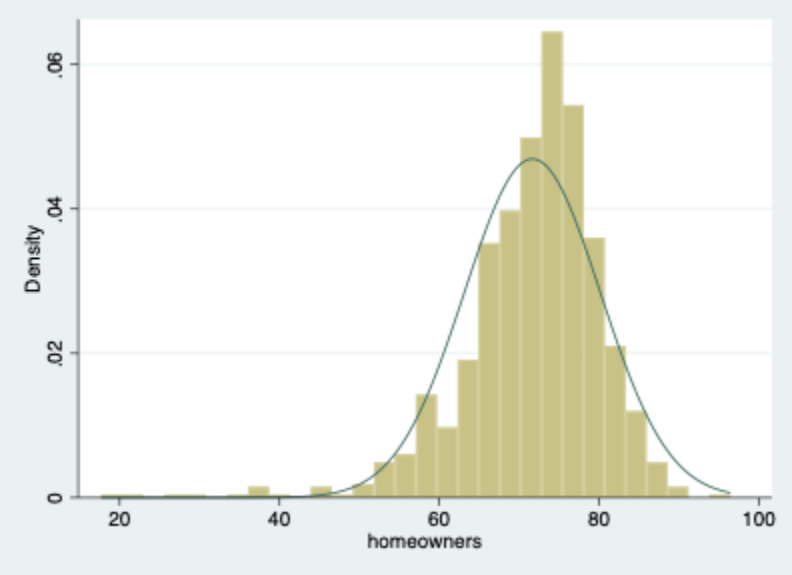
Appendix 42. Distribution Of Median Income in Texas



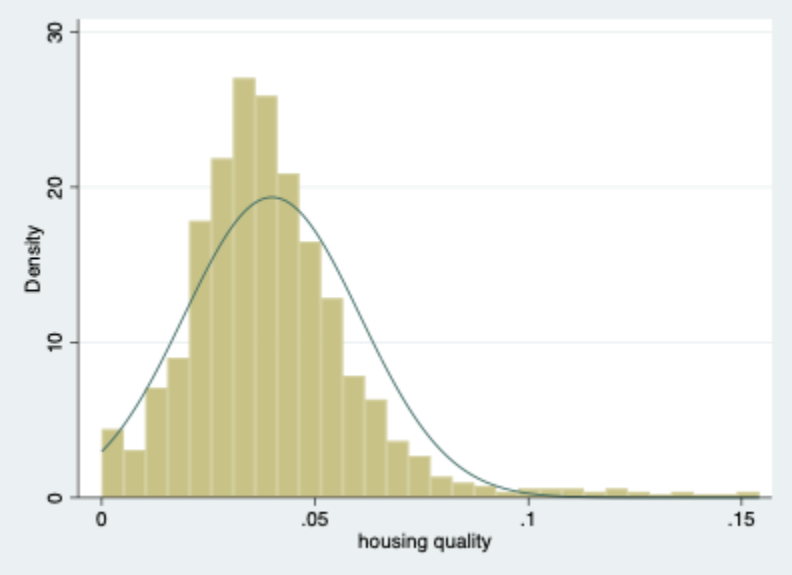
Appendix 43. Distribution Of Percent Of High School Completion in Texas



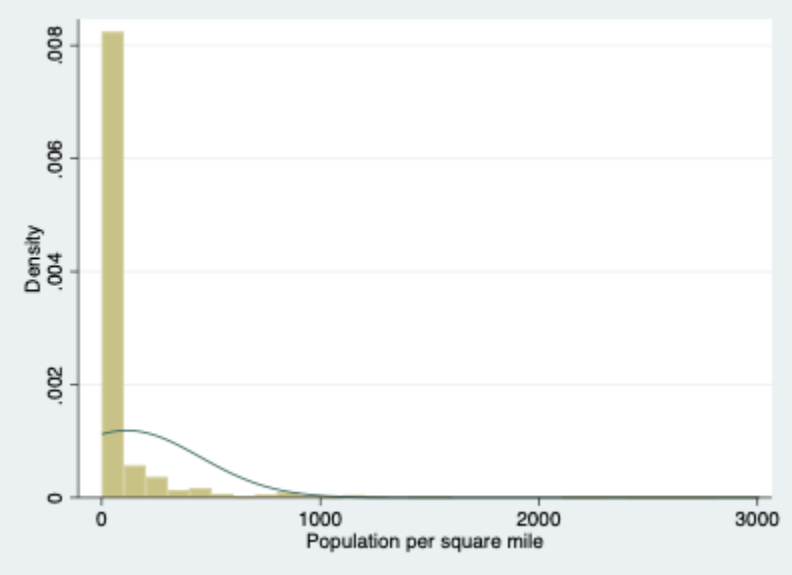
Appendix 44. Distribution Of Percent Of Housing Units Occupied By Owners in Texas



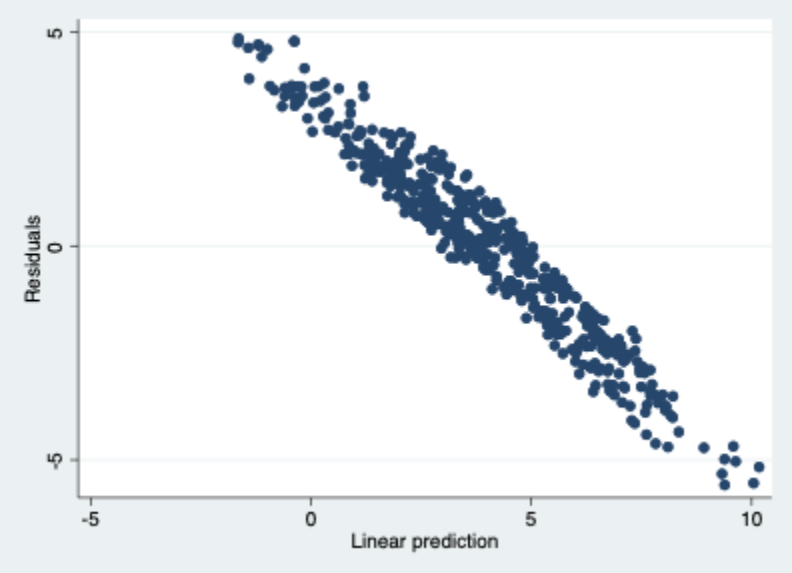
Appendix 45. Distribution Of Percent Of Housing Units With Quality Concerns in Texas



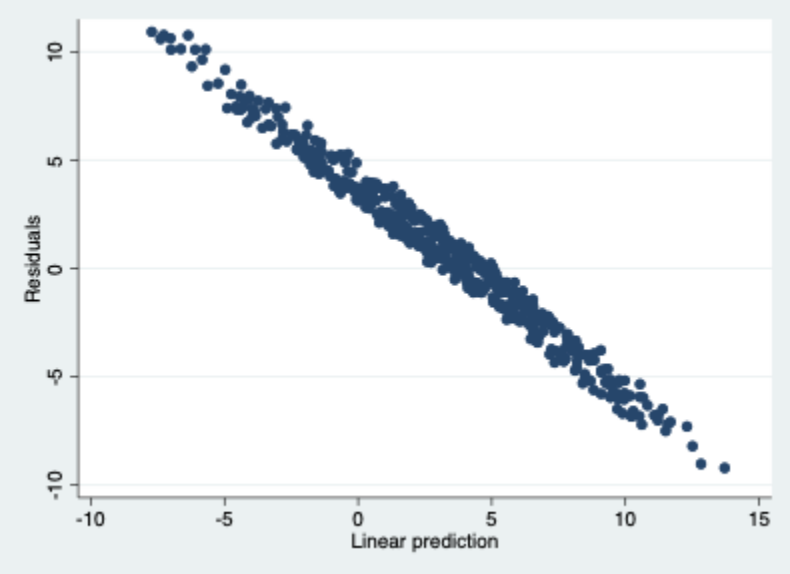
Appendix 46. Distribution Of Population Density in Texas



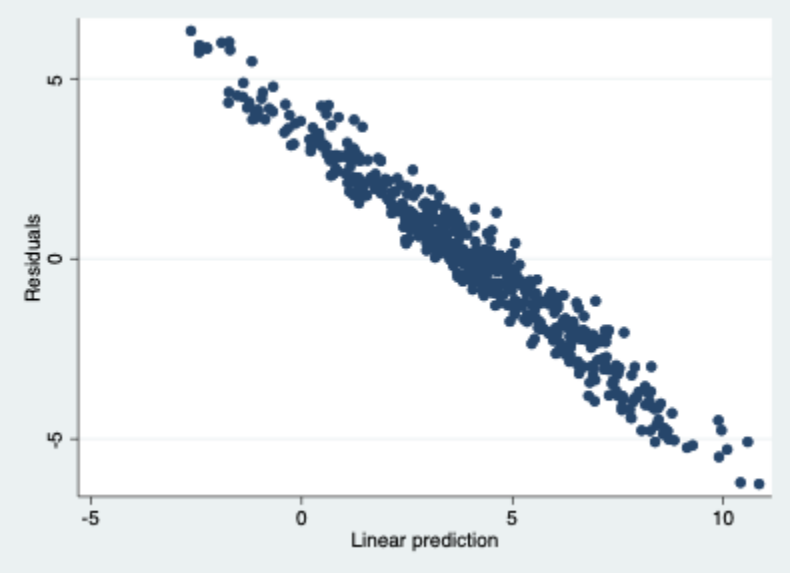
Appendix 47. Unweighted Test For Heteroskedasticity For Model Using Poor Mental Health Days As Dependent Variable in Texas



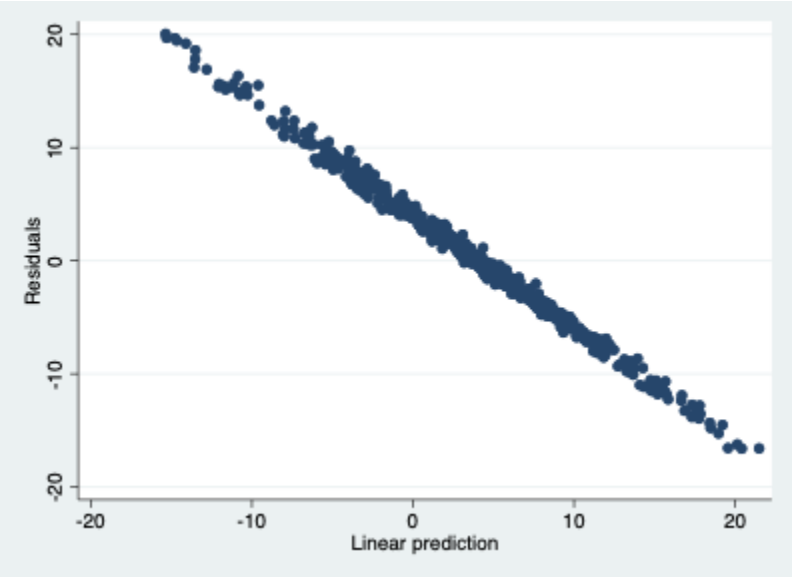
Appendix 48. Weighted Test For Heteroskedasticity For Model Using Poor Mental Health Days As Dependent Variable in Texas



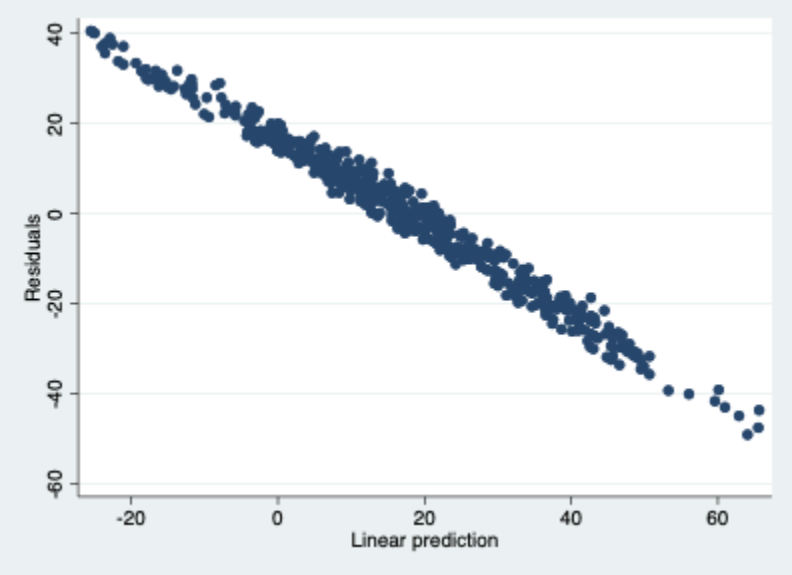
Appendix 49. Unweighted Test For Heteroskedasticity For Model Using Poor Physical Health Days As Dependent Variable in Texas



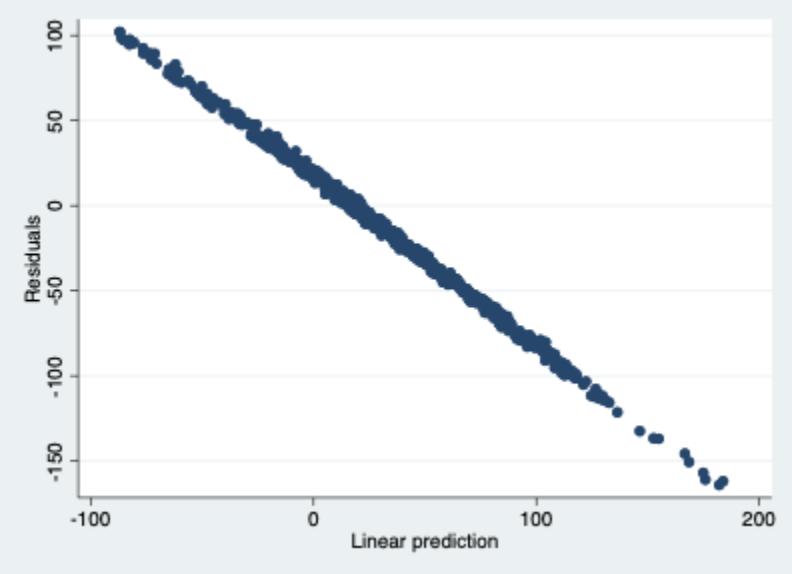
Appendix 50. Weighted Test For Heteroskedasticity For Model Using poor Physical Health Days As Dependent Variable in Texas



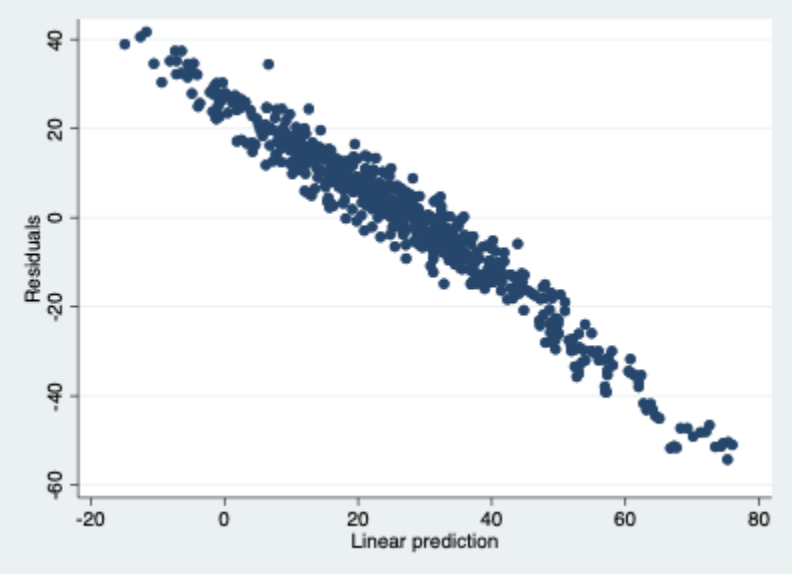
Appendix 51. Unweighted Test For Heteroskedasticity For Model Using Percent Of Adults That Smoked As Dependent Variable in Texas



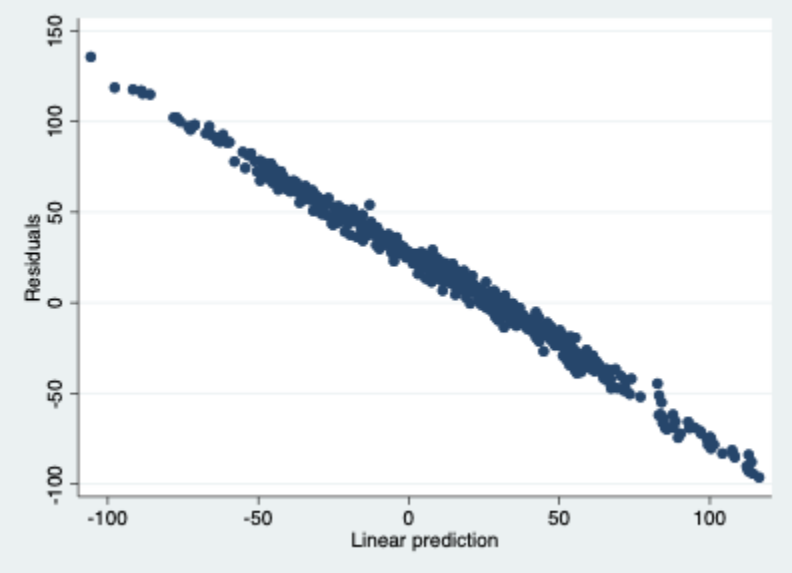
Appendix 52. Weighted Test For Heteroskedasticity For Model Using Percent Of Adults That Smoked As Dependent Variable in Texas



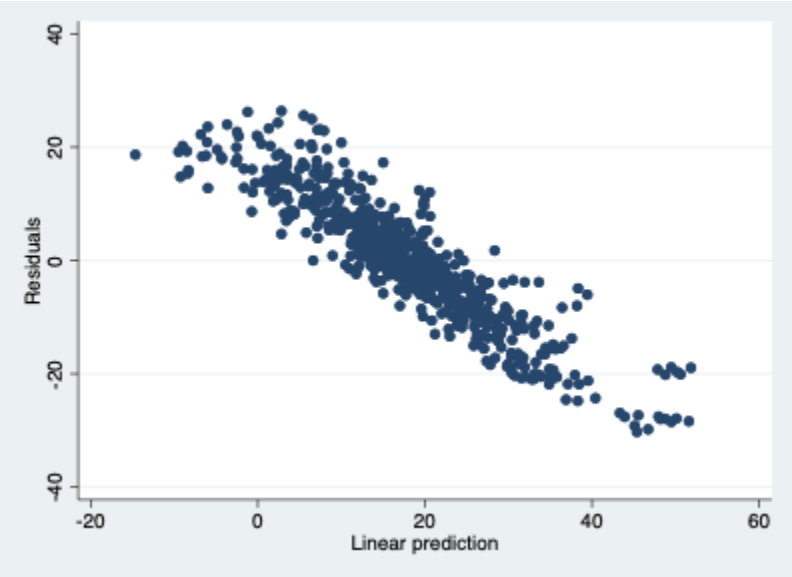
Appendix 53. Unweighted Test For Heteroskedasticity For Model Using Percent Of Adults That Were Physically Inactive As Dependent Variable in Texas



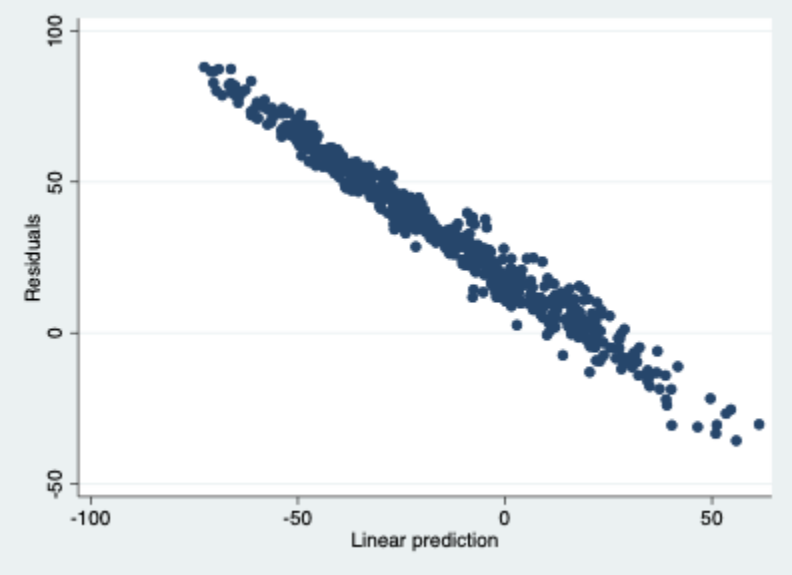
Appendix 54. Weighted Test For Heteroskedasticity For Model Using Percent Of Adults That Were Physically Inactive As Dependent Variable in Texas



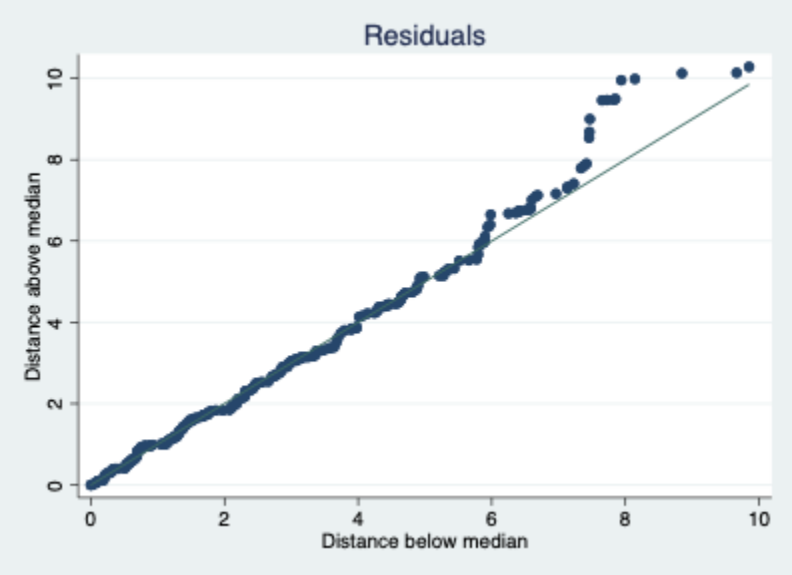
Appendix 55. Unweighted Test For Heteroskedasticity For Model Using Percent Of Adults That Were Uninsured As Dependent Variable in Texas



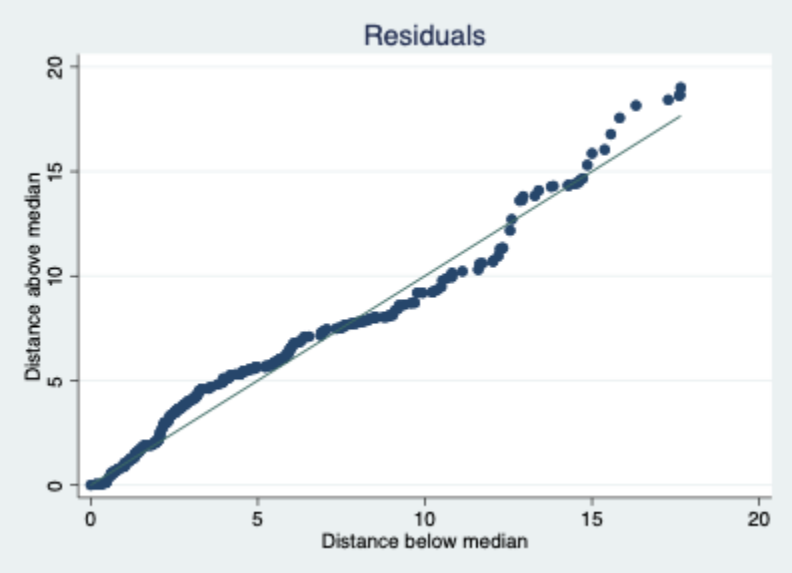
Appendix 56. Weighted Test For Heteroskedasticity For Model Using Percent Of Adults That Uninsured As Dependent Variable in Texas



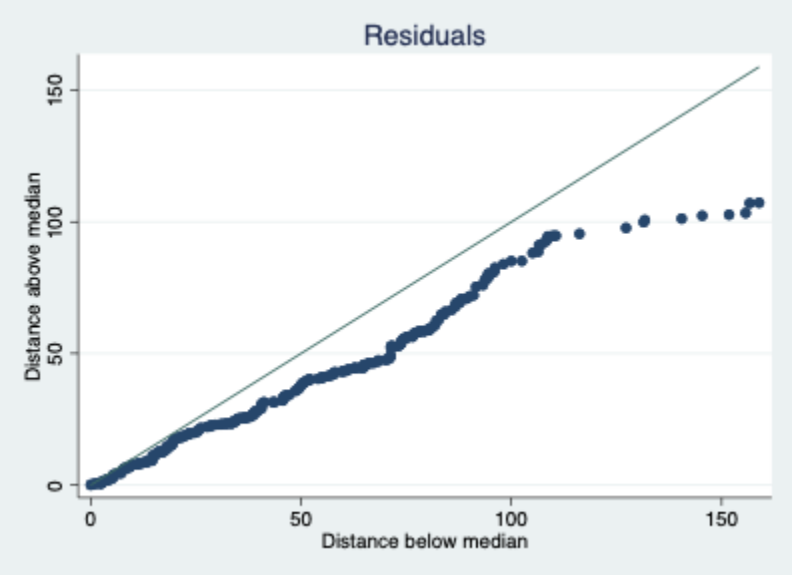
Appendix 57. Distribution Of Error For Model Using Poor Mental Health Days in Texas



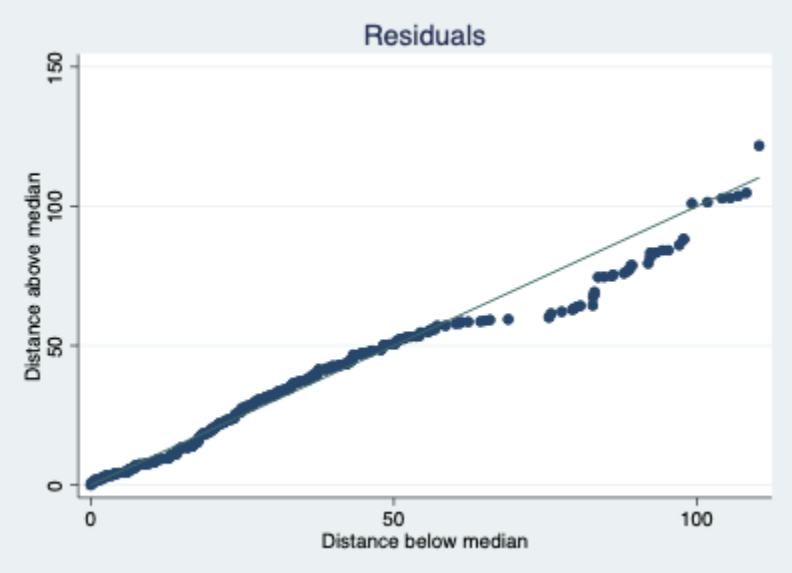
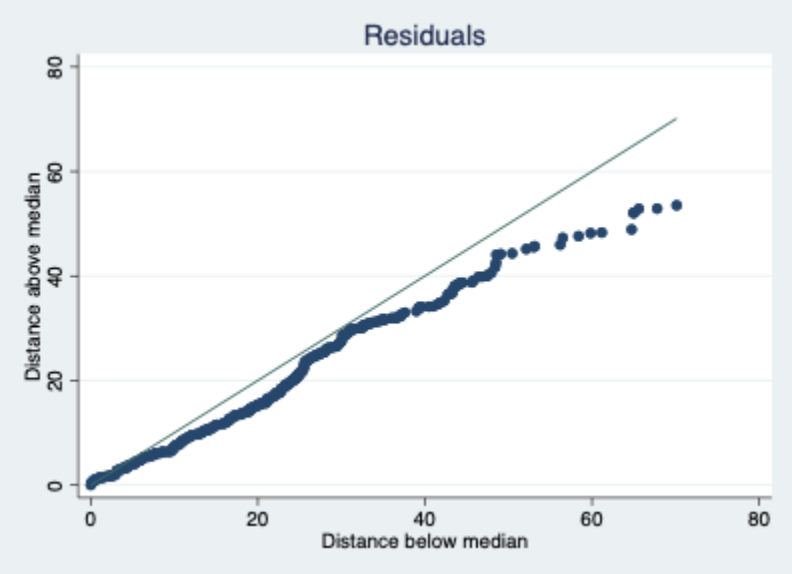
Appendix 58. Distribution Of Error For Model Using Poor Physical Health Days in Texas



Appendix 59. Distribution Of Error For Model Using Percent Of Adults That Smoked in Texas



Appendix 60. Distribution Of Error For Model Using Percent Of Adults That Reported No Physical Activity in Texas



Appendix 61. Distribution Of Error For Model Using Percent Of People That Were Uninsured in Texas