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Racism Across The American South: The Association Between Racism On Twitter, Rurality, & Black Mortality

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RACISM ACROSS THE AMERICAN SOUTH: THE ASSOCIATION BETWEEN RACISM ON TWITTER, RURALITY, & BLACK MORTALITY

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DEDICATION

I would like to dedicate this paper to my parents (Larry and Wanda Bullard) who have generously supported my academic and professional endeavors throughout my entire life. I am forever in debt to their love and support.

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ABSTRACT

Racism can be understood as a system of dominance and power designed to uphold the racially privileged of society. One can be exposed to racism through various mechanisms including the Internet and social media. Evidence indicates that exposure to racism is associated with poor mental and physical health outcomes as well as unhealthy behaviors. Current literature studying the effects of racism focus primarily on experienced or perceived racism. Furthermore, the geographic influence of racism on health at the county level and across levels of rurality is currently unknown. The purpose of this study was twofold; 1.) To explore the geographic distribution of observed racism as across the US South and 2.) To determine the influence of rurality on the association between observed racism and black mortality in the US South.

Data for this study were retrospectively combined from a variety of sources. All-cause, age adjusted black mortality rates were derived from the Centers for Disease Control and Prevention Wide-ranging Online Data for Epidemiological Research (CDC WONDER). The independent variables of interest, racism and rurality, were obtained from Twitter and the 2015-2016 Area Health Resource File (AHRF), respectively. Socioeconomic and factors influencing access to care acted as controls in the study and were obtained from the AHRF at the county level. Income inequality ratios for each county were collected from the 2017 Robert Wood Johnson (RWJ) County Health Rankings. Variables measuring social capital were obtained from the publicly available Northeast Regional Center for Rural Development. Twitter data was provided by the

Data on Local Life and You (DOLLY) project. Geotagged tweets at the county level were used as the measure of observed racism. A racist tweet was defined as one containing the racial slur "niggers". Rurality was defined according to the 2013 Rural-Urban-Continuum-Codes (RUCC). The sample population included 653 counties across seven southern US states; Virginia, North Carolina, South Carolina, Georgia, Alabama, Mississippi, and Louisiana. Counties with no reported black mortality rate were excluded from analysis. Generalized linear modeling was used to test for association. Results were interpreted for significance at 95% confidence intervals ($p \leq 0.05$).

Results indicate that rural areas experience lower odds of racist tweeting, in comparison to their urban counterparts. The odds of racist tweeting behavior decreases as a county's unemployment rate increases. The percent of voters in the 2012 Presidential Election was indirectly associated with racist tweeting behavior, suggesting a protective factor. Hotspots of racist tweeting can be observed in Mid-Georgia near Macon and among Columbia, South Carolina and surrounding counties. Observed racism was found to be significantly associated with black mortality. Counties with racist tweeting in the upper quartiles experienced significantly higher black mortality rates in comparison to counties in the lower quartile of racist tweeting. There was no significant interaction found between rurality and racist tweeting indicating that rurality does not influence the relationship between black mortality and racist tweeting. Rurality and socioeconomic factors like education, income inequality, and unemployment rates continue to be significant predictors of mortality. Furthermore, primary care physician (PCP) supply and hospital bed supply ratios are negatively associated with black mortality as results

indicate that the black mortality rate increases as the ratio of PCPs and hospital beds increase.

The findings in this study indicate that rural areas are less likely to experience observed racism, in comparison to their urban peers. There are significant hotspots of racist tweeting occurring mainly in parts of Georgia and South Carolina. Furthermore, when accounting for geographic influence across levels of rurality, higher rates of observed racism is significantly associated with increased black mortality rates. These findings also indicate that even in the presence of racial discrimination, socioeconomic factors still remain significant in predicting black mortality, contributing to health disparities. Future research should explore the relationship between observed racism and mortality as well as other indicators of health further.

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CHAPTER 1

INTRODUCTION

Webster[1] defines discrimination as "The practice of unfairly treating a person or group of people differently from other people or groups of people." Discrimination against an individual or a group of people can be based on many factors including gender, sexuality, religion, age, disability, or race. The latter factor, race, seems to be the most prevalent form of discrimination currently throughout society.

1.1 BACKGROUND

America is currently facing an unsettling time in history as African Americans and other groups of minorities fight for social and environmental justice, equality, and peace. The Black Lives Matter movement fueled after numerous violent deaths of African Americans. The movement began quietly as a hashtag (#BlackLivesMatter) on Twitter in 2013 following the acquittal of George Zimmerman for the murder in Florida of seventeen-year old Trayvon Martin.[2] Police brutality in Ferguson, Missouri in 2014 crystallized the movement making it a national campaign. Activists consider the #BlackLivesMatter movement "a love note" to black communities serving as a shorthand for diverse organizing efforts across the country against police aggression and racist violence. A second more recent and trending national movement against discrimination is the No Dakota Access Pipeline (DAPL). The movement was assigned the #NoDAPL to organize protesting efforts on Twitter. Native Americans in North Dakota are protesting against the construction of the DAPL which is engineered to run 1,100 miles crossing the

Missouri River about half-a-mile from the Standing Rock Sioux Reservation.[3] The DAPL is projected to bring oil from Canada and the Northwest to Chicago. Construction of the DAPL could result in a potential spill of oil into the Missouri River, a primary water supply for the Sioux Reservation.[3] Discrimination abounds amongst this issue since the planned construction site crosses sacred burial grounds and the original site was changed after white citizens in Bismarck spoke out against the threat of oil spills.[3] The #NoDAPL movement also touches on the concept of environmental justice. Bullard[4] defines environmental justice as the principle that all people and communities are entitled to equal protection of environmental and public health laws and regulations. Brulle and Pellow[5] highlight that there is a "class pattern" and "race pattern" that influences the unequal distribution of environmental risk. Due to racial residential segregation, minorities are highly concentrated in communities that are significantly more disadvantaged than communities that are highly white concentrated.[5] Governments and corporations "seek out the path of least resistance" when determining where to locate polluting facilities. Decided upon locations tend to be in areas with high minority concentrations due to their social isolation and relatively low political power.

Native Americans, African Americans and other minorities alike have dealt with discrimination such as the latter throughout the course of history. Discrimination is deeply rooted in American history In the fifteenth and sixteenth centuries during American colonialization, Native Americans were forced to submit to European colonizers experiencing warfare, disease, loss of territory, and loss of game for food and clothing.[6] This hardship not only produced physical hardships for Native Americans, but also destroyed their cultural identity and mechanisms of sociocultural reproduction. The

U.S. government participated in the discrimination of Native Americans by displacing tribes and relocating them using military power.[6] Native Americans underwent cultural genocide as they were forced to surrender their religious freedom and refrain cultural practices passed down generations.[6] African American populations in America were also exposed to discrimination. Slavery in the American colonies grew from the arrival of twenty enslaved Africans in Virginia in 1619 to a multitude of enslaved African American families who were forced into labor by the time of the outbreak of the American Revolution in 1776.[7] Colonial America was mostly agricultural depending on the land for survival and newfound wealth with the use of cash crops such as sugar, coffee, tobacco, rice and cotton.[7] Slavery permeated throughout the American colonies and was considered as a central component of social order.[7] The discrimination of African Americans by forcing them into slavery led to the prevalence of a racist society by way of racial stereotyping. In the 18th and 19th centuries during widespread practice of slavery, prominent Whites regarded black people as mentally inferior to their White counterparts.[8] Whites also stereotyped blacks as physically and culturally unevolved and apelike in appearance.[8] Racial stereotyping became an ideology crossing generations. Plous and Williams[8] carried out a study concerned with quantifying the existence of black racial stereotypes centuries after slavery was abolished. Their findings indicated that most respondents to their survey (58.9%) endorsed at least one stereotypical difference in inborn ability.[8] Whites were approximately 10 times more likely than blacks to be seen as superior in artistic ability and abstract thinking.[8] Furthermore, almost half (49%) of all respondents assigned at least one stereotypical physical difference between blacks and Whites including: thickness of skin and cranium and sensitivity to physical

pain and childbirth pain.[8] Racial stereotypes were also the subject of scientific and medical opinion in the 18th and 19th centuries. Scientists at the time argued that in the struggle for survival the "Negro" in America was doomed. Social Darwinists analyzed census data to predict the extinction of the black race in America in the 20th century due to a degenerative evolutionary process.[9] Physicians of the 18th and 19th century held similar beliefs arguing that freedom had caused the mental, moral, and physical deterioration of the black population.[9] Physicians claimed that cranial structures, wide nasal apertures, receding chins and projecting jaws, all typed the black as the lowest species in the Darwinian hierarchy.[9]

Native American genocide and slavery are not the only points in American history giving rise to racial discrimination. The U.S. government also took part in activities that subjected minorities to discrimination. The Tuskegee study was issued by the U.S. Public Health Service (USPHS) in 1932 to determine the natural course of untreated, latent syphilis in black males.[9] The study population was comprised of 400 syphilitic men, as well as 200 uninfected men serving as controls in Macon County, Alabama. The experiment continued for decades. When penicillin became widely available in the early 1950s as the preferred treatment for syphilis, the infected men in the study did not receive therapy.[9] On many occasions, the USPHS took actions to prevent the men from receiving treatment.[9] In 1972 when the study first appeared in the national press, the Department of Health, Education, and Welfare halted the experiment.[9] At the time the study was stopped, 74 of the test subjects were living and at least 28, but more likely more than 100 had died directly from advanced syphilitic lesions.[9] The Tuskegee study was ruled "ethically unjustified" stating that penicillin should have been provided to the test

subjects.[9] The study went on to serve as an example of unethical research. Furthermore, residential segregation became a driving factor for the development of American policies to maintain segregated neighborhoods. The Great Migration from 1915 to 1930 resulted in an influx of 1.5 to 2 million African Americans moving to urban areas in the North from the South. Cities like Chicago, New York, and Detroit saw their African American population rates multiply three to five times.[10] The exponential growth of African Americans in cities resulted in city government issuing zoning, deed restriction, and racially restrictive covenants to impose and increase racial residential segregation.[10] The mainstream opinion among real estate agents, appraisers, brokers, and mortgage bankers was that increase of African Americans in White neighborhoods would decrease property values and contribute to neighborhood deterioration.[10] In the event to uphold residential segregation and "whiteness" in neighborhoods, real estate boards established racially restrictive neighborhoods. For example, the St. Louis Real Estate Board in 1923 approved a policy which prohibited real estate agents from selling or renting property in White areas to African Americans.[10] By 1924, Milwaukee, Detroit, Kansas City, Los Angeles, and other cities followed suit.[10] With the passing of the Federal Housing Act (FHA) in 1934, policies upholding residential segregation surpassed local markets as the act included similar racially driven disadvantages. Mortgage insurance and lending policies, appraisal guidelines and home building subsidies, which stimulated high-and-moderate-cost housing, of the FHA was racially restrictive.[10] African Americans were excluded from participation in the federal government's mortgage system. This practice led to the lucrative and expansive White suburban neighborhoods of the 1950s.[10] Underwriting Manuals of the FHA considered African Americans as "adverse influences"

on property values and warned against the "infiltration of inharmonious racial or nationality groups" in racially homogenous neighborhoods.[10] Residential segregation gave way to racial health disparities among minority populations including: high rates of poverty, dependency, crime, poor academic performance among students, and all-cause mortality.[11,12]

Ample evidence suggests that stress is associated with poor physical health and poor mental health outcomes, including: hypertension, coronary heart disease incidence, depression, smoking, alcohol consumption, obesity, consumption of high fatty foods, and less physical exercise.[13–16] Racial and other forms of discrimination can act as a stressor influencing biological markers of stress (vagus nerve functioning, cognitive schema, allostatic load) thereby impacting health and contributing to racial disparities in health.[17,18] Current evidence highlights that exposure to racism is associated with poor mental health, obesity, unhealthy behaviors, and unmet healthcare needs.[19–26]

Most studies on racism are concerned with measuring the associated health effects of perceived racism on health, without any indications of geographical differences in the effects of racism. A few more recent studies, however, applied geospatial techniques to map out the most potentially racially biased places in America by analyzing a popular social media platform (Facebook, Twitter, etc.) and a widely used online search engine (Google, Yahoo, Bing, etc.). Humboldt State University researchers determined that the eastern and southern parts of America tend to be the most prone to racially biased expression in the country.[27] The study examined the frequency and quantity of "tweets" containing racist words and their use in a derogatory manner across the Twitter social broadcasting network. The states with the most observed racism included: Maryland,

Virginia, District of Columbia, North Carolina, Georgia, Alabama, and parts of Tennessee and Mississippi.[27] Similarly, a study conducted by Stephens-Davidowitz[28] concluded that the most racist places in America are rural areas in the Northeast and South. Stephens-Davidowitz used Google search terms for the "nigger" and geocoded the searches to determine the most racist places in America based on searches involving the racist word. Even though everyone that searches for the "nigger" are not all racist, aggregating the searches over several years and several million searches, can provide an accurate estimation of where racial attitudes are particularly the strongest.[28]

1.2 SIGNIFICANCE

Current studies are lacking the explicit investigation of effects of exposure to racial discrimination and racism across geographical areas and identifying where the effects of racism are the strongest. The studies above both indicated the presence of strong racial attitudes in the American South. Considering the differing social environments between geographical locations, the prevalence and effects of racism can be expected to be different. For example, since organized slavery was a common practice in the Old South, this primitive ideology might result in high rates of racism in the modern day South as well.[29]

Furthermore, racism across rurality is not well understood and documented. Rurality continues to be a significant indicator of health. Rural areas rank poorly on population health indicators, including health behaviors, mortality, morbidity, and child health measures.[30–32] Compared to residents at other levels of urbanization, rural residents experience higher death rates from unintentional injuries, chronic obstructive pulmonary disease, and suicide.[33] The most urban and most rural areas share similar concerns

including infant mortality rates and lack of health insurance.[33] In their study, Auchincloss and Hadden[34] find that the health disadvantages of rural areas can be partly explained by differences in population composition. The residual rural disadvantage was concentrated in rural populations with less than a high school education.[34] Tract poverty and county per capita income across rural counties are also significant predictors of morbidity.[34] Additionally, rural residents smoke more, exercise less, have less nutritious diets, and are more likely to be obese than their suburban and some urban counterparts.[30–32] Rural residents within all regions (Northeast, Midwest, South, and West) of the nation fare worse than their counterparts.[30] Rural southern residents experience higher rates of poverty, adult smoking prevalence, physical inactivity, death due to ischemic heart disease, and births to adolescents.[30] Western rural residents experience higher rates of alcohol abuse and suicide.[30] Mental disorders seem to equal out across urban and rural areas, but rural residents with mental illnesses are less likely to define themselves as needing care and to report three or more recent mental disorders, most likely due to stigma surrounding mental illness.[35–37] Furthermore, rural residents are more likely to suffer from unmet mental health needs.[38] When it comes to racial segregation between with respect to rurality, levels and trends in recent patterns of racial segregation in America's small towns are remarkably similar to patterns observed in larger metropolitan cities.[39] Like their big city counterparts, nonmetropolitan blacks are America's most highly segregated racial minority; Approximately 30% to 40% higher than that observed for Hispanics and Native Americans.[39] Lichter and associates conclude that racial residential segregation in rural places increases with growing minority percentage shares and is lower in "new" places (as measured by growth in the housing stock), while racially

select annexation and the implied "racial threat" accounting for the exacerbating racial segregation in rural areas.[39]

Much like rural areas, urban areas also suffer from disadvantages. Urban area disadvantages were brought on by historical activities and political aspirations. Using Los Angeles as a case study, Pulido[40] explains that urban areas and urban residents suffer from exposure to environmental racism; The idea that nonwhites are disproportionately exposed to pollution. This idea of environmental racism was brought upon urban populations by way of suburbanization, in which whites secured relatively cleaner environments by moving away from older, inner city industrial areas.[40] Pulido refers to these patterns of suburbanization and decentralization as instances of white privilege further propelled by political efforts. Federal policies such as Titles I and VI of the Federal Housing Act (FHA) of 1934, sought to increase the housing supply, but did so in a very overt racist way.[40] The Home Owners Loan Corporations (HOLC) and the FHA developed measures to protect small homeowners from foreclosure by issuing federal mortgage insurance.[40] In doing so, neighborhoods were categorized from "A" to "D."[40] Affluent suburbs strung out along curvilinear streets well away from the city were categorized into the "A" group. On the other end of the spectrum, non-white neighborhoods consisting of blacks, latinos, and asians were considered "C" and "D" neighborhoods. Working class white communities were categorized as "B" neighborhoods. This type of practice had a huge impact on the wellbeing of urban and minority populations. Roughly, less than two percent (2%) of housing financed with federal mortgage insurance was made available to blacks.[40] Furthermore, in 1955, the ratio between single-family and multifamily starts was more than nine-to-one in Los

Angeles.[40] Multifamily units were excluded from the new suburbs which meant greater crowding in the barrio and ghetto areas of Los Angeles.[40] Inner city areas received less financial resources as money was channeled into suburbia.[40] These practices left urban populations striving to survive with less resources and opportunities and lower quality of life. Inner-city and urban living is characterized with poor air quality, poor drinking water quality, lack of provision of sanitation and fire services, the availability and affordability of medical care, and high crime and violence rates.[41] This leads to poor health outcomes among the urban population including: high prevalence of asthma among inner city youth and emergency department utilization for asthma related services, asthma morbidity among inner city children, and mental health complications related to problems with alcohol, life stress, and social support.[42,43]

1.3 STUDY APPROACH

Due to the differing environmental, social, and structural nature of rural and urban populations brought on by way of historical perspectives and evolution as well as political efforts, it is plausible that these areas experience different racial related attitudes. Therefore, it can be expected that their associated effects to perceived racism and racial attitudes might be different as well. This study is concerned with measuring county level effects of observed racism and racial attitudes and its relationship with black mortality. This study is also concerned with exploring and mapping the geographic distribution of observed racism. Racial disparities in mortality have been long documented.[44] Although the overall mortality rates for minorities have declined over time for several causes of death (cancer, diabetes, suicide, cirrhosis of the liver, homicide), racial disparities in all-cause mortality continue to widen.[44] A recent study conducted by Chae et al.[45] found that

area racism was significantly associated with all-cause black mortality. Chae et al. utilized Google searches containing the "nigger" in 196 designated Nielsen media market areas as the measurement of area racism.[45] There are a total of 210 designated market areas (DMAs) as defined by Nielsen Media Research as geographic areas receiving common television broadcasts or radio programming as well as newspapers and Internet advertising.[45] Another study by Hatzenbuehler and associates[46] investigated whether structural stigma (living in communities with high levels of anti-gay prejudice) increases the risk of premature mortality for sexual minorities. Social stigmas were measured as the average level of anti-gay prejudice at the community level. Their findings indicated that sexual minorities living in communities with high levels of anti-gay prejudice experienced a higher hazard of mortality than those living in low-prejudice communities (Hazard Ratio [HR], 3.03).[46] Sexual minorities living in high prejudice communities experienced a shorter life expectancy of approximately 12 years.[46] These conclusions highlight the significance of studying area level prejudice and the effectiveness of utilizing an internet search based proxy measurement of racism to predict outcomes, such as all-cause mortality. It is pertinent to estimate the association between racism and mortality by accounting for geographical characteristics and demographics as evidence suggests that the intensity of prejudice and discrimination at an area level is associated with life expectancy and livelihood of impacted populations.

When studying the effects of racism, it is important to account for a number of potential confounding variables. Socioeconomic status (SES) is a potential confounding variable to account for when studying racism because it is unknown if it exerts a mediating, moderating, or additive effect on the relationship of racism and mortality.[47]

For example, poverty is accompanied by its own sets of stressors, e.g. overcrowding, which can independently affect the risk for negative health outcomes like hypertension and subsequent chronic health conditions and mortality. Stressors associated with poverty may combine with racism related stressors, e.g. interpersonal maltreatment, resulting in an overwhelming demand for coping which can influence the uptake of unhealthy behaviors and coping mechanisms.[47] Due to the close interaction between racism and poverty, SES could mediate the relationship between racism and health.[47] Brondolo and colleagues explain that racism may block economic access partly accounting for the fact that racial and ethnic minorities are disproportionately represented among low SES populations.[47] Krieger and associates[48] recommend accounting for SES indicators (income, poverty, education, deprivation) when studying racism related health effects in order to account for socioeconomic position and fluctuation in economic resources among geographic areas that are available to an individual. Another measure of area level SES, income inequality (distribution of income within a population) should be controlled for when studying mortality. In his review, Smith[49] encourages the assessment of income inequality as a potential covariate when studying mortality due to their strong correlation. Smith argues that income inequality goes hand in hand with underinvestment in human resources allowing for populations whose social and biological assets have been undermined which will generate poor health outcomes in the future.[49]

Furthermore Williams[44] suggests accounting for unemployment when studying the geographical effects of racism. Segregated and impoverished areas are challenged with adversities that can combine with the stressors of racism exerting an additive and/or interactive effect to SES and racism. Lack of access to jobs results in high rates of

unemployment.[44] Lastly, access to medical care is another mechanism by which racial discrimination can affect health and should be accounted for when studying health effects of racism. Racial inferiority persists with the realm of healthcare affecting the way minorities are treated when seeking care.[44] Evidence indicates that after adjusting for SES, health insurance, and clinical status, whites are more likely than blacks to receive a broad range of specific medical procedures.[44] When studying the effects of racism, it is important to account for access to care across geographical regions by controlling for health insurance status since having insurance is a proxy for seeking and receiving care.

1.4 PROPOSED RESEARCH QUESTIONS

The proposed study will help to identify the association and relationship between areas exhibiting strong racial attitudes and racism and county level mortality rates for minority groups. The proposed study will address two specific research questions, as follows:

1) What is the geographic distribution of observed racism across the US South?
2) Is there an association between observed racism and Black mortality in the US South and does rurality influence the relationship?

Data for this project will be derived from four retrospective datasets. The first is data collected from the Digital Online Life and You (DOLLY) Project at the University of Kentucky.[50] The DOLLY Project is a repository that has collected billions of geotagged tweets (approximately 8 million a day) since its initiation in December 2011. Most recent data (2015-2016) collected by the DOLLY Project will be used for the study.

The second dataset is the Centers for Disease Control and Prevention Wide-ranging Online Data for Epidemiologic Research (CDC WONDER). CDC WONDER is a web-based application that manages public-use data for U.S. births, deaths, cancer diagnoses, Tuberculosis (TB) cases, vaccinations, environmental exposures, and population estimates. The third dataset is the publicly available most recent (2015-2016) Area Health Resources Files (AHRF) maintained by the Health Resources and Services Administration (HRSA)[51]. The fourth dataset is publicly available measures of social capital to be obtained from the Northeast Regional Center for Rural Development.[52] The fifth and final dataset is the publicly available 2017 Robert Wood Johnson Foundation (RWJF) County Health Rankings. The geocoded data examining the use of racial slurs in "tweets" on the Twitter social networking platform (provided by the DOLLY Project) will be assessed at the county level and will be used as the measure of observed racism. County level all-cause, age-adjusted mortality rates will be derived from the CDC WONDER online application. County level estimates including, primary care provider supply, hospital bed supply, health insurance, education, and unemployment will be extracted from the AHRF and will be controlled for in the analysis. An additional control variable, income inequality, will be obtained from the 2017 RWJF County Health Rankings.

1.5 STRENGTHS AND LIMITATIONS

The proposed study will incorporate many strengths in comparison to current literature. First, the proposed study is concerned with ascertaining a relationship between observed racism (measured using racist tweet rates) and black mortality at the county level. This study will also hope to identify if the effect of observed racism on black

mortality is influenced or affected by rurality. Secondly, the study will build on current literature by applying a health services approach by controlling for access to care and utilization. Third, the study will utilize a more novel method using the number of racist tweets containing a racial slur at the county level as a proxy for observed racism.

There are a few limitations to the study which need to be discussed. First, the study is unable to determine causality between county level exposure to racism and black mortality due to applying a cross sectional analysis. Secondly, the study cannot determine the level of perceived racism due to the design and utilizing racist tweets as a proxy for county level racism. Third, the study is only applying a single measure of racism in lieu of an aggregate measure. The study will analyze the number of racist tweets using one trigger word in instead of applying a semantic analysis looking at a combination of words, phrases, and/or sentences. Lastly, the study will be unable to ascertain the effects of exposure to online racism to Twitter on stressful and/or responses. Future studies will need to focus on quantifying stressful responses induced by exposure to online racism or racial discrimination.

CHAPTER 2

EXPLORING THE ASSOCIATION OF RACISM AND POOR HEALTH

To quantify the association between racism and poor heath and subsequent mortality, the conceptualization of racism and the theories explaining the potential pathways linking racism to poor health must be understood. This chapter is concerned with exploring how race and racism is defined as it pertains to the study. Theories posited to explain the pathways by which racism affects health and the embodiment of racism as stressor will also be discussed. Furthermore, current evidence identifying and explaining the association of racism and health (stress, mental health, individual behavior, and health outcomes) will be reviewed to warrant the significance of studying racism as an indicator of health.

2.1 RACE AS A SOCIAL CONSTRUCT

Race can be best understood as a social construct. Counterintuitively, race is not a biological inheritance. Instead race is a social concept. All blacks or whites do not possess a single gene or cluster of genes nor marked by differences in gene frequencies or the rates of appearance of certain gene types.[53] Greater genetic variation exists within populations than between populations.[53] Not only is race assigned based on physical characteristics such as stature, skin color, hair texture, and facial structure, but also specific social relations and historical context.[53] The social assignment of race generates racial hierarchies. White is seen as a pure category. Any other race is non-pure making

one "nonwhite."[54] Socially assigned race morphs into racial ideologies or what Omi and Winant term as "racial etiquette," meaning a set of interpretative codes and racial meanings which operate in the interactions of daily life.[54] These codes or rules are shaped by individual perceptions of race in a racially mixed society and influence self-presentation, distinction of status, and appropriate modes of conduct.[54] Omi and Winant go on to explain that "racial etiquette" doesn't develop into adherence to the dominant groups rules, but as an aggregation of these rules with values and beliefs of subordinated groups.[54] Therefore, race becomes "common sense," a way of comprehending, explaining, and acting in the world.[54] Racial beliefs exist to explain the differing actions and behaviors between racial groups. This social order crosses generations and characterizes individuals essentially assigning them a way of life.

Omi and Winant explain that when the first enslaved Africans arrived in the Americas, they were not categorized slaves overnight. Due to skin color, they were labeled as blacks. This is termed racialization. Racialization is defined as the extension of racial meaning to a previously racially unclassified relationship, social practice or group.[54] Similarly, Whites went through racialization. First arriving as European settlers followed by Christian, English, Free, and lastly white, in chronological order.[54] Therefore, race is a socially assigned variable with no biological roots. The social order of race is not taught, but innate occurring naturally helping to shape ones perception and behavior.

2.2 DEFINING RACISM AND ITS PERCEPTION

When conceptualizing racism, it is important to note that it is not only concerned with interpersonal relationships, attitudes, distorted ideologies, and unfair treatment. The

differential of power is a major contributor to the conceptualization of racism. A more relevant and accurate definition of racism is given by Harrell[55] in which he recognizes racism as "a system of dominance, power, and privilege." Harrell goes on to explain that this system is designed to uphold the racially privileged and to exclude the unprivileged from "power, esteem, status, and/or equal access to social resources.[55]" The latter definition of racism takes into account the historical context that has allowed racism to flourish throughout society indicating a system dedicated to assigning power and privilege to dominant members of society while keeping others in their place on the social ladder.

Power also plays a role in how one perceives, interprets, and embodies racism. Schmitt and Branscombe[56] explain that due to the interpersonal nature of prejudice and racism, the state of intergroup relationships is vital to understand how one interprets or perceives a comment/action from another as discriminatory. The relevance of an action to prejudice or racism is a function of each involved individual's relative position of power within the social structure.[56] Ones interpretation of perceived racism or prejudice is different for each individual. Accounting for this difference depends on whether the person on the receiving end self-identifies with a group that is disadvantaged relative to other racial groups, or to a group that is relatively privileged.[56] Schmitt and Branscombe explain that both disadvantaged and privileged groups can experience discrimination.[56] However, the side effects and ramifications are quite different for each. Members of disadvantaged groups experience more harmful psychological consequences when exposed to perceived racism or prejudice.

2.3 THEORETICAL FRAMEWORKS ON RACISM

Racial discrimination can occur throughout many domains including: the labor market, the educational system, the justice system and in healthcare and most recently online and on social media, among others. However, no matter where an individual is exposed to racism, the potential effects on health and wellbeing are great. There are many theoretical frameworks or models dedicated to explaining the relationships between racism or racial discrimination and its implications on health.

2.3.1 KRIEGER THEORY OF RACIAL DISCRIMINATION & HEALTH

According to Krieger[57], racial discrimination can be conceptualized as a determinant of population health. Krieger posits a framework for understanding and measuring racial discrimination suggesting four dimensions, namely, legal or illegal; institutional; structural, interpersonal; direct or indirect; overt or covert. Acts of discrimination can take place at multiple levels including: individual, institutional, residential neighborhood, political jurisdiction, and regional economy. Understanding one's cumulative exposure to discrimination considers the timing of discriminatory action throughout one's life-course (conception; infancy; childhood; adolescence; adulthood), intensity (severity) of the discrimination, frequency (acute; chronic), and duration (how long the discriminatory action lasts). The embodiment of discrimination occurs across various pathways involving exposure, susceptibility and responses to the discrimination. The first pathway is economic and social deprivation which can unfold in the home, in the neighborhood, and in other socioeconomic regions. The second pathway is toxic substances and hazardous conditions (pertaining to physical, chemical, and biological agents) which can also take place in varying socioeconomic domains. The third pathway

of embodiment is socially inflicted trauma (mental, physical, or sexual, ranging from verbal to violent), also occurring throughout various domains. The fourth pathway is targeted marketing of legal and illegal psychoactive and other substances (alcohol, smoking, other drugs, junk food). The fifth and final pathway of embodiment is inadequate health care, by health care facilities and providers including: access to care, diagnosis, and treatment. There are two major responses to discrimination; protective and harmful. Protective response to discrimination is the practice of active resistance to the practice of discrimination by individuals or communities. Acts of active resistance involves organized movements, legal action, social networks, and social support. A harmful response to discrimination is suppressing the acts of discrimination resulting in internalized oppression and denial and the use of psychoactive substances, both legal and illegal. Krieger's theory of discrimination and health explains that discrimination can occur at multiple levels within society through various pathways, evoking both protective and harmful responses. This theory can be used to assess the impact and effects of discrimination on health from either a population or individual level.

Furthermore, Nancy Krieger points out that there are three main epidemiologic approaches to studying the health effects of discrimination.[57] The first approach is indirect, at the individual level. This approach is purposed in examining whether known risk factors explain the differences in health outcomes between advantaged and disadvantaged groups. The indirect approach to measuring the effects of discrimination relies heavily on observation such as observed differences in treatment and observed differences in health outcomes. The second approach is direct, at the individual level. This approach of study is done among the disadvantaged group purposed in examining

whether experiences of discrimination are associated with health outcome(s). The direct approach relies on self-report of perceived discrimination from the individual. The third approach is institutional, at the population level. The institutional approach is also carried out among the disadvantaged group in order to examine whether group level measures of discrimination are associated with health outcomes at the population rate.

2.3.2 JONES' LEVELS OF RACISM

Jones[58] posits yet another framework explaining the multiple levels of racism and their aggregate effects on individual wellbeing. Racism can be understood on 3 levels: institutionalized, personally mediated, and internalized. Institutionalized racism is defined as "…differential access to the goods, services, and opportunities of society by race.[58]" Racism is embedded within institutions (schools, political environments, workplaces, etc.) throughout society.[58,59] Institutional racism subsequently affects individuals' access to quality education, housing, and healthcare facilities; employment opportunities; and clean residential environments.[59] Additionally, institutionalized racism results in access to power in the form of access to information, resources (wealth and social networks), and voice (voting rights, government representation, and control of the media).[59] Personally-mediated racism is defined as "…prejudice and discrimination, where prejudice means differential assumptions about the abilities, motives, and intentions of others according to their race, and discrimination means differential actions towards others according to their race.[58]" Personall- mediated racism is the most commonly thought of level whenever one hears the word "racism." Personally-mediated racism can be either intentional or unintentional. This level of racism is a result of a lack of respect, suspicion, devaluation, scapegoating, and dehumanization.[58] Internalized

racism is defined as, "…acceptance by members of the stigmatized races of negative messages about their own abilities and intrinsic worth.[58]" At this level of racism, those on the receiving end begin to accept and conform to society's stigmatization by relinquishing their hopes and dreams and giving into societal limitations. Internalized racism manifests itself into people of color engaging in activities to blend into society, an activity referred to as "whiteness.[58]" Internalized racism also develops into self-devaluation, resignation, helplessness, and hopelessness.[58]

Jones[58] goes on to further explain the aggregation of these levels of racism using a story about gardening where a gardener prefers red flowers to pink ones and plants them in different soil types; red ones in fertile soil and pink ones in rocky soil. Institutionalized racism is conceptualized as the gardener's preference of red flowers over pink. This preference blinds the gardener from recognizing the implications of the two types of soils used to plant the flowers.[58] The soils are kept separate and the difference between the two is never addressed. The red flowers continue to flourish while even the strongest pink one's face difficulty to reach half the size and beauty of the red flowers. Personally-mediated racism in the tale is represented by the gardener proclaiming that the red flowers are indeed better due to the pink ones never reaching the magnitude and beauty of the red ones. Personally mediated racism also occurs when the gardener, in dismay of the pink flowers growth, plucks the pedals off a budding pink flower further impeding its growth or removing a pink flower seed from the red flower soil when the wind carries it there.[58] Internalized racism occurs in the tale when the pink flowers insist to the bees that they want pollen from the red flowers instead of pink flower pollen. The pink flowers have internalized the belief that the red flowers are better because of their beauty.[58] Jones

suggests that in her story, the gardener is a metaphorical representation of the government. When the government is not concerned with equity, in the case of the differing soils in the tale, the two types of flowers are not afforded with equal opportunity to grow and mature into equal, yet differing flowers of beauty and strength. Jones framework sheds light on the historical nature of institutional racism and its ramifications on individual nature, behavior, and wellbeing.

A more realistic example of institutionalized racism can be observed in the changes to the state of Delaware's death penalty statute in 1991.[60] Following a high-profile case that was heavily covered by the media involving four African American defendants and two White victims, Delaware changed their law regarding the death penalty. Since the law change, annual sentences to death have quadrupled in Delaware.[60] Regarding racial effects of the law change, cases involving black defendants and white victims are sentenced to death twice as often as other cases. In comparison to other states in the country (10.1%), the death sentencing rate of cases involving black defendants and white victims is twice as high in Delaware.[60] This example goes to show that institutional racism occurs at the government level and can result in unintended significant implications for minorities and other racial groups. This kind of effect signifies what Jones was describing in her gardener's tale. The government made a blinded decision from the basis of one case. Delaware state government relinquished the notion that this specific case involving white victims attracted heavy media coverage, ignoring cases involving black victims. This type of racism leads to personally mediated racism in the event that Delaware changed their death penalty statues believing that the white victims of this case required justice, completely ignoring black victims. Furthermore, this statute

can manifest into internalized racism in the event that the black community responds to the event feeling helpless and falling deeper into racial stigmatizations regarding criminal activity.

2.3.3 WILLIAMS AND MOHAMMED RACISM & HEALTH

Williams and Mohammed[61] posit another framework outlining the various pathways by which racism affects individual health. The basic causes include biology and geographic origins, societal institutions (political, legal, economic, cultural), and racism (institutional and cultural). These basic causes coupled with an individual's social status and demographic characteristics (SES, race, gender, age, marital status, etc.) are linked to individual health through a series of intervening mechanisms. Institutional and cultural racism affect health by introducing stigma, stereotypes, prejudice and racial discrimination.[61] The latter aspects of racism develop into differential access and opportunities afforded to individuals based on SES and other demographic characteristics.[61] One important proximal pathway by which racism affects health in Williams and Mohammed's framework is stress (racial discrimination, threat of stress, physical/chemical exposures, historical trauma, and macro racial stressors). Additional proximal pathways include access to societal resources (medical care, housing, and neighborhood/community) and knowledge.[61] Lastly, an individual's response ultimately influences the effect on one's health. These responses to racism range from behavioral patterns and psychological and physiological responses to collective and individual resilience, ultimately influencing morbidity, mortality, disability and positive health.[61] Williams and Mohammed's framework is an important one that takes into account the many macro levels of racism described by Jones and Krieger and interprets their

influence on individual social status and subsequent response to racism and individual health.

2.3.4 BONILLA-SILVA THEORY OF SOCIALLY CONSTRUCTED RACISM

Additional theories evaluate the effects of structural, neighborhood/residential and social media/online related racism on individual wellbeing and health. Bonilla-Silva[62] indicates that race is a social construct, meaning that race is socially assigned to an individual based on phenotypic characteristics. This social assignment of race results in racialization, subsequently developing into a structural hierarchical system producing social relations between races.[62] Races placed in the superior position of the hierarchy reap greater economic rewards including, better occupations and prospects in the labor market, higher social estimation (socially viewed as "smarter" or "better looking"), and are afforded the opportunity to initiate physical and social boundaries between themselves and other races lower on the hierarchy.[62] Additionally, as a result of racialization, the races develop collective objective interests. Collective interests are based on the struggles within each race to either transform or maintain a particular order within the hierarchy.[62] Evaluating the effects of racism through the lens of structural racism or racialization, results in the ability to account for all racial manifestations by tracing all racial phenomena (cultural, political, economic, social) to the racialization of that particular society.[62] The theory of racialization interprets changes in the hierarchy based on collective racial struggles. Lastly, racialization accounts for the occurrence, transformation, and disappearance of racial stereotypes. This type of structural effect of racism can be better understood as social relationships between racial groups. These

social interactions interplayed within racial groups result in differing behaviors and interests which can manifest in different outcomes across races.

2.3.5 POWELL'S STRUCTURAL RACISM THEORY

Racism also occurs within the context of neighborhoods and residential areas. John A. Powell[63] builds upon the systems theory in order to develop a structural racism framework. This structural racism framework is different from the one described earlier as Bonilla-Silva's focused on the social hierarchy existing between races. Powell's structural framework takes a more economical/societal approach to understanding the basis and subsequent effects of racism. The systems theory is a model that interprets causation as a result of relationships and processes.[63] Powell describes his structural perspective of racism as cumulative causation within and across domains as a product of reciprocal and mutual interactions within and between institutions.[63] This goes beyond individual relationships to understand practices and procedures leading to racial dispositions. Powell argues that racial outcomes are a result of the cumulative effects of disadvantage over time.[63] An example suggested by Powell indicates that housing discrimination results in high rates of black and hispanic children and youth attending schools located in high poverty areas. Children who attend these schools are at a disadvantage since they are more likely to drop out of school and less likely to attend college, as opposed to their peers in more affluent schools.[63] As a result, their options in the labor market are greatly reduced and so are their chances of achieving secure health and retirement benefits. Understanding the structural cumulative effects in this way can shine light on why so many African Americans and Hispanics live at or below the federal poverty line and their relationship to quality housing and education. Residential

segregation and racial isolation have major implications on overall health and wellbeing. Largely white affluent neighborhoods usually include high-performing schools, new grocery stores with fresh produce, better employment opportunities, quality childcare, modern healthcare facilities, and improved social cohesion with better opportunities for networking and civic engagement.[63] On the flipside, largely poor neighborhoods are challenged with racially segregated areas of concentrated poverty and high crime environments.[63] These areas also employ under-resourced schools, grocery stores with low-quality foods, and inadequate access to quality healthcare and employment opportunities. Powell argues that racial residential segregation was a result of the federal subsidies which initiated suburban housing and transportation.[63] These subsidies made it easy for middle-class, white families to leave cities and move to suburban areas. Minorities were somewhat forced to stay behind due to housing policies that prohibited integrated neighborhoods through lending restrictions and other racially restrictive policies.[63] The labor market and tax revenue followed the whites to these suburban areas, leaving behind minorities in cities challenged with poverty and inadequate access to healthcare, employment, and education. These cumulative effects result in poor health and wellbeing which even translates across generations since children who grow up in these environments tend to stay in them.

2.3.6 THEORETICAL PERSPECTIVES OF ONLINE RACISM

A theory explaining the system of racism which is somewhat new to the field of public health is the implications of social media and other online modalities. There are many platforms of social media that are widely used. The most popular platforms include: Facebook, Instagram, Twitter, Snapchat, and LinkedIn. In addition, there are

other media related outlets such as blogs and channels, where individuals can comment and reply on various topics. The Glitch Racism theory[64] suggests that anonymity provides a cover for online racism across gaming and media-related channels which increases the desire for individuals to engage in online racism when given the chance. The development of the Internet and social media outlets has created a new domain in which racism proliferates. Individuals are allotted the right to "freedom of speech." This right has been neglected to the point of engaging in hate speech (hateful, abusive, and racist related speech) on social media outlets online.[65] Individuals participate in the use of slurs (set of words, terms, or nicknames). Slurs can be used in a non-offensive and non-abusive manner or they can be used in a derogatory, insulting manner.[65] When used in the latter manner, they are directed at specific groups within society. The use of racial slurs has opened doors to the use of hate speech targeted towards certain racial groups. This theory is particularly relevant to the topic. Since data containing racial derogatory comments and "hate speech" related tweets will be used as an indicator of racial attitudes for this study, this theory explains the underlying nature and environment that enables for racism to exist within social media and other "online" settings.

2.3.7 BIOPSYCHOLOGICAL THEORY OF RACISM

As some of the theories above suggest, stress tends to be a potential pathway linking experiences with racism to individual health and wellbeing. Understanding the perception of racism as a stressor and its associated implications might point to the casual interpretation of racism and poor health. Clark and colleagues[66] posit a model explaining the biopsychosocial effects of perceived racism. The model suggests that the perception of an environmental stimulus as racist results in a series of psychological and

physiological responses. These responses are influenced by constitutional factors, sociodemographic factors, psychological factors and behavioral factors, and coping mechanisms. In their model, environmental stimuli refer to a myriad of things which can include: substandard housing, lack of skilled labor and managerial jobs, and lower wages for African Americans or other ethnic groups. Once an individual perceives exposure to an environmental stimulus as being racist, it kicks of a series of responses, sort of like a domino effect. However, due to the fact that these responses are highly sensitive to an individual's own perception of stressfulness in lieu of objective demands, there is no way to ascertain if a certain environmental stimulus will be perceived as racist by an individual.[66]

The variables used in their model are categorized into moderating and mediating variables. The moderating variables are constitutional factors, sociodemographic factors, and psychological and behavioral factors. Clark and colleagues suggest that constitutional factors such as, skin tone and family history of hypertension might influence the relationship between exposure to environmental stimuli and health outcomes.[66] Furthermore, these constitutional factors may interact with sociodemographic characteristics in increasing or decreasing the risk of negative health outcomes. Occupational status, income, and educational level are suggested by Clark et al. as being moderating SES factors influencing responses to racism related stress.[66] African Americans and other ethnic groups report a greater frequency of exposure to more stressors like racism and other unfair treatment, in comparison to their Caucasian counterparts.[66] As a result, African Americans and other ethnic groups must utilize coping mechanisms on a more frequent basis to deal with stressors. Clark et al. suggest

that the utilization of these coping mechanisms will differ within ethnic groups, highlighting that lower SES African Americans might have fewer resources to cope with racism related stressors.[66] Psychological and behavioral factors might also influence how individuals perceive and respond to environmental stimuli. For example, Type A behavior, cynical hostility, neuroticism, self-esteem, obsessive-compulsive disorder, hardiness, perceived control, and ager expression-suppression are all psychological and behavioral factors which can influence the stress process and associated health outcomes like cardiovascular disease, and immune functioning.[66] Clark et al. hypothesize that these behaviors influence the relationship between perceived racism and health status.

The mediator variables in the model include racism as a perceived stressor, coping responses, psychological and physiological stress responses, and health outcomes.[66] Clark et al. define perceived racism as the subjective experience of prejudice or discrimination.[66] Ones perception of an environmental stimulus as racist or some other factor as a stressor evokes coping responses. On the other hand, no perception of racism or other stressor does not lend itself to any necessary psychological or physiological stress responses. Clark et al. identify two categories of coping responses; maladaptive and adaptive.[66] Maladaptive coping responses are those that do not attenuate stress. Adaptive coping responses are those that attenuate stress by mitigating enduring psychological and physiological stress responses. The latter responses include anger, paranoia, anxiety, helplessness, hopelessness, frustration, resentment, and fear.[66] These psychological stress responses can also lead to the subsequent use of additional unhealthy coping mechanisms such as anger suppression, hostility, aggression, verbal expression of anger, and the use of alcohol or other substances to blunt these feelings.[66] These responses have an impact

on individual health and wellbeing as it is directly associated with health outcomes such as low birth weight, infant mortality, breast cancer survival, heart disease, mean arterial blood pressure changes, and chronic obstructive pulmonary disease.[66]

2.3.8 MECHANISMS EXPLAINING BLACK-WHITE HEALTH DISPARITY

Green and Darity[67] explore the mechanisms that give rise to black and white health disparities using theories from the biological and social sciences. Allostatic load attempts to bridge the gap between the physiological, biological, and social sciences.[67] Allostatic load is a useful way to measure the "wear and tear" on a person's body over time that results from repeated exposures to discrimination or other stressful experiences.[67] The original allostatic load index consisted of ten biological parameters that were markers of physiological activity across various bodily systems (cardiovascular, metabolic, hypothalamic-pituitary-adrenal axis, and sympathetic nervous).[67] The index contained ten physiological markers, including: systolic blood pressure, diastolic blood pressure, waist-to-hip ratio, ratio of total to high density lipoprotein cholesterol, high-density lipoprotein cholesterol, glycosylated hemoglobin, cortisol, norepinephrine, epinephrine, and dehydroepiandrosterone sulfate.[67] Green and Darity document studies showing black children and adults have higher allostatic load indices, in comparison to whites, even after controlling for education and impoverished conditions.[67] However, there are challenges related to conceptualizing allostatic load in research due to issues of measurement, whether the measures used capture the underlying biological processes or are outcomes associated with physiological breakdown, and aggregation across multiple measures of system dysregulation may cause researchers to overlook one or two systems that are mostly associated with outcomes and interactive effects.[67]

Green and Darity also explore the historical and cultural perspective of race on poor health. In the case of African Americans, posttraumatic slave syndrome or posttraumatic slavery disorder hypothesis posit that the experience of the Middle Passage and American slavery produced a collective trauma that has transmitted across generations of black individuals.[67] It is also believed that collective dysfunction might explain the tendency of African Americans to engage in self-defeating behaviors subsequently contributing to adverse health outcomes.[67] Although Green and Darity do not refute the notion of posttraumatic slave syndrome, they mention several difficulties applying this approach to studies. First, it does not clarify how daily indignities and discrimination affect psychological well-being above and beyond the memory of slavery.[67] Secondly, groups subjected to collective trauma are not all experiencing adverse health outcomes.[67] Lastly and arguably most importantly, this approach lacks predictive power and is near impossible to derive independent parameter estimates of the pure effect of trauma.[67]

2.4 LITERATURE REVIEW

Literature examining the impact of experienced racism and discrimination on health is ample. The search returned a variety of literature explaining the association of racism and stress, mental health, health behaviors, and health outcomes. A literature search was conducted using public health related databases including PubMed, PubMed Central (PMC), and Google Scholar. Keywords and search terms used in the literature search included: discrimination, racism, racial discrimination, perceived discrimination, racism and heath, racism and mental health, and racism and health outcomes. The results of the search will be discussed here.

2.4.1 RACISM AS A STRESSOR

The most straightforward case which explains how racism is conducive to poor health, is that it makes the lives of the disadvantages members of society much more stressful which results in negative health outcomes.[68] However, much more of the literature goes into greater detail explaining the physiological response of exposure to racism as it relates to stress.

2.4.1.1 STRESS & THE VAGUS NERVE

Those concerned with the physiological human adaptations to stressful live events study the vagus nerve, which is part of the parasympathetic branch of the autonomic nervous system.[68] The vagus nerve has different divisions dedicated to initiating responses depending on the environment. Neural circuitry from the frontal cortical regions is connected with vagal circuits in the brain stem allowing for the flexible facilitation of cardiac adaptation to the changing environment.[68] Increased vagal activation slows down the heart and vice versa.[68] These changes take place on a second-by-second basis making adjustments as deemed necessary depending on the environmental demands.[68] Thayer and Lane[69] studied the role of vagal function on the risk for the onset of cardiovascular disease and subsequent mortality. Indicators of vagal function included resting heart rate, heart rate recovery, heart rate variability, and baroreflex sensitivity. They conclude that decreased vagal function is associated with an increased risk for morbidity and mortality, independent of traditional, more commonly known risk factors for cardiovascular disease. The frontal lobes, containing brain centers which are responsible for some of the most complex human cognitive functions, house neural pathways that mediate the calming influences of the vagus on the heart.[68]

Cognitive processing failures occurring in the frontal lobes interferes with vagal functioning and can be detrimental to health.[68] Brosschot and associates[70] explain that perseverative cognition (worry and rumination) is a common and frequent response to stress and can moderate the health consequences of stressors as it can prolong stress-related affective and physiological activation, both in advance of and following stressors. Their review of the literature indicates that worry, rumination, and anticipatory stress are all associated with enhanced cardiovascular, endocrinological, immunological, and neurovisceral activity.[70] Furthermore, the chronic threats and aversive events from racism can interrupt the calming impact of the vagus nerve on cardiac functions by inducing worry and rumination.[68]

2.4.1.2 INFLUENCE OF STRESS ON COGNITIVE SCHEMA

Exposure to racism can also interrupt individual cognitive structures influencing one's cognitive schema. Racism can be interpreted as unpleasant memories threatening the cognitive schemata of an individual by mentally dispositioning themselves as worthless, hopeless, unproductive members of society.[58,68] Exposure to racism blocks their positive emotions which can impact their health.[68] Fredrickson[71] developed the broaden-and-build theory positing that experiences of positive emotions broaden people's momentary thought-action repertoires, which in turn serves to build their enduring personal resources, ranging from physical and intellectual resources to social and psychological resources. Fredrickson argues that positive emotions build psychological resiliency and trigger upward spirals toward improved emotional well-being by broadening the scopes of attention and cognition, enabling flexible and creative thinking.[71] However, when positive emptions are revoked into negative emotions, the

upward spiral reverts into a downward transition characterized by depressed moods and narrow minded pessimistic thinking leading to clinical levels of depression.[71]

2.4.1.3 STRESS AND EMOTION REGULATION

Another pathway by which racism can be embodied as a stressor is through emotion regulation.[68] As posited in the theoretical frameworks above in the preceding section, one's response to racism can have a significant impact on health and wellbeing. Emotion regulation refers to the ability to increase, maintain, or inhibit the expression and experience of an emotional response.[68] The suppression of one's emotional response occurs when an emotion is denied admission into consciousness. In a study examining the associations between blood pressure and self-reported experiences of racial discrimination and responses to unfair treatment by Krieger and Sidney[72], results indicated that among working-class black adults reporting that they typically accepted unfair treatment and had experienced racial discrimination in none of seven situations, was about 7mm Hg higher than those reporting that they challenged unfair treatment and experienced racial discrimination in one or two situations.[72] This type of trend was also relevant among professional black adults. The latter suggests that suppressing emotions related to racism is a systematic stressor that can lead to the onset of hypertension. On the other hand, actively challenging racism can have a more positive outlook on health.

2.4.1.4 STRESS & ALLOSTATIC LOAD

The tendency of exposure to racism existing as a stressor can be linked to the onset of disease by way of allostatic load. McEwen[73] refers to the long-term effect of the physiologic response to stress as allostatic load, which is the wear and tear that results from chronic overactivity or underactivity of allostatic systems. Allostasis is the ability to

achieve stability through change.[73] By way of allostasis, the autonomic nervous system, the hypothalamic-pituitary-adrenal (HPA) axis, and the cardiovascular, metabolic, and immune systems protect the body by responding to internal and external stress.[73] McEwen explains that varying situations can arise which are associated with allostatic load; The first and most obvious being frequent stress.[73] A surge in blood pressure can trigger myocardial infarction in susceptible individuals and repeated elevations of blood pressure over periods of weeks and months accelerating atherosclerosis, a pertinent risk factor of myocardial infarction.[73] Many of the theoretical frameworks discussed above point out that racism is a serious threat to health when it occurs throughout one's life course (especially at time sensitive periods such as childhood and adolescence) on a cumulative and frequent basis. Beatty and Matthews[74] carried out a study to determine if ambulatory blood pressure (ABP) at night relative to day among adolescents is influenced by unfair treatment and trait anger, and whether these associations are stronger in African American and adolescents from lower SES families and neighborhoods. Their results indicated that higher trait anger was associated with higher night/day DBP ratio.[74] Additionally, reports of unfair treatment was associated with a higher night/day DBP ratio among African Americans.[74] Furthermore, among those residing in lower SES neighborhoods, reports of greater unfair treatment also predicted a higher night/day DBP ratio.[74] Beatty and Matthews conclude that trait anger and unfair treatment in adolescent African Americans results in elevated night/day ABP ratios.[74] As this occurs over time, this might warrant allostatic load leading to an early onset of hypertension.

The literature discussed here indicates that exposure to racism and racial discrimination among minorities acts as a stressor (by way of varying mechanisms)

influencing biological pathways within the body. These biological responses evoke a physiological response, in turn affecting health and wellbeing. In addition to explaining the embodiment of racism as stress, there is ample literature suggesting other various associations of racism and health which will be discussed next.

2.4.2 RACISM AND MENTAL HEALTH OUTCOMES

Current literature reports significant associations between self-reported racism or discrimination and mental health. Kwate and Goodman[23] investigated the impact of racism on the mental health outcomes among African Americans at cross-sectional time points and longitudinally, over the course of 1 year in the black Living Inequality, Feelings, and the Environment (LIFE) study. Lifetime and chronic experiences with racism and unfair treatment was measured using the Experiences of Discrimination Scale and the Daily Life Experiences (DLE) subscale of the Racism and Life Experiences Scales, respectively. At the 1-year follow up, racism was not found to be associated with psychological distress; However, it was associated with poor mental health days. Each unit increase on the DLE scale was associated with an additional 2.93 days in poor mental health and each unit increase in the everyday discrimination scale with 3.70 additional days in poor mental health.[23] Longitudinal analysis showed significant associations between health outcomes and both measures of racism. Each unit increase in everyday discrimination over the 1-year time period produced an increase of 1.3 for distress.[23] Additionally, in estimating the longitudinal effects of racism on poor mental health, each unit increase in the everyday discrimination scale and the DLE scale resulted in an increase of 3.2 and 2.2 additional days of poor mental health, respectively.[23] Kwate and Goodman imply that individuals who denied thinking about their race fared worse in

these outcomes.[23] Individuals who "actively processed" the reality of race mitigated the significant implications of poor mental health.[23]

Similarly, a systematic review and meta-analysis conducted by Paradies et al.[24] indicated a positive association between racism and poor mental health, including depression, anxiety, and psychological stress. Racism was also associated with poorer general health and physical health.[24] The authors suggest that a stronger association between racism and mental health outcomes could be explained by the biological mechanisms by which racism affects health. Exposure to racism over time can lead to the dysregulation of cognitive-affective regions including the prefrontal cortex, anterior cingulate cortex, amygdala, and thalamus.[24] All of these are potential pathways into developing poor mental health outcomes such as anxiety, depression, and psychosis.[24] The effect size of negative mental health associations was larger among cross-sectional data analysis. The effect-size over longitudinal data (defined as more than one year between exposure and outcome) resulted in weaker associations.[24] Paradies et al. suggests this could be due to individuals becoming "hardened" to racism over time, accepting it as a societal norm.[24] Ethnicity significantly moderated the effect of racism on negative mental health.[24] The association between racism and negative mental health was stronger for Asian American and Latino(a) Americans when compared to African Americans.[24] This finding might suggest that African Americans are more resilient or perhaps better equipped to withstand racism, in comparison to their Asian American and Latino counterparts.[24]

In investigating the relationship between racial discrimination, psychological distress, and self-rated health among US-born and immigrant black Americans, Krieger

and colleagues[75] determined that both US-born and foreign-born black Americans undergo high levels of racial discrimination (76% and 60%, respectively) and self-reported high levels of severe psychological distress (14% and 16%, respectively). The Kessler 6 (K6) scale was used to measure psychological distress among survey respondents. After controlling for covariates, risk of racial discrimination (high vs. no exposure) was 4.0 and 3.3, respectively; corresponding odds ratios (OR) for severe psychological distress were 6.9 and 6.8.[75] In an additional study, Cuevas and associates[76] found that greater perceived discrimination among church going African Americans was associated with greater perceived stress and more depressive symptoms. A one standard deviation increase in perceived discrimination was associated with a decrease of .035 and .046 in self-rated health indirectly through perceived stress and depressive symptoms, respectively.[76] Their findings indicate that even among church going African Americans, experiences with discrimination results in poor self-rated health due to greater stress and depressive symptoms. This finding is surprising since being an active member within a church has its many benefits including improved social and spiritual support as well as social cohesion within communities.[76] Similar effects of racial discrimination were observed among a sample of college students. Dinh and colleagues[77] found that college students who self-reported experiences of racism were more likely to report depression and a poorer general health status. The authors indicate that racism in the context of intergroup anxiety (e.g., "I feel threatened when interacting with racial/ethnic minorities.") in lieu of perceived threats of racism (e.g., "Racial/ethnic minorities have more economic power than they deserve in this country.") appears to have a more profound effect on negative health outcomes.[77]

2.4.3 RACISM AND BEHAVIOR

In addition to poor mental health outcomes, current literature also provided ample evidence suggesting that the occurrence of perceived discrimination potentially resulted in individuals engaging in unhealthy behaviors. Hurd and associates[78] found that among a sample of black teens and young adults (aged 15 – 30), accounts of perceived discrimination was significantly associated with anxiety symptoms, depressive symptoms, and alcohol use. The authors indicate that this transitional period into adulthood is a sensitive time within one's life course suggesting experiences that take place during this time can have significant implications on one's life course trajectory.[78] Emerging adults might be more susceptible to negative outcomes such as psychological distress and alcohol use when experiencing heightened stressful experiences much like perceived racial discrimination. Additionally, denied educational or employment opportunities and housing discrimination can result in decreased earning potential and increased risk of poverty across the life course.[78] These cumulative effects trigger stressful responses which can manifest into negative health outcomes.

Purnell et al.[25] found that regardless of race or ethnicity, perceived discrimination within a healthcare setting was associated with increased odds of current smoking among a sample of respondents to the Behavioral Risk Factor Surveillance System (BRFSS) Survey. In comparison to individuals who reported receiving similar treatment as those of other races, those who reported being treated worse than people of other races in healthcare settings were more likely to be current smokers (OR 1.18).[25] Similarly, those who reported worse treatment in the workplace were also more likely to smoke (OR 1.13).[25] Purnell and colleagues posit that individuals who report perceived discrimination

might engage in negative health behaviors such as smoking to cope with the psychological distress.[25] When breaking down current smoking into subcategories, individuals who perceived worse treatment in healthcare settings were more likely to be everyday smokers.[25] This indicates an association between perceived discrimination, the setting in which discrimination is perceived, and the frequency of engaging in unhealthy behavior such as smoking.[25]

Todorova, Falcon and Lincoln[79] report that among a group of Puerto Ricans in the United States, perceived discrimination was significantly associated with a higher probability of ever having smoked (OR 1.32).[79] In addition, perceived discrimination was also associated with a higher probability of ever been a drinker (OR 1.43).[79] Similar to Purnell et al.'s rationale, Todorova and associates suggest that discrimination may be leading to increased drinking and smoking as a means of coping.[25,79] However, it is also suggested that participation in these behaviors might be an indication of more active social involvement which subsequently increases ones risk of exposure to perceived discrimination.[79] Among a cohort of adults participating in the Multi-Ethnic Study of Atherosclerosis, Borrell et al.[26] found that blacks who reported experiences of racial discrimination were 34% more likely to be current smokers and 51% more likely to report being drinkers.[26] Among Hispanic study participants, those who reported experiencing racial/ethnic discrimination were 62% more likely to report as being heavy drinkers.[26] Tobler and associates[80] found similar effects of perceived racial/ethnic discrimination on unhealthy and violent behavior among a group of minority urban youth. Perceived racial/ethnic discrimination was significantly associated with physical aggression, delinquency, victimization, depression, suicidal ideation, and risky sexual

behavior.[80] Both studies (Borrell et al. and Tobler et al.) indicate that participation in these behaviors can be interpreted as coping mechanisms due to increased stress related to racial discrimination.

The studies discussed above indicate stress as a potential link in the chain which might account for the association between perceived racism and engagement in negative and risky health behaviors. Additionally, the exposure to stress due to perceived racial discrimination holds significant implications on one's life course trajectory especially during critical phases of human development such as childhood and adolescence. Exposure to the chronic and/or acute stress as a result of perceived racial discrimination and how one copes with it will ultimately influence ones behavior and overall health and wellbeing. Therefore, one's frequency and intensity of exposure to stress by way of racial discrimination might be the key to understanding the causality between racism and poor health.

2.4.4 RACISM AND HEALTH OUTCOMES

Beyond mental health effects and unhealthy behavior, racial discrimination also holds great implications on one's overall health status and health outcome. A systematic review by Williams and Mohammed[61] found sufficient evidence highlighting significant associations between experiences of discrimination and psychosocial stressors related to an array of health outcomes and health risky behaviors including, coronary artery calcification, elevated blood pressure, low birth weight delivery, cognitive impairment, subjective and objective indicators of poor sleep, visceral fat, and even mortality. Using the results of the 2002 North Carolina BRFSS survey, Gizlice and Ngui[81] found that the rate of diabetes was significantly higher among individuals who reported being treated

worse than people of other races when seeking health care, 14.5% vs. 7.3%. Additionally, obesity prevalence was greater among those who reported having physical or emotional symptoms due to treatment based on race (37.6%) and also among those who reported experiences worse than other races when seeking health care (36.3%), compared to 23.2% and 24.8%, respectively.[81] Respondents who reported perceived racial discrimination while seeking health care services were also more likely to be diagnosed with arthritis (OR 3.04).[81] Similar to studies above, Williams and Mohammed and Gizlice and Ngui link negative health outcomes to racial discrimination by way of exposure to stress. Ones exposure to racism and racial stereotypes are considered to be chronic stressors that have a "weathering down" effect on an individual's health over time; thereby increasing their chances of developing chronic conditions. Additionally, continued exposure to stressors and multiple attempts to cope with it might also impact the integrity of one's immune system and its resilience to illness.[81]

Negative racial related experiences while seeking healthcare as described in studies above results in unmet healthcare needs and individuals not receiving adequate healthcare attention. In a study consisting of four races/ethnicities (White, African American, Mexican, and Puerto Rican), Benjamins and Whitman[82] found that experiences with racial discrimination was associated with an increased likelihood of having unmet health care needs (OR 2.48) and lower odds of perceiving excellent quality of care (OR 0.43). In studying the effect of perceived race consciousness (the frequency with which one thinks about his or her own race) within the patient-physician relationship, Brewer and associates[83] report that race-conscious blacks experienced significantly higher diastolic (79.4 vs 74.5mm Hg) and systolic (138.8 vs. 134.7mm Hg)

blood pressure than blacks who were not race-conscious. Crawford, Jones and Richardson[84] conducted a study purposed in examining the impact of reactions to race-based treatment on being up-to-date with colorectal cancer screening among non-hispanic whites, non-hispanic blacks, and hispanic adults. Study findings indicated that Hispanics who always thought about their race were less likely to be screened for colorectal cancer (OR 0.71) compared to those who never thought about their race.[84] Also, when compared to their White counterparts, Hispanics who always thought about their race were less likely to receive a screening (OR 0.27).[84] Similarly, Hausmann, Jeong and Bost[85] examined the relationship between perceived discrimination and preventative health care utilization using the 2004 BRFSS survey results and found that discrimination was associated with less utilization of mammogram, pap test, PSA test, blood stool test, and sigmoidoscopy/colonoscopy (ORs 0.53-0.73).

There are many mechanisms by which the above associations might be explained; one being avoiding healthcare systems and the utilization of healthcare services which can result in poor health outcomes due to sub-optimal care.[85] Another mechanism might be how often one thinks about their race. Ethnic groups who are aware of their social and cultural differences might be less willing to participate in preventative or healthcare related services.[83] Seeking care from healthcare providers who are not cultural competent according to the racial/ethnic demographics of their patient population, may influence an individual's perception of administered treatment and care (intentional or unintentional) which can result in individuals "doctor hopping" or avoiding the utilization of healthcare services altogether. Benjamins and Whitman suggest that decreased trust in healthcare providers or the healthcare system might be a plausible reason.[82] Furthermore,

individuals of lower socioeconomic status might face more discrimination and those facing financial difficulties might also be important factors as to why individuals with perceived experiences with racism might suffer from unmet healthcare needs.[82]

2.4.5 CHARACTERISTICS OF TWITTER AND ITS USERS

Twitter was launched as an online social media website in 2006. Since then its popularity and use has morphed into a cultural phenomenon allowing people to post (tweet) information in real time and to follow updates posted by others. As of 2013, Twitter has over 200 million active users generating over 400 million tweets per day.[86] Twitter is available in 33 different languages. Initially serving as a means of online communication between people, it has morphed into an arena for political debates, media gossip, entertainment news, and business ordeals. Some of the real-time spikes in Twitter activity occurred from people tweeting and sharing information related to the death of pop star Michael Jackson in 2009 and the royal marriage of Prince William and Kate Middleton in 2011.[86] A photo of former President Barack Obama and first lady Michelle posted immediately after his re-election as the President of the United States in 2012, became the most retweeted message in Twitter history.[86] Twitter has also become a place to share personal experiences and the aftermath of disasters like the historic flooding in Columbia, South Carolina in 2015 or the effects of Hurricane Matthew in 2016.

The demographics of Twitter users vary. According to a study by Smith and Brenner,[87] as of 2012 African Americans, young adults, and urban and suburban residents have the highest rates of Twitter usage relative to their peers. More than one quarter of online African Americans (28%) use Twitter, with 13% doing so on a typical day.[87] Roughly one quarter (26%) of internet users aged 18 – 29 use Twitter.[87] This is double

the rate for middle aged adults (30-49).[87] Comparing Twitter usage across geographical locations, urbanites and suburbanites are more likely to use Twitter than their rural counterparts.[87] Smith and Brenner did not find any significant variations in Twitter usage across education and income levels. More recent studies published by the Pew Research Center show that the demographics of Twitter users are changing as more and more people sign up for a Twitter account.[88] Compared to 2013, Twitter has seen significant increases among men (24% vs. 17%), whites (21% vs 16%), those aged 65 and older (10% vs 5%), and urbanites (25% vs 18%).[88] The prevalence of Twitter use is increasing among rural areas as well (17% vs. 11%), but not at a significant pace.[88] However, the most recent report published by the Pew Research center shows that Twitter usage continues to grow across geographic locations. The prevalence of Twitter usage in urban, suburban, and rural areas in 2016 was 26%, 24%, and 24%, respectively.[89]

Twitter users have the option to enable location services on their Twitter account. Twitter doesn't enable the location service by default. A user must manually enable Twitter to use location services on their device. Once enabled users can geotag their tweets with precise location data presented in the form of latitude and longitude. A study by Sloan and Morgan[90] indicates that approximately 60 percent (58.6%) of Twitter users do not have location services enabled while 41.6% of users do. Excluding retweets, 96.9% tweets are not geotagged while 3.1% are.[90] In comparing genders, males are slightly more likely than females (increase of 0.1%) to geotag their tweets.[90] The mean age between geotaggers and non-geotaggers is slightly higher, 21.58 vs. 20.76, respectively.[90] Wood-Doughty and associates[91] found similar characteristics in their study, but an additional finding that enabling geotagging was similar between white

(28.2%) and black (31.0%) Twitter users. Furthermore, the study found that the percentage of white and black users with at least one geotagged tweet was 6.1 and 6.8, respectively.[91] These findings indicate that the demographics of Twitter were relatively skewed towards young, black, urbanites. However, more recent reports on the demographics of Twitter show that these are changing as more and more whites, older adults, and rural residents are using Twitter.

As indicated above, the use of Twitter has outgrown its initial reason of inception. Just like its penetration into mainstream media, Twitter has recently become a breeding ground for hate speech and discrimination. A study conducted by the Think Tank Demos[92] in September of 2015 recorded an astonishing 6.7 million racial slurs on Twitter over a period of two weeks. The term "nigga" tends to be the most "tweeted" racial slur across the Twitter platform, followed by "white boy" and "nigger".[92] During this time, the researchers recorded about 10,000 racist tweets per day, but that has now increased to 484,139 per day, largely due to the use of the word "nigga."[92] These researchers explain that in some cases, these words are uses to offend others, but they are also used by groups to describe themselves by using words that were once used to insult them. Across the influx of tweets containing the racial slurs, the researchers suggest that the "nigga" word is used quite differently from its more primitive form "nigger" as a friendly means of communication between black people while the more traditional spelling of the word is used in a more racist way on Twitter.[92]

On the flipside of things, Twitter has also allowed for a more positive approach to dealing with racism. After the killing of Trayvon Martin in 2012, the #BlackLivesMatter movement started as a protest against police violence of African Americans. The

movement quickly spread across black communities throughout the nation and onto college campuses thanks to social media, like Twitter. Olteanu and associates[93] characterized the demographics behind the #BlackLivesMatter movement finding that most users only post a few tweets with the (hashtag) #BlackLivesMatter (62% users with only one tweet).[93] Across all users, young adults (aged 18 – 29) resulted in the most posts with the hashtag.[93] Additionally, black females tend to represent the most frequent race and gender posting with the hashtag on Twitter.[93]

The evidence discussed above suggests that Twitter is a widely used social media platform to post and share information relating to a broad range of topics. Twitter users tend to be young adults aged 18 – 29. However, the demographics of Twitter are changing from year to year as more older, white, and rural individuals become Twitter users. There is not much difference between genders when it comes to geotagged tweets. Twitter has become a novel outlet for individual expression, including racism. However, it is also a method for users to actively resist racism and revert its penetration and effects throughout society. Considering this, Twitter can be a useful data source for researchers to understand the potential prevalence of racism and response mechanisms.

2.5 NEED FOR PROPOSED RESEARCH

This literature review indicates that racial or ethnic discrimination results in harmful side effects including poor mental health, the practice of unhealthy behaviors, and poor health outcomes. There are multiple pathways suggesting the rationale resulting in these associations between racism and poor health; one common pathway being stress. Exposure to racism increases one's exposure to stress. The frequency of exposure to stress can manifest into negative health outcomes. Additionally, evidence discussed

above shows that individuals experiencing racial discrimination are less likely to receive adequate health care services subsequently resulting in poor overall wellbeing. There are also many pathways that explain this association. When a patient perceives racial discrimination while seeking healthcare services, it might indeed evoke a response to shy away from healthcare settings which can result in unmet needs and poor overall health. The latter pathway can have a profound impact in areas where access to care is limited and patients don't have the option to choose from a vast pool of healthcare providers. Perceived discrimination also disrupts the patient-provider relationship hindering a trustworthy relationship which can lead to inadequate care or a lower quality of care. This indicates the significance of cultural competency training for providers to mitigate the occurrence of unintentional racial and cultural discrimination and to ensure an open patient-provider relationship built on trust and respect. Lastly, race and racism consciousness also proves to be a very plausible mechanism explaining the relationship between health and experienced racism. Many of these pathways indicate that individual response to stressful experiences with racism is critical in understanding the causality between racism and health.

Social media platforms, like Twitter, have become a breeding ground for the proliferation of racism and "hate speech." It is necessary to explore social media data to ascertain and quantify the existence of racism on websites like Twitter. Additionally, given the ample evidence suggesting the association between racism and health, it is important to ascertain these effects given the presence of online racism. Also, current literature doesn't examine racism across geographical areas with respect to rurality (rural verses urban differences). This study is concerned with applying a relatively novel

measure of potential racism (using a measure of a racial slur from an online social media platform) linked with county level demographics and population characteristics to determine the association between the use of a racism related racial slur and black mortality.

This study will have significant implications on the field of public health and health policy. The study can serve as evidence of the health and longevity effects of racial tension and expression of racism in an online environment. Applying a geographical and rurality approach to the study will help to quantify the effects across specific areas to allow for effective, targeted public health interventions to monitor and remediate the effects. The potential findings of the study can also influence the future implementation of social media laws and policies relating to appropriate behavior in an online setting like Twitter. Furthermore, potential findings can influence the development of built-in methods to monitor, assess and control behavior across social media websites and applications. As technology advances and the gap between individuals' access to the world-wide web restricts, the potential for online racism and other forms of discrimination will worsen, subsequently influencing individual health and wellbeing. Therefore, public health efforts will be needed to combat the effects of online discrimination.

CHAPTER 3

METHODS

3.1 WORKING CONCEPTUAL FRAMEWORK

I have developed a working conceptual framework based on the culmination of the above theories that posits the influence of all levels (macro and micro) of experienced racism on individual health and wellbeing. Please refer to Figure 3.1 for a diagram of the framework. In the working framework, racism is broken down into two main levels; organized racism and social racism. I define organized racism as racial prejudice and discrimination initiated by institutions and/or systems including government, occupational, healthcare, educational, and online. Social racism is defined as prejudice and discrimination occurring between differing racial/ethnic groups throughout society based on the social assignment of race and racial hierarchies. The occurrence of organized and social racism accumulates and manifests into multiple pathways through which racism occurs at the individual or micro level. The interaction of these pathways is the central and most integral part of the framework. These pathways are represented in a circle to emphasize that they take place throughout one's life course. The frequency and intensity of these pathways result in established stress. However, what links racism to health is by way of response to the stress. Individual response can be either protective or harmful. Protective responses include taking affirmative action, building resilience, actively recognizing racism, and patriating in protests and national movements against racial discrimination. Harmful responses include internalizing stress brought on by

racism, acculturating to societal racial stereotypes and stigmas, and avoiding direct racial discrimination.

This working theoretical framework gets at the idea that stress derived from perceived racism and individual response to it might be the link needed to determine causality between experienced racism and poor health. The working framework considers racism occurring at all levels throughout society and their accumulating effect on individual health and wellbeing. As the framework adapts concepts from all of the models and theories discussed above, it is heavily influenced by those posited by Krieger, Jones, and Clark et. al. This model does not exist to explain why racial attitudes are more prevalent in one area or the other nor does it try to explain how or why an individual might perceive an interaction, behavior or some other stimulus to be racist; it merely tries to explain how racial related disparities of health and health outcomes might be a resultant of an aggregation of effects and responses imposed by the system of racism. The proposed study cannot measure the conceptual framework in its entirety. The study can only look at quantifying the association between racism in an online environment and mortality. The levels of stress experienced by those exposed to online racism will not be accounted for and measured in this study. Additionally, the study will not try to prove or validate the framework as an evidence based model to be applied for future studies.

3.2 STUDY DESIGN

To study the effect of the use of the racial slur “nigger” on Twitter and black mortality, a cross sectional analysis of black mortality will be applied at the county level. The study population is 653 counties across seven southern states including: Virginia (135 counties), North Carolina (100 counties), South Carolina (46 counties), Georgia

(159 counties), Alabama (67 counties), Mississippi (82 counties), and Louisiana (64 counties).

The American South has mostly been considered a distinct part of America. McKinney and Bourque[94] described the American south as traditionally being viewed as a "passive, backward, and often recalcitrant region of the country: a section whose existence the rest of the country would often like to ignore." McKinney and Bourque attribute this conception of the American south to three historical reasons.[94] First, the tradition with its emphasis on the uniqueness and difference of the south contributing to a "Southern mystique" emphasizing its distinctiveness of the region in contrast to its shared experiences and characteristics. Secondly, the emphasis on local color has developed a view of dramatic value, in lieu of objective value. Southern writers and playwrights wrote with dramatic value rather than representative purpose drawing on the southern life. Lastly, the mass media has created a somewhat negative image of the south focusing on the south's intransigence in race relations and the idiosyncrasies of southern politics. These three historical concepts have painted a picture of the American south as a "colorful land" with a variety of people consisting of: blacks, crackers, creoles, red-necks, sheriffs, mountaineers, sharecroppers, itinerant preachers, and Klansmen; and characterized by poverty, ignorance, traditionalism, and resistance to change.[94] McKinney and Bourque emphasize that the American south started to experience an economical change in the 1970s thanks to new processes changing the way in which persons obtain a living and new styles of daily life. These changes have been propelled by industrial and technological change, variance in occupational structure, development of transportation and communication infrastructure, and increased urbanization.[94] As the

south continues to experience growth and economic change however, similar health disparities can be identified across the South.

Holt[95] carried out a spatial analysis of the US at the county level to ascertain pockets of poverty. His findings indicated high poverty clusters spread across the southern United States as well as in the northern Great Plains states. Areas of extremely high poverty are those that have been historically and culturally defined as Appalachia, the Cotton Belt, the Bootheel of Missouri, the Mississippi Delta, the border region of Mexico, and tribal lands in the Four Corners region.[95] Holt described his findings as generating a distinct north-south divide (defined as the continental poverty divide) across most of the US in which concentrations of low poverty and spatial outliers of high poverty are confined to the north and concentrations of high poverty and spatial outliers of low poverty confined to the south.[95] Murray and colleagues[96] posit that the US can be divided into eight Americas based on their similarities of disparities; Asians, below-median income whites living in the Northland, middle America, poor whites living in Appalachia and the Mississippi Valley, Native Americans living on reservations in the West, black-middle America, poor blacks living in the rural south, and blacks living in high-risk urban environments. Similar patterns of life expectancy, middle aged and young adult mortality due to chronic disease death, patterns of tobacco use, alcohol consumption, and obesity are distinct to each America.[96] Hotez[97] also points out demographic similarities in the Mississippi Delta and the American South. In his study, Hotez notes high rural poverty rates, inadequate housing, and poor health as "hallmarks" of these areas.[97] Mortality rates attributed to cancer and heart disease in the south and Mississippi Delta are among the worst in the US.[97] Furthermore, tuberculosis, and several

parasitic and congenital infections plague blacks of the American south.[97] Hotez also mentions that "feminization of poverty," which is defined as the observation that women have fewer economic resources than do men and are more likely to be heads of single-parent families, is a southern landmark especially among single, southern black mothers living in poverty.[97] These findings indicate similar demographics in the American south creating a disadvantaged population in America experiencing poor health outcomes and poor living conditions. The demographic similarity of the American south represents its usefulness as a single sample population for research related to health disparities and health outcomes. This study will capitalize on the demographic similarities of the American south to ascertain mortality differences within the south as associated with the prevalence and intensity of racist tweets and racist tweeters.

3.3 DATA SOURCES

Data for this study will obtained from five retrospective data sources; Twitter, Area Health Resource File (AHRF), and CDC Wonder, County Health Rankings and social capital variables from a publicly available source maintained by the Northeast Regional Center for Rural Development. These data sources and their intending use for the study will be described here.

3.3.1 TWITTER DATA – THE DOLLY PROJECT

The Data on Local Life and You (DOLLY) Project based at the University of Kentucky is in the early phase of bringing a large social media dataset to the hands of researchers. The DOLLY project leverages on a very robust server-based data mining system along with the advantages of ad hoc desktop applications and small, relevant datasets to minimize technical barriers.[98] DOLLY has collected all geotagged tweets in

the world, dating back to June 2012; a corpus of over 12 billion tweets and counting. The system allows for real-time search and data extraction. Geotagged tweets are collected via the DOLLY system by using a 1 percent and 10 percent Streaming Application Program Interface (API).[98] Parallel streams are set up at the 1-percent level and filtered by a different spatial bounding box covering a continent.[98] Each one of these streams can collect 1 percent of tweets. In the case of a filter on a stream matching more than 1 percent, the resulting set is sampled down to 1 percent. The latter feature narrows each stream to a small bounding box to ensure that geotagged tweets that fall within the box are relatively always below 1 percent of all tweets.[98] The second level of the system collects a separate stream consisting of 10 percent of all tweets and not only geotagged tweets. This second level is used to monitor the total number of tweets that surface every day and to determine the proportion of those that are geotagged. There are three primary types of geotags attached to tweets: latitude/longitude coordinates (generated via GPS, cellular tower, or Wi-Fi location), a place (e.g. Columbia, SC), or place and a coordinate pair.[98] The latitude/longitude coordinate is used to perform a spatial join to larger areal units (country and state/province-level for all countries and county and census tract levels for the US).[98]

Immediately when tweets come in, they are indexed. This approach allows for accurate and relatively quick searches across the DOLLY system. ElasricSearch uses indices that are organized by month and the seven bounding boxes (continents) used for the Twitter Streaming API.[98] This allows for a researcher to search and extract data from a specific continent and month or a wider search like across an entire year. Every single field within each index is individually indexed. For fields containing text (like the tweet

itself or user bio), a full-text index is constructed by splitting the field into terms and creating n-grams – strings within each word up to the length n – for each term.[98] This allows for searches to match partial words and to search using wildcards. The latter feature of the DOLLY system allows for the application of Levenshtein's[99] string distance to account for spelling variations, singular-plural, shortened words and general typos.[98] Currently, the data from the DOLLY system is not publicly available. However, the DOLLY research team has a goal to make the data available via a website allowing for researchers to execute their own extraction. Use of the data from the DOLLY project for this study was cleared and provided by the Principal Investigator and Director of the project, Dr. Matthew Zook a Professor of Geography at the University of Kentucky.

3.3.2 AREA HEALTH RESOURCE FILE (AHRF)

The AHRF, formerly the Area Resource File (ARF), is a computerized, county-based data system that consolidates a vast array of data into a consistent, current and compatible set of files.[100] It is maintained in the Office of Data Analysis and Management in the Health Resources and Services Administration. The AHRF is a compilation from more than 200 sources if data assessing the nation's health care resources.[100] The data are merged and summarized at the county level. Normally, the AHRF has between 7,000 and 9,00 data elements at one time.[100] The major types of data contained in the ARF is information on health professions (physician specialty data by age, sex, and location of medical school); Hospital characteristics and utilization data (number of beds, patient days, admissions, outpatient visits, hospital personnel, etc.); Vital statistics (numbers of births, infant mortality, number of low-birth weights infants by race and sex and mortality by cause, age, sex, and race); Medicare expenditures by

county; Demographic data (detailed age-, sex-, and race specific population estimates and decennial census on housing units, households and families, urban and farm population, and educational level of the population); Economic data (income distribution, annual unemployment , and employment statistics); Health professions education (number of students, graduation and tuition statistics).[100] This data is publicly available and can be downloaded the website, https://ahrf.hrsa.gov/download.htm. Controlled variables including education level, household income, unemployment, primary care to population ratio, and hospital count per county to be used in the study will come from the AHRF and averaged according to the study time period (2012-2015).

3.3.3 CDC WONDER

The third and final dataset to be used for the study is the Centers for Disease Control and Prevention Wide-ranging Online Data for Epidemiological Research (also CDC WONDER). CDC WONDER is a comprehensive online public health information system that was developed for public health professionals to quickly and easily access information from a wide variety of sources, including surveys and surveillance systems, specialized studies, the Morbidity and Mortality Weekly Report (MMWR) and descriptions of state and local health department activities.[101] Using CDC WONDER, users can query data via menus. Tabular and textual results can be viewed on screen and downloaded to a computer or a device for further analysis. CDC WONDER also allows for a user to conduct search through textual databases like the MMWR. In lieu of keywords, the system searches for words or phrases that appear anywhere in the text, including titles and tables.[101] A third useful feature of the CDC WONDER system is allowing the user to look up International Classification of Disease (ICD-9) codes. The

system searches the full index and then displays a list of codes associated with the search term.[101] There are four types of data available on the CDC WONDER system. The first is large numerical datasets from which the user can create multiway tables, bar charts, county-level maps, and customized subsets for further analysis.[101] The second is preformatted tabular datasets consisting of tens of thousands of tables that can be searched, read, and printed but not otherwise manipulated.[101] The third is textual data made up of diverse materials such as the full text of the MMWR, listings of the CDC personnel, and organizational listings. The fourth type of data is a stock of dozens of SAS data sets derived from large health surveys; output is restricted to subsets analyzable with SAS or other statistical software.[101] Data from CDC WONDER is publicly available and can be accesses via the website, https://wonder.cdc.gov/. The outcome variable (gender combined county level black mortality rates) will be averaged for the study time period (2012-2015) and will be obtained from the CDC Wonder online tool.

3.3.4 RWJF COUNTY HEALTH RANKINGS & SOCIAL CAPITAL

Every year since 2010, the University of Wisconsin Population Health Institute and the Robert Wood Johnson Foundation have released the "County Health Rankings" which are considered to be a "population health checkup" for the nation's 3,000 plus counties.[102] The rankings are created using the "Rankings" conceptual model which includes both health outcomes and health factors. Health outcomes are divided into two components; length of life and quality of life.[102] Health factors are divided into four components including: health behaviors, clinical care, social and economic factors, and quality of life.[102] Data for over 30 measures are available at the county level. Each county is used as the geographical level of analysis and is defined by the FIPS code. Data for

each of the components of the County Health Rankins are selected from varying national data sources, including the National Center for Health Statistics, Behavioral Risk Factor Surveillance System, and American Community Survey.[102] The County Health Rankings are publicly available and can be accessed at http://www.countyhealthrankings.org/. The study will utilize the most recent (2017) County Health Rankings. Income inequality by county will be derived from the County Health Rankings to be used as a control variable in the study.

Two measures of social capital at the county level will be obtained from a publicly available dataset maintained by the Northeast Regional Center for Rural Development at Penn State.[52] The data is maintained in an excel file listing various measures of social capital at the county level (i.e. religious organizations, civic and social organizations, business associations, political organizations, professional organizations, fitness and recreational sports centers, etc.). The data also includes a social capital index as an aggregate measurement of all of the available factors. For the purpose of this study, voter turnout (percent of voters in the 2012 Presidential Election) and Census response rates (percent of respondents to the 2010 US Census Survey) both at the county level will be obtained from the 2014 version of the dataset. The data can be accessed at http://aese.psu.edu/nercrd/community/social-capital-resources.

3.3.5 TWITTER DATA AS A PROXY FOR RACISM

Data from social media outlets like Twitter and others is an effective proxy to measure area level racial discrimination and/or hate speech. The approach taken to capturing the measurement varies. Silva and colleagues[103] suggest applying a basic sentence structure to capture hate speech across online sites. The sentence structure can

be easily leveraged across posts to pinpoint explicit hate statements. Silva et al. suggest applying a sentence structure starting with "I" followed by intensity, user intent, and hate target. The "I" identifies that the post applies directly to their personal feelings or expression. The verb, user intent, specifies what the intent of the user is or how he/she feels. The intensity is used to capture tendencies where users might try to amplify their feelings (e.g. really). The hate target captures who the expression is targeted to. Other studies analyzing online websites or social media outlets have applied other ways to identify discrimination. Davidson et al.[104] applied a crowd-sourced hate speech lexicon to collect tweets containing hate speech keywords and labeled them into three categories: those containing hate speech, only offensive language, and those with neither. Tweets with the highest predicted probabilities of being hate speech tend to contain multiple racial or homophobic slurs. Tweets containing the slurs "nigger" and f*ggot tend to be correctly identified as hate. True hate speech tweets with the highest predicted probability of being offensive are genuinely less hateful and were perhaps mislabeled as offensive. The authors suggest that skimmers probably picked out words or phrases that appeared to be hateful without considering the context. Davidson et al. conclude that tweets misclassified as hate speech contain multiple slurs such as: n*gga, h*es, and b*tch. Terms used in racist tweets mostly included the words "nigger" and f*ggot. Similarly, Kwok and Wang[105] applied a supervised machine learning approach employing labeled data from Twitter accounts to learn a binary classifier for racist and nonracist labels. The authors designed a survey to identify the complexity of identifying hate speech and assessed statistical reliability of agreement using Fleiss' Kappa. The average accuracy rate was 76% with an average error rate of 24%. Text sentiments were not considered.

Kwok and Wang identified that “niggers” and “nigger” bear the greatest racist feature at counts of 3040 and 2363, respectively, whereas n*ggas and n*gga were only found in the nonracist dataset at 516 and 763 times, respectively. Their findings indicate that the terms “nigger” and “niggers” are standard for insulting blacks. The terms n*gga and n*ggas were limited to informal speech and confined within the black community on Twitter.

The evidence above suggests that online measures are effective and accurate in serving as a proxy for area racism. The evidence discussed here also highlights the accuracy of using the racial slur “nigger” and “niggers” as a measure of racism on Twitter and other similar websites.

3.4 DATA VARIABLES

The data variables to be studied (dependent, independent, and control) will be discussed in this section. Variables of interest are influenced by literature and their association with black mortality.

3.4.1 DEPENDENT VARIABLE

The outcome variable for the first paper is the Twitter data obtained through the DOLLY project. The primary outcome variable is gender combined age and population adjusted black mortality rates obtained from the CDC WONDER. The CDC WONDER allows for easy download of county level average all-cause mortality data by race and gender and for the specified study time-period (2012 – 2015).

3.4.2 INDEPENDENT VARIABLE(S)

For the purposes of this study, a racial slur will be defined as a tweet containing the word “nigger”. Literature has shown that the conventional spelling of the slur is predominately used in a derogatory or discriminating way on social media websites like

Twitter.[92] A count of tweets will be obtained from Twitter via the DOLLY Project. Data were extracted from the DOLLY system using a search for the keyword "nigger." The search was applied over the study states (Virginia, North Carolina, South Carolina, Georgia, Alabama, Mississippi, and Louisiana) and extracted at the county level across each state. The Twitter dataset contains state and county Federal Information Processing Standards (FIPS) codes to identify specific state and county.

The primary independent variable of interest will be the racist tweeter rate (tweeters as a percent of the total population per county). Additionally, tweeter intensity (racial slur tweets per tweeter for each county) will be a secondary independent variable of interest. To depict the racist tweeter rate and tweeter intensity, the proportion of each will be mapped by county for all 653 studied counties.

A third independent variable of interest to be applied to the study is rurality (rural vs. urban). Rurality information will be obtained from the most recent (2015-2016) AHRF. Rurality will be defined the same way as it is in the AHRF, according to the 2013 Rural-Urban Continuum Codes (RUCC). RUCC forms a classification scheme that distinguishes metropolitan counties by the population size of their metro area, and nonmetropolitan counties by degree of urbanization and adjacency to a metro area.[106] Metro and non-metro categories have been subdivided into three metro and six non-metro categories. Each county in the U.S. is assigned one of the nine codes as follows: 1 (Counties in metro areas of 1 million population or more); 2 (Counties in metro areas of 250,000 to 1 million population); 3 (Counties in metro areas of fewer than 250,000 population); 4 (Urban population of 20,000 or more, adjacent to a metro areas); 5 (Urban population of 20,000 or more, not adjacent to a metro area); 6 (Urban population of 2,500

to 19,999, adjacent to a metro area); 7 (Urban population of 2,500 to 19,999, not adjacent to a metro area); 8 (Completely rural or less than 2,500 urban population, adjacent to a metro area); 9 (Completely rural or less than 2,500 urban population, not adjacent to a metro area).[106] To depict the influence of rurality on the number of tweets containing the racial slur and the number of tweeters posting it on Twitter, a bivariate map showing the levels of rurality and the proportion of tweets and tweeters will be mapped by county for all 653 studied counties.

3.4.3 CONTROL VARIABLES

Current literature shows various associations between independent and area level socioeconomic status and access to care with all-cause mortality and black mortality rates. Education level[107], household income[108,109], unemployment[110], health insurance (insured vs. non-insured)[111], income inequality[112,113], primary care provider/population ratio[114], and count of hospitals per county[115,116] will be controlled for in the study in order to account for the differences in SES and access to care across counties. In the County Rankings data, income inequality is reported as the ratio of household income at the 80th percentile to that at the 20th percentile. A higher inequality ratio indicates greater division between the top and bottom ends of the income spectrum. The income inequality ratio for each county in 2017 County Health Rankings was generated using 2011-2015 data. Primary care provider supply is conceptualized as a ratio of the number of primary care physicians per 100,000. The primary care ratio for each county will be averaged for the study time period (2012-2015) for each county. Most of the controlled variables (education, household income, unemployment, health insurance, and primary care provider ratio) will be obtained from the most recent (2015-2016) AHRF and will be

assessed at the county level and averaged according to the study time period (2012-2015). Two variables of social capital, voter turnout and Census response rates, will be obtained from a publicly available website. Voter turnout is measured as the percent of voters in a county who voted in the 2012 Presidential election. The Census response rate measures the percentage of households within a county who completed the 2010 Census survey. Additionally, the percent of the black and white population at the county level will be averaged for the study time-period (2012-2015) to account for the proportion of each racial group across counties.

3.5 DATA ANALYSIS

The total sample for the study consists of 36,490 racist tweets coming from 615 of the 653 studied counties over the period of June 2012-2015. The total number of racist tweeters across the study population was 16,303 with an average of 2 racist tweets per person. The Twitter data obtained from the DOLLY Project consists only of extracted geotagged tweets containing the racial slur of interest, "nigger(s)." In order to obtain the primary and secondary independent variables of interest (racist tweeter rate and tweeter intensity per county) a count of all racist tweets per county will be generated. The racist tweeter rate will be calculated as the number of tweeters as a percentage of the total county population. The racist tweeter rate will be population adjusted to account for variance in number of tweeters for each county due solely to county population. The tweeter intensity rate will be calculated as the average number of tweets containing the racial slur per tweeter for each county. To depict the prevalence of racism, the racist tweeter rate and the tweeter intensity rate will be mapped by county for each research question. To show the influence of rurality, a bivariate map will be produced for each

measure that shows the variance across rural and urban defined counties. Spatial analysis will be

To test for associations between black mortality and tweets containing a racial slur, linear regression with generalized linear modeling will be used. Coefficient estimates and standard errors will be reported and interpreted at 95% Confidence Intervals and p-values at alpha (0.05). The statistical software that will be used to carry out all the above functions of analyses is SAS 9.4 (Cary, North Carolina) and ArcMap 10.2.2 (Redlands, California).

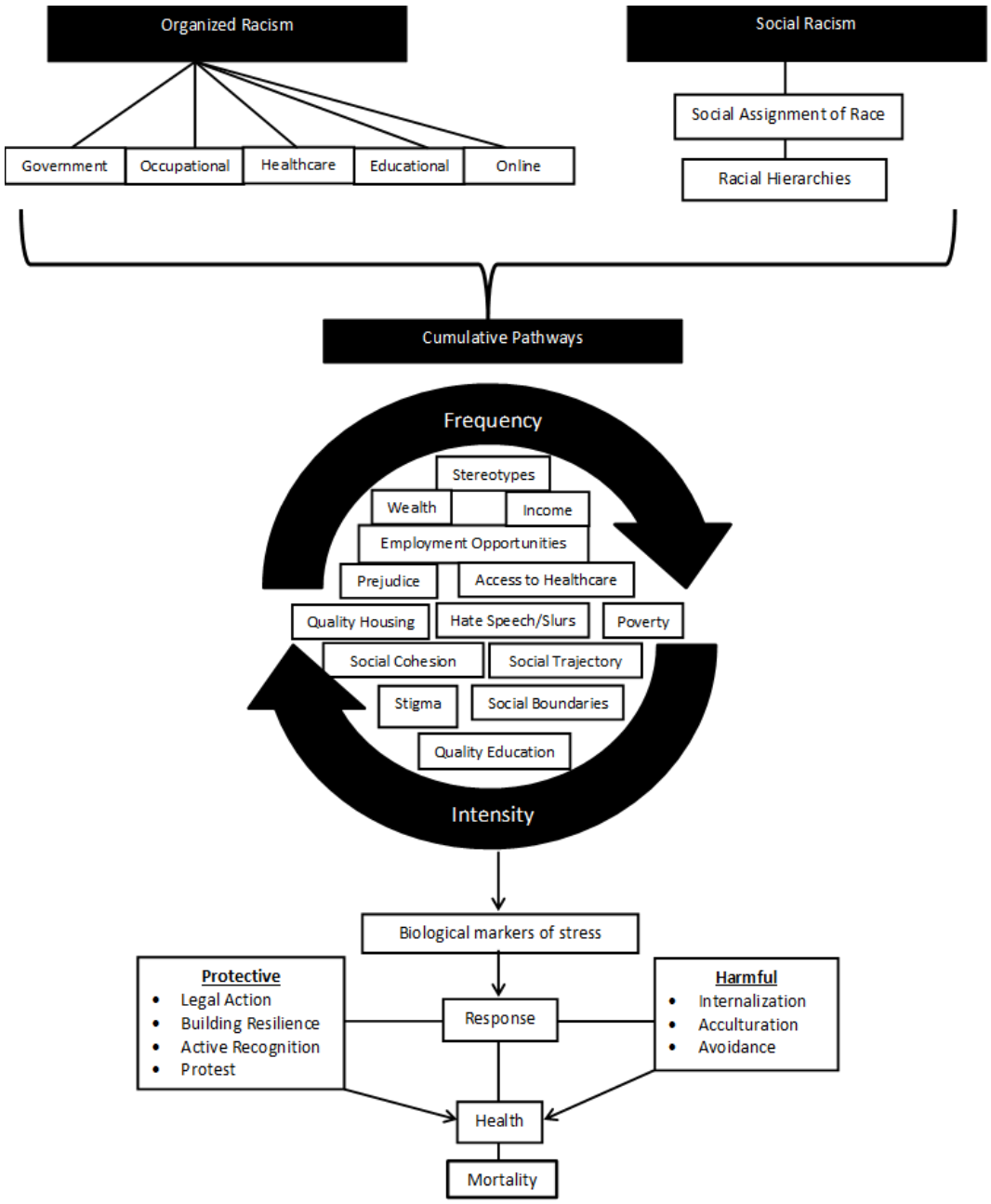

Figure 3.1 – Working Conceptual Framework

CHAPTER 4

MANUSCRIPT 1

"GEOGRAPHIC DISTRIBUTION OF OBSERVED RACISM ON TWITTER IN THE AMERICAN SOUTH"[1]

4.1 ABSTRACT

Racism is defined as a system of dominance and power designed to uphold the racially privileged of society. Exposure to racism is associated with socioeconomic status including educational level, income, and measures of social capital and social cohesion as well as poor health outcomes. The geographic distribution of observed racism and its relationship with socioeconomic factors and access to care at the county level is currently unknown. The purpose of this study is to explore the geographic distribution of observed racism as measured by use of the social application "Twitter" across the US south.

Data were retrospectively combined from Twitter, the 2015-2016 Area Health Resource File (AHRF), the 2017 Robert Wood Johnson Foundation (RWJF) County Health Rankings, and measures of social capital from the Northeast Regional Center for Rural Development. The study sample was made up of 653 counties across the states of Virginia, North Carolina, South Carolina, Georgia, Alabama, Mississippi, and Louisiana. Racist tweets were defined as geotagged tweets containing the racial slur "nigger(s)"

[1] Bullard, J. T., Probst, J. C., Hair, N., Eberth, J. M., Ingram, L. A. To be submitted to the Journal of Racial and Ethnic Health Disparities

between the years of 2012-2015. Three measures of observed racism (racist tweeter tare, racist tweet intensity, racist tweet rate) were calculated at the county level. Modeling of each measure of observed racism was done using logistic regression to test for association with county level predictors measuring socioeconomic status and access to care.

Findings indicate that for all three measures of observed racism, rural areas experience lower odds of racist tweeting, in comparison to their urban counterparts. Furthermore, the odds of greater racist tweeting behavior decreases as a county's unemployment rate increases. Voter turnout is a protective factor against racist tweeting behavior. Other factors including education and access to care were also found to be associated with racist tweeting behavior in at least one of the metrics. Spatial analysis indicates hotspots of high racist tweeting behavior across the American South, especially in mid-Georgia near Macon and among counties surrounding Columbia, South Carolina.

Overall, racist tweeting is minimal across the US South, except with a few hotspots mostly in Georgia and South Carolina. Rurality, unemployment rates, and voter turnout were found to be the most significant predictors of racist tweeting behavior. Findings suggests that county level socioeconomic and geographic factors are related to the behavior and distribution of racist tweeting across the South.

4.2 INTRODUCTION

The conceptualization of racial discrimination or racism goes beyond unfair treatment toward an individual or group of individuals with racial commonalities. According to Harrell[55], racism is defined as a system of dominance, power and privilege designed to uphold the racially privileged and to exclude the unprivileged from power, esteem, status, and/or equal access to social resources. Jones[58] posits that racism can be

understood on three levels, namely institutionalized, personally mediated, and internalized. Institutionalized racism is racism at a societal level (i.e. government) influencing individuals' access to information, resources, wealth, social networks, voting rights, government representation, and control of the media.[58] Personally mediated racism occurs at an individual level exhibited through a lack of respect, suspicion, devaluation, scapegoating, and dehumanization.[58] Internalized racism is potentially the most dangerous as Jones defines it as acceptance by members of the stigmatized races of negative messages about their own abilities and intrinsic worth.[58] Racial discrimination has played a large role throughout history influencing wars, government policies, political efforts, and national movements such as the Civil War, residential segregation and the Federal Housing Act of 1934, the Civil Rights Movement in the 1960s and most recently the #BlackLivesMatter movement on social media.[2,10]

Exposure to racism can occur at two levels; experienced or observed. Experienced racism is concerned with perception of discrimination due to race. Observed racism is a more objective measure of racism. Ample evidence suggests that experienced racism is associated with a myriad of negative health outcomes and behaviors including poor mental health, psychological distress, obesity, smoking, alcohol consumption, and unmet healthcare needs.[19–26] Racial and other forms of discrimination can act as a stressor influencing biological markers of stress such as vagus nerve functioning, cognitive schema, and allostatic load.[17,18] The onset of stress is associated with poor mental and physical health outcomes including hypertension, coronary heart disease and depression.[13,15,16] The aforementioned evidence suggests that experienced racism can lead

to negative health outcomes for minority populations resulting in subsequent health disparities.

Twitter, originally launched in 2006 as a social media website, has morphed into an integral part of American cultural allowing its users to post (tweet) information in real time and to follow other users.[86] As of 2013, Twitter use has expanded to over 200 million active users generating over 400 million tweets per day.[86] Twitter commonly finds itself in the midst of political debates, media gossip, entertainment news, celebrity fights, and business ordeals. The demographics of Twitter users consists mostly of young (18-29 years of age), black, urbanites.[87] However, these demographics are changing as the proportion of Twitter usage among older adults (those aged 65 and older) and whites significantly increased between 2013 and 2014.[87,88]

Observed racism can be measured by the use of racial slurs and/or hate speech on media sites like Twitter. Researchers at Humboldt State University examined the frequency and quantity of tweets containing racist words and their use in a derogatory manner and found that the eastern and southern parts of America are prone to be the most racially biased parts of the country.[27] Maryland, Virginia, the District of Columbia, North Carolina, Georgia, Alabama, and parts of Tennessee and Mississippi were the states with most observed racism.[27] A similar study by Stephens-Davidowitz[28] concluded that rural areas in the Northeast and South are the most racist places in America by using geocoded Google search terms for the ""nigger".." Like Stephens-Davidowitz, Chae and colleagues[45] utilized Google search phrases including the "nigger" as their measure of racism and studied its association on black mortality across 210 designated market areas (DMAs) as defined by Nielsen Media Research. In assessing the effects of observed

racism, Chae et al. found that area racism was significantly associated with all-cause black mortality.

The internet and social media platforms like Twitter have become a breeding ground for individual expression of attitude, behavior, ideas, political views, opinions, etc. Subsequently, as society becomes more technologically dependent, the practice of racial discrimination has found its way onto the internet becoming a more anonymous way to post views, ideas and comments about others.[64,65] A recent study recorded a total of 6.7 million racial slurs on Twitter over a period of two weeks during the month of September in 2015.[92] The term "nigga" was the most popular followed by "white boy" and the ""nigger".." The researchers concluded "nigga" is used a friendly means of communication between two black individuals while the more primitive spelling of the word is used in a much more offensive manner.[92] Findings from additional studies concerned with ascertaining the application of racism and hate speech on the internet and websites like Twitter, also found that the use of words like "nigger", "niggers", and "f*ggot" tend to be used in more offensive and racist language directed at certain groups of individuals.[104,105] These findings suggest that online measures of racism can serve as a proxy for observed racism.

The purpose of this study is to identify the factors associated with racist tweeting and its geographic distribution across the South. Tweets containing the racist slur, "nigger", will be used as a measure of observed racism. This study will expand upon the literature cited above to determine what social factors are related to observed racism at the county level and to determine geographic distribution with regards to ascertaining clusters and/or hotspots of racist tweeting. Furthermore, due to the history of slavery in

the American South and its similar demographic makeup[94,95,97], the study will focus on seven southern states considered to be part of the deep, American South: Virginia, North Carolina, South Carolina, Georgia, Mississippi, Alabama, and Louisiana.

4.3 METHODS

4.3.1 POPULATION AND DATA SOURCES

The sample population consisted of a total of 653 counties across seven southern states: Virginia, North Carolina, South Carolina, Georgia, Mississippi, Alabama, and Louisiana. There were a total of 36,490 racist tweets coming from 615 of the 653 documented counties. These tweets were generated from 16,303 tweeters. A total of 2 counties were removed from the study due to having unreliable or unknown values for social factors, leaving a final total of 651 counties.

Data for the study were retrospectively combined from a combination of sources including: Twitter, the Area Health Resource File (AHRF), the Robert Wood Johnson Foundation (RWJF) County Health Rankings, and social capital variables from the Northeast Regional Center for Rural Development.[52]

4.3.2 DEPENDENT VARIABLE

The outcome is racist tweeting on Twitter measured using three metrics. Twitter data was provided by the Data on Local Life and You (or DOLLY) project housed at the University of Kentucky. The DOLLY project has collected all geotagged tweets in the world, dating back to June 2012, a corpus of over 12 billion tweets[98] The DOLLY project leverages on a very robust server-based data mining system along with the advantages of ad hoc desktop applications and small, relevant datasets to minimize technical barriers.[98]

The system allows for real-time search and data extraction based on terms and/or phrases. Geotagged tweets were extracted from the system based on the search term “niggers”. Tweets were restricted to a specific time-period (June 2012 – December 2015). Tweets from 2016 were excluded due to the racial tension and uneasy climate surrounding the 2016 presidential campaign. A racist tweet was defined as a tweet containing the racial slur “niggers”. A count of all racist tweets and racist tweeters for each county were used to calculate three different measurement of racist tweets/tweeters. First a racist tweeter rate was calculated as the rate of racist tweeters divided by the county population then multiplied by 10,000. Secondly, racist tweeter intensity was calculated as the rate of tweets per racist tweeter for each county then multiplied by 10,000. Third, a racist tweet rate was calculated as the rate of racist tweets divided by the county population then multiplied by 10,000. Average county population rates for 2012-2015 were used in the calculation of these measures of racism. Population estimates were obtained from the 2015-2016 AHRF. The racist tweeter rate and tweet intensity were mapped using a color saturated legend to show variation of each across the sample population.

For analysis purposes, each independent variable was split into quartiles at the 25^{th} (Q1) 50^{th} (Q2), 75^{th} (Q3), and $>75^{th}$ (Q4) percentiles. The cutoff points for each quartile of the racist tweeter rate measurement was 1.57, 2.67, 4.06, and >4.06 for Q1, Q2, Q3, and Q4, respectively. Cutoff points for Q1 – Q4 for the racist tweet intensity measure was 1.00, 1.49, 1.93, and >1.93, respectively. For the last measure of racism, racist tweet rate, the cutoff points for each quartile was 2.17, 4.02, 7.28, and >7.28 for Q1 – Q4, respectively.

4.3.3 PREDICTOR VARIABLES

Potential predictors of interest, due to their association with racism and health, were pulled from the most recent (2015-2016) AHRF for each county. The AHRF is a computerized, county-based data system consisting of more than 200 sources of data aimed at assessing the nation's health care resources.[100] Predictors included: education (% of county population with a college degree, 2010-2014); unemployment rate (averaged 2012-2015); health insurance (% of county population 18-64 without health insurance averaged 2012-2014); primary care physician supply (calculated as the number of primary care physicians per 10,000 of the county population, averaged 2012-2014); and hospital bed supply (calculated as the number of beds per 10,000 of the county population, 2013). Rurality, defined as rural and urban according to the 2013 Rural Urban Continuum Codes (RUCC), was also obtained from the 2015-2016 AHRF file. RUCC Codes 1-3 were categized as urban while RUCC codes 4-9 were categorized as urban. Two measures of social capital, voter turnout (percent of voters in the 2012 Presidential Election) and census response rate (percent of responders to the decennial Census survey), were obtained from the 2014 county level measures of social capital maintained by the Northeast Regional Center for Rural Development.[52] A final predictor variable, income inequality for the period 2011-2015, was obtained from the 2017 RWJF County Health Rankings. The 2017 RWJF county rankings measures income inequality as the ratio of household income at the 80th percentile to that at the 20th percentile[102] A higher inequality ratio indicates greater division between the top and bottom ends of the income spectrum. The percent of the white and black population (averaged from 2012-2015) was controlled for to account for the proportion of each across counties.

4.3.4 ANALYSIS

Potential predictors and tweets containing a racial slur were tested for association using logistic regression. Coefficients estimating the unit change in the varying quantiles of racist tweeting and odds ratios were reported and interpreted at 95% Confidence Intervals and p-values at alpha (0.05). Three models which tested the county predictor variables with each measure of observed racism were ran independently to determine association of predictors on each measure. Cluster analysis using Anselin Local Moran's I was used to identify statistically significant clusters of racist tweeting. Statistically significant hot spots and cold spots were tested for using Getis-Ord Gi* statistic. The distribution of racist tweeting quantiles were mapped across the study population for each measure using color saturated maps. Hot spots and cold spots were mapped across the study population for each measure. All analyses were carried out using SAS 9.4 (Cary, North Carolina) and ArcMap 10.2.2 (Redlands, California).

4.4 RESULTS

Table 1 shows the characteristics of studied counties. The mean racist tweeter rate, racist tweet intensity and racist tweet rate across the counties was 3.9 (±16.9), 1.8 (±1.6), and 7.9 (±37.7) per 10,000, respectively. The mean primary care provider supply and hospital bed supply across the counties was 4.9 (±3.5) and 3.0 (±4.2) per 10,000, respectively. The average income inequality ratio across the same population was 4.9 (±0.8). An average of 18.9% (±9.6) of the population across the counties were college educated. The mean percentage of uninsured adults and the average unemployment rate across the sample was 22.7 (±4.1) and 7.9 (±2.1), respectively. The respective mean voter turnout and Census response rate for the study population was 68.5%(±6.1) and

70.4%(±10.0). The sample population, on average, consisted of 67.0% (±18.2) and 27.6% (±19.3) of whites and blacks, respectively. The majority of the study population was rural (52.8%) while the remaining 47.2% was categorized as urban.

Figure 1 maps the racist tweeter rate across all counties included in the sample population. Color saturation was used to show changing levels between quartiles. The shade of the red color darkens going from Q1 to Q4 racist tweeter rates across counties. Racist tweeter rates categorized in the highest quartile can be seen throughout the sample in counties such as in the southern part of Louisiana in the Lafourche, Terrebonne, Saint Charles, Saint John the Baptist and Saint James parishes. High racist tweeter rates can also be seen in counties surrounding major cities across the sample like Atlanta Georgia, Montgomery Alabama, and Virginia Beach and Norfolk Virginia. Clustering analysis did not indicate any significant clusters of racist tweeter rates in the sample ([Moran's I p-value],0.8637). Figure 2 maps the hot and cold spots of the racist tweeter rate across the sample. There are hotspots of counties with high racist tweeter rates situated in mid-Georgia (Hancock, Washington, Johnson, Baldwin, Wilkinson, Laurens, Jones, Twiggs, Bleckley, Houston, Bibb) and areas surrounding South Carolina's state capital, Columbia (Richland, Sumter, Clarendon, Calhoun, Orangeburg, Bamberg, Lexington).

Figure 3 maps the racist tweet intensity across counties in the sample population. High rates of racist tweet intensity can be seen in the southern part of Louisiana. The three counties with the highest observed racist tweet intensity are: Greene, Virginia (12.0); Newton, Mississippi (15.6); and Marion, Georgia (18.0). Clustering analysis did not indicate any significant clusters of racist tweet intensity rates across the sample (0.2778). Figure 4, however, indicates some counties with significant hot and cold spots

of racist tweet intensity rates. Hotspots can be observed in Mississippi (Kemper, Lauderdale, Clarke, Neshoba, Newton, Jasper, Leake, Scott, Smith, Pearl River), northwestern Alabama (Lauderdale and Colbert), Georgia (Harris, Muscogee, Chattahoochee, Stewart, Talbot, Marion, Webster, Taylor, Macon, Schley, Sumter), southern and coastal South Carolina (Charleston, Berkeley, Colleton, Orangeburg), mid-South Carolina (Richland), and Virginia (Orange, Albemarle, Louisa, Fluvanna). Some cold spots can be observed in Louisiana (Madison), Georgia (McDuffie, Warren, Taliaferro), and North Carolina (Macon).

Figure 5 maps the racist tweet rate at the county level across the sample population. Spots of counties with racist tweet rates categorized in the highest quartile (Q4) can be seen in counties surrounding Atlanta, Georgia and Montgomery, Alabama and along the coast of South Carolina in Horry, Georgetown, and Charleston counties. Clustering analysis did not indicate any significant clusters of racist tweet rates across the sample population (0.8606). Figure 6 shows similar hotspots as observed for high racist tweeter rates are also observed for racist tweet rates in mid-Georgia and counties surrounding the state capital of South Carolina, Columbia.

Table 2 shows the relationship between each county level predictor and the racist tweeter rate. Going from urban to rural, a 0.55 unit (<.0001) decrease is expected in the racist tweeter rate. Compared to urban, the odds of a racist tweeter rate in the upper quartiles (Q2, Q3, Q4) verses the lowest quartile (Q1) for rural areas is 1.33 times lower. Every one unit increase in the primary care provider and hospital bed supply is associated with a 0.13 unit (<.0001) and 0.05 unit (0.0041) increase in the racist tweeter rate. With every one unit increase in the primary care provider supply and hospital bed supply ratio,

the odds of a racist tweeter rate in the upper quartiles verses the lowest is 1.14 and 1.05 times higher, respectively. College education was also found to be significant with the racist tweeter rate. For every one unit increase in the percent of college educated adults, a 0.06 (<.0001) unit increase in the racist tweeter rate is expected. With every one unit increase in the percent of college educated adults, the odds of a racist tweeter rate in the upper quartiles verses thee lowest quartile is 1.06 times higher. The uninsured and unemployment rate was also found to be significant with the racist tweeter rate. A one unit increase in the percent of uninsured adults and a county's unemployment rate was associated with a respective 0.08 (<.0001) and 0.15 (<.0001) unit decrease in the racist tweeter rate. With every one unit increase in the percent of uninsured and the unemployment rate, the odds of a racist tweeter rate in the upper quartiles verses the lowest quartile is 0.92 and 0.86 times lower, respectively. The census response rate was significantly associated with the racist tweeter rate. A one unit increase in a county's census response rate is associated with a 0.02 (0.0072) unit increase in the racist tweeter rate. With every one unit increase in the census response rate, the odds of a racist tweeter rate in the highest quartile verses the lowest quartile is 1.02 times higher. The percent of whites and blacks in a county was significantly associated with the racist tweeter rate. A one unit increase in the percent of whites and blacks in a county was associated with a respective 0.02 (<.0001) unit decrease and 0.01 (0.0003) unit increase in the racist tweeter rate. For every one unit increase in the percent of whites in a county, the odds of a racist tweeter rate in the higher quartiles verses the lowest quartile is 0.98 times lower. On the other hand, with every one unit increase in the percent of blacks in a county, the

odds of a racist tweeter rate in the upper quartiles verses the lowest quartile is 1.01 times greater.

Table 3 shows the bivariate relationships between each county predictor variable and the second metric, racist tweet intensity. The results were similar to the relationships observed with the racist tweeter rate above. Rurality, primary care provider supply ratio, education, percent of uninsured adults, unemployment rates, and the census response rate remained significant and showed similar relationships as observed with the racist tweeter rate. A new relationship, voter turnout showed a significant association with racist tweet intensity. A one unit increase in the voter turnout was associated with a 0.02 (0.0415) unit decrease in the racist tweet intensity rate. For every one unit increase in the voter turnout, the odds of racist tweet intensity in the upper quartiles verses the lowest quartile is 0.98 times lower.

Table 4 shows the results of testing for the relationship between each predictor and the third metric of observed racism, racist tweet rate. Similar to the previous metrics, rurality, primary care provider supply ratio, the percent of college educated adults and uninsured adults, and the average unemployment rate showed similar relationship with the racist tweet rate as observed with the earlier two metrics. Furthermore, the hospital bed supply ratio and the percent of whites and blacks in a county's population popped back up showing a significant association with the racist tweet rate. The bivariate relationships for this metric closely resembled those observed for the racist tweeter rate.

Table 5 shows the results of the association between quantiles of the racist tweeter rate and the county level predictor variables. Going from urban to rural, a 0.38 (<.0001)

unit decrease is expected in the racist tweeter rate while the other predictor variables in the model are held constant. Additionally, going from urban to rural, the odds of a racist tweeter rate in the upper quartiles (Q2, Q3, Q4) verses the lowest quartile (Q1) is 0.46 times lower given all the other variables remain constant. A one unit increase in the percentage of uninsured adults is associated with a 0.05 (0.0476) unit decrease in the racist tweeter rate. With every one unit increase in the percent of uninsured adults, the odds of a racist tweeter rate in the upper quartiles verses the lowest quartile is 0.95 lower. The unemployment rate was found to be significantly associated with racist tweeter rates at the county level. A one unit increase in a county's unemployment rate is associated with a 0.18 (0.0009) unit decrease in the racist tweeter rate. The odds of a racist tweeter rate in the upper quartiles verses the lowest quartile is 0.83 times lower, with every one unit increase in the unemployment rate. The percent of whites and blacks in a population was also found to be significantly associated with the racist tweeter rate. With every one unit increase in the percent of whites and blacks, a respective 0.12 (<.0001) and 0.08 (0.0008) unit decrease in the racist tweeter rate is expected given the other variables are held constant. With every one unit increase in the percent of whites and blacks in a county, the odds of a racist tweeter rate in the upper quartiles verses the lower quartile is 0.89 and 0.93 lower, respectively.

Table 6 shows the results of the association between quantiles of the racist tweet intensity and the county level predictor variables. In comparison to model 1, some relationships as observed with the racist tweeter rate remained consistent (rurality and unemployment rate). Unlike model 1, the percent of whites and blacks in a county and the percent of uninsured adults, was not found to be significant with the second metric.

However, other county level predictors (voter turnout and census response) showed a significant association with racist tweet intensity. A one unit increase in the percentage of voters in the 2012 Presidential election is associated with a 0.05 (0.0003) unit decrease in the racist tweet intensity. Furthermore, with every one unit increase in the percent of a county's voter turnout, the odds of racist tweet intensity in the upper quartiles verses the lowest quartile is 0.88 times lower given the other variables in the model remain constant. Response rates to the 2010 Census was also found to be significantly associated with the racist tweet intensity. A one unit increase in the percent of census survey responders is associated with a 0.03 (0.0022) unit increase in a county's racist tweet intensity. With every one unit increase in the percent of responders, the odds of racist tweet intensity rates in the upper quartiles verses the lowest quartile is 1.03 times greater.

Table 7 shows the results of the model testing the association between county level predictor variables and upper and lower quantiles of the racist tweet rate. Rurality and unemployment rates continued to remain significant with racist tweet rates by showing a similar relationship as observed in the earlier models. Similar to the relationship in model 2, voter turnout was significantly associated with the racist tweet rate. The percent of whites and blacks in a county was also found to be significant with the third metric by showing similar relationships as observed in model 1. There was no significant relationship between census response rates and the racist tweet rate as was seen in model 2. The percent of college educated adults was found to be significant with racist tweet rates. A one unit increase the percent of college educated adults was associated with a 0.03 (0.0396) unit increase in the racist tweet rate. With every one unit increase in a county's percent of college educated adults, the odds of a racist tweet rate in

the higher quartiles verses the lowest quartile is 1.03 times greater, given the other variables in the model remained constant.

4.5 DISCUSSION

The results indicate a strong and consistent association between rurality and racist tweeting behavior as well as unemployment and racist tweeting. In comparison to their urban counterparts, rural areas experience lower odds of having greater racist tweeting rates across all three metrics. Furthermore, the odds of racist tweeting behavior declines as a county's unemployment rate increases. Measures of social capital (2012 Presidential election voter turnout) was also found to be associated with racist tweeting behavior across two of the three metrics suggesting voter turnout to be a protective factor against racist tweeting.

More recent studies suggest that the most racist places in the county are those in rural areas. Stephen Davidowitz[28] used Google searches for the n-word and aggregated them over multiple years as a measure of observed racism. His findings concluded that rural places in the South and the Northeast have higher observations of racist activity.[28] The findings indicated statistically significant clusters concentrated along the Appalachians and in rural southern portions of the nation including: North and South Carolina, Georgia, Alabama, Louisiana and Florida.[28] Racial activity decreased moving westward. An additional study by students at Humboldt University found similar results as their findings indicated hotspots of hate speech (including racism, homophobia, or anti-disability) on Twitter with the majority stemming from small towns and rural areas.[27] The study however, does not indicate what proportion of hate speech is racist and to what extent rural accounts for racist hate speech. These findings indicate that rural areas tend

to experience high rates of observed racism. These findings are not parallel to those of this study. The odds of racist tweeting behavior among rural counties in the study population was found to be less than that of urban areas. Studies on Twitter demographics indicate that compared to urbanites, rural residents are much less likely to have active Twitter accounts and use Twitter on a daily basis.[87] Less utilization of Twitter by rural residents might help to explain the finding that urban areas are at greater odds of engaging in racist tweeting behavior.

Study findings indicated that the odds of greater racist tweeting behavior decreased as a county's unemployment rate increased. Ample evidence suggests a significant relationship between racial discrimination and unemployment.[44,68,117] Evidence also indicates a relationship between residential segregation and unemployment suggesting that racial segregation has led to clusters of unemployed minorities.[118,119] By way of institutional discrimination, employment opportunities and competitive income is restricted for minorities.[120] Furthermore, literature shows that segregation isolates blacks and other minorities into segregated communities from models of stable employment and social networks that could provide a segue to employment.[120] A study by Cutler and Glaeser[118] find that black outcomes are significantly worse among racially segregated cities in comparison to their integrated counterparts. As segregation increases, blacks have lower high school graduation rates, more likely to be in an idle situation (unemployed nor in school), earn less income, and are more likely to be single mothers.[118] A study by Collins and Margo[119] also found similar results that closely resembled those of Cutler and Glaeser. These findings indicate that unemployed minorities, namely blacks, tend to be clustered together and their segregation accounts for

their unemployment due to lack of opportunity surrounding them.[119] This might help to explain our finding of an indirect relationship between racist tweeting behavior and unemployment. As the unemployment increases, so does the chances of racial segregation and clusters of unemployed, racial groups which might account for a decreased odds of racist tweeting behavior in counties of higher unemployment.

Study findings also indicated that voter turnout was protective against increased racist tweeting behavior. This finding parallels to that of current evidence. A systematic review of the relationship between social capital and health inequality find that social capital and social cohesion are protective factors against racial discrimination and aide in coping responses to discrimination, especially among individuals of lower socioeconomic status.[121] The proportion of voting increases as social capital increases and it is widely used as an indicator in social capital metrics and indices.[52] Counties with higher voter turnout rates might indicate greater indices of social capital and social cohesion which could explain the reasoning behind the finding that the odds of racist tweeting decreases as voter turnout increases. A somewhat surprising finding was that racist tweeting behavior (racist tweet rate only) is estimated to increase as the percent of college educated adults in a county increases. A recent study by Wodtke[122] finds that intelligent, high-ability whites are less likely to report prejudicial attitudes and more likely to support racial equality in principle, in comparison to their low-ability counterparts. The author(s) used verbal ability as measure of intelligence by using the Gallup-Thorndike Verbal Intelligence Test (GTVIT) which determines cognitive ability by employing a vocabulary test. High performing whites are more likely to support racial integration and acknowledge awareness of racial discrimination.[122] However, high-ability whites are no

less likely than low-ability whites to support racial discriminatory policies. Findings by Wodtke indicated that high-ability whites were significantly less likely than whites with lower ability to support school busing programs and workplace racial preference policies.[122] Findings also indicated that high-ability whites acknowledge that it is wrong to segregate communities racially, however almost half of the study group report that they would not vote for a law with the intentions of preventing prejudicial real estate practices.[122] Wodtke discusses that these findings are consistent with the ideological refinement theory. High-ability, intelligent whites are much more suited than their low performing counterparts in protecting and maintaining their advantaged position within society.[122] These findings might help to explain why the odds of racist tweeting are greater among counties with larger proportions of adults with a college education.

There are some strengths to this study in comparison to current literature on the topic. This is one of the first studies concerned with determining what social factors are associated with observed racism. Secondly, the study added to current literature by conducting an analysis at the county level and applying spatial and cluster analyses to identify hotspots and/or clusters of high racist tweeting. Third, the study applied a more novel method of using racist tweeting at the county level as a proxy for observed racism.

However, the study is not without its limitations. First, the study is unable to determine causality. Secondly, the study cannot determine the level of perceived racism due to the design and utilizing racist tweets as a proxy for county level racism. Third, the study is only applying a single measure of racism in lieu of an aggregate measure. The study analyzed the number of racist tweets using one trigger word in instead of applying a semantic analysis looking at a combination of words, phrases, and/or sentences. Future

studies will need to focus on quantifying the associated health effects of the observed measures of racism in combination with the county predictors tested in the study.

4.6 CONCLUSION

Rurality and unemployment rates were significant county level predictors associated with racist tweeting behavior. Rural counties are at a decreased odd of engaging in higher rates of racist tweeting, in comparison to their urban peers. The odds of greater racist tweeting behavior decreases as a county's unemployment rate increases. The latter associations were consistent across all three metrics of observed racism. Furthermore, voter turnout was significant with two measures showing a protective factor against racist tweeting behavior. There were no significant clusters of high racist tweeting observed for either measure. However, there were several significant hot spots (mainly located in Georgia, Louisiana, and South Carolina) and cold spots of racist tweeting. Future research should focus on testing the association between racist tweeting behaviors and health outcomes while controlling for the county level predictors tested in this study.

Table 4.1 – Study Sample Characteristics at County Level (n=651)

Demographics	**Mean±SD**	**Range**
Racist Tweeter Rate	3.9±16.9	0-406.5
Racist Tweet Intensity	1.8±1.6	0-18.0
Racist Tweet Rate	7.9±37.7	0-904.8
Primary Care Provider Supply	4.9±3.5	0-31.4
Hospital Bed Supply	3.0±4.2	0-40.3
Income Inequality	4.9±0.8	2.7-9.0
% College Educated Adults	18.9±9.6	6.0-75.1
%Uninsured Adults	22.7±4.1	7.4-40.7
Unemployment Rate	7.9±2.1	3.3-16.0
Census Response Rate	70.4±10.0	30.0-86.0
2012 Presidential Election Voter Turnout	68.5±6.1	35.9-84.8
% White Population	67.0±1882	13.7-98.8
% Black Population	27.6±19.3	0.1-85.7
Rurality	**Frequency**	**%**
Urban	307	47.2
Rural	344	52.8

Table 4.2 – Bivariate Analysis of the Relationship between County Predictors and the Racist Tweeter Rate

	Estimate	OR	Intercept Q2	Intercept Q3	Intercept Q4	P-value
Rural	**-0.55**	**0.33**	**1.12**	**-0.03**	**-1.16**	**<.0001**
*Primary Care Physician Supply**	**0.13**	**1.14**	**1.43**	**-0.68**	**-1.78**	**<.0001**
Income Inequality	0.02	1.02	0.90	-0.17	-1.23	0.8021
*Hospital Bed Supply***	**0.05**	**1.05**	**0.87**	**-0.22**	**-1.29**	**0.0041**
% College Educated Adults	**0.06**	**1.06**	**-0.05**	**-1.19**	**-2.33**	**<.0001**
% Uninsured Adults	**-0.08**	**0.92**	**2.88**	**1.78**	**0.70**	**<.0001**
Average Unemployment Rate	**-0.15**	**0.86**	**2.20**	**1.11**	**0.03**	**<.0001**
Voter Turnout	0.01	1.01	0.14	-0.93	-1.99	0.2711
Census Response Rate	**0.02**	**1.02**	**-0.34**	**-1.42**	**-2.48**	**0.0072**
% White Population	**-0.02**	**0.98**	**2.41**	**1.30**	**0.21**	**<.0001**
% Black Population	**0.01**	**1.01**	**0.67**	**-0.42**	**-1.50**	**0.0003**

Boldface indicates significance at alpha 0.05
**Indicates a ratio per 10,000 of the county population*
***Indicates a ratio per 1,000 of the county population*

Table 4.3 – Bivariate Analysis of the Relationship between County Predictors and Racist Tweet Intensity

	Estimate	OR	Intercept Q2	Intercept Q3	Intercept Q4	P-value
Rural	**-0.37**	**0.48**	**0.97**	**-0.07**	**-1.17**	**<.0001**
*Primary Care Physician Supply**	**0.08**	**1.08**	**0.56**	**-0.46**	**-1.55**	**0.0001**
Income Inequality	-0.07	0.93	1.28	0.29	-0.79	0.4197
*Hospital Bed Supply***	0.02	1.02	0.88	-0.11	-1.20	0.2050
% College Educated Adults	**0.04**	**1.05**	**0.12**	**-0.93**	**-2.05**	**<.0001**
% Uninsured Adults	**-0.06**	**0.94**	**2.29**	**1.28**	**0.19**	**0.0007**
Average Unemployment Rate	**-0.15**	**0.86**	**2.10**	**1.08**	**-0.02**	**<.0001**
Voter Turnout	**-0.02**	**0.98**	**2.56**	**1.57**	**0.48**	**0.0415**
Census Response Rate	**0.03**	**1.03**	**-1.28**	**-2.31**	**-3.40**	**<.0001**
% White Population	-0.00	0.99	1.23	0.23	-0.85	0.2726
% Black Population	0.00	1.00	0.94	-0.05	-1.14	0.9392

Boldface indicates significance at alpha 0.05
**Indicates a ratio per 10,000 of the county population*
***Indicates a ratio per 1,000 of the county population*

Table 4.4– Bivariate Analysis of the Relationship between County Predictors and the Racist Tweet Rate

	Estimate	OR	Intercept Q2	Intercept Q3	Intercept Q4	P-value
Rural	**-0.52**	**0.35**	**1.08**	**-0.03**	**-1.19**	**<.0001**
*Primary Care Physician Supply**	**0.12**	**1.13**	**0.43**	**-0.66**	**-1.79**	**<.0001**
Income Inequality	0.03	1.03	0.84	-0.21	-1.30	0.7204
*Hospital Bed Supply***	**0.05**	**1.05**	**0.86**	**-0.20**	**-1.30**	**0.0078**
% College Educated Adults	**0.06**	**1.07**	**-0.13**	**-1.26**	**-2.44**	**<.0001**
% Uninsured Adults	**-0.08**	**0.92**	**2.83**	**1.75**	**0.64**	**<.0001**
Average Unemployment Rate	**-0.14**	**0.87**	**2.14**	**1.07**	**-0.03**	**<.0001**
Voter Turnout	-0.00	0.99	1.10	0.05	-1.04	0.8926
Census Response Rate	**0.02**	**1.02**	**-0.38**	**-1.44**	**-2.54**	**0.0061**
% White Population	**-0.02**	**0.98**	**2.33**	**1.24**	**0.12**	**<.0001**
% Black Population	**0.01**	**1.01**	**0.67**	**-0.40**	**-1.51**	**0.0006**

Boldface indicates significance at alpha 0.05
**Indicates a ratio per 10,000 of the county population*
***Indicates a ratio per 1,000 of the county population*

Table 4.5 – Model #1: Adjusted Analysis of County Predictors associated with Racist Tweeter Rate

	Estimate	OR	STD Error	P-value	95% OR CI
Intercept Q4	9.85	-	2.66	0.0002	-
Intercept Q3	11.15	-	2.67	<.0001	-
Intercept Q2	12.44	-	2.68	<.0001	-
Rural	**-0.38**	**0.46**	**0.09**	**<.0001**	**0.33-0.65**
Primary Care Physician Supply	0.04	1.04	0.03	0.1634	0.98-1.11
Income Inequality	0.17	1.19	0.11	0.1222	0.96-1.47
Hospital Bed Supply	0.03	1.03	0.02	0.1256	0.99-1.07
% College Educated Adults	0.01	1.01	0.01	0.5902	0.98-1.03
% Uninsured Adults	**-0.05**	**0.95**	**0.03**	**0.0476**	**0.90-1.0**
Average Unemployment Rate	**-0.18**	**0.83**	**0.06**	**0.0009**	**0.75-0.93**
Voter Turnout	-0.01	0.99	0.01	0.5373	0.97-1.02
Census Response Rate	0.01	1.01	0.01	0.3794	0.99-1.03
% White Population	**-0.12**	**0.89**	**0.02**	**<.0001**	**0.85-0.93**
% Black Population	**-0.08**	**0.93**	**0.02**	**0.0008**	**0.89-0.97**

Boldface indicates significance at alpha 0.05

Table 4.6 – Model #2: Adjusted Analysis of County Predictors associated with Racist Tweet Intensity

	Estimate	**OR**	**STD Error**	**P-value**	**95% OR CI**
Intercept Q4	2.28	-	2.41	0.3447	-
Intercept Q3	3.43	-	2.41	0.1547	-
Intercept Q2	4.54	-	2.41	0.0598	-
Rural	**-0.19**	**0.68**	**0.09**	**0.0230**	**0.49-0.95**
Primary Care Physician Supply	-0.00	1.00	0.03	0.9149	0.94-1.05
Income Inequality	0.09	1.09	0.11	0.4193	0.88-1.35
Hospital Bed Supply	0.01	1.01	0.02	0.6911	0.97-1.05
% College Educated Adults	0.02	1.02	0.01	0.0619	1.00-1.05
% Uninsured Adults	0.00	1.00	0.02	0.9049	0.96-1.05
Average Unemployment Rate	**-0.13**	**0.88**	**0.05**	**0.0137**	**0.79-0.97**
Voter Turnout	**-0.05**	**0.95**	**0.01**	**0.0003**	**0.93-0.98**
Census Response Rate	**0.03**	**1.03**	**0.01**	**0.002**	**0.93-1.01**
% White Population	-0.03	0.97	0.02	0.1267	0.93-1.01
% Black Population	-0.01	0.99	0.02	0.5881	0.95-1.03

Boldface indicates significance at alpha 0.05

Table 4.7 – Model #3: Adjusted Analysis of County Predictors associated with Racist Tweet Rate

	Estimate	OR	STD Error	P-value	95% OR CI
Intercept Q4	7.24	-	2.54	0.0043	-
Intercept Q3	8.56	-	2.54	0.0008	-
Intercept Q2	9.83	-	2.55	0.0001	-
Rural	**-0.34**	**0.50**	**0.09**	**<.0001**	**0.36-0.71**
Primary Care Physician Supply	0.04	1.04	0.03	0.1715	0.98-1.10
Income Inequality	0.12	1.12	0.11	0.2958	0.90-1.39
Hospital Bed Supply	0.02	1.02	0.02	0.2356	0.99-1.06
% College Educated Adults	**0.03**	**1.03**	**0.01**	**0.0396**	**1.00-1.05**
% Uninsured Adults	-0.03	0.97	0.03	0.2973	0.93-1.02
Average Unemployment Rate	**-0.20**	**0.82**	**0.06**	**0.0002**	**0.73-0.91**
Voter Turnout	**-0.03**	**0.97**	**0.01**	**0.0230**	**0.95-1.00**
Census Response Rate	0.01	1.01	0.01	0.3284	1.00-1.03
% White Population	**-0.08**	**0.92**	**0.02**	**0.0001**	**0.89-0.96**
% Black Population	**-0.04**	**0.96**	**0.02**	**0.0740**	**0.92-1.00**

Boldface indicates significance at alpha 0.05

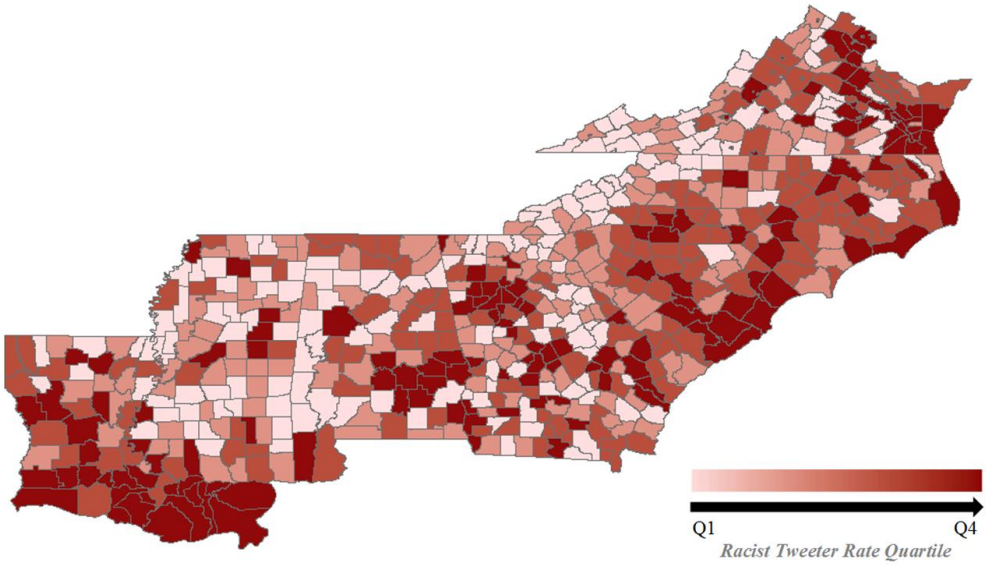

Figure 4.1 – Racist Tweeter Rate Across Counties

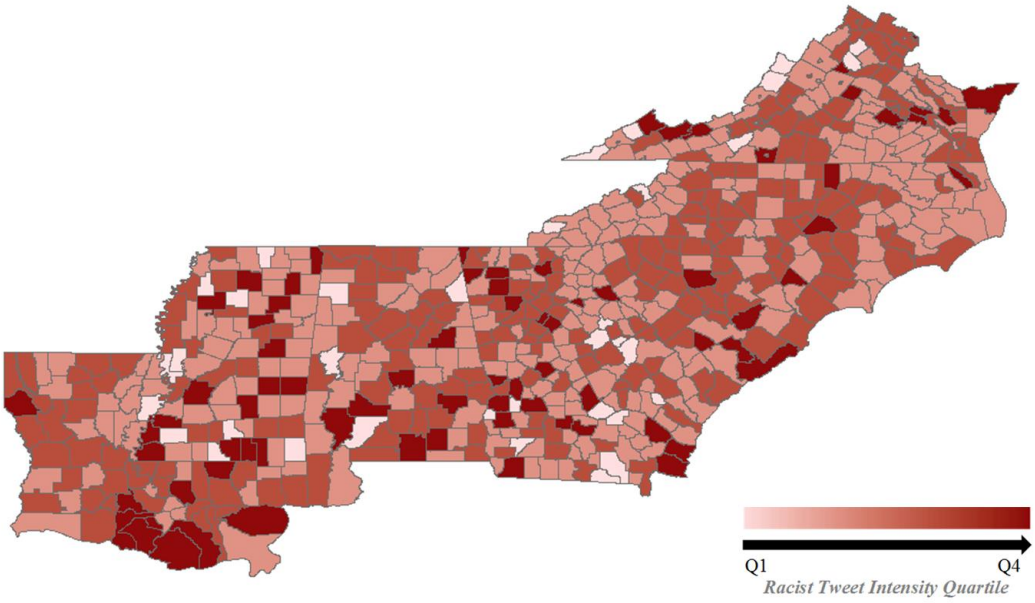

Figure 4.2 – Racist Tweet Intensity Across Counties

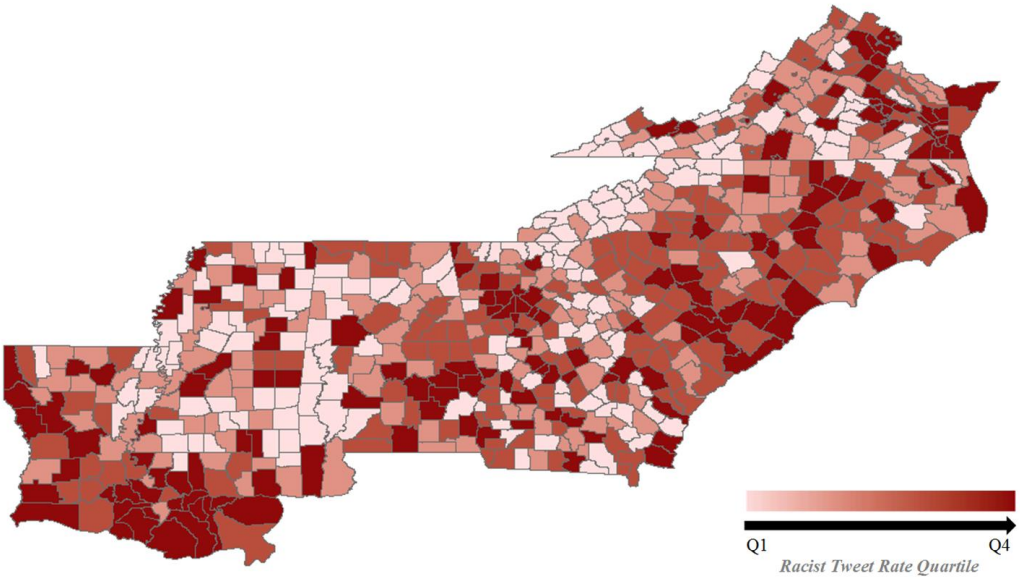

Figure 4.3 – Racist Tweet Rate Across Counties

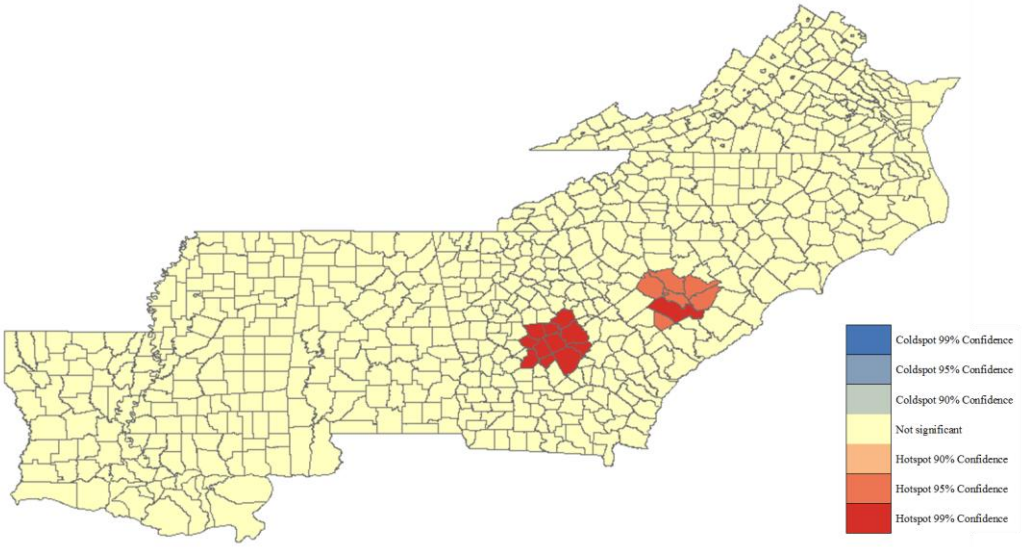

Figure 4.4 – Hot Spots/Cold Spots of Racist Tweeter Rate

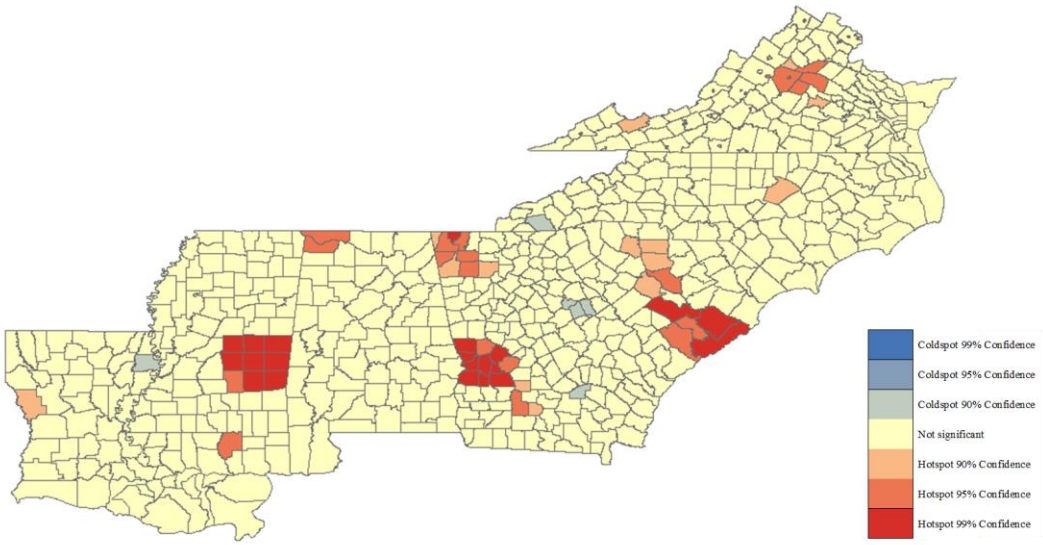

Figure 4.5 – Hot Spots/Cold Spots of Racist Tweet Intensity

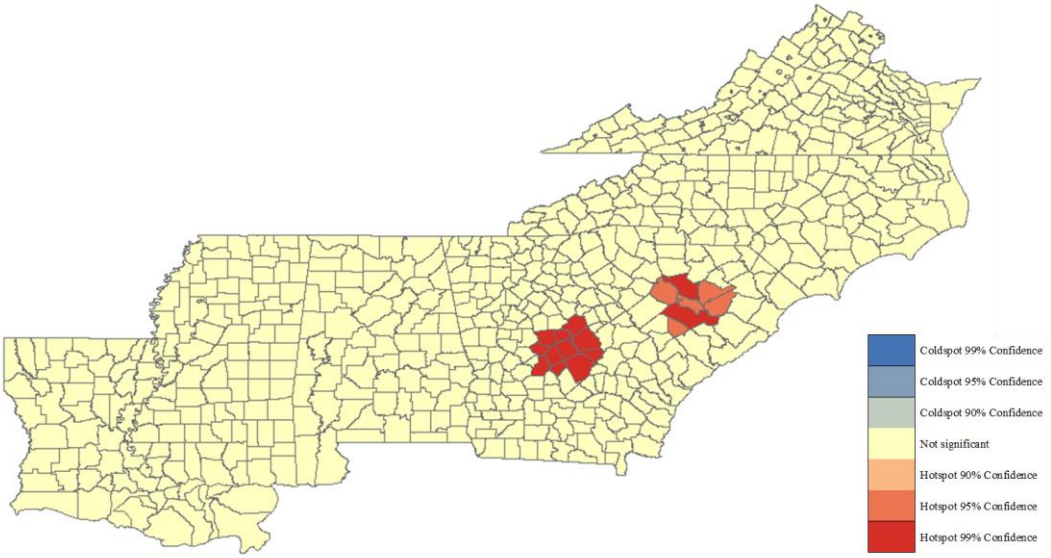

Figure 4.6 – Hot Spots/Cold Spots of Racist Tweet Rate

CHAPTER 5

MANUSCRIPT 2

"OBSERVED RACISM ON TWITTER AND BLACK MORTLAITY IN THE AMERICAN SOUTH: THE INFLUENCE OF RURALITY"[2]

5.1 ABSTRACT

Racial discrimination or racism can be understood as a determinant of population health. Exposure to racism is associated with a myriad of poor mental and physical health outcomes including, depression, anxiety, psychological distress, alcoholism, smoking, hypertension, and diabetes. Exposure to racism comes in two forms; expressed or observed. The relationship between county level observed racism and associated health effects across levels of rurality is currently unknown. The purpose of this study is to investigate if a relationship between observed racism and black mortality exists at the county level and across rurality in the American south.

Data was retrospectively combined from Twitter, the 2015-2016 Area Health Resource File (AHRF), the Centers for Disease Control and Prevention Wide-ranging Online Data for Epidemiological Research (CDC WONDER), and the 2017 Robert Wood Johnson (RWJ) County Health Rankings. The sample population consisted of 653 counties across seven southern states; Virginia, North Carolina, South Carolina, Georgia,

[2] Bullard, J. T., Probst, J. C., Hair, N., Eberth, J. M., Ingram, L. A. To be submitted to the Journal of Rural Health

Alabama, Mississippi, and Louisiana. Geotagged tweets containing the racial slur "n*gger(s)" between the years of 2012-2015 were defined as racist and were used in calculating three county level measures of observed racism; racist tweeter rate, racist tweet intensity, and racist tweet rate. Rurality was defined according to the 2013 Rural-Urban Continuum Codes (RUCC). Generalized linear regression modeling was used to test the association between each measure of observed racism and the gender combined, all-cause and age-adjusted black mortality rate while controlling for socioeconomic characteristics and factors affecting access to care.

Racist tweeting for all measures was found to be significant with black mortality. Rural areas experience increased rates of black mortality by an estimated 32 units in comparison to their urban counterparts. However, there was no significant interaction between rurality and racist tweeting which indicates that rurality does not influence the relationship between racist tweeting and black mortality. Education was a protective factor as predicted black mortality rates decreased by 2 units as the percent of college educated adults increased. Also across all models, black mortality was predicted to be 67, 9, and 11 units higher with every one unit increase in a county's income inequality ratio, hospital bed capacity, and unemployment rate, respectively.

The frequency of racist tweets measured as a rate of the county population has a significant negative relationship with county level black mortality. Furthermore, as the proportion of racist tweets posted by Twitter users in a county increases, so does the associated black mortality rate. Rurality and socioeconomic factors continue to be significant predictors of health outcomes giving way to health disparities.

5.2 INTRODUCTION

Racial discrimination can be conceptualized as a determinant of population health.[57] According to Krieger, there are five pathways to the embodiment of racism: economic and social deprivation, toxic substances and hazardous conditions, socially inflicted trauma, targeted marketing of legal and illegal psychoactive and other substances, and inadequate health care.[57] Ones response to discrimination can be either protective (active resistance) or harmful (suppressing the acts of discrimination).[57] Exposure to racism comes in two forms either experienced (perceived) or observed. Ample evidence suggests that exposure to racial discrimination through expression or perception is associated with poor mental health outcomes such as depression, anxiety, and psychological stress.[23,24,75,76] Experienced racism has also been found to be associated with smoking, binge drinking, and a myriad of poor health outcomes like hypertension, low birth weight delivery, and diabetes.[25,26,61,81] Stress tends to be a potential pathway linking experiences with racism to individual health and wellbeing. Clark and colleagues[66] posit a model explaining that the perception of an environmental stimulus as racist evokes a series of psychological and physiological responses which are influenced by constitutional factors, sociodemographic factors, psychological and behavioral factors, and coping mechanisms.

Most of the current literature on racism and health has been conducted with the loci on understanding the associated health effects of experienced racism only and without taking into account geographical influences. Although, some recent studies using observed measures of racism have generated findings indicating that the most racist places in America tend to be rural areas in the Northeast and the South in states like

Maryland, District of Columbia, Virginia, North Carolina, Georgia, Alabama, and parts of Tennessee, and Mississippi.[27,28] However, current literature lacks the quantification of observed racism across rurality and its effects on health. The association of health and observed racism across rural and urban areas is expected to differ since these areas look and behave differently. Rural areas rank poorly on health indicators, including mortality, morbidity, and child health measures.[30–32] Compared to urbanized residents, rural residents experience higher death rates from unintentional injuries, chronic obstructive pulmonary disease (COPD), and suicide.[32] Health behaviors also vary widely across rurality. Rural populations smoke more, exercise less, consume less nutritious diets, and are more likely to obese than their suburban and urban counterparts. Looking at racial discrimination across rurality, there are some similarities. Much like their metropolitan counterparts, nonmetropolitan blacks are the nation's most highly segregated minority.[39] Lichter and associates highlight there is a direct relationship between racial residential segregation and the proportion of minorities throughout rural areas.[39] Residential segregation in urban areas was brought on by establishment of the 1934 Federal Housing Act (FHA) and the notions that minorities like blacks in white neighborhoods would result in decreases property values and subsequent neighborhood deterioration.[10]

Due to the variation between urban and rural areas, it can be expected that the effects of exposure to observed racism within each can vary. The purpose of this study is to quantify the differences in county level effects of observed racism on all-cause black mortality across rurality, by way of exposure to racism through the use of racial slurs on a popular social media platform. Additionally, given the history of racism in the American South and its demographic homogeneity, the study will focus on a sample population

from the South.[94,95,97] The findings of this study hope to quantify geographical differences in exposure to racism and subsequent health effects.

5.3 METHODS

5.3.1 POPULATION AND DATA SOURCES

The total sample consisted of 653 counties across the seven included states of Virginia, North Carolina, South Carolina, Georgia, Alabama, Mississippi, and Louisiana. There was a total of 36,490 racist tweets across 615 of the sampled counties. Tweets were generated by 16,303 Twitter users. A total of 33 counties were removed from the sample as their black mortality rates were too small to report leaving a final sample totaling 620 counties. Data for this study was retrospectively combined from four data sources; Twitter, the Area Health Resource File (AHRF), the Centers for Disease Control and Prevention Wide-ranging Online Data for Epidemiological Research (CDC WONDER), and the Robert Wood Johnson Foundation (RWJF) County Health Rankings.

5.3.2 DEPENDENT VARIABLE

The outcome variable, age-adjusted and gender combined all-cause black mortality rates, were obtained from CDC WONDER. CDC WONDER is an online repository of public health data from a variety of sources like surveys and surveillance systems. Users of CDC WONDER are able to query data via menus and view it in textual or tabular form. CDC WONDER allowed for easy tabulation of the outcome variable averaged across the study time-frame (2012-2015).

5.3.3 INDEPENDENT VARIABLES

Because of anonymity, online outlets like social websites, blogs, and YouTube channels have become breeding grounds for racism as expressed in racial slurs like

"n*gger," and hate speech.[64,65,92] Therefore, online modalities like Twitter act as good proxies for measuring expressed, observable racism.[104,105]

Twitter data for the study was provided by the Data on Local Life and You (or DOLLY) Project housed at the University of Kentucky. The DOLLY project served the purpose in developing a very robust server-based data mining system along with the advantages of ad hoc desktop applications and small, relevant datasets to capture and store all geotagged tweets in the world, dating back to June 2012.[98] These tweets are captured by using a 1-percent and 10-percent Streaming API and are indexed based upon location and month upon capture allowing for accurate and relatively quick search and extraction across the system.[98] Tweets containing the racial slur "n*gger(s)" were extracted from the DOLLY system at the county level for the seven southern states. Tweets were extracted over the time-frame of July 2012 – December 2015. Tweets beyond December 31, 2015 were not extracted due to the racial tension surrounding the 2016 Presidential race. A racist tweet was defined as one that contained the racial slur "nigger" in either its plural or singular form.

Three measures of observed racism were calculated in the study. The racist tweeter rate was calculated as the number of racist tweeters divided by the county population (averaged between 2012-2015) multiplied by 10,000. Racist tweet intensity was calculated using the number of racist tweets per tweeter for each county then multiplied by 10,000. The racist tweet rate was calculated by dividing the number of racist tweets by the average 2012-2015 county population then multiplied by 10,000. For modeling purposes, each independent variable was split into quartiles at the 25^{th}, 50^{th}, 75^{th}, and > 75^{th} percentile. The cutoff values for the racist tweeter rate quartiles were

1.57, 2.67, 4.06, > 4.06, for Q1 – Q4, respectively. Cutoff values for Q1 – Q4 of the racist tweet intensity were 1.00, 1.48, 1.93, and > 1.93, respectively. Q1 – Q4 cutoff values for the racist tweet rate measure was 2.17, 4.02, 7.28, and > 7.28, respectively. A bivariate, color saturated map of the racist tweeter rate and racist tweet intensity was generated to show variation of racist tweeting across counties and levels of rurality. The color red was used to show urban counties while the color gray was used for rural counties. Each shade of color darkened moving from Q1 to Q4 across the sample.

Rurality (rural vs. urban), was defined according to the 2013 Rural-Urban Continuum Codes (RUCC).[106] RUCC forms a classification scheme that distinguishes metropolitan counties by the population size of their metro area, and nonmetropolitan counties by degree of urbanization and adjacency to a metro area. Each county in the U.S. is assigned a code ranging from 1 (Counties in metro areas of 1 million population or more) to 9 (Completely rural or less than 2,500 urban population, not adjacent to a metro area.[106] County level RUCC codes were provided by the most recent 2015-2016 AHRF. The AHRF is a county-based data system that assess the nation's health care resources. It covers over 200 sources of data and is released annually. Rurality was categorized into two levels in the study; urban (RUCC codes 1-3) and rural (RUCC codes 4-9).

5.3.4 CONTROL VARIABLES

Additional county level socioeconomic variables and factors influencing access to care were controlled for in the study. These control variables included: education (% of county population with a college degree, 2010-2014); unemployment rate (averaged 2012-2015); health insurance (percent of persons aged 18-64 without health insurance, 2013); primary care physician (PCP) supply per county (average number of PCPs divided

by average county population and multiplied by 10,000, 2012-2014); and hospital bed supply (number of hospital beds per county divided by the county population and multiplied by 10,000, 2013). The latter variables were also pulled from the 2015-2016 AHRF. An additional sociodemographic factor, income inequality, was obtained from the 2017 RWJF County Health Rankings. Income inequality is measured as the ratio of household income at the 80th percentile to that at the 20th percentile from 2011-2015. A higher ratio indicates greater segregation between top end and bottom end of the income spectrum in a county. The percent of the white and black population was averaged from 2012-2015 and acted as controls in the study to account for the proportion of each across counties.

5.3.5 ANALYSIS

Association between the outcome and observed racism was tested using multiple linear regression and generalized linear modeling. The coefficients for black mortality were estimated as one unit changes. Coefficients were reported and interpreted at 95% Confidence Intervals and p-values at alpha (0.05). Three models testing each independent measurement of observed racism (racist tweeter rate, racist tweet intensity, racist tweet rate) and the interaction between rurality and each measure of observed racism were ran independently to determine association of each and were compared for overall model fit and explanation of variation using F-statistic and R-squared values. All analyses were carried out using SAS 9.4 (Cary, North Carolina) and ArcMap 10.2.2 (Redlands, California).

5.4 RESULTS

The mean and standard deviation of the county level descriptors across the sample are reported in Table 1. The mean black mortality rate was 1207.5 (±263.0) The mean rate for the three measures of observed racism, racist tweeter rate, racist tweet intensity, racist tweet rate, was 4.1 (±17.3), 1.8 (±1.6), and 8.2 (±38.6), respectively. The levels of rurality across the sample is reported as frequency and percent in Table 1. The majority of counties were classified as being rural (52%) while the remaining 48% was classified as urban. The mean primary care provider and hospital bed to population ratios for the sample counties was 4.8 (±3.4) and 3.1 (±4.1) respectively. In assessing the socioeconomic factors across the sample population, the mean income inequality ratio, percent of college educated and uninsured adults, and the unemployment rate was 4.9 (±0.8), 19.0 (±9.7), 22.7 (±4.0), and 7.9 (±2.1), respectively. The mean percent of whites and blacks across the sample population was 65.6 (±18.2) and 28.8 (±18.8), respectively.

Table 2 shows the mean racist tweeter rate, racist tweet intensity, and racist tweet rate across rurality. The rates between urban and rural areas are very similar for all measures of racism. The mean racist tweeter rate for urban and rural counties is 4.1±7.2 and 4.1±23.0, respectively. The mean racist tweet intensity for urban and rural counties is 1.9±1.6 and 1.7±1.6, respectively. The mean racist tweet rate for urban and rural counties is 8.4±17.0 and 8.0±51.1. When comparing tweet rates for all three measures between urban and rural counties, there is no significant difference.

Table 3 shows the results of a simple bivariate analysis of the age-adjusted black mortality rate across levels of rurality. Rural counties experience a statistically higher

mean black mortality rate of 1257.3±195.0 (<.0001) in comparison to their urban counterparts which experience a mean black mortality rate of 1139.8±195.1.

Table 4 shows the results of a bivariate analysis of the relationship between rurality and county level predictors of mortality. Significant differences between urban and rural were found for each county level predictor, except for hospital bed supply. The mean for predictors of mortality worsened moving across levels of rurality with rural counties experiencing higher income inequality ratios (5.1±0.8, <.0001) lower percentile of college educated adults (14.9±5.5, <.0001), a higher percentile of uninsured adults (24.1±3.5, <.0001) and a higher unemployment rate (8.9±2.1, <.0001). Rural counties also experienced lower percentiles of whites (62.3±19.4, <.0001) and higher percentiles of blacks (33.2±20.0, <.0001), in comparison to their urban counterparts.

Figure 1 shows a bivariate mapping of rurality and the racist tweeter rate for each county across the sample. Rurality was dichotomized into two levels; urban (RUCC codes 1-3) and rural (RUCC codes 4-9) for each map. Most of the counties were categorized in the lower quartile (Q1) of the racist tweeter rate measure with rural (20.9%) making up the majority while only 7.4% of counties in Q1 were urban. The sample consisted of 10.8% urban counties and 14.1% rural counties categorized in Q2. Counties categorized in quartile 3 made up 23.8% of the sample with 12.1% urban and 11.7% rural. The sample consisted of 7.7% of rural counties categorized as having racist tweet rates in the highest quartile (Q4) while 16.9% of the sample were urban counties with racist tweet rates observed in the highest quartile. Rural clusters of high racist tweeter rates can be observed in western parts of Louisiana (Sabine and Natchitoches

parishes), southern Alabama (Macon, Bullock, Pike, and Crenshaw counties) and eastern parts of South Carolina (Georgetown, Marion, and Williamsburg counties).

Figure 2 is a bivariate map depicting racist tweet intensity across rurality. Once again, rurality was categorized into two levels for this map; Urban (RUCC codes 1-3) and Rural (RUCC codes 4-9). The majority of the sample (27.9%) was categorized in the lower quartile (Q1) of racist tweet intensity with 20.7% rural and 7.2% urban. Quartile 2 of the racist tweet intensity measure made up 23.2% of the sample, with 11.8% urban and 11.4% rural. Counties categorized in quartile 3 made up 24.4% of the sample, 16.1% urban and 8.3% rural. The sample contained 12.0% urban counties and 12.4% rural counties categorized in the highest quartile (Q4) of the racist tweet intensity measure. Clusters of rural counties with tweet intensity levels in the highest quartile (Q4) can be observed in northern Mississippi (Lee, Chickasaw, Webster, Choctaw, Oktibbeha, and Winston counties) and southern Alabama (Escambia, Conecuh, Covington, and Coffee counties).

Figure 3 shows a bivariate mapping of rurality and the racist tweet rate across the sample. The majority of the sample (36.1%) were categorized in the lowest quartile (Q1) of racist tweet rates, 16.7% urban and 19.4% rural. Quartile 2 made up 24.4% of the sample with 10.4% urban counties and 14.0% rural. Quartile 3 also made up 24.4% of the sample population; 13.0% urban and 11.4% rural. The highest quartile of racist tweet rates (Q4) made up 24.1% of the sample population, with 16.0% urban counties and 8.1% rural.

The results of modeling each measure of observed racism with black mortality is shown in Tables 4, 5, and 6. Table 5 is model 1 which tests the association between

mortality and the racist tweeter rate. Quartile 4 of the racist tweeter rate measurement is found to be significantly associated with the black mortality rate. The estimated difference in black mortality between the lowest (Q1) and highest (Q4) quartile of racist tweeters is 66.6 (0.0423). Looking across levels of rurality, there is an estimated difference of 71.6 (0.0269) in the mean black mortality rate between rural counties and urban counties, with rural counties experiencing increased mortality rates. There was no significant interaction found between rurality and the racist tweeter rate suggesting that the relationship between tweeting and mortality is not affected by rurality. Income inequality and the supply of primary care physicians and hospital beds was associated with black mortality. For every one unit increase in a county's income inequality ratio, primary care physician to population ratio, and hospital bed to population ratio, a 66.7 (<.0001), 5.4 (0.0490), and 8.5 (<.0001) unit increase in black mortality is predicted, respectively. Education is significant in predicting county level black mortality rates. For every one unit increase in a county's percent of college educated adults, there is a 2.9 (0.0150) unit decrease in the black mortality rate. A one unit increase in the unemployment rate is associated with a predicted 11.4 (0.0328) unit increase in the black mortality rate at the county level. Also, for every one unit increase in a county's percent of white and black population, a 6.7 (0.0008) and 6.0 (0.0032) unit increase in the black mortality rate is expected. The F-statistic for model 1 was 17.3 (<.0001) which suggested a good model fit. The R-squared for model 1 indicated that 30.0% of the variation in the outcome was explained by the model.

Model 2 results testing the association between racist tweet intensity and black mortality is shown in table 6. There is an association found between the racist tweet

intensity and black mortality. The mean difference in black mortality between county level observed racist tweet intensity rates at the 25th (Q1), 50th (Q2), and 75th (Q3) percentile is 70.4 (0.0383) and 67.9 (0.0360), respectively, with Q2 and Q3 categorized counties experiencing increased mortality rates in comparison to Q1 categorized counties. Rurality continued to remain significant as the mean difference in the black mortality rate between moderately rural and urban counties was 72.3 (0.0219). There was no significant interaction found between rurality and racist tweet intensity suggesting that rurality does not influence the relationship between racist tweet intensity and black mortality at the county level. Similar to model 1, county level descriptors (income inequality, hospital bed supply, college education, unemployment rate, percent of whites and blacks) also remained significant showing similar relationships with black mortality as observed in model 1 except for primary care physician supply. There was no significant association between the primary care physician to population ratio and black mortality in model 2. Model fit for model 2 was good with a F-statistic of 17.6 (<.0001). The R-squared value for model 2 indicated that 30.4% of the variation in black mortality is explained by the model.

The results of the third model testing the association between the third measure of observed racism, racist tweet rate, and the outcome is shown in table 7. The model suggested an association between racist tweet rates and black mortality moving between counties in all quartiles of the racist tweet rate measure. There is a predicted difference of 66.7 (0.0464), 84.2 (0.0102), and 76.0 (0.0216) in the mean black mortality rate between counties with observed racist tweet rates ranked in quartiles 2, 3, and 4 verses those ranked in quartile 1, respectively. The difference in the mean black mortality rate

between rural counties and urban counties was 87.4 (0.0060). There is no predicted influence on the relationship between racist tweet rates and black mortality moving between levels of rurality as there was no significant interaction found between rurality and racist tweet rates. Similar associations between county level predictors (income inequality, hospital bed supply, college education, unemployment, percent of whites and blacks) and black mortality as were seen in models 1 and 2 were also observed in model 3. The primary care provider to population ratio once regained significance showing a similar association as observed in model 1. Model fit and explanation of variation for model 3 was very similar to that of models 1 and 2. The F-statistic for model 3 was 17.6 (<.0001). The R-squared value for model 3 suggested that 30.4% of variation in black mortality can be explained by the model.

5.5 DISCUSSION

The findings in this study do not indicate any influence on the relationship between the black mortality rate and racist tweeting as no significant interaction was found between rurality racist tweeting. This latter finding indicates that racist tweeting does not account for the difference in the age-adjusted black mortality rates between urban and rural counties. However, findings indicate that when accounting for levels of rurality in the US South, there is a significant association between black mortality and racist tweeting when moving from lower to higher quartiles of racist tweeting. Counties categorized with observed racist tweeting in the upper quartiles are experiencing increased means of black mortality, in comparison to their lower quartile counterparts. Furthermore, there were significant differences in associated black mortality rates across levels of rurality with more rural areas faring worse in predicted black mortality rates.

This is one of the first studies looking at the county level effects of racism and accounting for the influence of rurality. Differences in the perception of racial fairness might help to explain these findings. A 2013 survey conducted by the Pew Research Center suggested a large and consistent black-white gap in perception of fair treatment. Blacks are more likely than whites to say African Americans are treated less fairly than whites.[123] Out of seven measured categories (police, court system, the workplace, stores and restaurants, public schools, the health care system, and elections) 49% of whites do not see unfair treatment in any of the seven categories while 58% of blacks say at least four of these are unfair.[123] In assessing rural and urban differences, urban adults, regardless of race, are more likely to observe racial inequality in each of the seven categories, in comparison to those living in rural areas. A study by the Washington Post Kaiser Family Foundation also found similar results to that of the Pew Research Center survey. When asked, "Which of these do you think is the bigger problem in this county: blacks and Hispanics losing out because of preferences for whites, or whites losing out because of preferences for blacks and Hispanics?", rural whites were less likely (by 14.1 units) than urban whites to say they are more concerned about blacks and Hispanics losing out.[124] The survey also found differences between blacks and whites within rural areas. Many rural Americans express a sense of shared identity that serves as a connection between rural Americans. However, these differ between white and minority rural populations. While 78% of white rural residents agree there is a sense of shared identity, this percentile drops to 64% and 55% for Hispanics and blacks, respectively.[124] The findings from these surveys indicate that rural whites are less likely to perceive and/or show concern for inequality and racial discrimination, when compared to white

urbanites suggesting a difference in attitudes, beliefs, and values. Blacks in rural areas are also less likely to report a sense of shared identity with their rural peers in comparison to their rural white counterparts which suggests that blacks in rural areas lose a sense of connection that so many rural residents resonate with. The differences in the beliefs and values between whites and blacks living in urban and rural areas might explain why there is an increased black mortality rate in rural areas and why increased levels of observed racism is associated with increased black mortality rates. The rural, white privileged are less concerned with the way blacks feel and perceive discrimination and possibly don't consider the potential side effects of their actions. This no-care attitude might also warrant increased levels of discrimination via tweets with racial slurs and hate speech on Twitter and other sites.

These findings are also somewhat similar to those from another recent study. Chae et al. found a significant association between googling the ""nigger"." and area level black mortality rates. Among 210 Nielsen Media Research designated market areas (DMAs), the proportion of google searches containing the ""nigger"." was associated with higher rates of black mortality. These studies differed in nature considering that Chae and colleagues utilized google search phrases as their measure of racism while this study employed tweets as the measure of racism. Chae et al. also defined the sample as Nielsen Media Research designated areas while the sample in this study was analyzed at the county level.

Similar to current literature, rurality remains a significant predictor in black mortality rates.[125–127] Singh and Siahpush[126] find that mortality rates in the US increased with increasing levels of rurality overall and for some minority populations, including:

non-Hispanic whites, blacks, and American Indians/Alaska Natives. Although overall mortality trends have been declining over time, mortality risks for males, females, blacks, and whites have been increasingly higher in non-metropolitan areas, in comparison to their metropolitan counterparts.[126] Furthermore, the gap between black and white mortality continues to widen. James and Cossman[127] find that the most advantageous regions of mortality for blacks exhibit higher mortality than the most disadvantageous regions for whites. Clusters of rural high mortality throughout the US can be found in the Black Belt, Appalachia, Mississippi valley and Delta Region.[128] Given the findings of the study, differences in racist tweeting rates across counties might help to explain some of the variation in mortality rates across levels of rurality. However, the use of Twitter differs across levels of rurality. Urbanite and suburbanites are more likely to use Twitter when compared to their rural counterparts.[87] These findings were also suggestive of this given that the majority of racist tweeting originated from urban counties. However, observed racist tweeting was similar across urban and rural populations in the study.

Our findings also mirror current literature that finds socioeconomic factors like education and income inequality to be associated with overall health and mortality.[112,129,130] The study findings indicated that a higher income inequality ratio within a county is associated with increased mortality rates. Lynch and colleagues[129] found a similar association in that areas with high income inequality and low average income had excess mortality of 139.8 deaths per 100,000 compared to areas with low income inequality and high income. Education was also found to be significant in each of the models indicating that the percentage of college-educated adults is associated with lower rates of mortality. However, current studies like Muller[130], find that the effect of

income inequality disappeared in a model once the proportion of people without a high school diploma was added, suggesting that lack of a high school education accounts for the income inequality effect. These findings indicate that even when accounting for racist tweeting across counties and rurality, education and income remain significant predictors for all-cause black mortality suggesting opportunities for improvement by way of upstream efforts addressing social determinants of health.

Factors affecting access to care, like the primary care provider supply and hospital bed supply ratios, were not associated with improved rates of mortality across counties. Both the supply of primary care physicians and hospital beds within a county were negatively associated with black mortality as findings suggested that increased ratios resulted in increased black mortality rates. These results mirror some of the current literature. Fisher and colleagues[131] find that the per capita supply of hospital beds is associated with greater utilization by 30% among Medicare beneficiaries. Furthermore, inpatient hospitalization and deaths are significantly higher in areas with greater hospital capacity after controlling for socioeconomic characteristics and burden of disease.[131] Fisher and associates did not find a significant decreased risk of death or benefit in mortality in areas with greater hospital capacity or increased utilization[131]. These findings suggest that utilization and subsequent death increases as resources increase. This might explain why there is a significant negative association between primary care physician and hospital bed supply ratios and mortality. In looking at the association between physical distance to a healthcare facility and mortality, Ohio, Yamashita and Kunkel[115] found an association between access to care (measured by physical distance to hospitals) and heart disease mortality, but the association became insignificant when accounting for

socioeconomic and socio-demographic factors. This evidence further warrants the opportunity to address the social determinants of health to mitigate health disparities in indicators like mortality across populations.

There are some strengths to the design and approach of the study. This is one of the first studies concerned with ascertaining a geographic rurality influence on the association of area level racism and mortality at the county level. Secondly, the study added to current literature on the effects of racism by applying a health services approach by controlling for access to care and socioeconomic factors. Third, the study utilized a more novel method with the number of racist tweets containing a racial slur at the county level as a proxy for racism.

However, the study is not without its limitations. First, the study is unable to determine causality between county level exposure to racism and black mortality across levels of rurality due to applying a cross sectional analysis. Secondly, the study cannot determine the level of perceived racism due to the design and utilizing racist tweets as a proxy for county level effects. Third, the study used one trigger word in instead of applying a semantic analysis looking at a combination of words, phrases, and/or sentences or their use in a derogatory manner.

5.6 CONCLUSION

County level racist tweeting rates are found to be significantly associated with age-adjusted black mortality rates. These associations remain when adjusting for levels of rurality and accounting for socioeconomic differences at the county level. Rurality, however, does not explain or influence the relationship between racist tweeting and black mortality. There is no significant variability in the prevalence of using racial slurs in

tweets across rural and urban counties tested in the study. Rurality continues to be a significant predictor of mortality with rural counties faring worse. Evidence discussed here as well as current studies warrants the importance of focusing on social determinants of health in minding the gap in mortality. However, our findings also suggest that consideration should be given to observed racism. Greater exposure to observed racism might account for mortality disparities between races. Future research should explore this relationship further.

Table 5.1 – County Level Characteristics of Study Sample (n=620)

	Mean±SD	**Range**
Black Mortality Rate	1200.8±203.6	473.1-1931.8
Racist Tweeter Rate	4.1±17.3	0-406.5
Racist Tweet Intensity	1.8±1.6	0-18.0
Racist Tweet Rate	8.2±38.6	0-904.8
Level of Rurality	**Frequency(n)**	**Percent(%)**
Urban	298	48.1
Rural	322	51.9
County Level Predictors	**Mean±SD**	**Range**
Primary Care Provider Supply	4.8±3.4	0-31.0
Hospital Bed Supply	3.1±4.1	0-40.3
Income Inequality	4.9±0.8	2.7-9.0
% College Educated Adults	18.9±9.7	6.0-75.1
%Uninsured Adults	22.7±4.0	7.4-37.9
Unemployment Rate	7.9±2.1	3.3-16.0
% White Population	65.6±18.2	13.7-97.8
% Black Population	28.8±18.8	0.8-85.7

Table 5.2 – Mean Racist Tweets and Tweeters Across Levels of Rurality *(Mean±SD)*

	Urban	**Rural**
Racist Tweeter Rate	4.1±7.2	4.0±23.0
Racist Tweet Intensity	1.9±1.6	1.7±1.6
Racist Tweet Rate	8.4±17.0	8.0±51.1

**Indicates statistical difference between urban and all rural at alpha 0.05*

Table 5.3 – Mean Black Mortality Rate Across Levels of Rurality *(Mean±SD)*

	Mean Black Mortality Rate	**SD**	**P-value**
Urban	1139.8	195.1	<.0001
*Rural**	1257.3	195.0	

**Indicates statistical difference between urban and rural at alpha 0.05*

Table 5.4 – Bivariate Analysis of Relationship between Rurality and Predictors of Mortality

	Total	Urban	Rural	P-value
*Primary Care Provider Supply**	4.8±3.4	5.6±4.1	4.1±2.4	<.0001
Hospital Bed Supply	3.1±4.1	2.9±4.6	3.2±3.7	0.2642
*Income Inequality**	4.9±0.8	4.7±0.8	5.1±0.8	<.0001
*% College Educated Adults**	18.9±9.7	23.4±11.3	14.9±5.5	<.0001
*% Uninsured Adults**	22.7±4.0	21.1±4.0	24.1±3.5	<.0001
*Unemployment Rate**	7.9±2.1	6.9±1.6	8.9±2.1	<.0001
*% White Population**	65.6±18.2	69.2±16.1	62.3±19.4	<.0001
*% Black Population**	28.8±18.8	24.2±16.2	33.2±20.0	<.0001

**Indicates statistical difference between urban and all rural at alpha 0.05*

Table 5.5 –Model #1: Adjusted Association between Racist Tweeter Rate, Rurality, and Black Mortality

	Estimate	**STD Error**	**P-value**	**95% CI**
Intercept	28.9	222.7	0.8967	-408.5-466.4
Racist Tweeter Rate Q2	45.2	33.6	0.1791	-20.8-111.2
Racist Tweeter Rate Q3	63.2	33.0	0.0562	-1.7-128.1
Racist Tweeter Rate Q4	**66.6**	**32.7**	**0.0423**	**2.3-130.9**
Racist Tweeter Rate Q1	Ref.	Ref.	Ref.	Ref.
Rural	**71.6**	**32.3**	**0.0269**	**8.2-135.0**
Urban	Ref.	Ref.	Ref.	Ref.
*Racist Tweeter Rate Q2*Rural*	-47.0	41.8	0.2614	-129.1-35.1
*Racist Tweeter Rate Q2*Urban*	Ref.	Ref.	Ref.	Ref.
*Racist Tweeter Rate Q3*Rural*	-40.9	41.8	0.3292	-123.0-41.3
*Racist Tweeter Rate Q3*Urban*	Ref.	Ref.	Ref.	Ref.
*Racist Tweeter Rate Q4*Rural*	-67.1	43.4	0.1230	-152.4-18.2
*Racist Tweeter Rate Q4*Urban*	Ref.	Ref.	Ref.	Ref.
*Racist Tweeter Rate Q1*Rural*	Ref.	Ref.	Ref.	Ref.
*Racist Tweeter Rate Q1*Urban*	Ref.	Ref.	Ref.	Ref.
Primary Care Physician Supply	**5.4**	**2.7**	**0.0490**	**0.0-10.8**
Income Inequality	**66.7**	**10.3**	**<.0001**	**46.4-87.1**
Hospital Bed Supply	**8.5**	**1.9**	**<.0001**	**4.9-12.2**
% College Educated Adults	**-2.9**	**1.2**	**0.0150**	**-5.3-(-0.6)**
% Uninsured Adults	3.4	2.5	0.1722	-1.5-8.4
Unemployment Rate	**11.4**	**5.3**	**0.0328**	**0.9-21.8**
% White Population	**6.7**	**2.0**	**0.0008**	**2.8-10.7**
% Black Population	**6.0**	**2.0**	**0.0032**	**2.0-9.9**

Boldface indicates significance at alpha 0.05

Table 5.6 –Model #2: Adjusted Association between Racist Tweet Intensity, Rurality, and Black Mortality

	Estimate	**STD Error**	**P-value**	**95% CI**
Intercept	70.9	219.2	0.7463	-359.5-501.4
Racist Tweet Intensity Q2	**70.4**	**33.9**	**0.0383**	**3.8-137.0**
Racist Tweet Intensity Q3	**67.9**	**32.3**	**0.0360**	**4.4-131.3**
Racist Tweet Intensity Q4	48.0	34.0	0.1583	-18.8-114.9
Racist Tweet Intensity Q1	Ref.	Ref.	Ref.	Ref.
Rural	**72.3**	**31.5**	**0.0219**	**10.5-134.1**
Urban	Ref.	Ref.	Ref.	Ref.
*Racist Tweet Intensity Q2*Rural*	-77.8	42.2	0.0652	-160.7-4.9
*Racist Tweet Intensity Q2*Urban*	Ref.	Ref.	Ref.	Ref.
*Racist Tweet Intensity Q3*Rural*	-25.4	42.8	0.5539	-109.5-58.8
*Racist Tweet Intensity Q3*Urban*	Ref.	Ref.	Ref.	Ref.
*Racist Tweet Intensity Q4*Rural*	-41.3	42.0	0.3259	-123.9-41.2
*Racist Tweet Intensity Q4*Urban*	Ref.	Ref.	Ref.	Ref.
*Racist Tweet Intensity Q1*Rural*	Ref.	Ref.	Ref.	Ref.
*Racist Tweet Intensity Q1*Urban*	Ref.	Ref.	Ref.	Ref.
Primary Care Physician Supply	4.6	2.8	0.0950	-0.8-10.0
Income Inequality	**65.4**	**10.3**	**<.0001**	**45.2-85.5**
Hospital Bed Supply	**8.8**	**1.8**	**<.0001**	**5.2-12.4**
% College Educated Adults	**-2.9**	**1.2**	**0.0148**	**-5.3-(-0.6)**
% Uninsured Adults	3.0	2.5	0.2331	-1.9-7.9
Unemployment Rate	**10.9**	**5.3**	**0.0383**	**0.6-21.4**
% White Population	**6.4**	**2.0**	**0.0011**	**2.6-10.3**
% Black Population	**5.9**	**2.0**	**0.0035**	**1.9-9.8**

Boldface indicates significance at alpha 0.05

Table 7 –Model #3: Adjusted Association between Racist Tweet Rate, Rurality, and Black Mortality

	Estimate	**STD Error**	**P-value**	**95% CI**
Intercept	-9.1	223.1	0.9676	-447.2-429.0
Racist Tweet Rate Q2	**66.7**	**33.4**	**0.0464**	**1.1-132.3**
Racist Tweet Rate Q3	**84.2**	**32.7**	**0.0102**	**20.0-148.3**
Racist Tweet Rate Q4	**76.0**	**33.0**	**0.0216**	**11.2-140.9**
Racist Tweet Rate Q1	Ref.	Ref.	Ref.	Ref.
Rural	**87.4**	**31.7**	**0.0060**	**25.1-149.7**
Urban	Ref.	Ref.	Ref.	Ref.
*Racist Tweet Rate Q2*Rural*	-73.3	41.5	0.0779	-154.9-8.2
*Racist Tweet Rate Q2*Urban*	Ref.	Ref.	Ref.	Ref.
*Racist Tweet Rate Q3*Rural*	-63.8	41.6	0.1255	-145.5-17.9
*Racist Tweet Rate Q3*Urban*	Ref.	Ref.	Ref.	Ref.
*Racist Tweet Rate Q4*Rural*	-76.1	43.1	0.0779	-160.8-8.5
*Racist Tweet Rate Q4*Urban*	Ref.	Ref.	Ref.	Ref.
*Racist Tweet Rate Q1*Rural*	Ref.	Ref.	Ref.	Ref.
*Racist Tweet Rate Q1*Urban*	Ref.	Ref.	Ref.	Ref.
Primary Care Physician Supply	**5.4**	**2.7**	**0.0475**	**0.1-10.8**
Income Inequality	**64.8**	**10.2**	**<.0001**	**44.7-85.0**
Hospital Bed Supply	**8.6**	**1.9**	**<.0001**	**4.9-12.2**
% College Educated Adults	**-3.0**	**1.2**	**0.0144**	**-5.4-(-0.6)**
% Uninsured Adults	3.4	2.5	0.1693	-1.5-8.3
Unemployment Rate	**11.1**	**5.3**	**0.0380**	**0.6-21.5**
% White Population	**7.1**	**2.0**	**0.0004**	**3.2-11.0**
% Black Population	**6.4**	**2.0**	**0.0017**	**2.4-10.4**

Boldface indicates significance at alpha 0.0

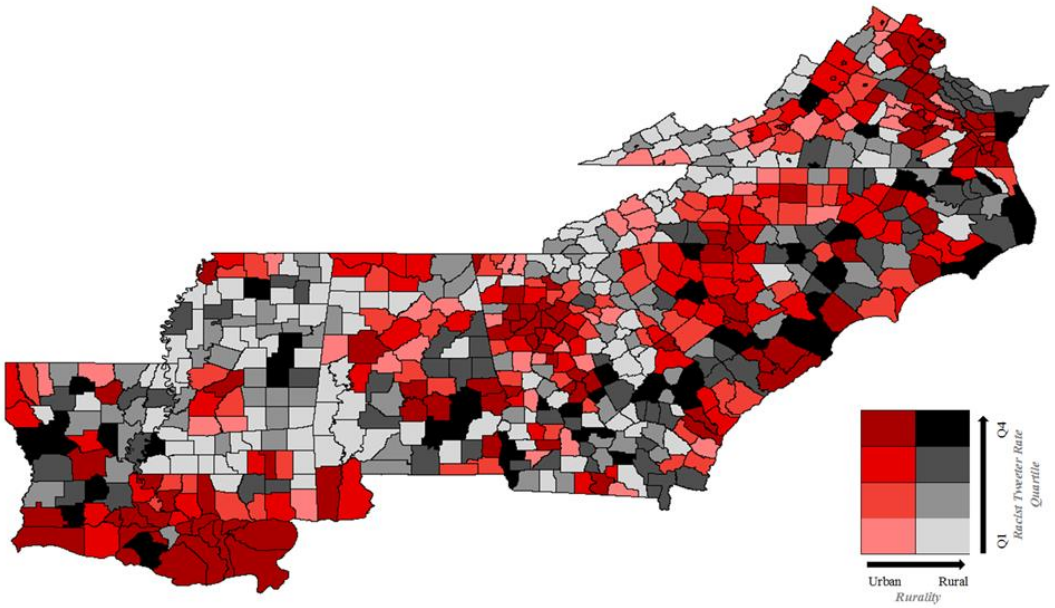

Figure 5.1 – County Racist Tweeter Rates Across Levels of Rurality

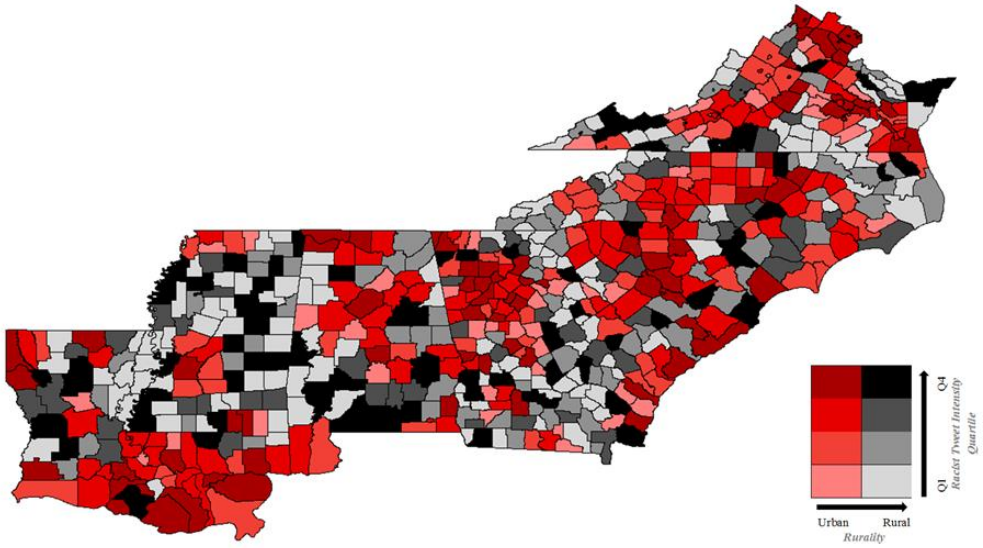

Figure 5.2 – County Racist Tweet Intensity Across Levels of Rurality

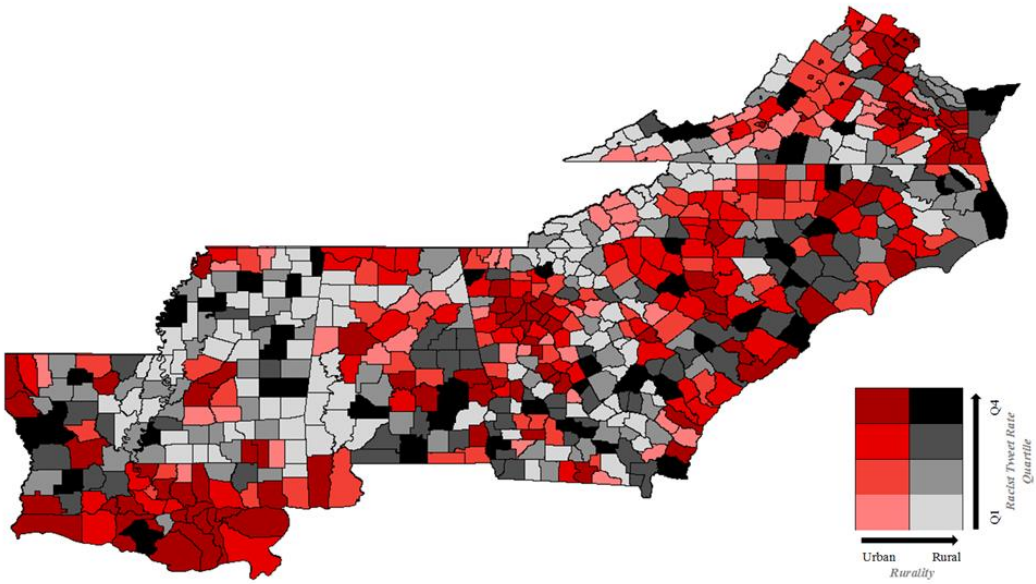

Figure 5.3 – County Racist Tweet Rate Across Levels of Rurality

CHAPTER 6

CONCLUDING REMARKS

6.1 SUMMARY

Racial discrimination and racism is not novel to society. It is a part of US history influencing culture and way of live throughout time. The effects of racism on health are well documented showing that exposure to racism can lead to poor mental and physical health outcomes. Individuals can be exposed to racism through an array of pathways including occupation, healthcare, government, and more recently, the internet. Evidence documents that the internet and social media websites like Twitter have become breeding grounds for racial discrimination and hate speech. Since evidence suggests that racism influences poor health, it is important to understand the subsequent effects of racism.

Current literature prior to this study has primarily focused on ascertaining the associated health effects of experienced or perceived racism. The geographic distribution of observed racism and the health effects of observed racism like that which takes place on Twitter, is understudied. Furthermore, geographic influence on the association of effects of observed racism at the county level and across rurality was unknown. This study sought out to mind this gap in the literature with the purpose of ascertaining a relationship between observed racism on twitter and black mortality at the county level and to determine if rurality influenced the relationship and to explore the geographic distribution of observed racism.

Findings in this study indicates hotspots of observed racist tweeting behavior in Georgia in South Carolina. Rural areas are less likely to engage in racist tweeting, in comparison to their urban counterparts When accounting for rurality, there is a significant association between observed racism and black mortality. Counties in the higher quartile of racist tweeting experience increased black mortality rates in comparison to their counterparts in the lowest quartile of racist tweeting. Socioeconomic factors like education and income inequality also remain significant in predicting black mortality, further contributing to disparities. Access to care factors such as primary care physician supply and hospital bed to population ratios, contribute to higher black mortality rates as the supply of these factors increase at the county level. This indicates that access to care is not mitigating the associated health effects of observed racism.

In relation to the working framework introduced in earlier chapters, the findings of this study indicate that when accounting for rurality or geographical differences, there is an association between mortality and observed racism. Observed racism on Twitter is a cumulative pathway to an individual's exposure to racism. One's frequency and intensity to exposure of racism on Twitter can influence poor health and mortality. The study determined that this relationship existed but only when accounting for geographic differences. Furthermore, causation of the relationship could not be explored due to limitations in the data. The study also addressed other socioeconomic pathways that influence exposure to racism including: income, education, employment, and access to healthcare. The study findings indicated that even when accounting for observed racism, the latter pathways remain significant indicators of mortality. Future research should examine these potential pathways further and their relationship with observed racism to

determine if socioeconomic differences between populations affect or influence the relationship between observed racism and mortality.

This study holds significant implications in the field of public health. Future research should be undertaken to understand the indicated relationship between observed racism and black mortality with respect to geographic influence. In order to eliminate black-white health disparities in mortality, public health efforts will need to address social determinants of health like education and subsequent employment and income as these are protective factors against increased levels of mortality at the county level.

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