Fall 2021

The Association of Demographic Characteristics and Social Vulnerability with COVID-19 Outcomes

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THE ASSOCIATION OF DEMOGRAPHIC CHARACTERISTICS AND SOCIAL VULNERABILITY WITH COVID-19 OUTCOMES

by

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ABSTRACT

This research explored 102 Illinois counties' COVID-19 data to determine whether demographic characteristics and social vulnerability are associated with increased vulnerability to COVID-19 infections and deaths. COVID-19 is disproportionately impacting vulnerable groups and has been deadlier for African American and Hispanic people. The findings of this research will contribute to the knowledge base regarding social vulnerability and assist public health officials in targeting resources and designing interventions. This study used a retrospective cross-sectional design to assess demographic characteristics of race, gender, ethnicity, and social vulnerability to the increased likelihood of COVID-19 infections and deaths. Multiple regression was performed to assess COVID-19 outcomes with race, ethnicity, and gender. Results of the study found a positive association for COVID-19 infections with race, gender, minority status, poverty level, per capita income, children 17 and younger, disability status, and multi-unit housing. Results of the study also found positive associations for COVID-19 deaths in race, gender, minority status, English proficiency, poverty level, per capita income, children 17 and younger, households with a disability, and multi-unit housing.

INDEX WORDS: Coronavirus, COVID-19, Ethnicity, Health disparities, SARS-CoV-2, Severe acute respiratory syndrome infection, Social vulnerability, Social vulnerability index

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A Dissertation Submitted to the Graduate Faculty of Georgia Southern University in Partial Fulfillment of the Requirements for the Degree

DOCTOR OF PUBLIC HEALTH

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Electronic Version Approved:
December 2021

DEDICATION

This dissertation is dedicated to my children Xylona Kiana Shale, Daan-Wayne Jubriel, and Dean-Warren Jabari who have been with me from the beginning of this journey and encouraged me along the way. I recognize the sacrifices that were made and thank you for supporting my academic endeavors even though it has been a long journey. You have each inspired me and remind me that a delayed journey does not diminish the joy of arriving at the destination. I thank my mom, my sisters, my extended family, and my friends for supporting and believing in me. Your support, encouragement, and prayers have fortified me through this dissertation experience. Thank you to Jacklyn Slaughter and Noimot Bakare for your assistance and subject matter expertise. I offer an extra special thank you to Barbara Boone and Jannis Shannon for graciously providing support and encouragement during this journey. I appreciate and thank everyone who has supported my efforts in completing this dissertation.

ACKNOWLEDGMENTS

I acknowledge my committee chair Dr. Gulzar Shah. Thank you, Dr. Shah, for your advice and guidance, patience, flexibility, attention to detail, and encouragement. Your support and encouragement have been invaluable in completing this dissertation. Thank you also to my committee members Dr. Rita Adeniran, Dr. William Mase, and Dr. Hani Samawi for sharing your skills, insight, expertise, and guidance in the completion of this work. I appreciate your efforts and thank you.

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CHAPTER 1

INTRODUCTION

Purpose of the Study

This research will explore whether demographic characteristics of race, ethnicity, gender, and social vulnerability are associated with an increased vulnerability to COVID-19 infections and deaths. COVID-19 is a contagious respiratory disease thought to be transmitted by inhaling airborne droplets from infected people or touching contaminated surfaces (National Institute of Health, 2020). In March 2020, the World Health Organization (WHO) declared COVID-19 a public health emergency of international concern (PHEIC), after an infectious outbreak in China spread throughout the country and across the globe in less than three months (Kim, 2020) (WHO Director - General's opening remarks at the media briefing on COVID-19, 2020) (Li et al. 2020). COVID-19 also known as SARS-CoV-2 causes severe acute respiratory syndrome infection (Yancy, 2020). COVID-19 is an infectious virus 80 percent identical to the severe acute respiratory syndrome (SARS) coronavirus which is believed to have originated from bats and was spread by person-to person-contact causing pneumonia before progressing to respiratory failure. SARS symptoms included fever, cough, dyspnea, watery diarrhea, viral pneumonia respiratory failure, and eventually resulted in 20 to 30 percent of patients on ventilators and a higher fatality rate in older patients and individuals with medical comorbidities. COVID-19 symptoms include mild, moderate, or severe acute respiratory infection, fever, cough, chills, headaches, sore throat, runny noses, nausea, diarrhea, severe pneumonia, loss of smell and taste, and can progress to a reliance on mechanical

ventilation, and higher fatality rates for some patients with comorbidities (Suganthan, 2019)(Coronavirus, 2020)(Tosh, 2020) (National Institute of Health, 2020).

The WHO declaration of COVID-19 as a pandemic disrupted the world and caused widespread fear of the highly contagious and mysterious illness because the 1918 Spanish flu pandemic infected 500 to 100 million people worldwide and resulted in 50 million deaths, including 675,000 deaths in the United States (McDonald, 2020). Experts warn that COVID-19, which has no medical cure, could infect half the world's population and result in more than 100 million deaths (Jones, 2020). There are currently more than a million cases of COVID-19 in the U.S., and growing concern that low-income and minority populations are disproportionately carrying the burden of the pandemic (Beth Israel Deaconess Medical Center, 2020).

COVID-19 has been called the great equalizer because nobody has been immune and anybody could be infected (Gupta, 2020), however, documented health disparities between racial and ethnic groups including groups with higher rates of chronic diseases show that some populations are more vulnerable to COVID-19 compared to White populations (Williams, 2020). Communities with pre-existing health conditions, African Americans, and other minorities are at increased risk of severe disease or death from COVID-19 because of higher prevalence of diabetes, hypertension, or kidney disease which contribute to higher mortality rates (Jones C., 2020) (APA Statement on COVID-19 and Health Disparities, 2020) (American Heart Association, 2020). Health disparities exposed by the COVID-19 health crisis are influenced by socio-economic and environmental factors because some communities are least able to buffer against COVID-19 infections (American Heart Association, 2020) (Chowkwanyun, 2020). COVID-19 is

disproportionately impacting African American communities with death rates 2.4 times more likely than in the general population and may be influenced by increased exposure, a higher rate of jobs in the service industry, higher rates of poverty, unemployment, living in a crowded housing environment, food insecurity, chronic medical conditions and disabilities (Cooper, 2020) (Williams, Senior Editor, 2020). COVID-19's impact on other racial and ethnic groups is still emerging (COVID-19 in Racial and Ethnic Minority Groups, 2020), but an analysis of COVID-19 deaths in some states show that COVID-19 is deadlier for African American and Hispanic people than White people because 52 percent of deaths in Chicago are African Americans who represent 30 percent of the population (Sharpening the global focus on ethnicity and race in the time of COVID-19, 2020). COVID-19 has been deadly for the elderly (Sova, 2020). In New York City, Hispanic American's represent 28 percent of the population and 38 percent of COVID-19 deaths (Yancy C., 2020). In New Mexico, Native Americans are 11 percent of the population but represent 37 percent of COVID-19 cases, and may have increased vulnerability to COVID-19 because of health inequities that include households that are 19 times more likely to not have indoor plumbing compared to White households (Haynes, At the Heart of the Matter: Unmasking and Addressing COVID-19's Toll on Diverse Populations, 2020) (COVID-19: The painful price of ignoring health inequities, 2020). Another analysis indicates that ethnic minority groups have been disproportionately affected by COVID-19 compared to White populations, and ethnicity could influence the spread of COVID-19 because of cultural, behavioral, and multi-generational housing practices (Khunti, 2020) (Ethnicity and COVID-19: an urgent public health research priority, 2020). Research has indicated that the male gender is a

risk factor associated with worse COVID-19 outcomes and that the female gender may have an increased risk of COVID-19 because of the role as family caregivers and essential health workers (Yancy C., 2020) (Hussein, 2020). Natural disasters and previous epidemics have suggested that vulnerable populations suffered disproportionately (Chowkwanyun & Reed, 2020). The American Psychiatric Association has urged officials to be conscious of disparities in the African American community, and local and national officials have reported that in addition to African Americans, Hispanic and Native Americans have experienced higher rates of positive cases, hospitalizations, and deaths (American Heart Association, 2020).

The purpose of this study is to assess whether demographic characteristics of race, ethnicity, gender, and social vulnerability are associated with an increased vulnerability to COVID-19 infections and deaths. Social vulnerability factors that increase vulnerability to the pandemic and other disasters include socioeconomic status, household composition, minority status, language, housing, and transportation. (United Nations Development Programme, 2016) (Center for Disease Control and Prevention, 2020). It is not known if and to what extent social vulnerability and demographic characteristics contribute to increased vulnerability to COVID-19 infections and deaths in vulnerable populations. This study may contribute to policies and interventions that address the disproportionate impact COVID-19 has had on vulnerable populations with pre-existing health conditions or socio-economic and environmental factors that contribute to increased risk to COVID-19 infections and deaths. The problem is of utmost concern and importance to the researcher and the entire public health community because current studies indicate that minority communities are disproportionately

impacted by COVID-19 with death rates 2.4 times higher than the general population and COVID's impact on other ethnic groups is still emerging.

Research Questions and Hypothesis

The following research questions and hypotheses guide this quantitative study:

Q1: What are the state-level patterns in COVID-19 outcomes by race, ethnicity, and gender?

Q2: Is county-level diversity regarding race, ethnicity, and gender associated with increased vulnerability to COVID-19 infection?

Q3: Is county-level diversity regarding race, ethnicity, and gender associated with increased vulnerability to COVID-19 death?

The hypothesis statements to be applied to questions two and three are:

Hypothesis for Q1

H1o: The county-level diversity regarding race is not associated with the risk of COVID-19 infection.

H2o: The county-level diversity regarding ethnicity is not associated with the risk of COVID-19 infection.

H3o: The county-level diversity regarding gender is not associated with the risk of COVID-19 infection.

Hypothesis for Q2

H4o: The county-level diversity regarding race is not associated with the risk of COVID-19 death.

H5o: The county-level diversity regarding ethnicity is not associated with the risk of COVID-19 death.

H6o: The county-level diversity regarding gender is not associated with the risk of COVID-19 death.

Delimitations

This research addressed the questions of what are the state-level patterns in COVID-19 outcomes by race, ethnicity, and gender, and is county-level diversity relating to race, ethnicity, and gender associated with increased vulnerability to COVID-19 infections and deaths? This research was confined to the state of Illinois and specifically focused on African American Black and Hispanic populations because studies indicate this vulnerable population was disproportionately impacted by COVID-19. The variables examined in this study include COVID-19 infection rates, COVID-19 death rates, and demographic characteristics of race, ethnicity, and gender. Age and the elderly population were not a specific focus of this research. Social vulnerability variables examined in this study included minority status, English speaking ability, below poverty status, per capita income, no high school diploma, age under 17, disability status, multi-unit apartments, and mobile homes.

Significance of the Study

This study is significant because COVID-19 contributed to a global pandemic that infected more than four million individuals in the United States at the time of this study, and claimed the lives of more than 150,000 U.S citizens (Maxouris & Levenson, 2020) (Beth Israel Deaconess Medical Center, Retrieved July 30, 2020)(John Hopkins University of Medicine, 2020). COVID-19 has affected a huge portion of the population

(Chowkwanyun & Reed, 2020), and emerging data indicate that individuals with pre-existing health conditions are at increased risk for COVID-19 fatalities (Haynes et al., 2020). Findings from this study will contribute to the knowledge base regarding social vulnerability related to COVID-19 and other hazards based on demographic characteristics and will be significant for assisting public health and governmental officials in targeting resources, developing policies, and designing interventions that address vulnerable populations, and for raising awareness of community social vulnerabilities and assistance that minimizes its disproportionate impact. The research questions are whether segregation related to race, ethnicity, and gender are associated with increased social vulnerability to COVID-19 infections and deaths. African-American, Hispanic/LatinX, and Native Americans have higher COVID-19 positive rates compared to White Americans, have increased hospitalizations, and substantially higher deaths (American Heart Association, 2020). Research indicates that health differences between minority populations are common and often due to economic and social conditions (CDC, 2019). Emerging data also indicate that COVID-19 is disproportionately impacting socially vulnerable groups and race, poverty, age, gender, and household composition are factors that contribute to risk because poverty requires individuals to work outside the home increasing their risk for exposure, individuals with pre-existing health conditions are at increased risk for negative outcomes, social distancing may not be feasible in multi-generational households, and in some racial and ethnic populations, a distrust of the health system along with contradictory pandemic information and warnings may contribute to increased infections and poor outcomes (CDC, 2019)(Bethel et al., 2013). The implications from this study are that the impact of

social vulnerability factors that contribute to community suffering, financial loss, and mortality can be mitigated to reduce the likely impact from pandemics, disasters, and other hazards in vulnerable communities (Flanagan et al, 2011)(What is social vulnerability, 2020). Social vulnerability refers to increased vulnerability or potential risk or harm to groups of people confronted with natural disasters, disease outbreaks, or pandemics (United Nations Development Programme, 2016). A social vulnerability index measures factors that increase vulnerability to disaster and include socioeconomic status, household composition, minority status, language, housing, and transportation (Center for Disease Control and Prevention, 2020).

Definition of Terms

This section presents the terms used throughout this research.

Coronaviruses are a group of highly diverse enveloped single-stranded RNA viruses that can be divided into alpha, beta, delta, and gamma genes that can be found in humans and animals (Suganthan, COVID-19, 2019). Coronavirus (CoV) is a pathogenic human respiratory virus transmitted by direct human to human contact or through droplets, (Perlman, 2020), causes illness ranging from the common cold to severe disease, and is from a large family of viruses identical to the Middle East respiratory syndrome (MERS-CoV), and severe acute respiratory syndrome (SARS-CoV) (VHL Regional Portal Information and Knowledge for Health, 2021). SARS-CoV-2 is related to two bat coronavirus, bat-SL-CoVZC45, and bat-SL-CoVZXC21 (Lai et al., 2020) (Suganthan, 2019).

SARS-CoV-2 is also known as severe acute respiratory syndrome coronavirus 2 (Feng, 2020), or coronavirus disease 2019 (Suganthan, 2019). It is a coronavirus genetic

combination that emerged from different coronavirus forming a new virus that is more transmissible than SARS and MERS (Suganthan, 2019)(Wu & McGoogan, 2020).

COVID-19 can be transmitted through droplets, orally, and has been found in tears. The incubation period ranges from one to fourteen days. Main symptoms of COVID-19 include fever, fatigue, dry cough, muscle pain, headache, and shortness of breath. Symptoms can be classified as mild, severe, and critical and can also include pneumonia and chest pain, an infected individual exposes at least two to three individuals (Feng, 2020).

Ethnicity is defined as national origin and language, cultural and social status (Cooper L., 2006), as being composed of genetic make-up, social constructs, cultural identity, and behavioral patterns (Pareek et al., 2020), ethnicity is used to explore genetic and differences among populations (Pan et al, 2020), lifestyle factors, and to emphasize disadvantages ethnic minorities experience (Khunti et al., 2020). Ethnic classifications have been used for genetic and population differences despite their limitations (Pareek et al., 2020).

Disparities are defined as differences in healthcare utilization and health outcomes between populations (Kim et al., 2020). Health disparity refers to situations where inequitable medical outcomes are observed because of social, economic, or environmental disadvantages that are not entirely explained by differences in access, clinical appropriateness, or patient preferences and remain despite adjusting for socioeconomic factors (Cooper et al., 2006) (Braveman, 2014). Health disparities are defined by Healthy People 2020 as differences that occur because of gender, race or ethnicity, education, income, disability, sexual orientation, and geography, (Braverman et

al., 2011). The National Institute of Health (NIH) defines health disparities as differences in the incidence, prevalence, mortality, and burden of disease among specific groups.

Vulnerability is determined by factors that increase the susceptibility of a community to the impact of hazards, or human conditions resulting from social, economic, and environmental factors which determine the likelihood and scale of damage from the impact of a hazard (Birkmann, 2006). Social vulnerability refers to increased vulnerability to potential risk or harm to populations confronted with natural disasters, disease outbreaks, or pandemics (United Nations Development Programme, 2016). Communities with higher social vulnerability have more adverse outcomes during and after public health events (CDC, 2020). The social vulnerability index is defined to measure the presence of factors that contribute to community vulnerability to human suffering and financial loss in the presence of a disaster (Center for Disease Control and Prevention, 2020), and is a numerical expression that provides a statistical measure of changes in value (Tascon-Gonzalez et al., 2020).

Chapter one presented information on the COVID-19 pandemic's disproportionate impact of deaths in the African-American, Hispanic/LatinX, and Native American communities and individuals with pre-existing health conditions (Chowkwanyun & Reed, 2020) (Haynes et al., 2020). Chapter two will present a review of the current literature related to race, ethnicity, gender, social vulnerability, and COVID-19 infections and deaths. Chapter three will describe the study's methodology, chapter four will present an analysis of the data, and chapter five will present results and interpretation of the study findings.

CHAPTER 2

LITERATURE REVIEW

This chapter provides a literature review of whether social vulnerability related to the demographic characteristics of race, ethnicity, and gender contributes to an increased vulnerability to COVID-19 infections and death. This review summarizes past research that addresses the related research questions of whether social vulnerability increases the risk for COVID-19. To conduct this review, a literature search was conducted for available peer-reviewed journal articles and related reports using search terms of coronavirus, COVID-19, race, ethnicity, gender, health disparities, social vulnerability, and disasters. The Boolean operator AND was combined with key terms and the word disaster was added resulting in dissertation abstracts, journal articles, and reports. Articles were reviewed for methodologies, frameworks, findings, and conclusions.

Factors Associated with COVID-19 Outcomes

Race

Studies have found significant disparities in COVID-19 infection rates and outcomes such as deaths. For instance, Chowkwanyum & Reed (2020) examined racial health disparities in COVID-19 deaths. Chowkwanyun and colleagues state Black people are more than twice as likely to die from COVID-19 than White people and that marginalized populations will suffer disproportionately, they caution that it's crucial to collect racial and ethnic data and necessary to put the data in context to dispel the view that there is a biologic explanation for the disparity or racialized behavior such as obesity contributes to medical conditions that increase the risk for COVID-19. The article calls

for disaggregated COVID-19 geographic data and cautions that race-specific data and neighborhood-level data could cause stigmatization in resource-deprived neighborhoods and amplify stigmatization. The authors stress the collection of socio-economic data along with COVID-19 data can clarify how racial and class forces are intertwined because socioeconomic factors may contribute to disparities in COVID-19 outcomes (Chowkwanyun & Reed, 2020). Karaye and Horney (2020) examined the impact of social vulnerability on COVID-19 in the U.S. and found that minority communities are disproportionately impacted by detrimental outcomes during disasters and may experience increased COVID-19 risks because of essential work conditions where remote work is not permitted, living in neighborhoods where social distancing is not feasible, have less access to health care, and are less likely to be referred for screening when presenting with symptoms (Karaye, 2020).

Laurencin & McClinton examined the racial and ethnic distribution of COVID-19 cases and deaths in Connecticut where there was concern marginalized groups would be disproportionately impacted by COVID-19 and experience a greater proportion of infection and death (Laurencin & McClinton, 2020). The authors retrieved data from the department of public health which indicated that Fairfield, New Haven, and Hartford were counties that had the most COVID-19 cases although there was missing data on the racial and ethnic composition. The medical examiner office provided a breakdown of COVID-19 deaths showed 76.5% White, 14.4% Black, 6.7% Hispanic, and 2.2% Asian, although Connecticut population comprised 66.5% White, 12% Black, 4.9% Asian, 0.6% American Indian/Alaska Native, and 16.5% Hispanic/Latinx was viewed as a microcosm of America (Laurencin & McClinton, 2020). The authors conclude that although

COVID-19 doesn't discriminate Black people in Connecticut have a higher risk of COVID-19 infections compared to their percentage in the population, and the impact on racial and ethnic minority populations result in disproportion death and disease burden, and social upheaval that includes job loss, limited health care care, lack of resources and health disparities similar to what was experienced during the HIV/AIDS epidemic (Laurencin & McClinton, 2020). Karmakar et al., (2021) examined county-level sociodemographic risk factors and the association of COVID-19 incidence and mortality found most sociodemographic factors, particularly racial and ethnic minority status were significantly associated with COVID-19 incidence and mortality and found that social factors were associated with the increased rate of COVID-19 infection and death. The authors suggest that social factors and their root causes including socioeconomic status, racial and minority status, family, and household composition were associated with COVID-19 and should be addressed during the COVID-19 and future epidemics.

Ethnicity

Khunti et al., (2020) examined whether ethnicity is linked to the incidence or outcomes of COVID-19. Ethnicity is defined as being composed of genetic make-up, social constructs, cultural identity, and behavioral patterns (Pareek et al., 2020). Khunti and colleagues found that minority groups are disproportionately affected by COVID-19 with an analysis of COVID-19 cases showing that black communities had three times the rate of COVID-19 cases and six times the death rates compared to white communities. This article examined potential reasons for higher COVID-19 incidence and severity and explored if ethnic factors related to socioeconomic, cultural, lifestyle, genetic

predisposition or pathophysiological differences in susceptibility or infection response contribute to COVID-19 (Khunti et al., 2020). Khunti and colleagues suggest additional research is needed to determine if there is an association between ethnicity and COVID-19 outcomes and called for the collection of detailed ethnicity data because minority communities are more likely to be socioeconomically disadvantaged than white communities and face several disadvantages related to overcrowded housing, jobs, and difficulty in practicing and maintaining social distancing increasing their risk for COVID-19 infection. The authors conclude that research is needed to confirm the association between ethnicity and COVID-19 outcomes and if confirmed, the causes.

Kirby and associates examined evidence indicating that COVID-19 has a disproportionate effect on ethnic minorities, and factors such as hypertension, diabetes, heart disease, workplace, and work roles contribute to increased risk of COVID-19 infection (Kirby, 2020). Data from the UK Intensive Care National Audit and Research Center report that of 6574 COVID-19 patients, one third were non-white, even though they represent 13% of the population, and a disproportionate number of black and minority communities have died, and younger minority people have higher death rates from COVID-19 than the White population. Center for Disease Control (CDC) reports that African Americans are disproportionately affected by COVID-19 with 14 states showing African Americans represent 33% of COVID-19 hospitalizations out of 18% of the population, 92.3 death per 100,00 for African Americans, 74.3 death per 100,000 Hispanic/Latino population compared to 45.2 per 100,000 for White and 34.5 per 100,000 for Asian populations. Authors indicate studies are needed to confirm the data and understand the impact of chronic health conditions, crowded housing conditions, working

in low paying jobs, inability to work from home, and how using public transportation has increased COVID-19 infections and deaths, as well as identify strategies to reduce the disproportionate impact COVID-19 has on racial and ethnic minority communities**.**

Gender

Hussein and associates examined COVID-19 implications for sexual and reproductive health found that women's gender role of the family caregiver and responsibilities of caring for children, as well as frontline health care workers, may increase their risk of COVID-19 infection and found no evidence that pregnancy makes women more susceptible to COVID-19 (Hussein, 2020). Historical analyses of epidemics have resulted in the exploitation of social divisions, social conflict, and power imbalances, but It's unknown how gender, sexual, and reproductive health, and rights will play out during the current pandemic.

Research from the Association of Black Cardiologists reports that people of color are disproportionately impacted by COVID-19 with data from the Center for Disease Control (CDC) showing that 33% of COVID-19 hospitalizations are Black people who are 18% of the study population and represent 32% of the population and 70% of deaths in Louisiana, In New York City the Hispanic/LatinX are 28% of the population and 34% of deaths and in New Mexico, Native Americans are 11% of populations and 37% of COVID-19 cases (Haynes et al., 2020). Data from the United kingdom report that 12% of COVID-19 ICU patients are Black, represent 3% of the population, disproportionately required ventilators, and had a 67% increased risk of mortality associated with ventilator use. This study suggests that socio-economic and environmental factors contribute to the

disproportionate impact of COVID-19 on minority people because of difficulty in practicing social distancing related to multigenerational housing or work conditions where working from home is not feasible. Distrust of the health system leads to minority groups seeking treatment at a later stage, and low health literacy and limited English fluency contribute to disparities in the health care system related to COVID-19.

Social Vulnerability

Bethel's research examined disparities in disaster preparedness between racial and ethnic minority groups using cross-sectional data from the Behavioral Risk Factor Surveillance System (BRFSS) survey analyzing data of non-Hispanic Whites, non-Hispanic blacks, and Hispanic respondents because research shows there is an increased vulnerability during public health disasters and factors such as cultural, language, issues of trust related to the message and messenger, risk perception, and the information source all contribute to the vulnerability (Bethel et al., 2013). A social vulnerability index used county-level socioeconomic and demographic data to assess vulnerability to environmental hazards in racial and ethnic minority communities to minimize the impact of a disaster identified 11 factors that contribute to vulnerability.

Bergstrand's study assessed the relationship between social vulnerability and community resilience to disasters by mapping communities threat risk and recovery abilities, as there are indications that most vulnerable communities tend to be least resilient to hazards or disasters (Bergstrand et al., 2015) which is relevant to this study's aim to assess the impact of COVID-19 outcomes based on demographic characteristics of race, ethnicity, and gender. This research states that vulnerability to disaster is socially

constructed, and social systems contribute to vulnerability, and demographics is one of several factors used to measure vulnerability to the susceptibility of harm or loss (Norris et al., 2008), risk difference, or traits and condition that increase vulnerability (Alwang et al., 2001). Other factors related to vulnerability race and ethnicity are perceptions of an unfair public health system response (Eisenman et al., 2004), an absence of culturally relevant messages delivered to the African-American and Hispanic community, cultural ignorance, ethnic insensitivity, information dissemination, racial isolation, and bias in housing and assistance (Fothergill et al., 1999). Previous research on racial and ethnic populations' disaster preparedness was assessed during the influenza pandemic (Hutchins et al., 2009). Indicators of social vulnerability can be measured at various levels ranging from individual, community, regional, or national. Social vulnerability at the individual level can be measured by characteristics such as gender, race, ethnicity, and age, community-level measurements can include aggregated measurements of race and age, minority status, residency in poor and rural communities with few resources, and gender roles where women's work may increase their risk to hazard or disaster. Relationships between community resiliency index and social vulnerability index (SoVI), data from the U.S.Census, USA counties, the City and County Data Book, federal statistical bureaus, governmental administrative, regulatory, and private research were used to acquire county-level data and assemble variables for 3,143 counties and to understand how social vulnerability and community resiliency operate. The study confirmed a relationship between social vulnerability and community resilience found various factors including the type of threat that contributes to increased vulnerability in communities experiencing

disaster including messaging, limitation of community resources, lack of skills, and inadequate infrastructure.

Chapter two presented the current literature on COVID-19 and the topics of race, ethnicity, gender, social vulnerability, and COVID-19 infections and deaths. Laurencin's study found marginalized groups experienced a greater proportion of infections and deaths (Laurencin & McClinton, 2020). The literature found black people are twice as likely to die from COVID and that marginalized populations suffer disproportionately from COVID-19 infections (Chowkwanyun & Reed, 2020), and that marginalized populations experience a greater proportion of infections and deaths (Laurencin & McClinton, 2020). The literature identified a gap in research that provided detailed ethnicity data on minority communities likely to be disadvantaged. The literature also identified a need for additional research to clarify the relationship between race and class, and research to confirm the association between factors related to ethnicity and COVID-19 outcomes.

Conceptual Framework

The social-ecological model (SEM) selected for this study is a theory-based framework for understanding the interactive effects of personal and environmental factors. The social-ecological model was developed by Bronfenbrenner in the 1970s as a conceptual model for understanding human development but was later formalized as a theory-based framework. McLeroy and colleagues expanded the SEM framework in 1988 to advance the theory that health is not only determined by biological factors but influenced by individuals, interpersonal social networks, institutions, community, and

public policy (Golden et al, 2015). The SEM theory is represented in Figure one by overlapping rings that represent various levels that include individual, interpersonal relationships, institutions, community, and public policy characteristics that affect health (Kilanowski, 2017) (Harvard Medical School, 2021). The first ring refers to the individual and represents individual characteristics biological and personal factors that may include age, education, income, and reflect attitudes beliefs, and behaviors related to embracing public health safety measures related to the COVID-19 pandemic. Race, ethnicity, gender, minority status, and age under 17 variables in this research correspond to the individual first ring, with the social and demographic indicators reflecting the diversity of the population and influencing community trends. The second ring represents formal and informal interpersonal relationships with peers, partners, and family members that shape identities and influence behavior that may be reflected in community testing, limiting social interactions and social distancing, and mask-wearing. Variables in this research that correspond to an interpersonal relationship include multi-unit housing, crowded housing, and populations under age 17. The third ring represents institutions that shape behavior and attitudes such as schools, churches, and neighborhoods, and can influence behavior through rules, regulations, and cultural expectations. Variables that correspond with this ring include limited English speaking ability and no high school diploma and can be reflected in adherence to school and business closure, social distancing in neighborhood establishments, attending virtual religious services. The fourth ring represents community and societal characteristics, societal factors, social and cultural norms, health, economic, and educational factors, and social networks that exert negative and positive interactive forces. Variables in this research that correspond to this

ring include per capita income, below poverty, and disability. Increased COVID-19 infection and fatality rates may be a reflection of the community increased risk to exposure because of economic status, fewer restrictions, no sheltering in place, no mandated mask-wearing, no social distancing, no remote work, or following public health protective measures compared to communities that implemented restrictions and decreased COVID-19 infection and fatality rates (Akanbi et al., 2020) (Kilanowski, 2017). The fifth ring is public policy and refers to laws and policies at the federal, state, or local level, and the influence of public health and government officials who issued mandated restrictions, school, and business closures, and made testing and protective resources available to address COVID-19 to increase the likelihood of favorable health outcomes resulting in reduced COVID-19 infections and deaths. Variables that correspond to the public policy ring in this study are health outcomes related to a reduction in COVID-19 infection cases and COVID-19 death rates (Community Tool Box, 2021). Community indicators that assess this would include efforts by government officials to mandate sheltering in place, regulated school closures, social distance, and mask-wearing mandates. The conceptual model is depicted in Figure 1.

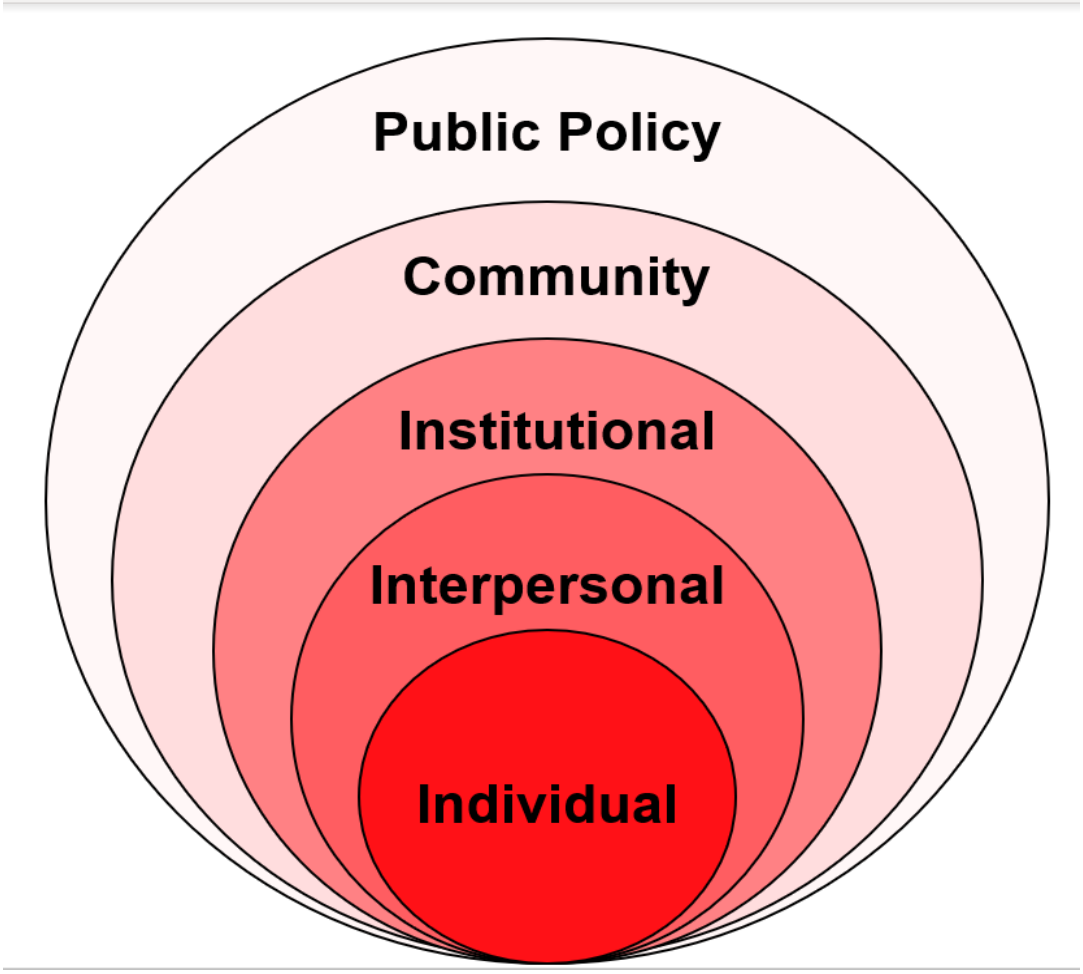

Figure 1. The Social-Ecological Model (Harvard Medical School, 2020)

CHAPTER 3

METHODOLOGY

Study Design, Background, and Research Hypothesis

A retrospective cross-sectional design is used for this study to assess the demographic characteristics of race, ethnicity, gender, and social vulnerability on the impact of COVID-19 infections and fatalities in the State of Illinois from March 11 through August 31, 2020.

Illinois is a state in the Midwest of 57,914 square miles and a population density of 230 people per square mile, it was one of the first states during the pandemic with confirmed cases of positive coronavirus patients. Illinois 2019 population was 12.6 million people with a demographic composition of 71.67%, White, 14.23% Black or African American, 5.39% Asian, 0.25% Native American, and 0.04% Native Hawaiian or Pacific Islander, 5.95% other race, and 2 million Hispanic residents the 5th highest population in the country (World Population Review, 2020).

This research used secondary data from multiple sources including the State of Illinois COVID-19 data on confirmed coronavirus infections and deaths by county, race, ethnicity, and gender collected by the Illinois Department of Public Health (IDPH), data from the United States Census Bureau QuickFacts on county demographic characteristics, the Census Reporter, and data from USA Facts on U.S. Coronavirus Cases and Deaths tracked daily by state and county. The Illinois Department of Public Health is a centralized health department with seven regional offices and a network of 96 local health departments that protects 12.6 million Illinois residents from 102 counties.

IDPH monitors COVID-19 positivity rate, the percent of COVID-19 positive tests out of the number tested, transmissions, and increases in disease burden using the Illinois syndromic surveillance system that collects almost real-time emergency department and inpatient visit demographic data, chief complaint, symptoms, and diagnosis and compiles statistics on coronavirus testing, positive cases, deaths, total tests performed and recovery rate (Illinois Regional COVID-19 Resurgence Criteria, 2020). The U.S.Census Bureau QuickFacts data provides statistics for states and counties on population estimates, gender, race and ethnicity, population characteristics, housing composition, education, health, income. and poverty levels (United States Census QuickFacts, 2021). QuickFacts data is obtained from population estimates, community and population surveys, health insurance and area income and poverty estimates, housing estimates, surveys of business owners, and building permits. The Census Reporter is an independent project not affiliated with the U.S. Census that provides data from the Census and the American Community Survey on census-related subjects at the county subdivision summary level (Bureau, 2021). USA Facts is a dataset of standardized government data maintained by the Penn Wharton Budget Model (PWBM) that tracks daily US Coronavirus Cases and Deaths with data from the Centers for Disease Control and Prevention and local public health agencies which is presented on a granular county and state level (USAFACTS, 2020). The Cook County social vulnerability map provides social vulnerability index score (SVI) and population indicators that measure the presence of 15 social factors (poverty, unemployed, household income, no high school diploma, age 65 or older, age 17 or younger, residents with a disability, single-parent household, racial/ethnic minority, limited English proficiency multi-unit housing, mobile home, overcrowded housing, no

vehicle, and institutional group living) or the presence of socioeconomic status, household composition, minority status, and language and housing and transportation factors that increase a community vulnerability to COVID-19 (What is Social Vulnerability? 2020) (Cook County Social Vulnerability, 2020).

This research explores whether demographic characteristics of race, ethnicity, gender, and social vulnerability are associated with an increased vulnerability to COVID-19 infections and deaths. The research questions for this study are what are the state-level patterns in COVID-19 outcomes by race, ethnicity, and gender? Is county-level diversity regarding race, ethnicity, and gender associated with increased vulnerability to COVID-19 infections and deaths?

The research hypotheses are:

H1o: The county-level diversity regarding race is not associated with the risk of COVID-19 infection.

H2o: The county-level diversity regarding ethnicity is not associated with the risk of COVID-19 infection.

H3o: The county-level diversity regarding gender is not associated with the risk of COVID-19 infection.

H4o: The county-level diversity regarding race is not associated with the risk of COVID-19 death.

H5o: The county-level diversity regarding ethnicity is not associated with the risk of COVID-19 death.

H6o: The county-level diversity regarding gender is not associated with the risk of COVID-19 death.

Sample and Population

The study population is 102 Illinois counties (Map figure 2-4). The data available about infections and deaths is summary data at the county level, therefore the unit of analysis is a county. To provide some context, 234,953 residents aged under one year of age to older than 100 years of age received a positive SARS-CoV-2 (COVID-19) diagnosis after being tested by either a nasopharyngeal swab, an oropharyngeal swab, or a nasopharyngeal wash or nasal aspirates from March 11, 2020, through August 31, 2020.

Instrumentation

The Illinois Department of Public Health, the Illinois National Electronic Disease Surveillance System, and the USA Facts Coronavirus dashboard provide an online interactive COVID-19 dashboard that is used as instrumentation for this study. The Illinois Department of Public Health (IDPH) required providers and testing sites to collect data on individuals tested for COVID-19 under the requirements of the Illinois Control of Communicable Disease code (COVID-19, 2020). The Illinois Department of Public Health web portal posted demographic data (age, gender, race, ethnicity), geographic data (county and zip code), number of total tests performed,

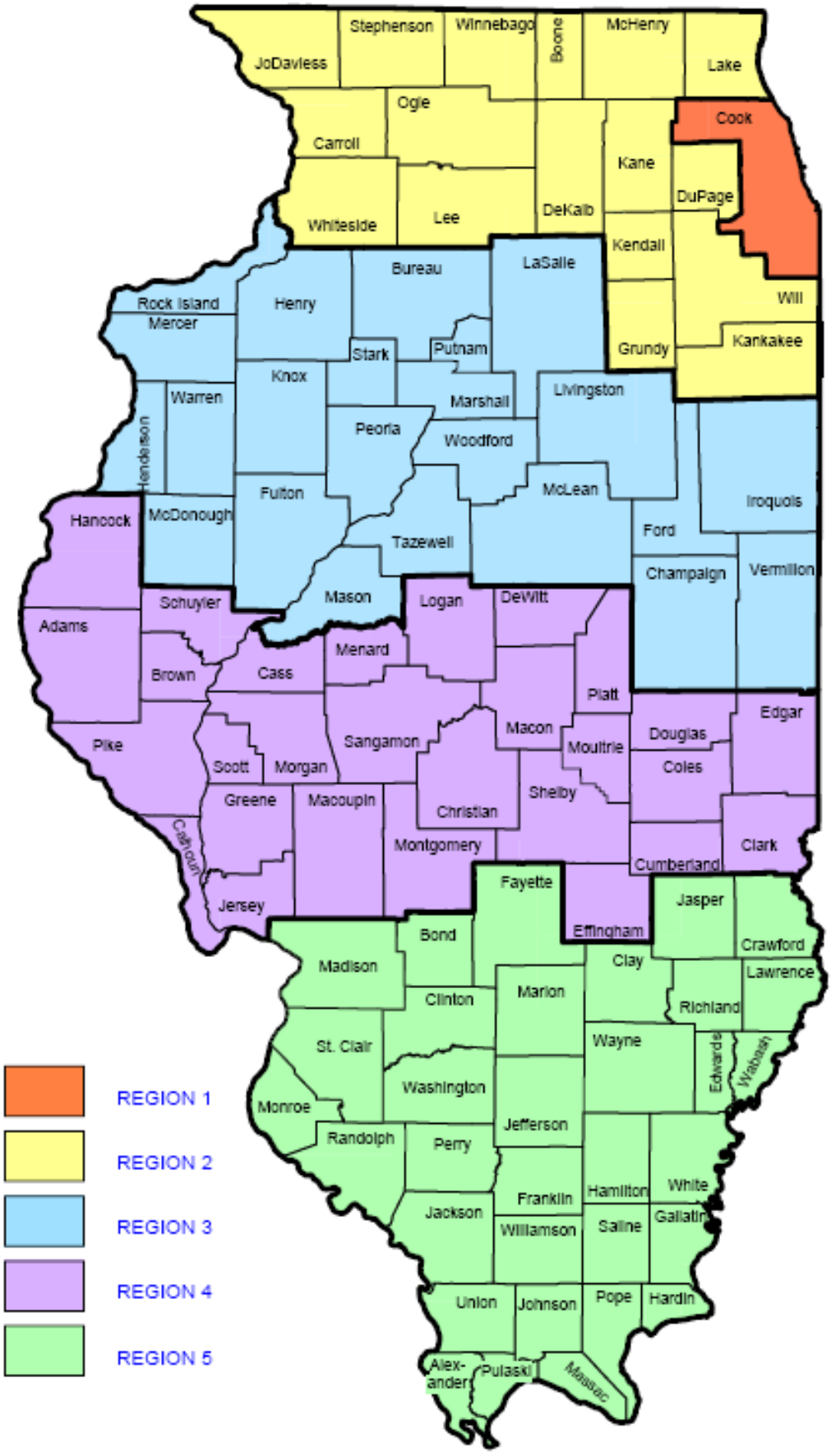

Figure 2 Map of Illinois Counties

Figure 3. COVID-19 Regional Map.

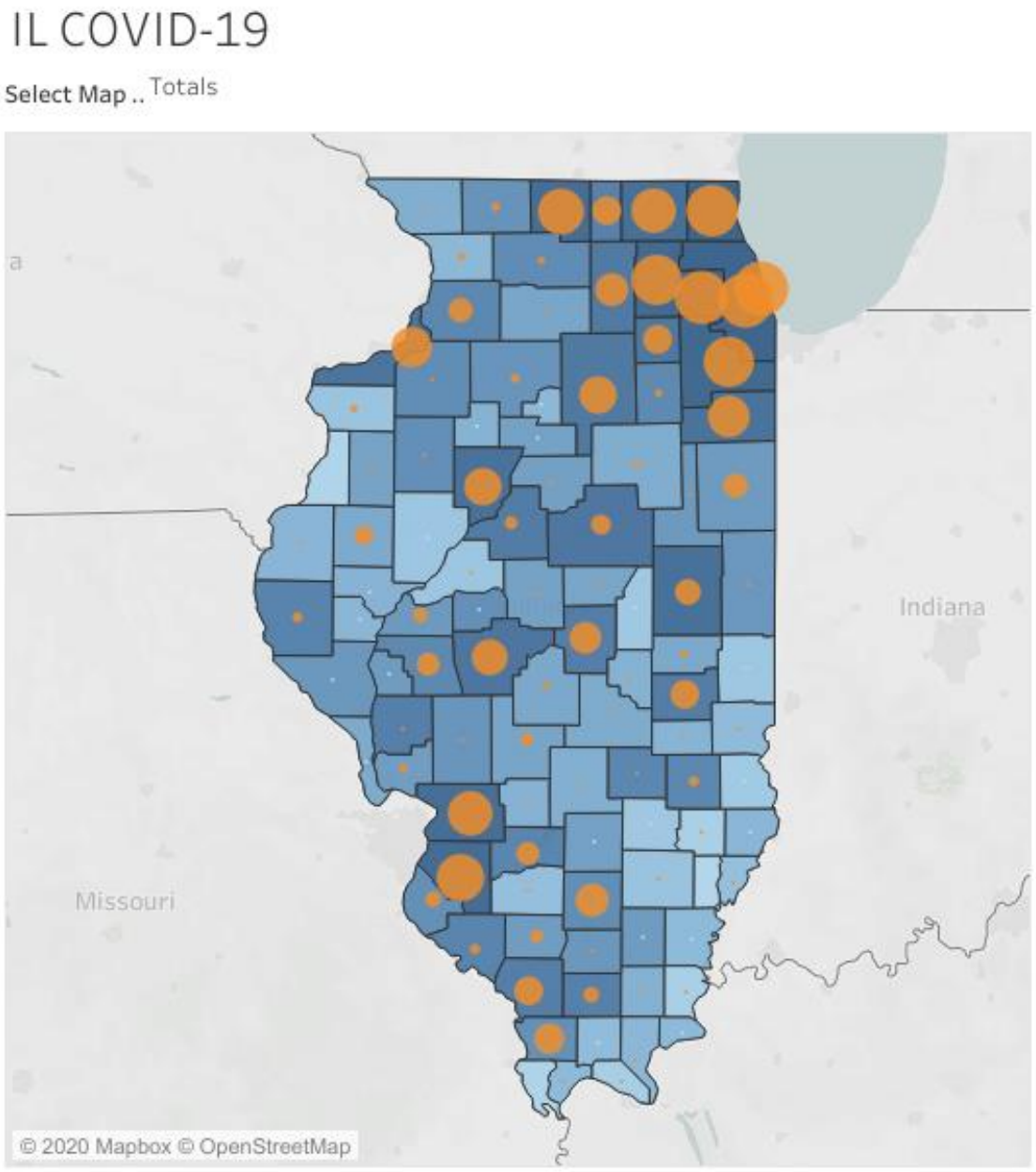

Figure 4. **Illinois Map Circles representing COVID-19 Surge**.

confirmed positive cases and deaths reported via the Illinois National Electronic Disease Surveillance System, along with data on emergency department and inpatient visits, chief complaints, diagnosis, date of visit, and recovery rates. The United States Census Bureau QuickFacts web posted secondary survey data on county population estimates, demographic characteristics, income, and poverty estimates, the Census Reporter website provide housing estimates, and the interactive dashboard from USA Facts on U.S. Coronavirus Cases and Deaths was used to confirm cumulative state and county information on daily COVID-19 cases and deaths.

Data Collection and Methods

Observations were conducted from March 11 through August 31, 2020, of COVID-19 data drawn from the IDPH syndromic surveillance, the Census Bureau QuickFacts, and the USA Facts Coronavirus dashboard. Data from 102 Illinois counties grouped into 11 regions was collected in a standardized approach that compared and measured the health burden of COVID-19. A database was constructed of confirmed coronavirus cases, the number of deaths, and county demographic characteristics including race, gender, and ethnicity. IDPH used a standardized approach to measure daily regional and county level indicators based on pre-established thresholds to monitor the state for COVID-19 transmission, resurgence, and to evaluate disease burden, which is then compared to county and regional targets**.** Data was collected on county income and employment level, minority status, English language proficiency, and household composition to assess overall vulnerability status. Social vulnerability determines a community or population's vulnerability to suffering during a disaster and is measured by

themes that include socioeconomic status, minority status and language, household composition and disability, and transportation and housing. A social vulnerability index (SVI) score for each county was used to assess if there is an association between social vulnerability and COVID-19 infections and death.

Measures

The Illinois Department of Public Health used a standardized approach to calculate daily, regional, and county-level indicators based on a pre-established threshold to monitor for COVID-19 transmission, resurgence, and to evaluate disease burden, which is then compared to county and regional targets**.** COVID-19 infections are determined by calculating the rate of recent cases divided by 100,000 people over seven days (County Level COVID-19 Risk Metrics, 2020).

A social vulnerability index was used to determine a community or population's vulnerability to suffering or loss during a disaster and is measured by themes that include minority status, language, household composition, transportation, housing, and disability. A social vulnerability index (SVI) score was calculated for each county to assess if there is an association between social vulnerability and COVID-19 infections and death. Vulnerability variables were used which will give a value to the proportion of the population that is at risk or vulnerable in each county. The score is based on a dimension index borrowed from the financial inclusion access literature which is similar to the United Nations Human Development Index (Human Development Report. Beyond income, beyond averages, beyond today: Inequalities in human development in the 21st Century, 2019). The index is based on data from the United Nations Human

Development Index and is relevant for calculating vulnerability (Sarma, 2008). The difference is that the interpretation of the index has been changed to values being inputted into the index as risk values. The dimension index removes the idea that all risks carry equal weight and places a higher weight on the most important variable by normalizing all the variables. Multiple variables were incorporated into a single index between zero and one. The vulnerability index takes values between zero and one, the higher the county moves to one, the more vulnerable the county is.

The Euclidean distance is a straight-line distance between two points in the space creating a Euclidean norm. In n-dimensional Euclidean space, the Euclidean distance is calculated as the numerator of the equation. The square root from the number of dimensions. The equation is subtracted to normalize the vulnerability index, and the value is normalized to a number between 0 and 1, where 0 represents low vulnerability and 1 represents high vulnerability. A high-risk county is represented as 1 = (1.1.1…), The equation is: $D_i = \underline{A_i - m_i,} M_i - I, VI_i = 1 - \underline{sqrt((1 -d1)^2 + (1 - d2)^2 + . +(1 - dn)^2),} Sqrt(n)$. Di calculates the average value of all dimensions for each Illinois County.

Dependent Variables

The outcome variables for this study are COVID-19 infection rates and COVID-19 death rates (Table 1). COVID-19 infection rates for each county are determined by calculating the rate of cases divided by 100,000 people over seven days if fewer than ten new cases for seven days the rate is not calculated because of instability in rate and the exact count is used (County Level COVID-19 Risk Metrics, 2020). The number of

deaths per county is obtained from Illinois Vital Records data of confirmed deaths with COVID-19 listed as an underlying or contributing cause or from matched records with a target of decrease or the stable number for seven days.

Independent Variables

The independent variables for this study are race, ethnicity, gender, and variables related to social vulnerability to COVID-19 measured by minority status, English speaking ability, below poverty level, per capita income, no high school diploma, age under 17, disability status, and housing type: multi-unit apartment or mobile home (table 2). Race, ethnicity, and gender are self-identified by patients at the time of testing and classification include White, Asian, Hispanic, Black, or African American and unknown if the patient did not self-identify. Ethnicity is classified as yes if Hispanic or Latino, or no if not Hispanic or Latino. Gender categories were male or female.

Table 1 Dependent Variables

Variable Name	Variable Description	Operational Definition	Research Question
COVID-19 INFECTION CASE RATES	Tested positive for COVID-19 with either nasopharyngeal swab, oropharyngeal swab, or nasopharyngeal wash or nasal aspirate and received positive COVID-19 diagnosis	Tested for COVID-19 with either nasopharyngeal swab, oropharyngeal swab, or nasopharyngeal wash or nasal aspirate and received positive COVID-19 diagnosis	Is county-level diversity regarding race, ethnicity, and gender associated with increased vulnerability to COVID-19 infection?
COVID-19 DEATH RATES	Number of COVID-19 deaths with the underlying cause of death or contributing cause of death confirmed by investigation or records match from Illinois Vital Records	Number of COVID-19 deaths with the underlying cause of death or contributing cause of death confirmed by investigation or records match from Illinois Vital Records	Is county-level diversity regarding race, ethnicity, and gender associated with increased vulnerability to COVID-19 death?

Table 2 Independent Variables

Variable Name	Variable Description	Operational Definition
RACE	County-level percent of the population self-identifying as Black and/or African-American	Percent distribution of county population by race category
ETHNICITY	Self-identified percent of the population identifying as Hispanic/Latino or not Hispanic/Latino	Percent distribution of county population by ethnicity
GENDER	Percent Female Percent Male	Percent distribution of county population by Female gender
MINORITY	Percent minority population	Percent distribution of minority status
LIMITED ENGLISH LANGUAGE ABILITY	Percent of population with limited English ability that speaks less than well"	Percent distribution of county population
BELOW POVERTY	Percent below poverty	Percent distribution
PER CAPITA INCOME	Percent of Per Capita Income	Percent distribution of county PCI
NO_HSDP	Percent of adults with no high school diploma	Percent distribution of county population without a high school diploma
AGE_17	Percent of the population age 17 or younger	Percent distribution of county under age 17

Variable Name	Variable Description	Operational Definition
DISABLE	Percent of persons with disability	Percent distribution of county population with a disability
M_UNIT_HOUSING	Percent of multiunit apartment buildings	Percent distribution of county population in multiunit buildings
MOBILE HOUSING	Percent of mobile housing	Percent distribution

Table 2 Independent Variables Continued.

Data Analysis

Upon authorization from the Institution Review Board, this study adhered to the key principles of the Belmont Report (respect, justice, and beneficence) in the study design, sampling procedure and within the theoretical framework, research problem, and questions. An analysis was conducted to test the general hypothesis that social vulnerability has no significant difference in COVID-19 infections and deaths by race, gender, and ethnicity using a multivariable linear regression model**.** The outcome variables assessed for this study were COVID-19 infections and deaths by race, ethnicity, and gender and its association with social vulnerability. Karaye and associate's model was used to assess the association between COVID-19 infections and deaths and social vulnerability using ordinary least square regression (OLS), the relationship of the outcome variables was assessed for social vulnerability (Karaye & Horney, 2020). OLS regression was used to estimate a single parameter for the independent variables (race, ethnicity, and gender**).** To identify social vulnerability themes that predict COVID-19 infections and increased risk of deaths, the CDC's social vulnerability index was used to select variables that estimate the relative vulnerability of Illinois 102 counties by rank using four major themes (comprised of 15 variables) socioeconomic status, minority status and language, housing, household composition, and disability status. Socioeconomic variables selected from the major themes are percentage below poverty, no high school diploma, and per capita income. Minority status and language variables include percentages who are minority and who speak English less than well. Housing and transportation variables selected are percentages living in multi-unit structures, and

mobile homes. Household composition and disability variables are the percentages of those aged more than 65, the percentage of households with children under 17, the percentage of single-parent households, and the percentage with a disability. Social vulnerability is scored from zero to one with high values indicating high vulnerability and low values indicating low vulnerability. In a similar study by Karaye and associates, the authors derived the outcome variable by dividing the cumulative counts of confirmed COVID-19 cases by county total population multiplied by 100,000 and a satisfied parametric requirement for normality by log-transforming the outcome variable and exponent the model coefficients for ease of interpretation.

A descriptive analysis of variables used was summarized using numbers, percentages, means, and standard deviation. IBM SPSS Statistics, Version 22.0 (Armonk, NY) was used to perform all statistical analyses. Descriptive statistics for all variables were computed as appropriate, and measured central tendency (mean, medians), measures of variation (standard deviations and interquartile range), and derived moments of skewness and kurtosis for continuous variables. T-test and chi-square analysis was conducted for continuous and categorical data to compare variables and multiple regression and chi-square to test the research hypothesis. Multiple regression was used to assess the association of COVID-19 cases and deaths, from the predictor variables of race, ethnicity, gender, minority status, limited English speaking ability, poverty level, per capita income, age below 17, disability status, multi-unit apartment, and mobile home housing (Nguyen, 2021).

CHAPTER 4

RESULTS

This research explored whether demographic characteristics of race, ethnicity, gender, and social vulnerability are associated with an increased vulnerability to COVID-19 infections and deaths.

This chapter presents the results of this study which analyzed data from 102 Illinois counties to determine whether county-level demographic characteristics and social vulnerability were associated with increased vulnerability to COVID-19 infections and deaths. This research adhered to the key principles of the Belmont report (respect, justice, and beneficence). Secondary data with no identifying information was used in this study and IRB approval was obtained.

A descriptive analysis of all study variables with minimum, maximum, mean, and standard deviation is provided in Table 3. The descriptive analysis indicates case rate varied from 18 to 126,557, and death rates varied from 0 to 5,058. The descriptive statistics reveal wide variations among COVID-19 outcomes based on demographic characteristics of race, ethnicity, minority status, limited English proficiency, and social vulnerability variables of households with children under age 17, disability status, and multi-unit housing.

Table 3 Descriptive Statistics

Descriptive Statistics for Dependent and Independent Study Variables (N=120)				
	Minimum	Maximum	Mean	Std. Deviation
No. of Cases	18	126577	2303.46	12699.09
No. of Deaths	0	5058	78.69	505.17
Case rate (per 100,000)	9.48	-.62	-6.71	1.66
Death rate (per 100,000)	8.99	-.46	6.83	1.80
Race-Black/African American	.30	41.50	5.65	7.58
Race-White	51.40	98.30	90.85	9.05
Ethnicity Hispanic	1.10	32.40	5.36	6.01
Ethnicity Non-Hispanic	38.90	97.10	86.13	12.18
Gender Female	35.70	52.10	49.90	2.06
Gender Male	47.90	64.30	50.12	2.08
Minority Status	1.70	61.60	14.57	12.66
Limited English	.70	35.20	6.07	6.78
Below Poverty	4.20	30.40	13.10	4.65
Per Capita Income	26.85	44287.00	27960.06	5296.95
No High School Diploma	4.00	24.90	10.85	3.64
Age 17 or younger	12.00	28.10	21.37	2.19
Disability	5.00	19.00	10.07	3.05
Multi-Unit Housing	.03	54.00	10.19	10.70
Mobile Home	.00	24.00	5.04	7.39

Regression Analysis of County-level COVID-19 Infection Cases

The following tables provide a model summary, ANOVA summary, unstandardized and estimated standardized regression coefficients, adjusted R^2 values from the regression models of the significance of COVID-19 infection cases and deaths with the demographic characteristics of race, ethnicity, gender, and social vulnerability factors of, minority status, limited English speaking ability, poverty level, per capita

income, age 17 or younger, disability status, multi-unit, and mobile home housing followed by histograms that depict COVID-19 infection by race, ethnicity, and gender.

Table 4 presents the COVID-19 infections model summary with the adjusted R^2 value suggesting a 73% variance in COVID-19 infection cases explained by the predictor variables.

Table 4 COVID-19 Infection Cases Model Summary

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.880	.774	.734	.85398	1.966

It is hypothesized that COVID-19 infection is not influenced by race, ethnicity, gender, and social vulnerability factors that include living in mobile homes, no high school diploma, age below 17, per capita income, living in multi-unit and mobile home housing, disability status, below poverty, minority status, and speaking English less than well. Table 5 presents an ANOVA summary that reveals if there is a statistically significant association between social vulnerability variables and COVID-19 infection cases. (F (15,86) = [19.592], p = .000).

Table 5 COVID-19 Infection Cases ANOVA Summary

ANOVA						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	214.317	15	14.288	19.592	.000
	Residual	62.718	86	.729		
	Total	277.036	101			

We reject the null hypothesis that COVID-19 infection is not influenced by race, gender, ethnicity, and social vulnerability index variables (Sig.=.00).

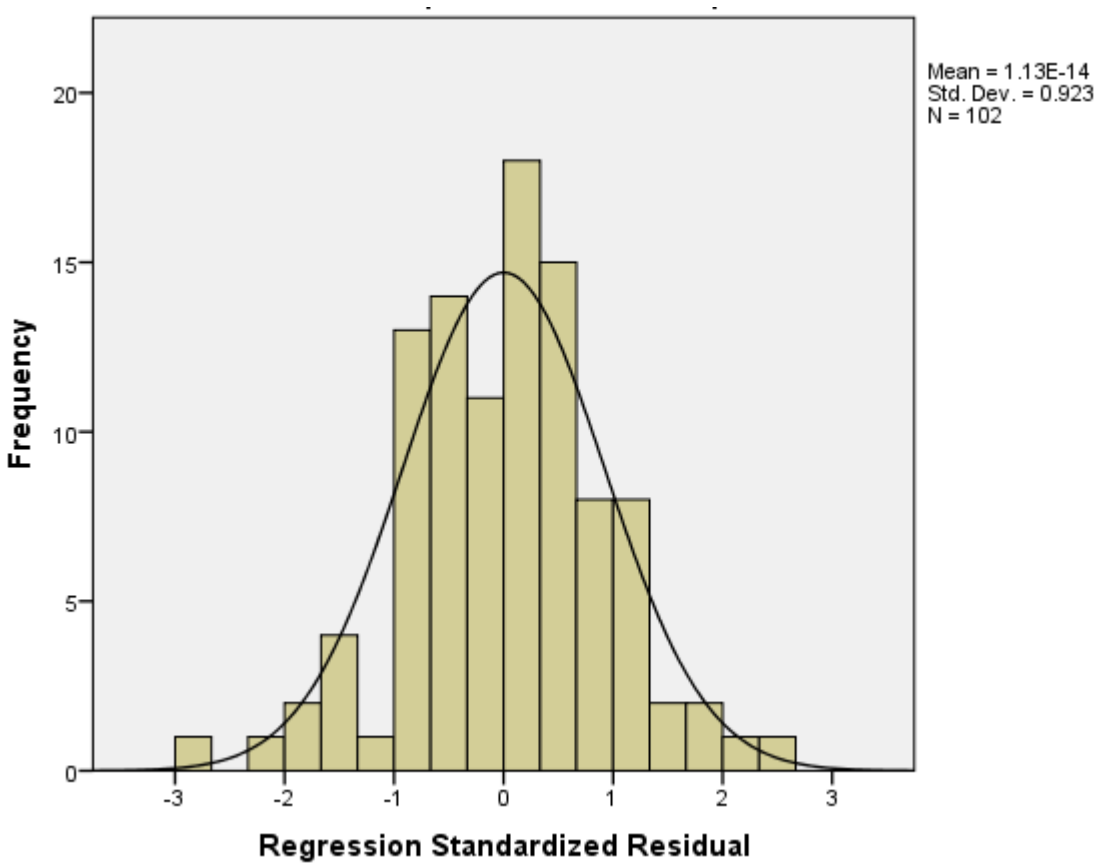

Figure 5: Histogram of COVID-19 Infection Cases

The unstandardized coefficients and estimated standardized regression coefficients for the COVID-19 infection cases model are presented in Table 6.

Gender Female (B_{case} = .655) and Gender Male (B_{case} = .722) are positively associated with the likelihood of being infected with COVID-19. Race-White (B_{case} = .413) is positively associated with the likelihood of being infected with COVID-19. In contrast, Race- Black/African American (B_{case} = -.142) is negatively associated with the

likelihood of being infected with COVID-19. Hispanic Ethnicity (B_{case} = -.1472) is negatively associated with the likelihood of being infected with COVID-19, and Ethnicity Non- Hispanic (B_{case} = -.549) is negatively associated with the likelihood of being infected with COVID-19.

Social vulnerability predictor variables positively associated with the likelihood of being infected with COVID-19 are minority status (B_{case} = .035), below poverty (B_{case} = .012) per capita income (B_{case} = 3.288), households with age 17 or younger (B_{case} = .207), and multi-unit housing (B_{case} = .059). In contrast, limited English speaking (B_{case} = -.027) is negatively associated with the likelihood of being infected with COVI-19. No high school diploma (B_{case} = -.022) is negatively associated with the likelihood of being infected with COVID-19. Households with a disability (B_{case} = -.006) are negatively associated with the likelihood of being infected with COVID-19. Mobile home housing (B_{case} = -.015) is negatively associated with the likelihood of being infected with COVID-19.

Table 6 Regression Analysis of County-level COVID-19 Infection Cases

Coefficients							
Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	-68.552	102.650		-.668	.506	-272.613	135.509
Race-Black/African American	-.142	.098	-.651	-1.455	.149	-.336	.052
Race-White	.413	.410	2.256	1.006	.317	-.403	1.229
Ethnicity Hispanic	-.472	.373	-1.712	-1.264	.210	-1.214	.270
Ethnicity Non-Hispanic	-.549	.406	-4.038	-1.352	.180	-1.356	.258
Gender Female	.655	1.032	.815	.635	.527	-1.397	2.707
Gender Male	.722	1.031	.909	.700	.486	-1.327	2.772
Minority Status	.035	.066	.265	.523	.602	-.097	.167
Limited English	-.027	.056	-.111	-.484	.630	-.139	.084
Below Poverty	.012	.048	.035	.257	.798	-.083	.107
Per Capita Income	3.288E-5	.000	.105	1.206	.231	.000	.000
No High School Diploma	-.022	.040	-.049	-.550	.584	-.103	.058
Households with Age 17 or younger	.207	.059	.274	3.540	.001	.091	.324
Households with a Disability	-.006	.058	-.011	-.099	.921	-.120	.109
Multi-unit Housing	.059	.016	.382	3.646	.000	.027	.091
Mobile Home housing	-.015	.018	-.067	-.854	.395	-.050	.020

Regression Analysis of County-level COVID-19 Deaths

The following tables provide a model, ANOVA, and multiple regression analysis of the significance of COVID-19 deaths and the predictors of race, ethnicity, gender, and social vulnerability factors. Table 7 presents the COVID-19 death model summary with the adjusted R^2 value suggesting a 68% variance in COVID-19 deaths explained by the predictor variables.

Table 7 COVID-19 Deaths Model Summary

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.857	.735	.676	1.02688	2.072

It is hypothesized that COVID-19 deaths are not influenced by race, ethnicity, gender, and social vulnerability variables that include living in mobile homes, age less than 17, per capita income, no high school diploma, multi-unit housing, disability status, below poverty, minority status, and speaking English less than well. Table 8 presents an ANOVA summary that reveals whether there is a statistically significant association between social vulnerability variables and COVID-19 deaths ($F(14,63) = [12.478]$, $p = .000$).

Table 8 COVID-19 Deaths ANOVA Summary

ANOVA						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	184.216	14	13.158	12.478	.000
	Residual	66.433	63	1.054		
	Total	250.649	77			

We fail to reject the null hypothesis that COVID-19 death is influenced by race, gender, ethnicity, and the social vulnerability index variables (Sig.=.00).

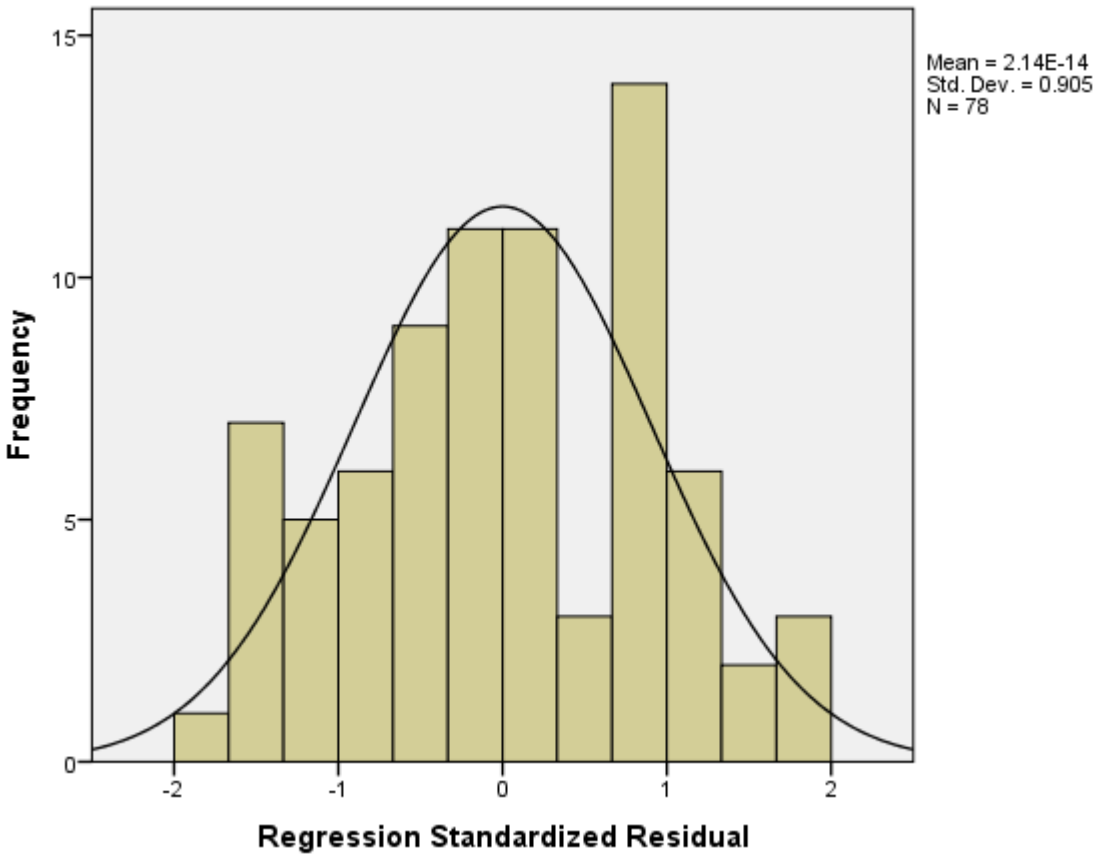

Figure 6 - Histogram of COVID-19 Deaths

Table 9 presents the unstandardized coefficients and estimated standardized regression coefficient from the COVID-19 deaths regression model. Race- Black/African American (B_{death} = .152) is positively associated with the likelihood of COVID-19 death. Race-White (B_{death} = 1.145) is positively associated with the likelihood of COVID-19 death. Gender male (B_{death} = .118) is positively associated with the likelihood of COVID-19 death. Minority status (B_{death} = .064) is positively associated with the likelihood of COVID-19 death. Limited English speaking (B_{death} = .117) is positively associated with the likelihood of COVID-19 death. Below poverty (B_{death} = .063) is positively associated with the likelihood of COVID-19 death. Per Capita Income (B_{death} = 7.304) is positively associated with the likelihood of COVID-19 death. Households with age 17 or younger (B_{death} = .055) are positively associated with the likelihood of COVID-19 death. Households with a disability (B_{death} = .077) are positively associated with the likelihood of COVID-19 death. Multi-unit housing (B_{death} = .001) is positively associated with the likelihood of COVID-19 death. In contrast, the following variables were inversely associated with an increased likelihood of COVID-19 deaths. Ethnicity Hispanic (B_{death} = -.991) is negatively associated with the likelihood of COVID-19 death. Ethnicity Non- Hispanic (B_{death} = -1.054) is negatively associated with the likelihood of COVID-19 death. No high school diploma (B_{death} = -.126) is negatively associated with the likelihood of COVID-19 death. Mobile home housing (B_{death} = -.003) is negatively associated with the likelihood of COVID-19 deaths.

Table 9 Regression Analysis of County-level COVID-19 Deaths

Coefficients								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-26.822	18.632		-1.440	.155	-64.056	10.411
	Race-Black/African American	.152	.143	.599	1.058	.294	-.135	.438
	Race-White	1.145	.582	5.646	1.966	.054	-.019	2.309
	Ethnicity Hispanic	-.991	.540	-3.613	-1.836	.071	-2.069	.088
	Ethnicity Non-Hispanic	-1.054	.595	-7.357	-1.772	.081	-2.243	.135
	Gender Male	.118	.129	.086	.918	.362	-.139	.376
	Minority Status	.064	.090	.464	.709	.481	-.116	.243
	Limited English	.117	.088	.480	1.340	.185	-.058	.292
	Below Poverty	.063	.071	.164	.891	.376	-.078	.204
	Per Capita Income	7.304E-05	.000	.225	2.070	.043	.000	.000
	No High School Diploma	-.126	.091	-.234	-1.388	.170	-.307	.055
	Households with Age 17 or younger	.055	.083	.067	.658	.513	-.111	.220
	Households with a Disability	.077	.084	.122	.912	.365	-.091	.245
	Multi-unit Housing	.001	.023	.006	.040	.968	-.046	.048
	Mobile Home housing	-.003	.028	-.011	-.113	.911	-.058	.052

Regression Analysis of COVID-19 and Race-Black

The following table summarizes a multiple regression analysis of the significance of COVID-19 cases and deaths to Race-Black and the social vulnerability predictor variables of minority status, speak English less than well, poverty level, per capita income, no high school diploma, age less than 17, disability status, living in a multi-unit apartment, and mobile home housing to COVID-19 cases and deaths. Table 10 presents the Black-Race model summary with an adjusted R^2 value suggesting 98% variance in COVID-19 explained by the predictor variable of Race-Black.

Table 10 COVID-19 Race-Black Model Summary

Model					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.993	.987	.985	.93742	2.175

It is hypothesized that COVID-19 is not associated with Race-Black and the following social vulnerability variables: mobile homes, no high school diploma, household composition age less than 17, per capita income, multi-unit housing, disability status, below poverty level, minority status and, speak English less than well. Table 11 presents an ANOVA summary that reveals whether there is a statistically significant association between Black-Race and COVID-19 (F (14,87) = [465.390], p = .000).

Table 11 COVID-19 Race-Black ANOVA Summary

ANOVA						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	5725.444	14	408.960	465.390	.000
	Residual	76.451	87	.879		
	Total	5801.895	101			

We fail to reject the null hypothesis that COVID-19 is not influenced by race and the following social vulnerability index variables: lives in mobile homes, speaks English less than well, no high school diploma, households with children aged 17 or younger, per capita income, multi-unit housing, disability status, below poverty, and minority status (Sig.=.00).

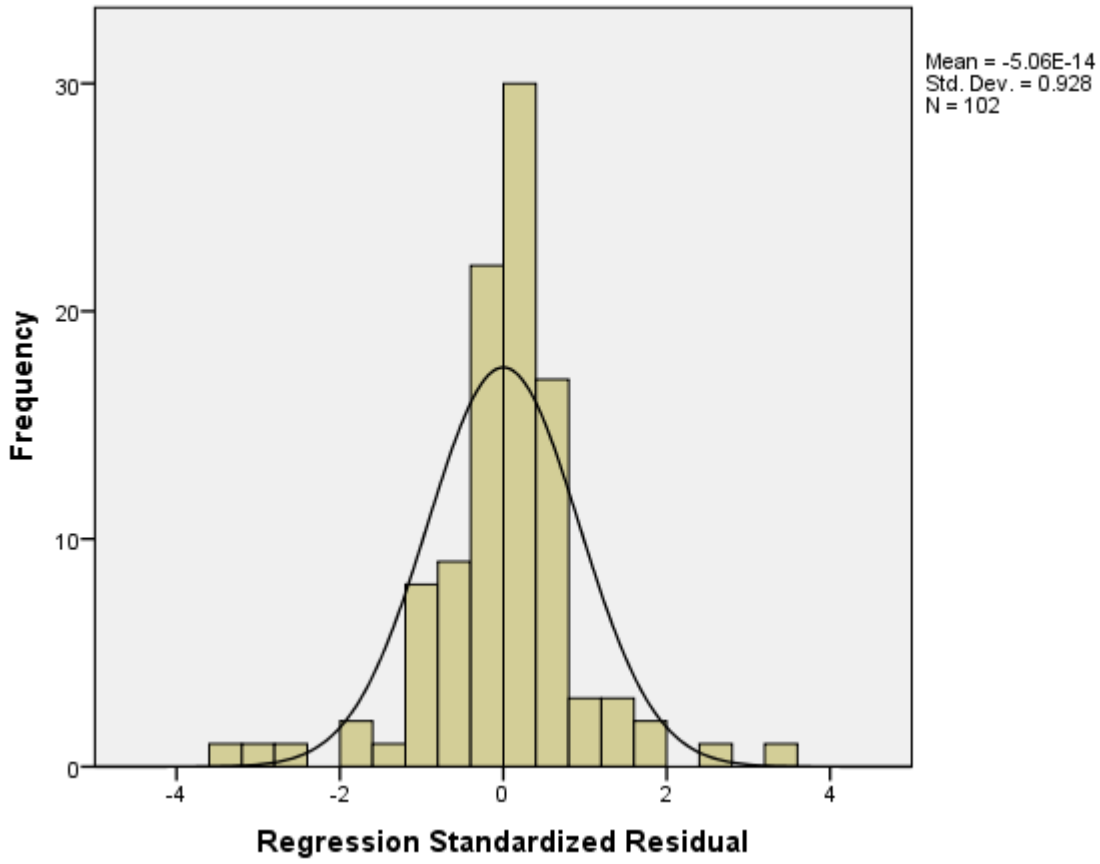

Figure 7 - Histogram Race-Black

Table 12 presents the unstandardized coefficients and estimated standardized regression coefficient for COVID-19 and the Race-Black regression model. Race-White (B = -1.141) is negatively associated with the likelihood of COVID-19. Ethnicity Hispanic (B = .378) is positively associated with the likelihood of Race-Black and COVID-19. Ethnicity Non- Hispanic (B = .344) is positively associated with the likelihood of Race-Black and COVID-19. Gender Female (B = -1.219) is negatively associated with the likelihood of Race-Black and COVID-19. Gender Male (B = -1.149) is negatively associated with the likelihood of Race-Black and COVID-19. Minority status (B = .102) is positively associated with the likelihood of Race-Black and COVID-19. Limited English speaking (B =.-.386) is negatively associated with the likelihood of Race-Black and COVID-19. Below poverty (B = -.129) is negatively associated with the likelihood of Race-Black and COVID-19. Per Capita Income (B = -6.46) is negatively associated with the likelihood of Race-Black and COVID-19. No high school diploma (B = .198) is positively associated with the likelihood of Race-Black and COVID-19. Households with age 17 or younger (B = .113) are positively associated with the likelihood of Race-Black and COVID-19. Households with a disability (B = .036) is positively associated with the likelihood of Race-Black and COVID-19. Multi-unit housing (B = .008) is positively associated with the likelihood of Race-Black and COVID-19. Mobile home housing (B = -.026) is negatively associated with the likelihood of Race-Black and COVID-19.

Table 12 Regression Analysis of COVID-19 and Race-Black

Coefficient								
Model		Unstandardized Coefficients		Standardized Coefficient	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	195.588	110.710		1.767	.081	-24.461	415.636
	Race-White	-1.141	.434	-1.362	-2.632	.010	-2.003	-.279
	Ethnicity Hispanic	.378	.408	.299	.926	.357	-.433	1.188
	Ethnicity Non-Hispanic	.344	.444	.552	.773	.442	-.540	1.227
	Gender Female	-1.219	1.125	-.331	-1.083	.282	-3.456	1.017
	Gender Male	-1.149	1.125	-.316	-1.021	.310	-3.385	1.087
	Minority Status	.102	.072	.171	1.420	.159	-.041	.245
	Limited English	-.386	.046	-.346	-8.480	.000	-.477	-.296
	Below Poverty	-.129	.051	-.079	-2.542	.013	-.230	-.028
	Per Capita Income	-6.462E – 05	.000	-.045	-2.220	.029	.000	.000
	No High School Diploma	.198	.039	.095	5.071	.000	.120	.276
	Household with Age 17 or younger	.113	.063	.033	1.792	.077	-.012	.238
	Households with a disability	.036	.063	.015	.575	.567	-.089	.162
	Multi-Unit Housing	.008	.018	.011	.444	.658	-.027	.043
	Mobile Home Housing	-.026	.019	-.025	-1.332	.186	-.064	.013

Regression Analysis of COVID-19 and Ethnicity

The following table summaries are derived from multiple regression analysis of COVID-19 and the significance of Hispanic and non-Hispanic ethnicity and the social vulnerability predictor variables of minority status, speak English less than well, poverty level, per capita income, no high school diploma, age less than 17, disability status, multi-unit housing, and mobile homes. Table 13 presents the non-Hispanic Ethnicity model summary with an adjusted R^2 value suggesting 100% variance in COVID-19 explained by the predictor variables.

Table 13 COVID-19 Non-Hispanic Ethnicity Model Summary

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	1.000	1.000	1.000	.22541	2.400

It is hypothesized that COVID-19 is not influenced by ethnicity, race, gender, and the following social vulnerability variables: living in mobile homes, no high school diploma, household composition, age less than 17, per capita income, multi-unit housing, disability status, below poverty level, minority status, and speak English less than well. Table 14 presents an ANOVA summary that reveals whether there is a statistically significant association with non-Hispanic Ethnicity and COVID-19 (F (14,87) = [21063.58], p =.000).

Table 14 COVID-19 Non-Hispanic Ethnicity ANOVA Summary

ANOVA						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	14983.543	14	1070.253	21063.582	.000
	Residual	4.421	87	.051		
	Total	14987.963	101			

We fail to reject the null hypothesis that COVID-19 is influenced by ethnicity, race, gender, and lives in mobile homes, speaks English less than well, no high school diploma, households with children aged 17 or younger, per capita income, multi-unit housing, disability status, below poverty, and minority status (Sig.=.00).

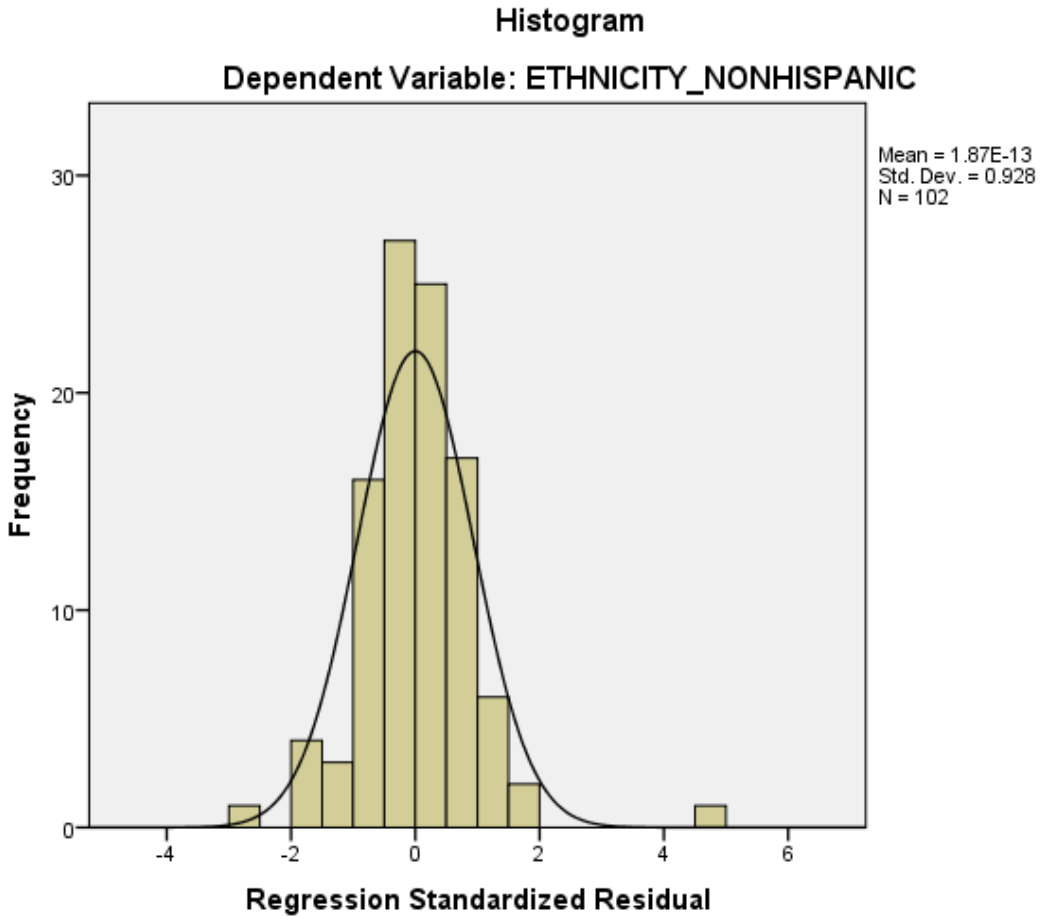

Figure 8: COVID-19 Non-Hispanic Ethnicity

Table 15 presents the unstandardized coefficients and estimated standardized regression coefficient for non-Hispanic Ethnicity and COVID-19 regression model. Race-Black (B = .020) is positively associated with the likelihood of non-Hispanic Ethnicity and COVID-19. Race-White (B = .979) is positively associated with the likelihood of non-Hispanic Ethnicity and COVID-19. Ethnicity Hispanic (B = -.898) is negatively associated with the likelihood of COVID-19. Gender Female (B = -.053) is negatively associated with the likelihood of non-Hispanic Ethnicity and COVID-19. Gender Male (B = -.020) is negatively associated with the likelihood of non-Hispanic Ethnicity and COVID-19. Minority status (B = -.018) is negatively associated with the likelihood of non-Hispanic Ethnicity and COVID-19. Limited English speaking (B =.-.003) is negatively associated with the likelihood of non-Hispanic Ethnicity and COVID-19. Below poverty (B = .047) is positively associated with the likelihood of non-Hispanic Ethnicity and COVID-19. Per Capita Income (B = -1.918) is negatively associated with the likelihood of non-Hispanic Ethnicity and COVID-19. No high school diploma (B = .003) is positively associated with the likelihood of non-Hispanic Ethnicity and COVID-19. Households with age 17 or younger (B = .014) are positively associated with the likelihood of non-Hispanic Ethnicity and COVID-19. Households with a disability (B = -.035) are negatively associated with the likelihood of non-Hispanic Ethnicity and COVID-19. Multi-unit housing (B = -.008) is negatively associated with the likelihood of non-Hispanic Ethnicity and COVID-19. Mobile home housing (B = -.006) is negatively associated with the likelihood of non-Hispanic Ethnicity and COVID-19.

Table 15 Regression Analysis COVID-19 and Non-Hispanic Ethnicity

Coefficients								
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	5.370	27.089		.198	.843	-48.472	59.211
	Race-Black/African American	.020	.026	.012	.773	.442	-.031	.071
	Race-White	.979	.027	.727	36.651	.000	.926	1.033
	Ethnicity Hispanic	-.898	.021	-.443	-43.511	.000	-.939	-.857
	Gender Female	-.053	.272	-.009	-.196	.845	-.595	.488
	Gender Male	-.020	.272	-.003	-.074	.941	-.561	.521
	Minority Status	-.018	.017	-.019	-1.032	.305	-.053	.017
	Limited English	-.003	.015	-.001	-.179	.858	-.032	.027
	Below Poverty	.047	.012	.018	4.091	.000	.024	.070
	Per Capita Income	-1.918E-06	.000	-.001	-.267	.790	.000	.000
	No High School Diploma	.003	.011	.001	.292	.771	-.018	.024
	Household composition with age 17 or younger	.014	.015	.003	.940	.350	-.016	.045
	Household with a disability	-.035	.015	-.009	-2.413	.018	-.065	-.006
	Multi-unit Housing	-.008	.004	-.007	-1.934	.056	-.016	.000
	Mobile home housing	-.006	.005	-.004	-1.303	.196	-.015	.003

Table 16 presents the Hispanic Ethnicity model summary with an adjusted R^2 value suggesting a 99% variance in COVID-19 explained by Hispanic Ethnicity and the social vulnerability predictor variables.

Table 16 COVID-19 Hispanic Ethnicity Model Summary

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.999	.999	.998	.24535	2.371

It is hypothesized that COVID-19 deaths are not influenced by ethnicity, race, gender, and the following social vulnerability variables: lives in mobile homes, speaks English less than well, having no high school diploma, family composition age less than 17, per capita income, multi-unit housing, disability status, below poverty, and minority status. Table 17 presents an ANOVA summary that reveals whether there is a statistically significant association between Hispanic Ethnicity and COVID-19 (F (14,87) = [4323.189], p =.000).

Table 17 COVID-19 Hispanic Ethnicity ANOVA Summary

ANOVA						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	3643.526	14	260.252	4323.189	.000
	Residual	5.237	87	.060		
	Total	3648.763	101			

We fail to reject the null hypothesis that COVID-19 deaths are influenced by ethnicity, race, gender, and the social vulnerability index variables: lives in mobile homes, speaks English less than well, no high school diploma, family composition age less than 17, per capita income, multi-unit housing, disability status, below poverty, and minority status (Sig.=.00).

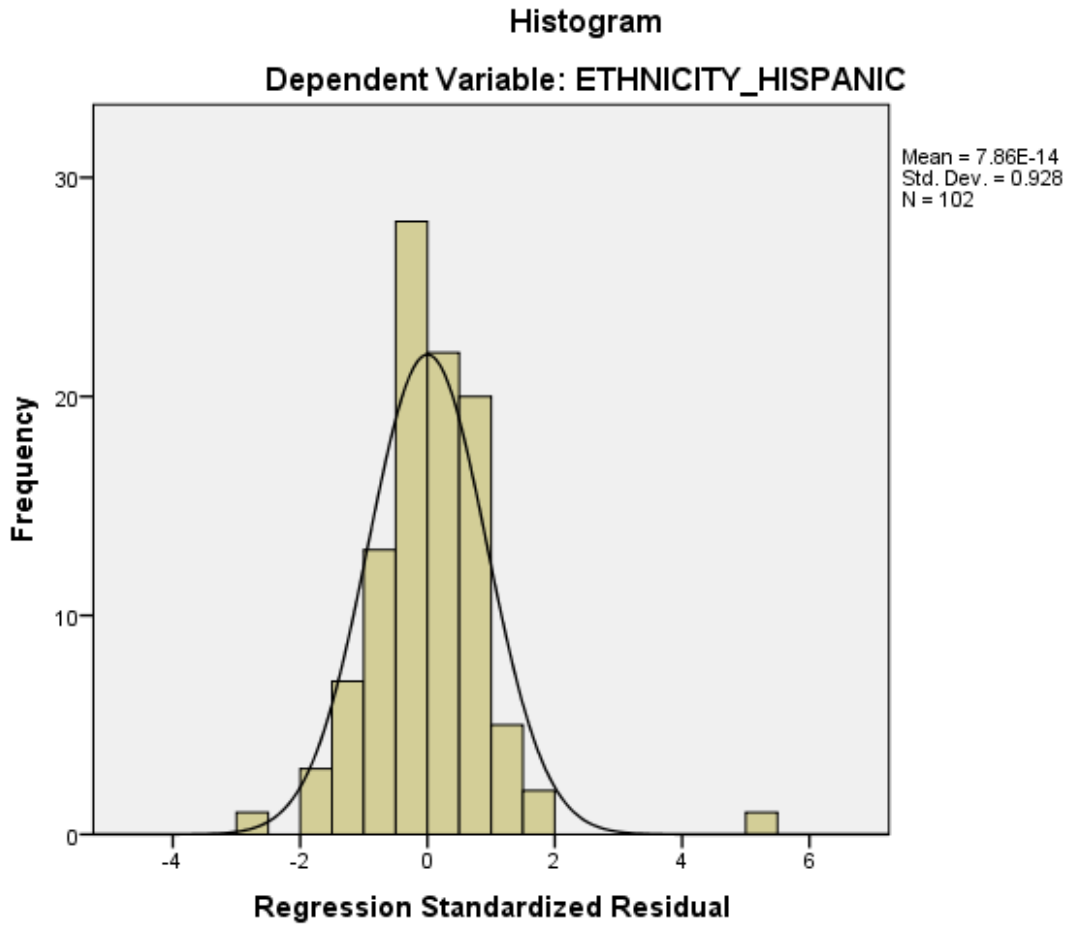

Figure 9: Histogram of COVID-19 Hispanic Ethnicity

Table 18 presents the unstandardized coefficients and estimated standardized regression coefficient for the Hispanic-Ethnicity regression model. Ethnicity non-Hispanic (B = -1.064) is negatively associated with the likelihood of COVID-19. Gender

Female (B = -.237) is negatively associated with the likelihood of ethnicity and COVID-19. Gender Male (B = -.201) is negatively associated with the likelihood of ethnicity and COVID-19. Race-Black (B = .026) is positively associated with the likelihood of ethnicity and COVID-19. Race-White (B = 1.076) is positively associated with the likelihood of ethnicity and COVID-19. Minority status (B =.012) is positively associated with the likelihood of ethnicity and COVID-19. Limited English speaking (B = .010) is positively associated with the likelihood of ethnicity and COVID-19. Below poverty (B = .047) is positively associated with the likelihood of ethnicity and COVID-19. Per Capita Income (B = -6.092) is negatively associated with the likelihood of ethnicity and COVID-19. No high school diploma (B = .002) is positively associated with the likelihood of ethnicity and COVID-19. Households with age 17 or younger (B = .019) are positively associated with the likelihood of ethnicity and COVID-19. Households with a disability (B = -.035) are negatively associated with the likelihood of ethnicity and COVID-19. Multi-unit housing (B = -.010) is negatively associated with the likelihood of ethnicity and COVID-19. Mobile home housing (B = -.008) is negatively associated with the likelihood of ethnicity and COVID-19.

Table 18 Regression Analysis COVID-19 and Hispanic Ethnicity

Coefficients								
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	20.413	29.411		.694	.489	-38.044	78.870
	Ethnicity Non-Hispanic	-1.064	.024	-2.157	-43.511	.000	-1.113	-1.016
	Gender Female	-.237	.295	-.081	-.803	.424	-.825	.350
	Gender Male	-.201	.295	-.070	-.679	.499	-.788	.387
	Race-Black/African American	.026	.028	.033	.926	.357	-.030	.081
	Race-White	1.076	.024	1.620	43.921	.000	1.027	1.125
	Minority Status	.012	.019	.026	.638	.525	-.026	.050
	Limited English	.010	.016	.011	.624	.534	-.022	.042
	Below Poverty	.047	.013	.036	3.646	.000	.021	.072
	Per Capita Income	-6.092E-06	.000	-.005	-.781	.437	.000	.000
	No High School Diploma	.002	.012	.001	.190	.850	-.021	.025
	Households with Age 17 or younger	.019	.017	.007	1.161	.249	-.014	.053
	Households with Disability	-.035	.016	-.018	-2.193	.031	-.067	-.003
	Multi-Unit Housing	-.010	.005	-.018	-2.267	.026	-.019	-.001
	Mobile Home Housing	-.008	.005	-.009	-1.498	.138	-.017	.002

Regression Analysis of COVID-19 and Gender

The following table summaries are derived from a multiple regression analysis of the significance of the Female gender with social vulnerability predictor variables. Table 19 presents the Female gender model summary with an adjusted R^2 value suggesting 99% variance in COVID-19 explained by the Gender-Female variable.

Table 19 COVID-19 Gender-Female Model Summary

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.999	.998	.998	.08871	2.081

It is hypothesized that COVID-19 is not associated with gender and the following social vulnerability variables: mobile homes, no high school diploma, household composition age less than 17, per capita income, multi-unit housing, disability status, below poverty level, minority status and, speak English less than well. Table 20 presents an ANOVA summary that reveals whether Gender-Female is a statistically significant association with COVID-19 (F (14,87) = [3885.097], p = .000.

Table 20 COVID-19 Gender-Female ANOVA Summary

ANOVA						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	428.005	14	30.572	3885.097	.000
	Residual	.685	87	.008		
	Total	428.689	101			

We fail to reject the null hypothesis that COVID-19 is not influenced by gender and the following social vulnerability index variables: mobile homes, no high school diploma, household composition age less than 17, per capita income, multi-unit housing, disability status, below poverty, minority status, and speak English less than well, no high school diploma, family composition age less than 17, per capita income, multi-unit housing, disability status, below poverty, and minority status (Sig.=.00).

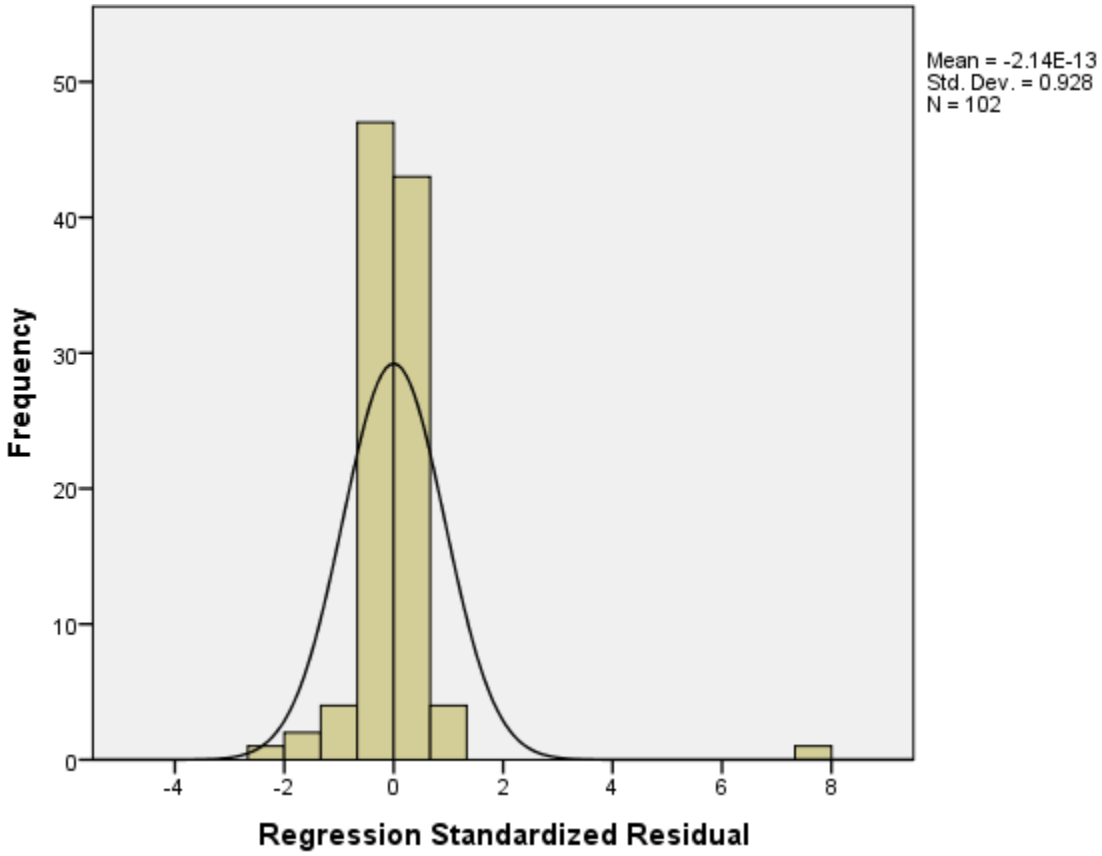

Figure 10: Histogram Gender-Female

Table 21 presents the unstandardized coefficients and estimated standardized regression coefficients for the Gender-Female and COVID-19 regression model.

Ethnicity-Hispanic (B = -.031) is negatively associated with the likelihood of female gender and COVID-19. Ethnicity non-Hispanic (B = -.008) is negatively associated with the likelihood of female gender and COVID-19. Race-Black (B = -.011) is negatively associated with the likelihood of female gender and COVID-19. Race-White (B = .020) is positively associated with the likelihood of female gender and COVID-19. Minority status (B = .025) is positively associated with the likelihood of female gender and COVID-19. Limited English speaking (B = -.007) is negatively associated with the likelihood of female gender and COVID-19. Below poverty (B = -.008) is negatively associated with the likelihood of female gender and COVID-19. Per Capita income (B = -5.457) is negatively associated with the likelihood of female gender and COVID-19. No high school diploma (B = .009) is positively associated with the likelihood of female gender and COVID-19. Households with age 17 or younger (B = -.002) are negatively associated with the likelihood of female gender and COVID-19. Households with a disability (B = -.011) are negatively associated with the likelihood of female gender and COVID-19. Multi-Unit housing (B = .000) is positively associated with the likelihood of female gender and COVID-19. Mobile home housing (B = .003) is positively associated with the likelihood of female gender and COVID-19.

Table 21 Regression Analysis COVID-19 and Gender-Female

Coefficients								
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	98.929	1.095		90.334	.000	96.753	101.106
	Gender Male	-.997	.006	-1.008	-160.41	.000	-1.010	-.985
	Ethnicity Hispanic	-.031	.039	-.091	-.803	.424	-.108	.046
	Ethnicity Non-Hispanic	-.008	.042	-.049	-.196	.845	-.092	.076
	Race-Black/African American	-.011	.010	-.040	-1.083	.282	-.031	.009
	Race-White	.020	.043	.090	.479	.633	-.064	.105
	Minority Status	.025	.006	.153	3.915	.000	.012	.038
	Limited English	-.007	.006	-.021	-1.127	.263	-.018	.005
	Below Poverty	-.008	.005	-.018	-1.638	.105	-.018	.002
	Per Capita Income	-5.457 E-6	.000	-.014	-1.970	.052	.000	.000
	No High School Diploma	.009	.004	.016	2.224	.029	.001	.017
	Households with Age 17 or younger	-.002	.006	-.002	-.360	.720	-.014	.010
	Households with a disability	-.011	.006	-.017	-1.901	.061	-.023	.001
	Multi-Unit Housing	.000	.002	.001	.141	.888	-.003	.004
	Mobile Home Housing	.003	.002	.011	1.644	.104	-.001	.007

CHAPTER 5

SUMMARY DISCUSSION AND CONCLUSIONS

This research explored whether demographic characteristics of race, ethnicity, gender, and social vulnerability were associated with an increased vulnerability to COVID-19 infections and deaths.

The research questions for this study were: What are the state-level patterns in COVID-19 outcomes by race, ethnicity, and gender? Is county-level diversity regarding race, ethnicity, and gender associated with increased vulnerability to COVID-19 infections? Is county-level diversity regarding race, ethnicity, and gender associated with increased vulnerability to COVID-19 deaths? To produce research evidence to answer these questions and test the associated hypothesis, this research analyzed demographic characteristics and social vulnerability associated with COVID-19 infections and deaths. County-level data from the Illinois Department of Public Health surveillance system, the USA Facts on Coronavirus dashboard and, the U.S. Census Bureau were examined to identify state-level patterns and to assess social vulnerability to COVID-19 infection and death by minority status, English speaking ability, below poverty level, per capita income, no high school diploma, under age 17, having a disability and living in multi-unit apartments and mobile home housing.

Summary and Interpretation of Findings

The findings from this study revealed the following variables were positively associated with the increased likelihood of COVID-19 infections. Race, gender, minority status, income below poverty level, per capita income, households with children aged 17 or younger, and living in multi-unit housing were positively associated with the likelihood of COVID-19 infection cases. In contrast, Race-Black, Hispanic ethnicity, non-Hispanic ethnicity, limited English speaking, no high school diploma, households with a disability, and mobile home housing were negatively associated with the likelihood of COVID-19 infection cases.

This study found a positive association between COVID-19 deaths with Race-Black, male gender, minority status, limited English speaking, below poverty status, per capita income, households with children aged 17 or younger, households with a disability, and multi-unit housing. Per capita income had a statistically significant association with COVID-19 deaths. In contrast, Hispanic ethnicity, non-Hispanic ethnicity, no high school diploma, and mobile home housing were inversely associated with increased association to COVID-19 deaths. These findings were consistent with Chowkwaynun's study that emphasized racial and socioeconomic factors may contribute to COVID-19 outcomes (Chowkwanyun & Reed, 2020), and Laurencin's study which stressed that marginalized groups would be disproportionately impacted by COVID-19 infection and deaths and that Black people have a higher risk of COVID-19 compared to their percentage in the population (Laurencin & McClinton, 2020).

This study revealed a positive association between COVID-19 infections and deaths in households with children 17 or younger and people living in multi-unit housing.

The Center for Disease Control (CDC) reports that there are fewer COVID-19 infections reported in children, but they can have viral loads like adults, their incubation period appears to be like adults, and they can spread the virus to others although they may be asymptomatic or have non-specific symptoms. Reports also indicate children with underlying medical conditions such as obesity, diabetes, asthma, sickle cell disease, chronic lung disease, and immunosuppression may be at increased risk for severe illness from COVID-19 infections, and that Hispanic and Black children had higher rates of hospitalization (Center for Disease Control and Prevention, 2020). The American Academy of Pediatrics reports that children under the age of 17 represent a smaller percentage of COVID cases which are less severe in children than adults, are primarily infected by family members, pregnant women may transmit COVID-19 to newborns, and common symptoms for COVID-19 infected children are fevers, cough, shortness of breath, sore throat, headache, and myalgia (muscle soreness or aches (American Academy of Pediatrics, 2020).

This study also revealed that speaking English less than well had a positive association for COVID-19 deaths. More than 65 million people in the US speak languages other than English and have been particularly impacted by COVID-19 because of language barriers, including limited ability to read, speak, write or understand English. Critical health information related to COVID-19 such as identifying symptoms, COVID prevention advice, how to get tested, and accessing medical care if needed was initially offered primarily in English and Spanish. Literature indicating that minority groups are disproportionately affected by COVID-19 attempted to assess if ethnic factors related to socioeconomic, cultural, lifestyle, genetic predisposition or pathophysiological

differences in susceptibility or infection response contributes to COVID-19 called for detailed ethnicity data because minority communities were likely to be socioeconomically disadvantaged (Khunti et al., 2020). Literature also indicated that minority communities and Black people have been disproportionately impacted by COVID infections and deaths because of underlying health conditions such as heart disease, diabetes, asthma, high blood pressure, and other preexisting conditions. Results from this study indicate that speaking limited English had a positive association with COVID-19 deaths. The ability to access language services including translators, interpreters, or web-based services accessible through computers or smartphone devices would be beneficial to limited English-speaking and minority populations impacted by COVID-19 infections and deaths.

Limitations

This research had several limitations which should be considered when using the study findings and generalizing them. A major limitation of this research is that it uses a convenience sample of COVID-19 cases and deaths. Another limitation is that the information and data related to the COVID-19 pandemic continue to change because it is an ongoing public health challenge that has affected the entire global population and claimed additional lives since this research began. Another limitation is that there is a risk of ecological fallacies where inferences may be made for individuals based on group data as the unit of analysis was county-level. Some county-level variables used as independent variables were measured by multiple organizations for purposes other than COVID-19, and several variables found insignificant in this research might have their effects

mediated by other indicators. Local policies to mitigate COVID-19 may have impacted COVID infections and death rates in this research. This is a cross-sectional analysis of COVID-19 infections and deaths in Illinois, so causal inference should not be extrapolated from these findings. Additional limitations are that officials who are providing information about COVID-19 symptoms, method of transmission, contagion period, and immunity have confused segments of the population resulting in some people not adhering to the prevention measures. There is a risk that a lack of trust in health messengers and contradictory information being provided may result in rejection of vaccines or treatment by vulnerable populations which will contribute to populations being negatively impacted. Scientific and public health institutions have been tarnished because manipulation of data and misinformation has threatened the credibility of scientific research because of perceived and actual politicalizing of the pandemic.

Public Health Practice Implications

Factors contributing to the disproportionate impact of COVID-19 include lack of access to medical care and treatment, distrust of pandemic messengers, financial conditions that necessitated going to jobs, essential work that prevent social distancing, and fewer opportunities for remote work from home. Additionally, community disinvestment, limited educational opportunities, inequity in resource distribution, and social and systemic institutional racism contribute to the increased risk of infection and deaths in some minority communities (Waterfield et al., 2021) (Shah et al., 2020).

The implications for public health professionals and government officials are numerous and include an awareness of the disparate negative outcomes in vulnerable

communities to disasters, identifying and promoting clear consistent messages for vulnerable communities by using trusted messengers and identifying and building collaborative partnerships with stakeholders who are willing to address and protect the health of vulnerable populations during a public health crisis or disaster (Shah et al., 2020).

Additional implications indicate interventions should be routinely developed that target populations with social vulnerabilities during pandemics and other public health disasters. There are 65 million people in the US who speak languages other than English. Mass public communication can alert populations to disasters, pandemics, and health threats. There is potentially an enormous opportunity to expand public health outreach messaging in multiple languages.

Conclusion and Next Steps

In conclusion, this study examined whether demographic characteristics of race, ethnicity, gender, and social vulnerability were associated with an increased vulnerability to COVID-19 infections and COVID-19 deaths. The results of this study found significant evidence of an association between COVID-19 infection and gender, poverty level, per capita income, households with children under 17, and multi-unit housing. The study also found an association between COVID-19 deaths, race, gender, speaking English less than well, income below poverty, per capita income, households with children 17 or younger, households with disability status, and living in multi-unit housing. COVID-19 has had a devasting impact across the entire globe, however vulnerable Black and Hispanic populations have suffered worse outcomes compared to

White communities, and contributing factors include social and structural inequities, institutional racism, inequitable resource distribution, and disparities in health and healthcare

It is imperative to address the elimination of health disparities by collecting racial and ethnic group data on health status and developing interventions that identify and target chronic health conditions in socially vulnerable populations (Khurshid et al., 2020). Language barriers need to be considered when mass public communication messages are developed because 65 million people in the U.S. speak languages other than English, and the ability to understand health information will determine whether health instructions and preventative guidance are followed (Waterfield et al., 2021). Most communication during the COVID-19 pandemic was in English, Spanish, and American sign language. Public health communication should be disseminated in a clear consistent manner that alerts the population to health threats and provides instructions on prevention or risk mitigation. Vulnerable populations suffer disproportionate shares of detrimental health outcomes after all types of disasters, social vulnerabilities and determinants of health should be routinely assessed during the pandemic and other disasters so targeted interventions and support can be dispatched to vulnerable populations (Waterfield et al., 2021) (Karaye & Horney, 2020). Future research is needed to examine the association of COVID-19, vulnerable populations, and social determinants of health in a post-pandemic recovery (Richmond et al., 2020).

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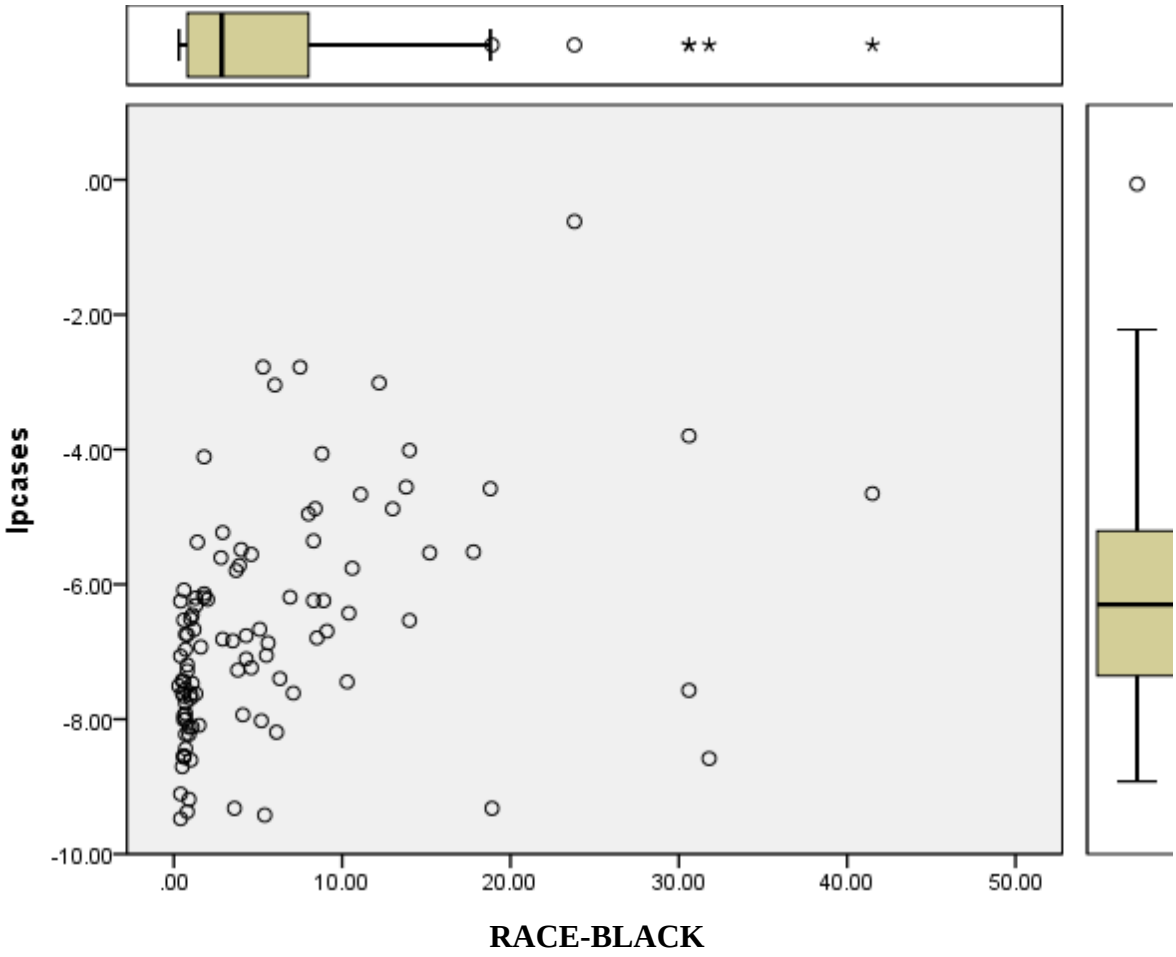
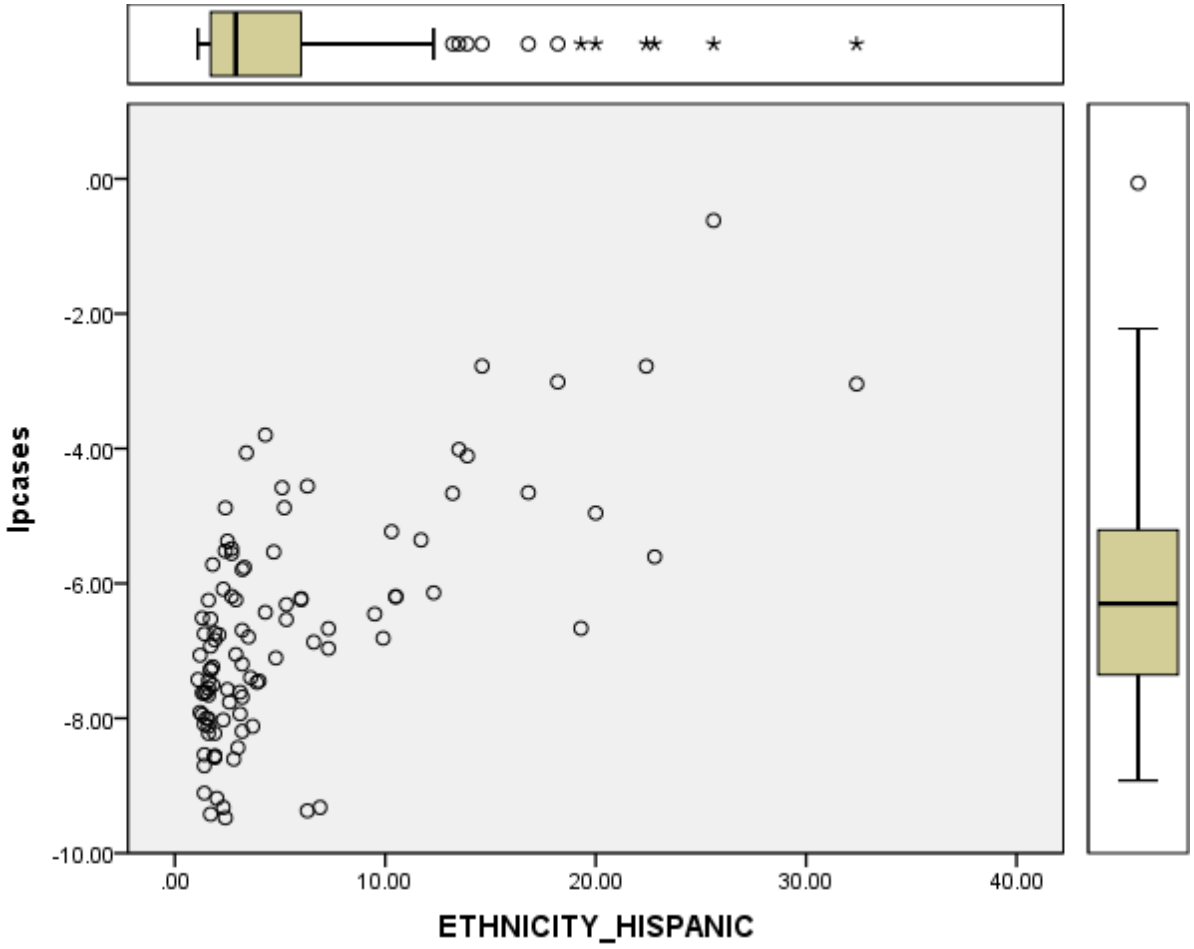
APPENDIX A

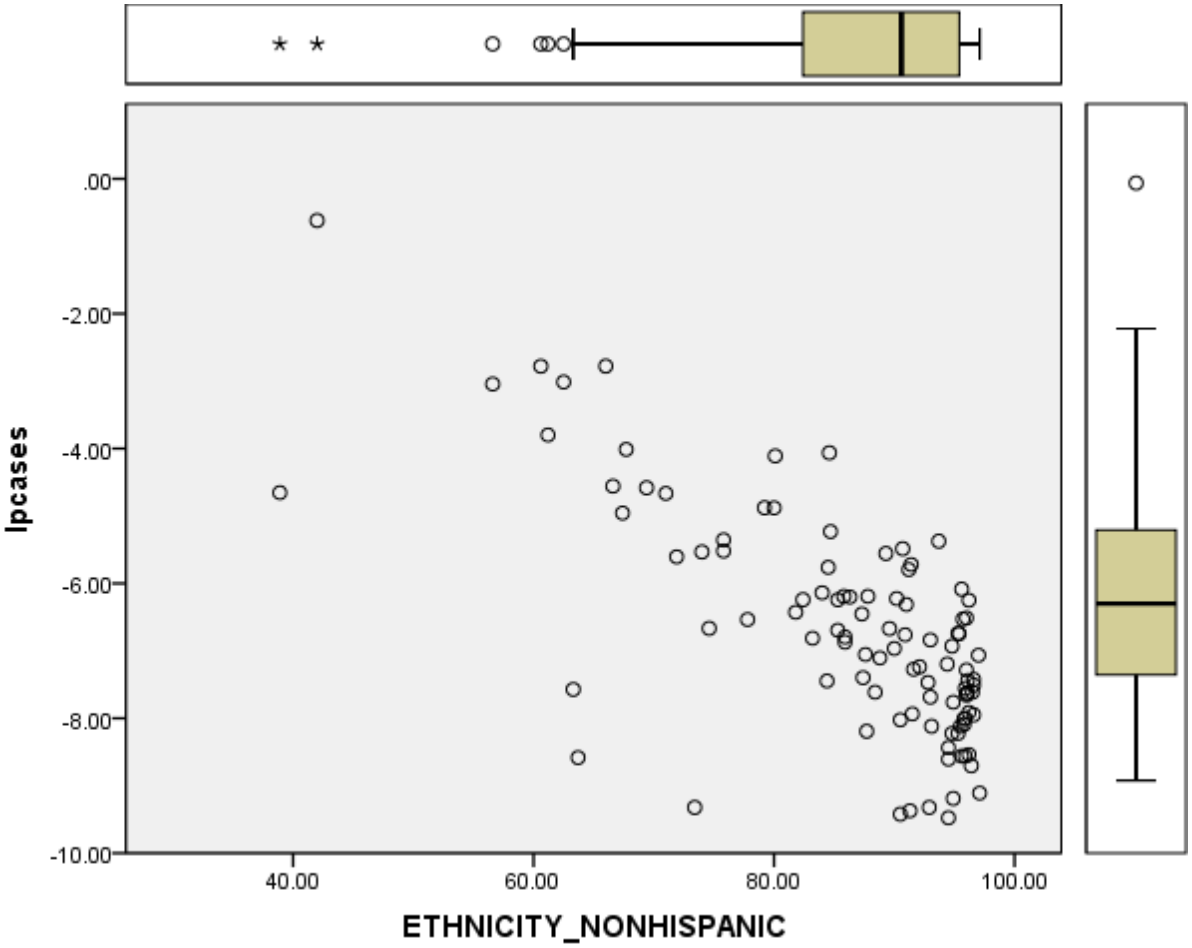
COVID-19 CASES SCATTER PLOT – RACE-BLACK/AFRICAN AMERICAN



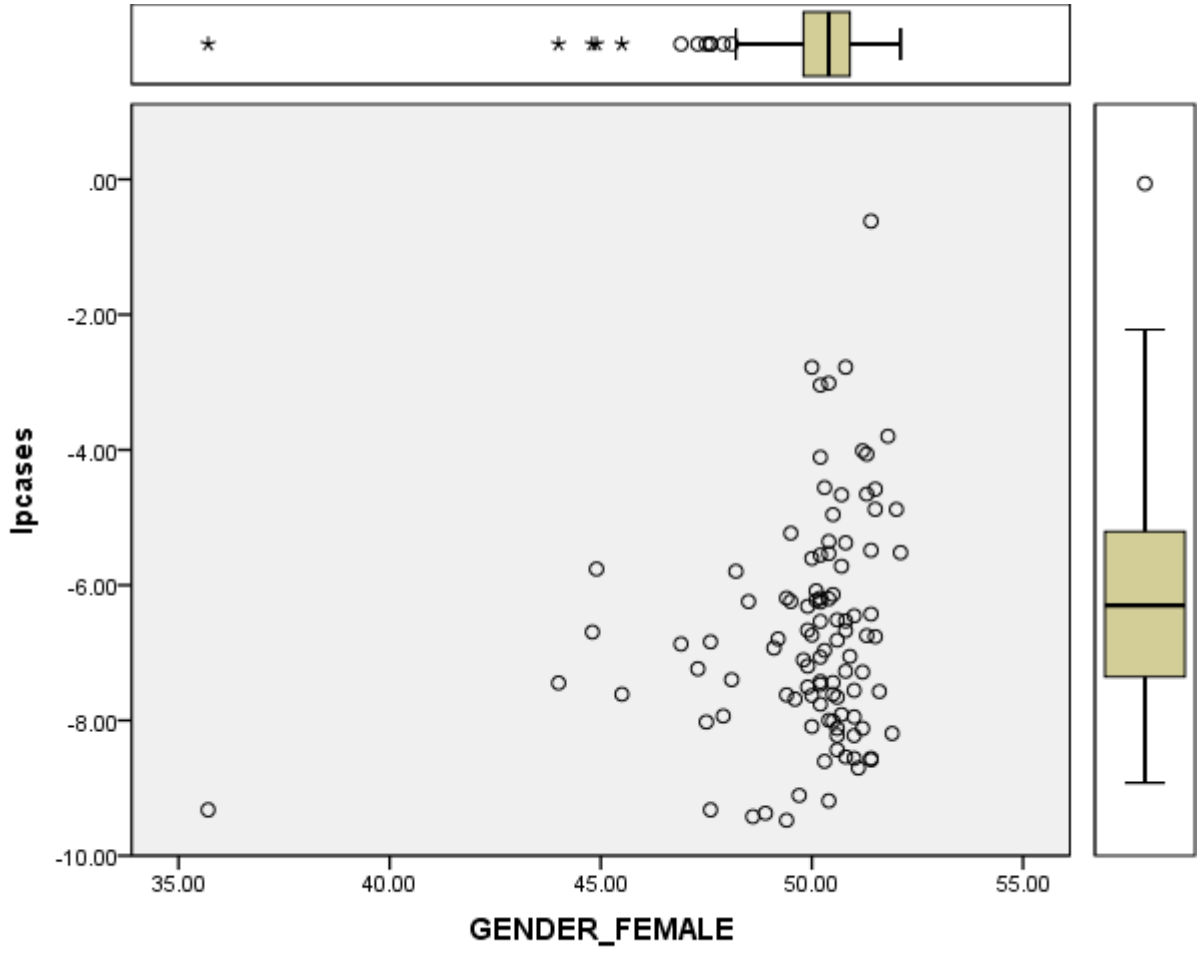
COVID-19 CASES SCATTER PLOT - ETHNICITY HISPANIC



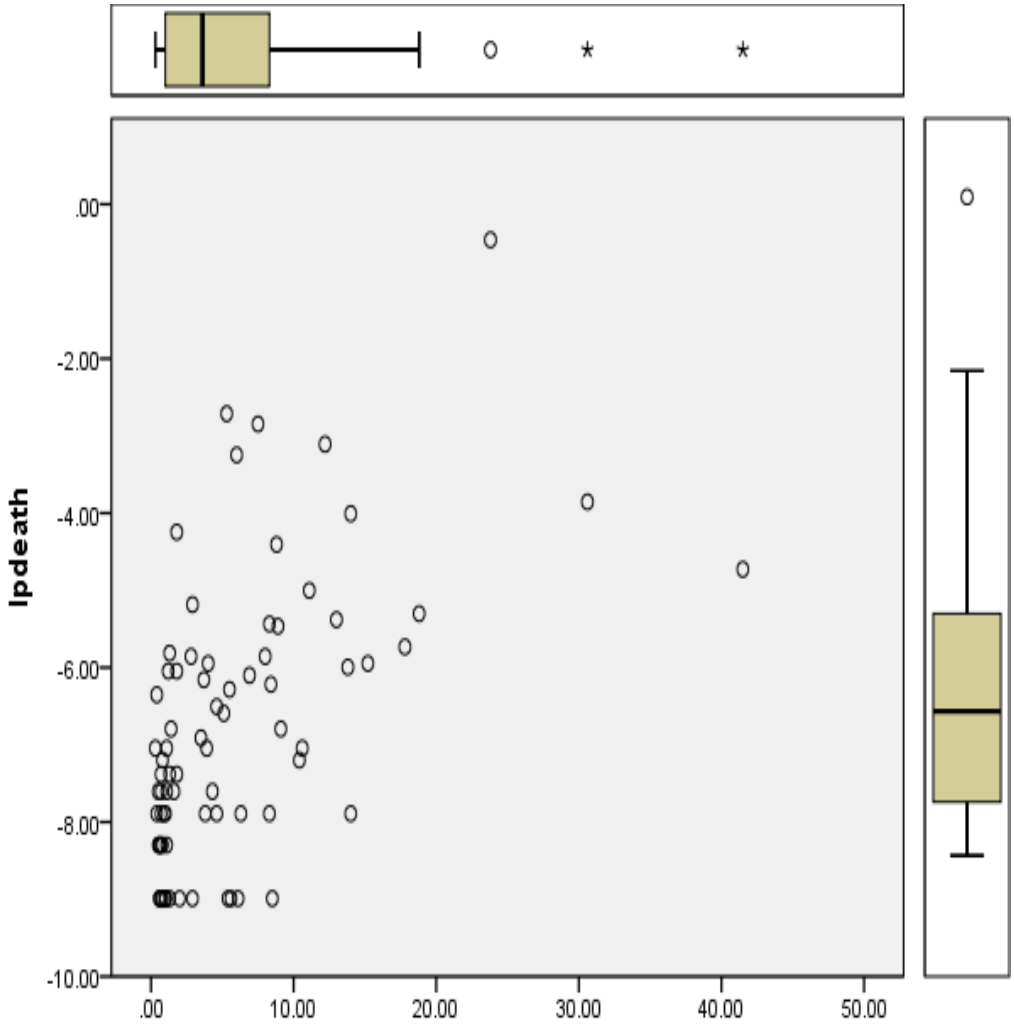
COVID-19 CASES SCATTER PLOT – ETHNICITY NON-HISPANIC



COVID-19 CASES SCATTER PLOT - GENDER



COVID-19 DEATHS SCATTER PLOT – RACE-BLACK/AFRICAN-AMERICAN



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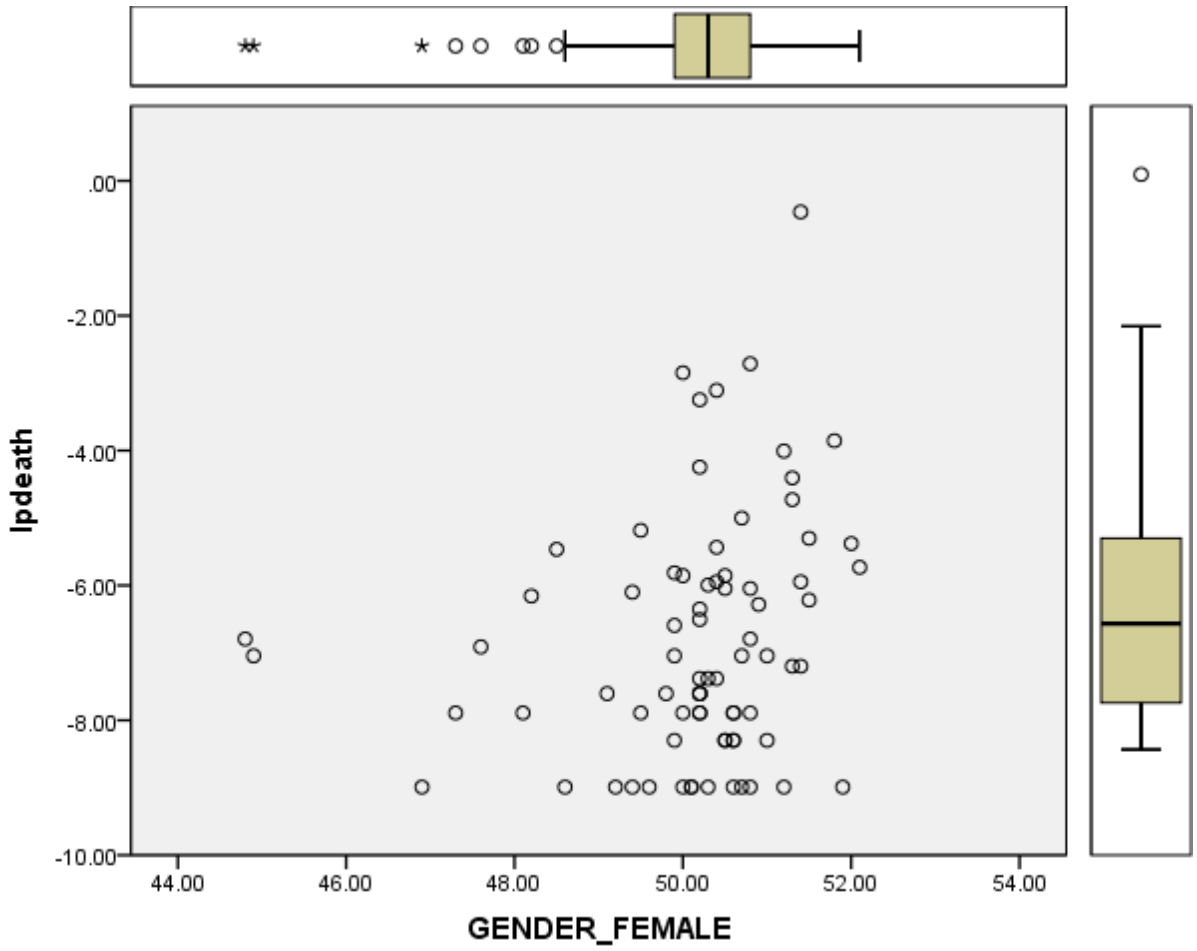

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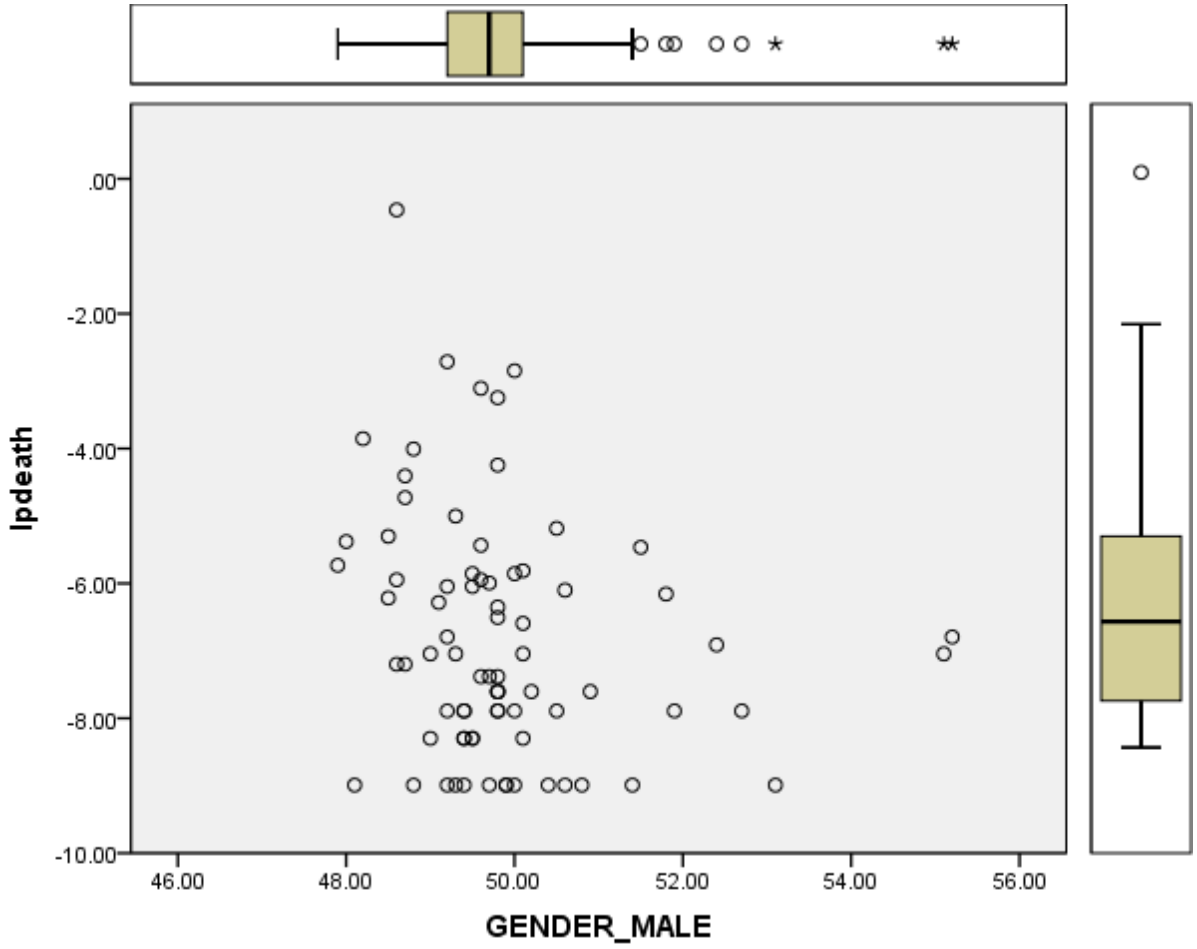

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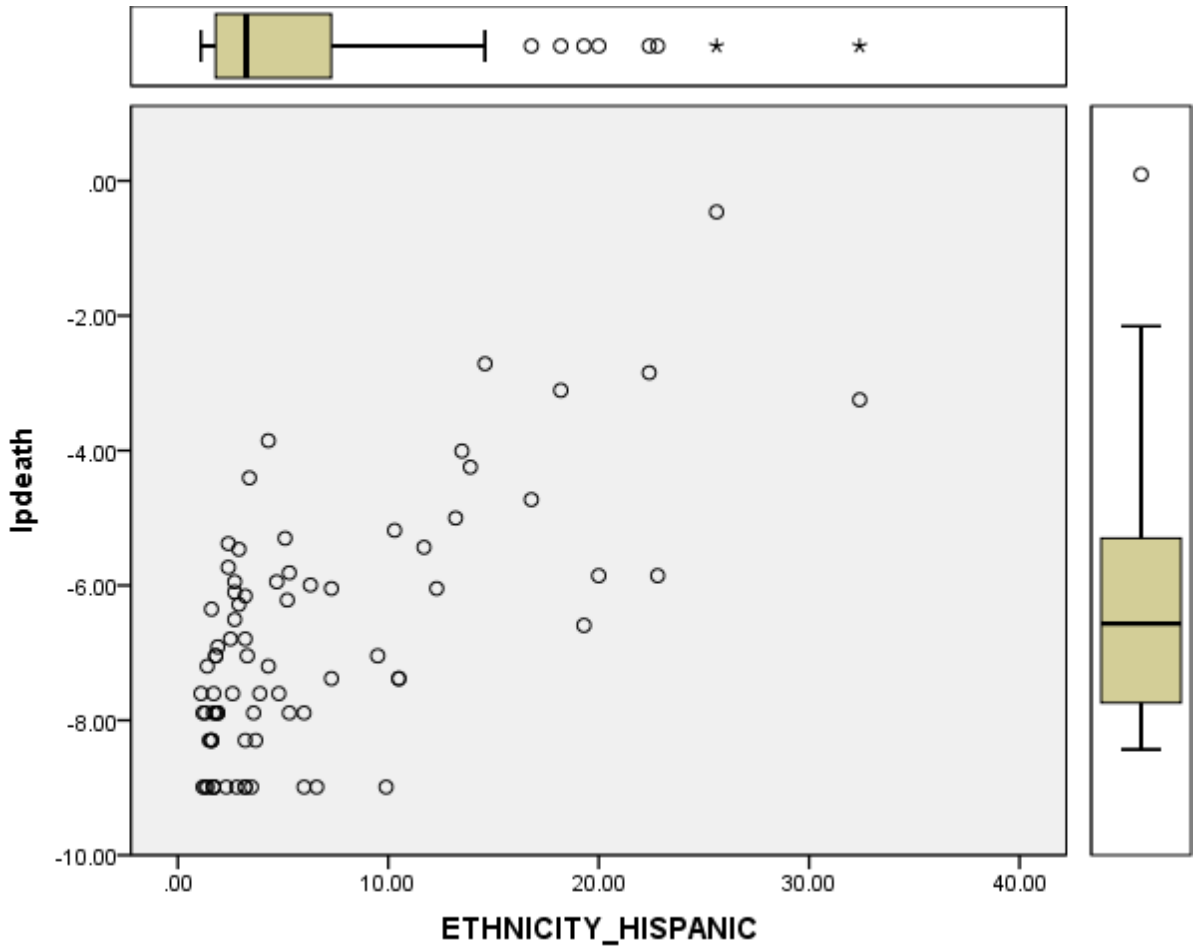

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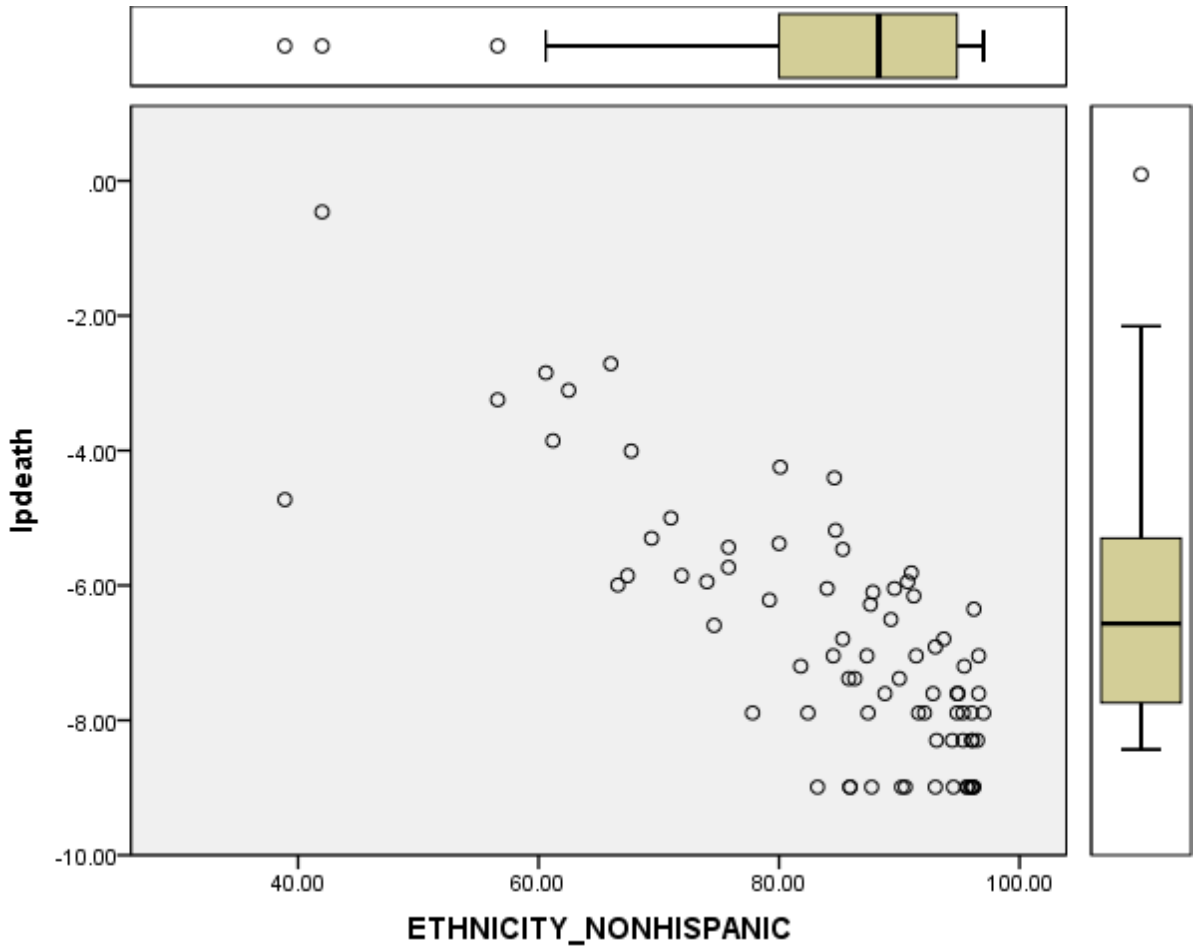
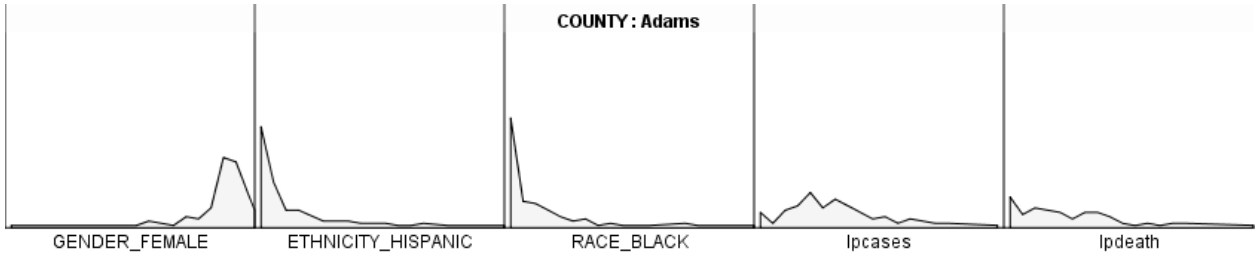
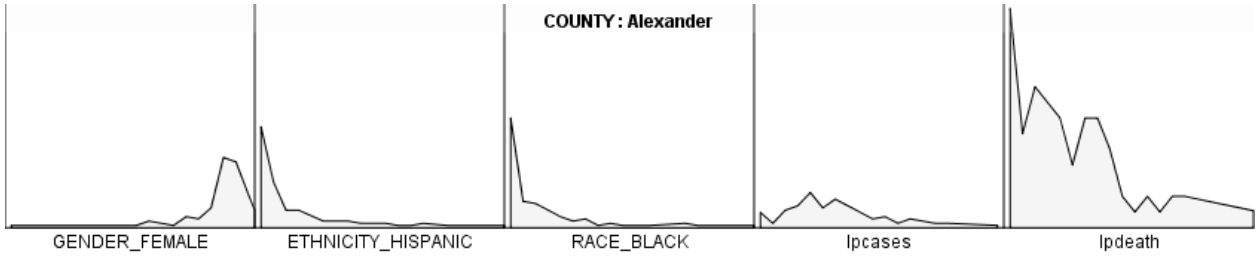
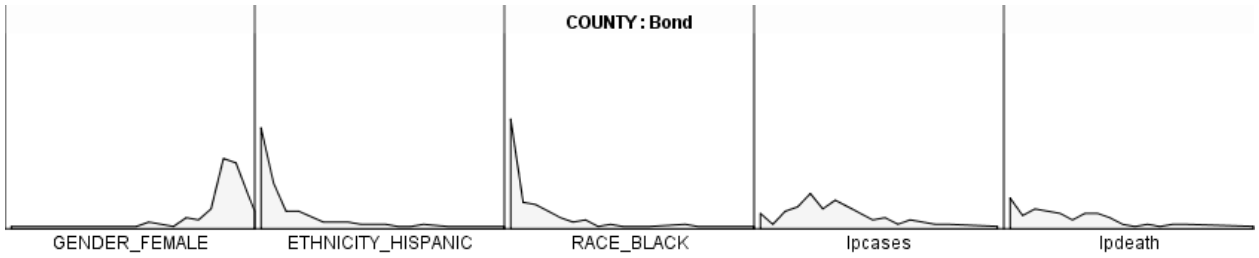


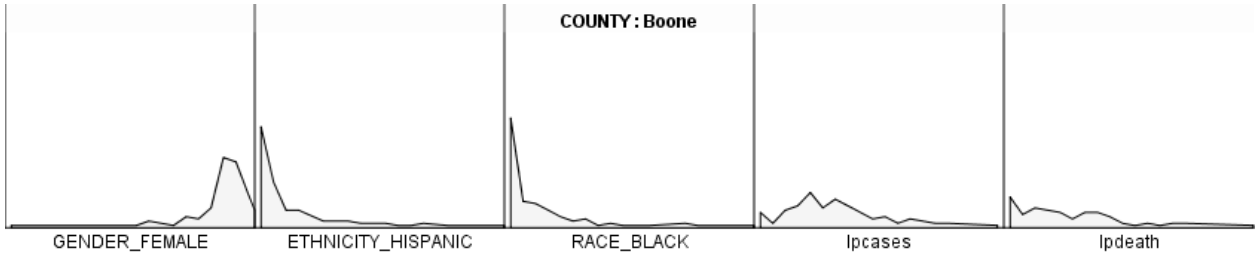
APPENDIX B

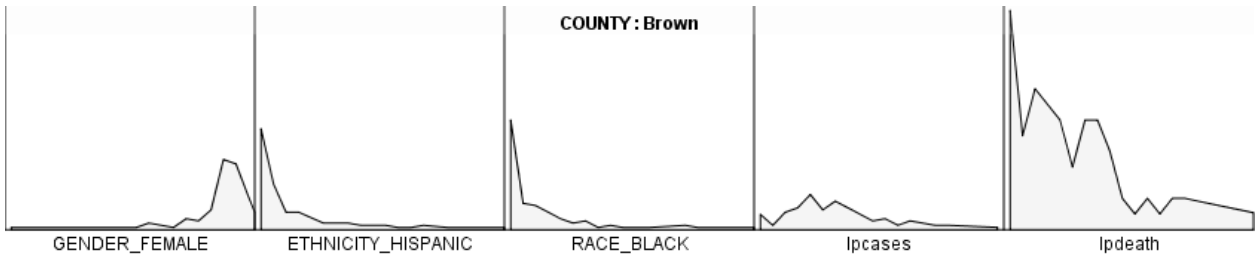
COVID-19 AT THE COUNTY-LEVEL BY GENDER, RACE, ETHNICITY

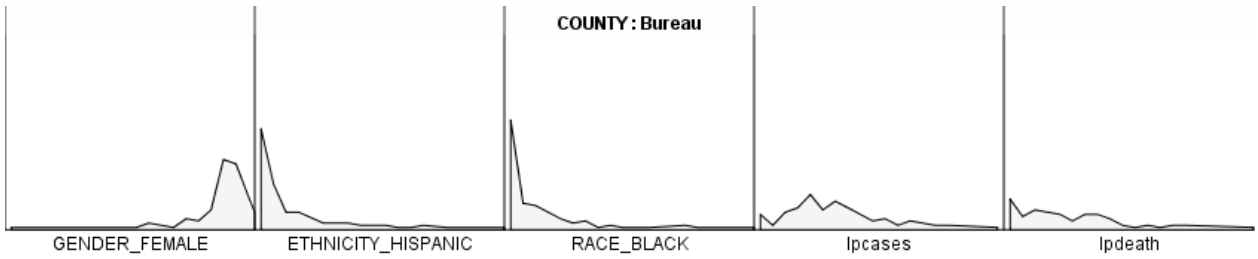


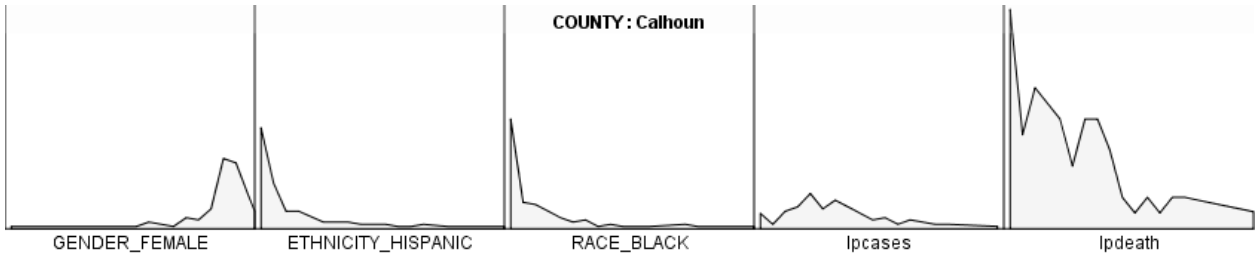







COUNTY : Brown
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath


COUNTY : Bureau
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath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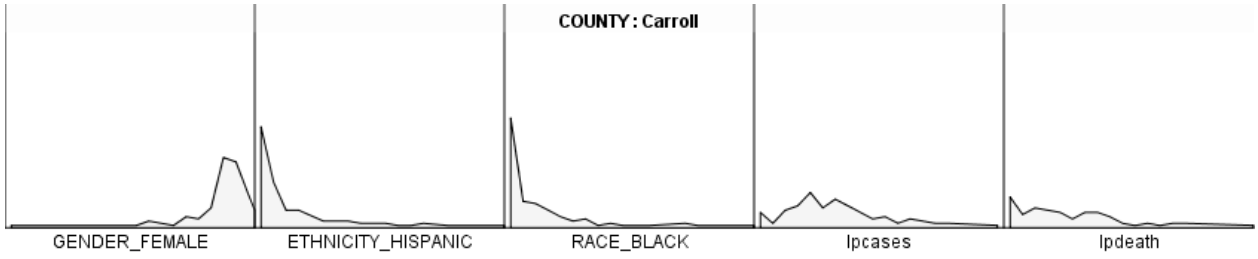
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath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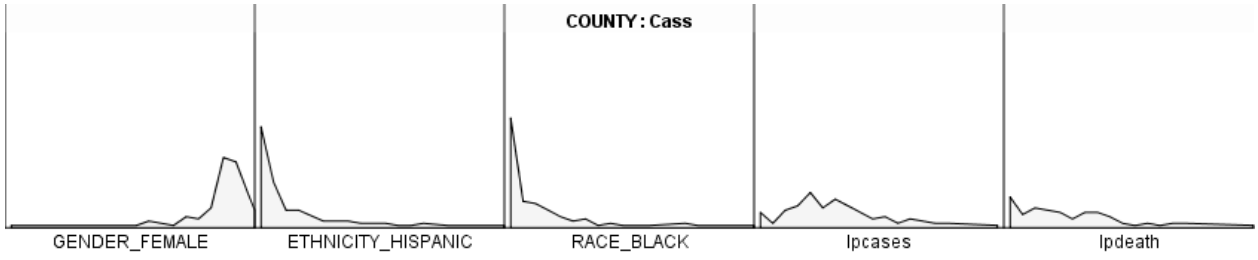
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath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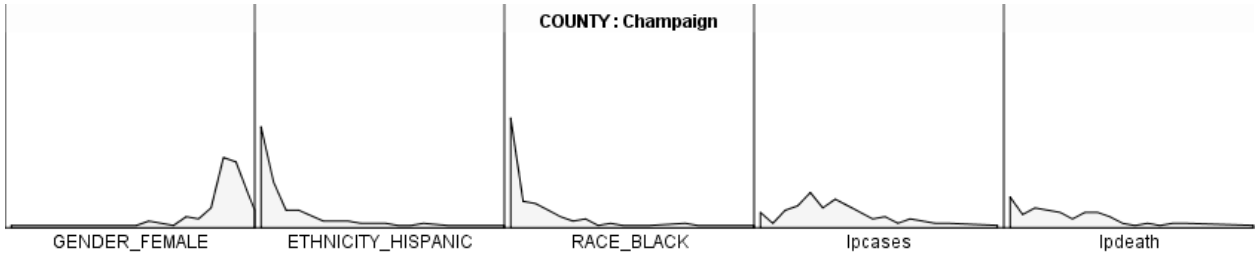
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath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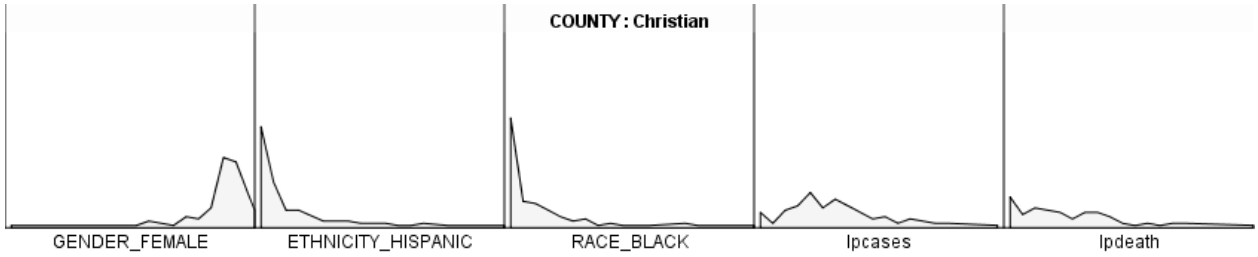
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath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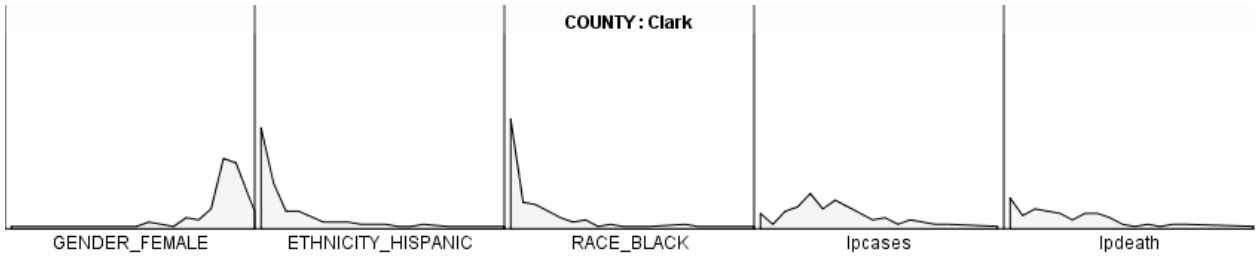
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath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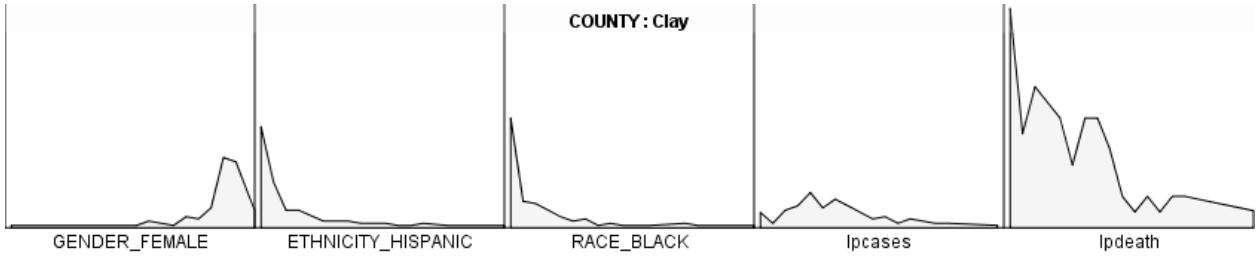
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath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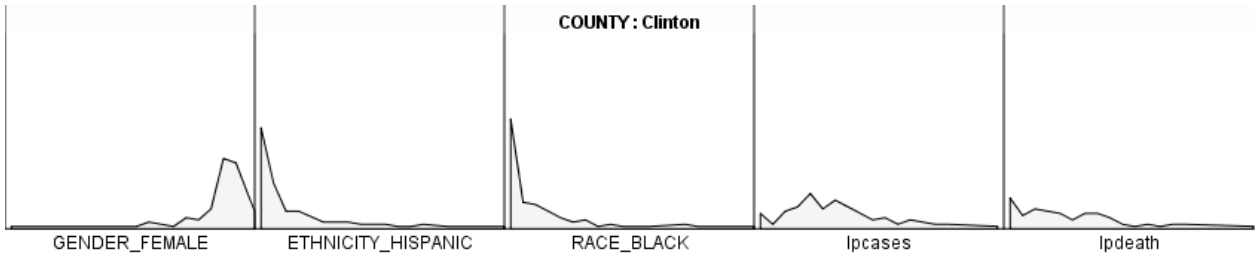
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath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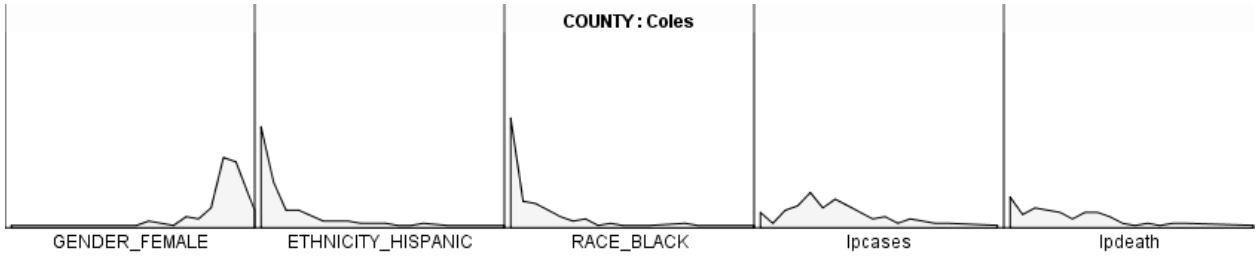
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath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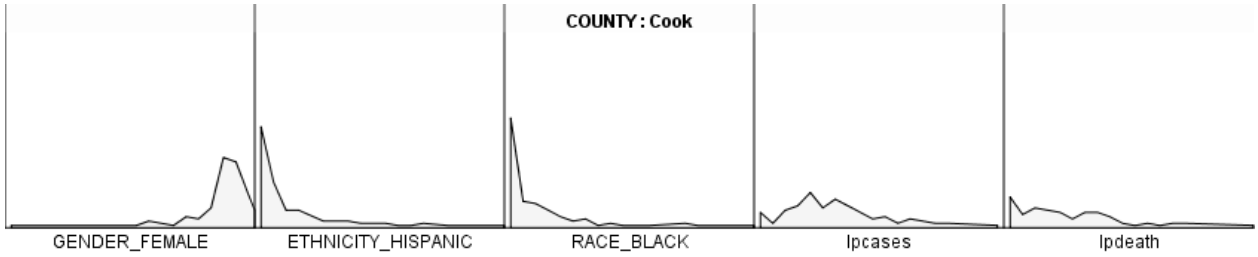
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath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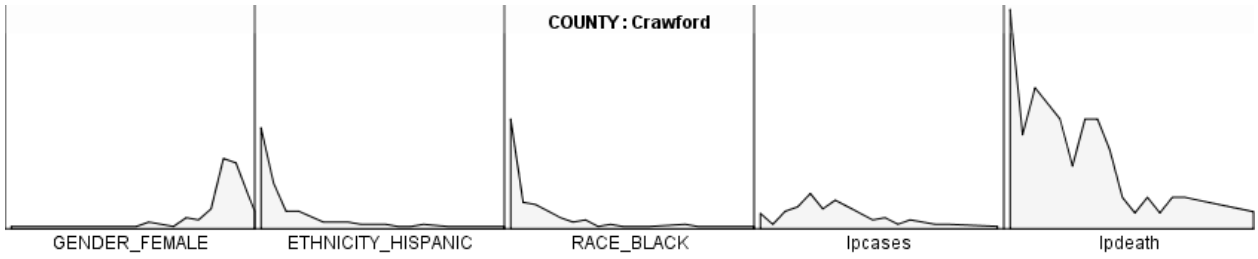
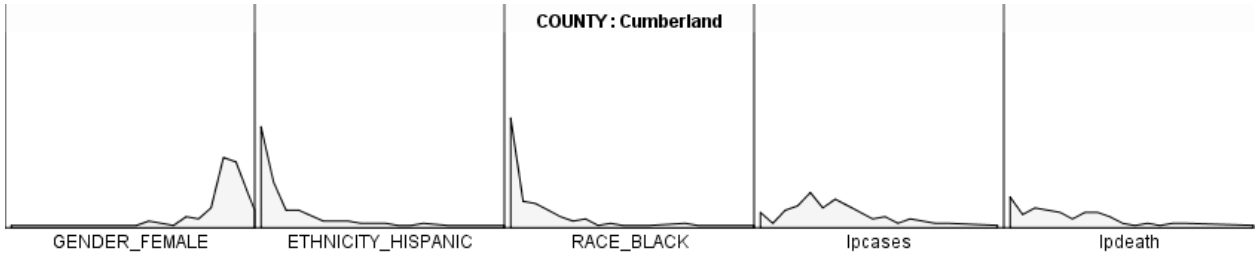
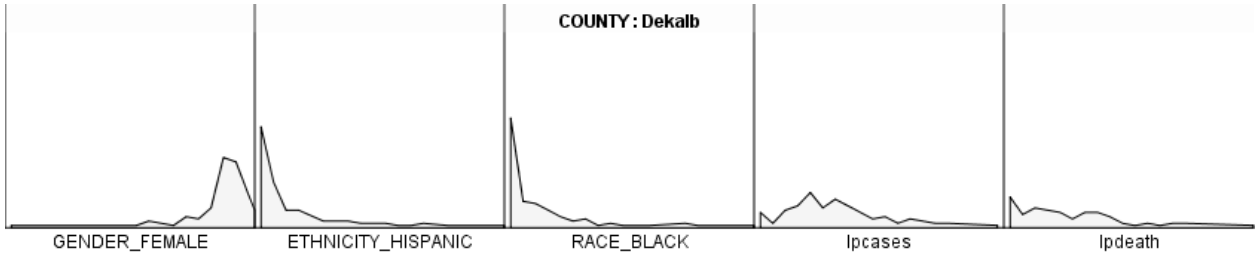
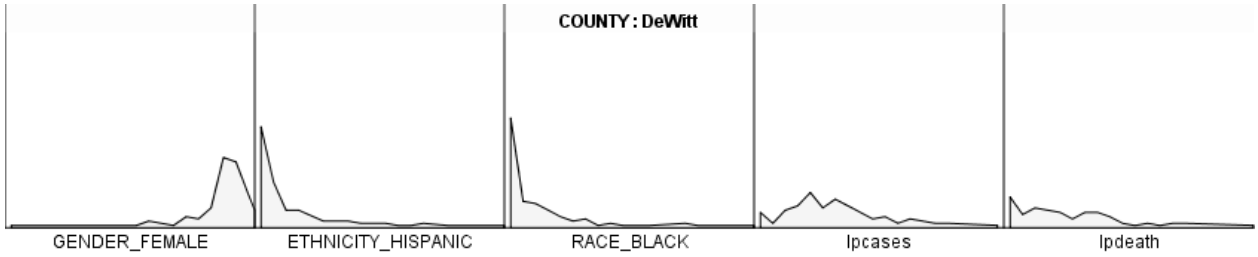
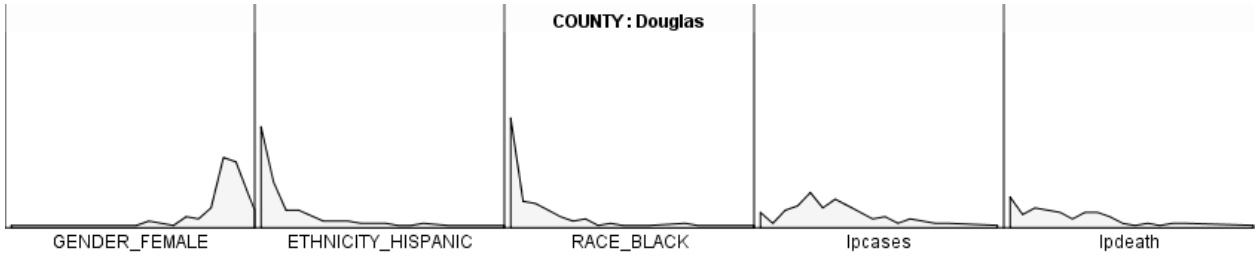
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

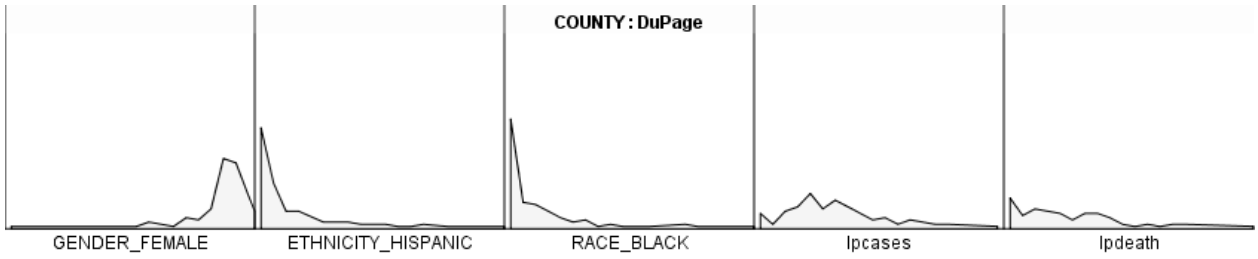

COUNTY : Crawford
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

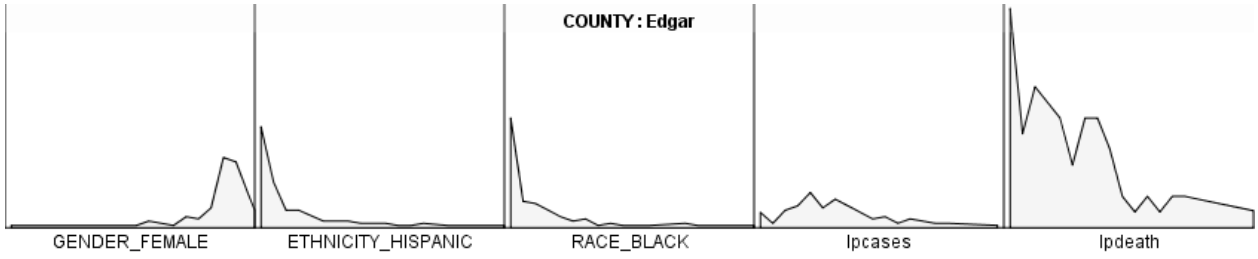

COUNTY : Cumberland
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

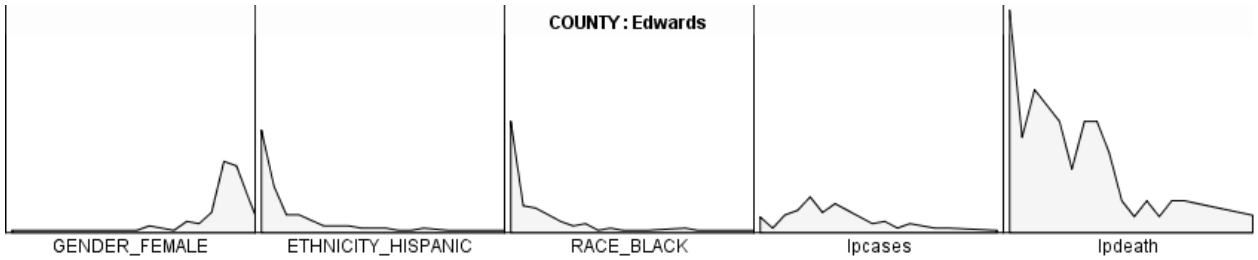

COUNTY : Dekalb
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

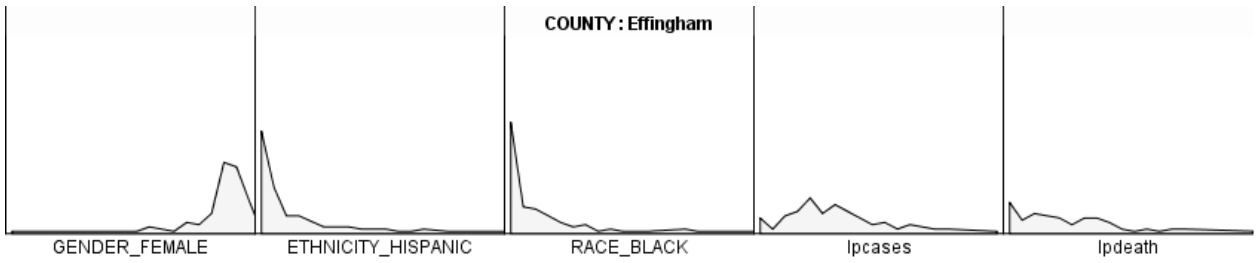

COUNTY : DeWitt
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

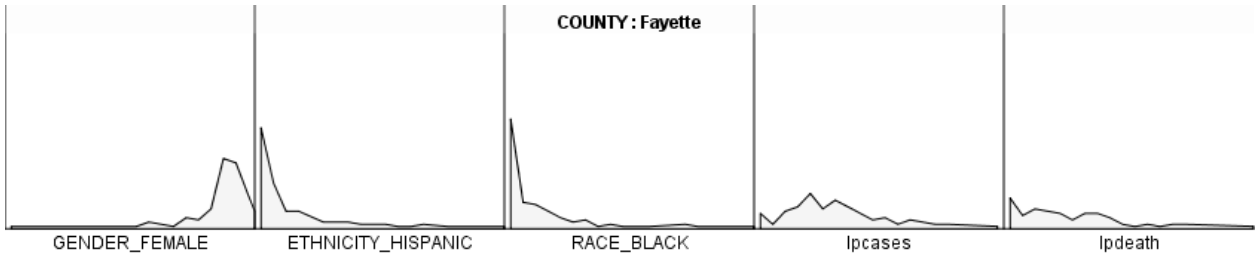

COUNTY : Douglas
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

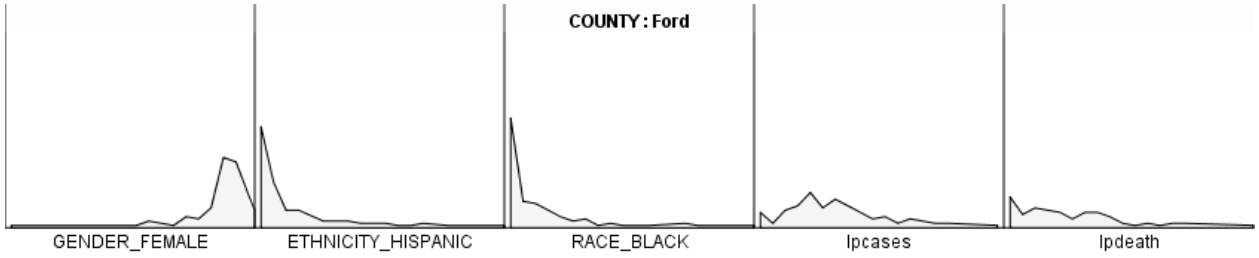

COUNTY : DuPage
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

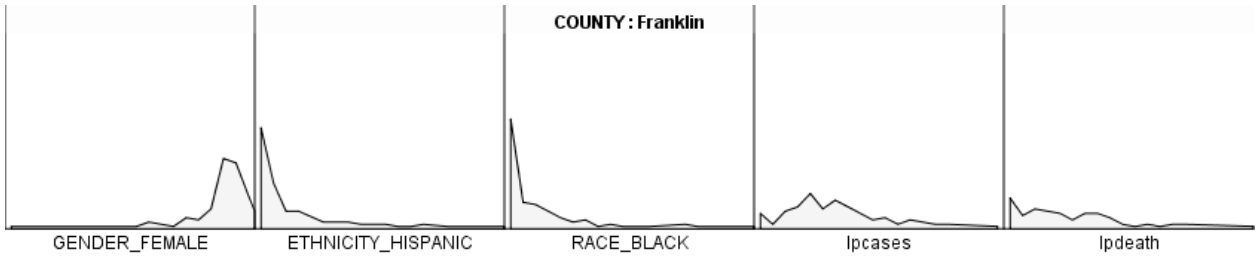

COUNTY : Edgar
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

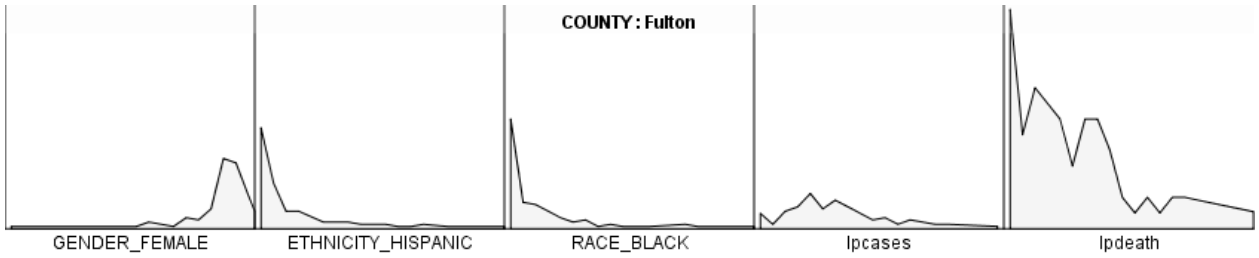

COUNTY : Edwards
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

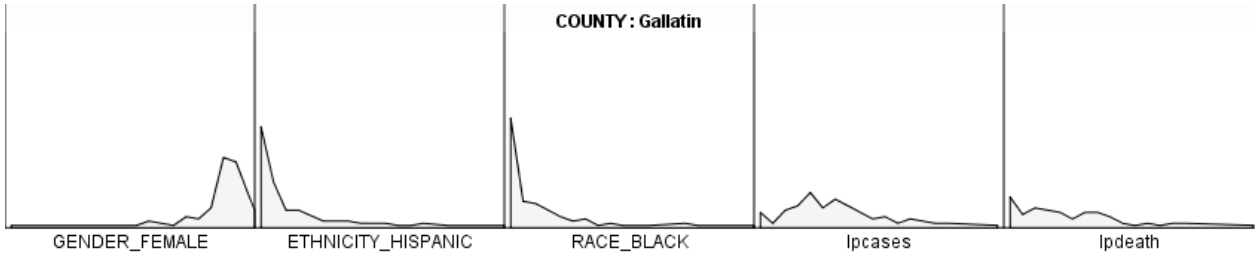

COUNTY : Effingham
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

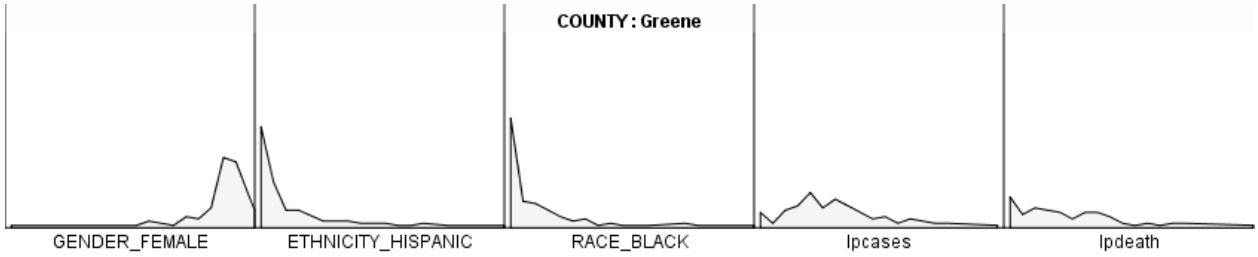

COUNTY : Fayette
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

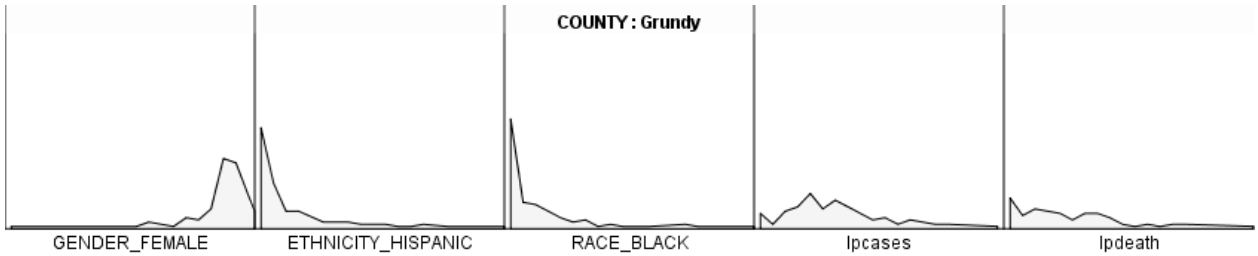

COUNTY : Ford
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

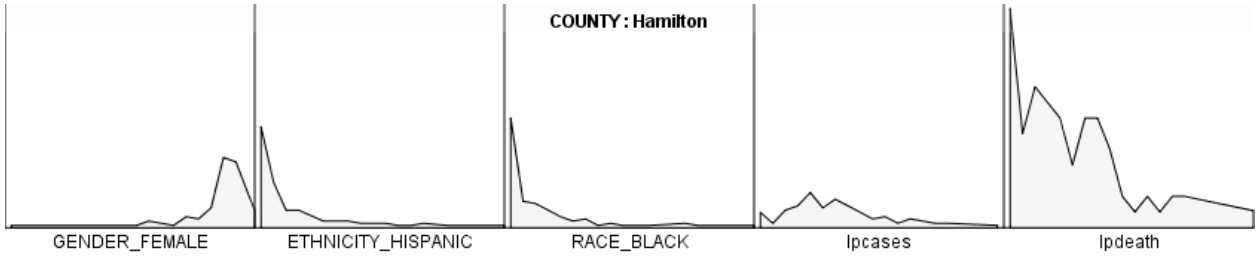

COUNTY : Franklin
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

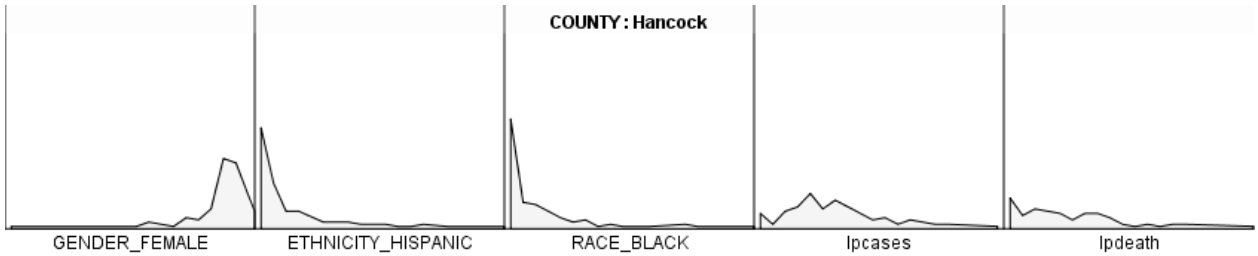

COUNTY : Fulton
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

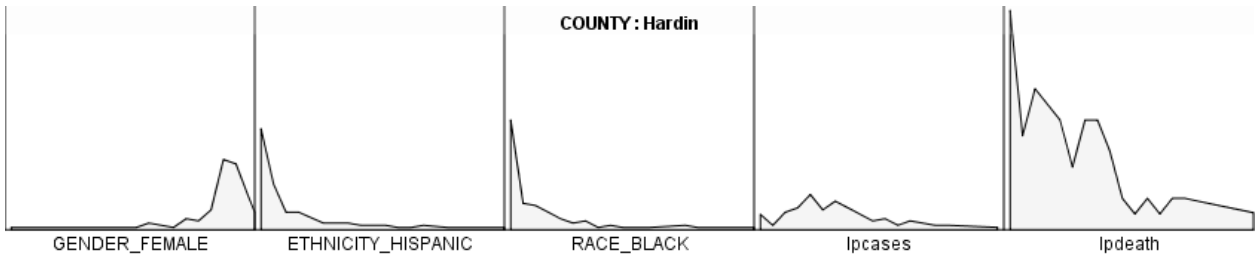

COUNTY : Gallatin
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

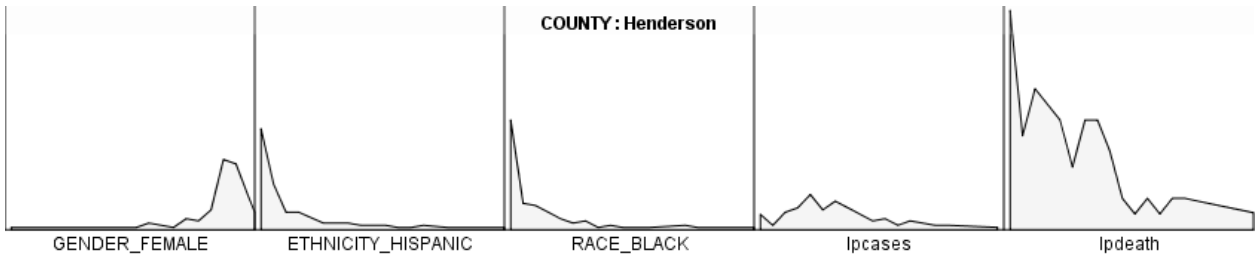

COUNTY : Greene
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

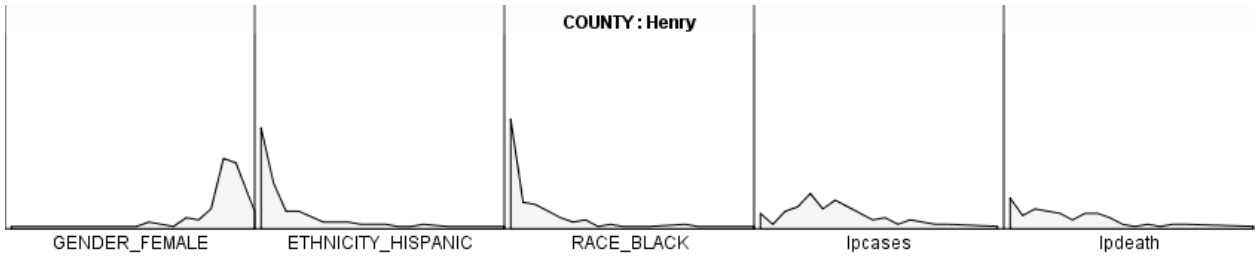

COUNTY : Grundy
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

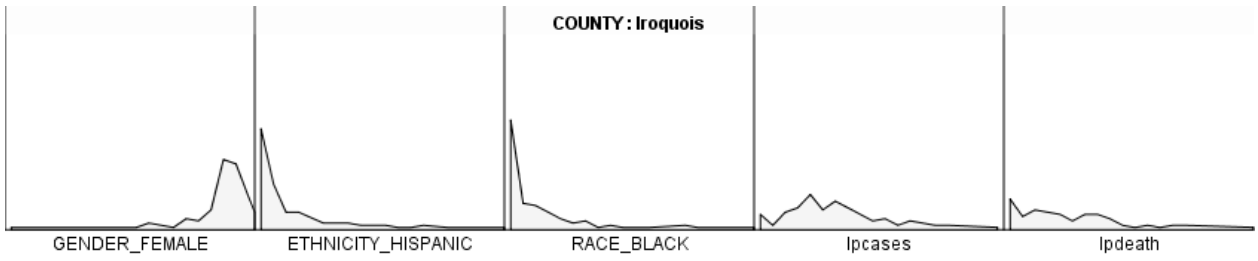

COUNTY : Hamilton
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

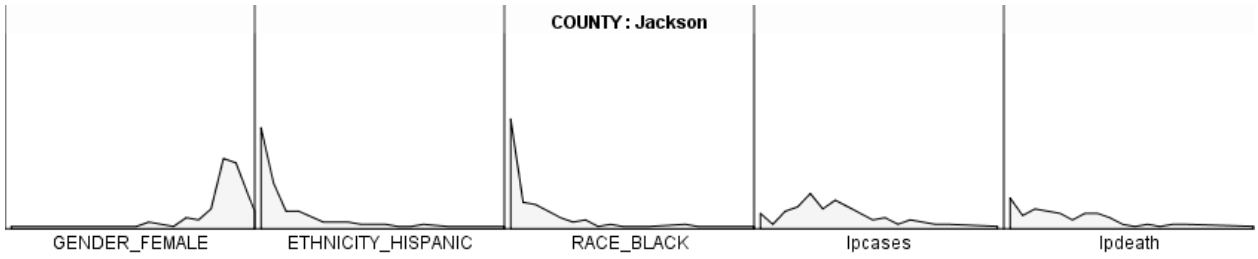

COUNTY : Hancock
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

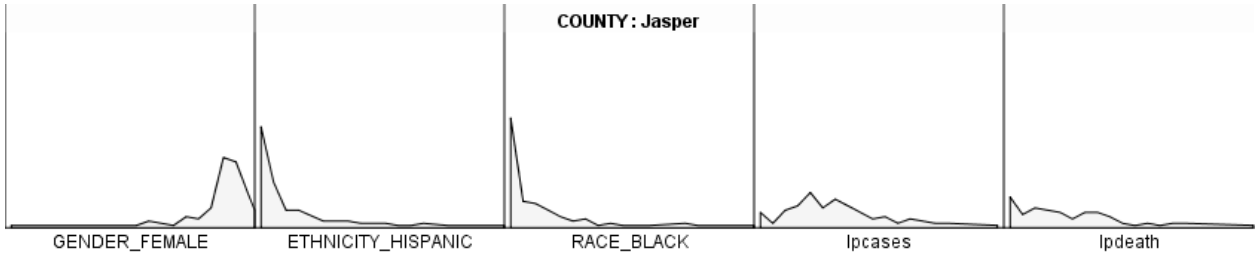

COUNTY : Hardin
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

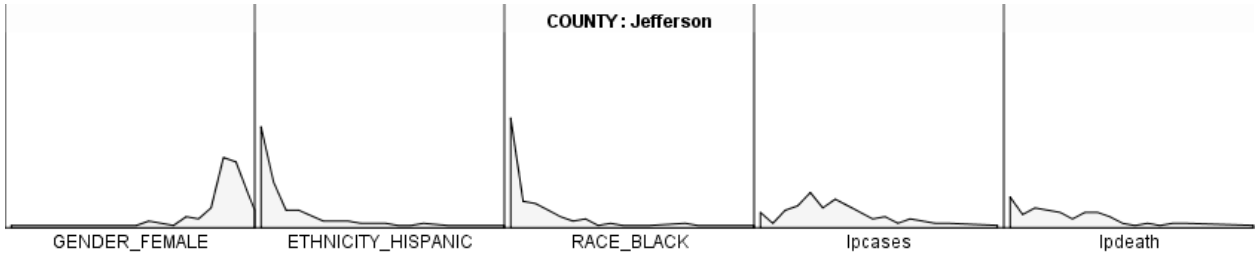

COUNTY : Henderson
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

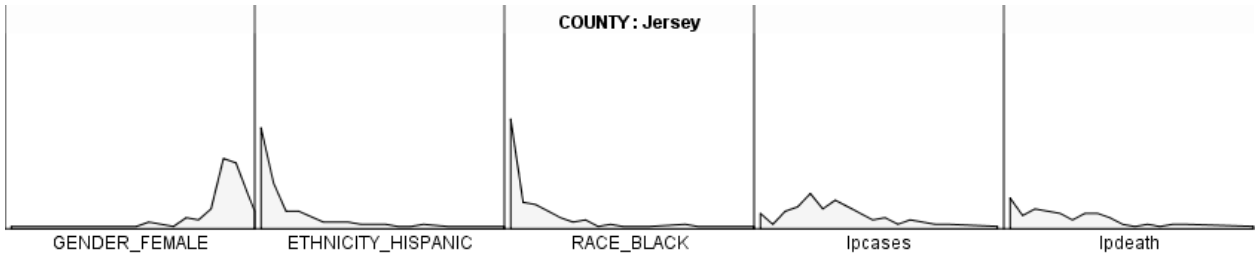

COUNTY : Henry
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

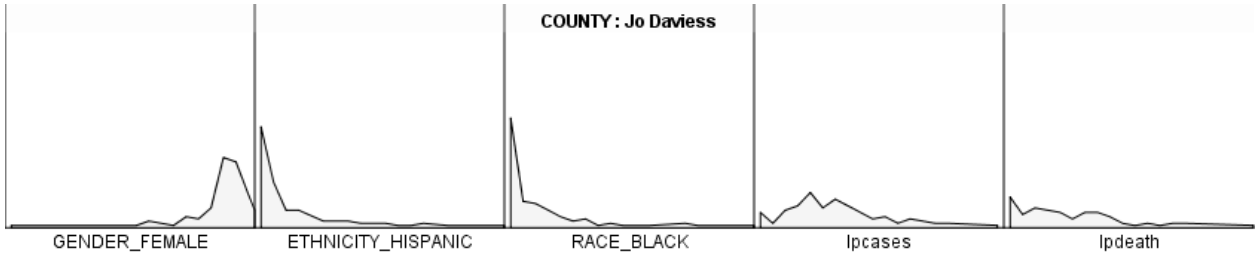

COUNTY : Iroquois
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

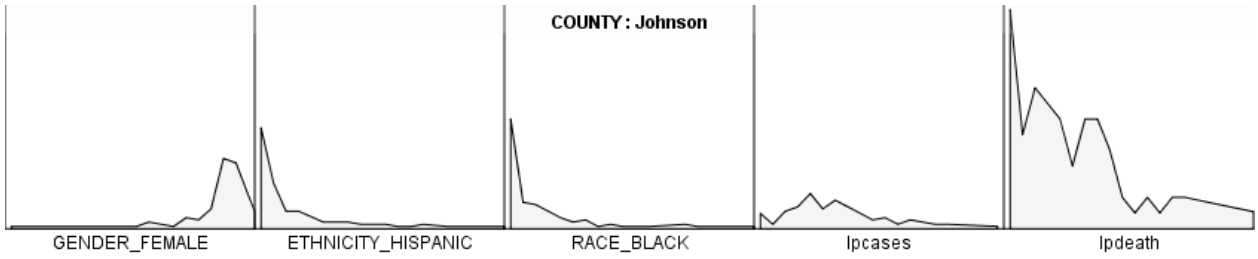

COUNTY : Jackson
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

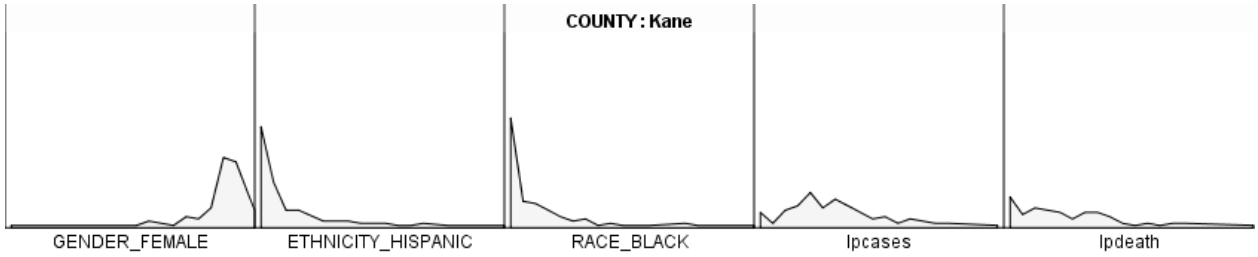

COUNTY : Jasper
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

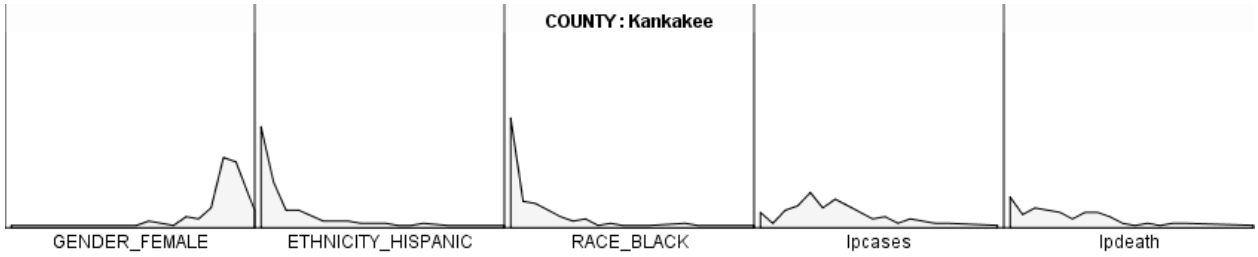

COUNTY : Jefferson
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

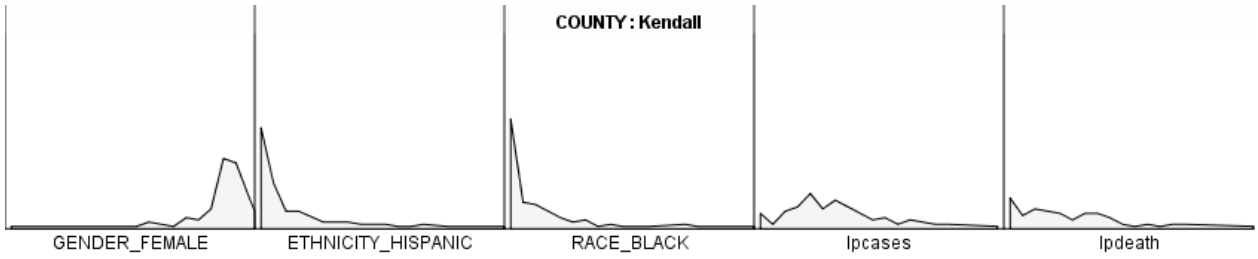

COUNTY : Jersey
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

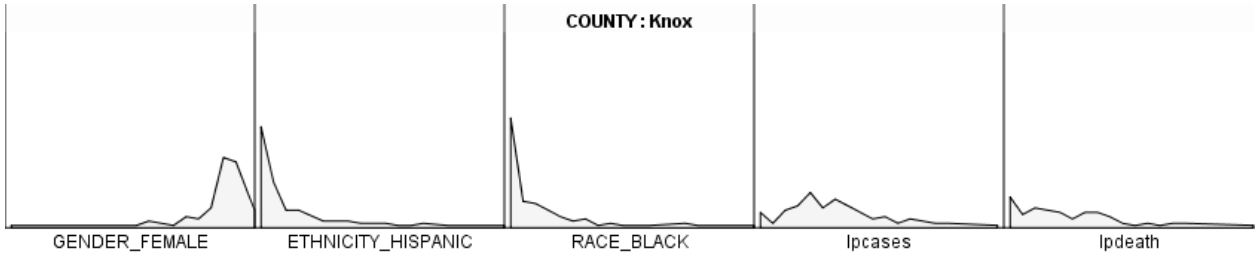

COUNTY : Jo Daviess
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

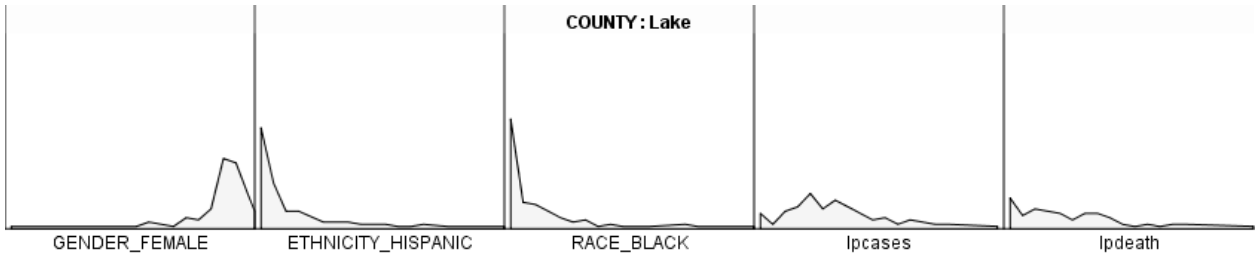

COUNTY : Johnson
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

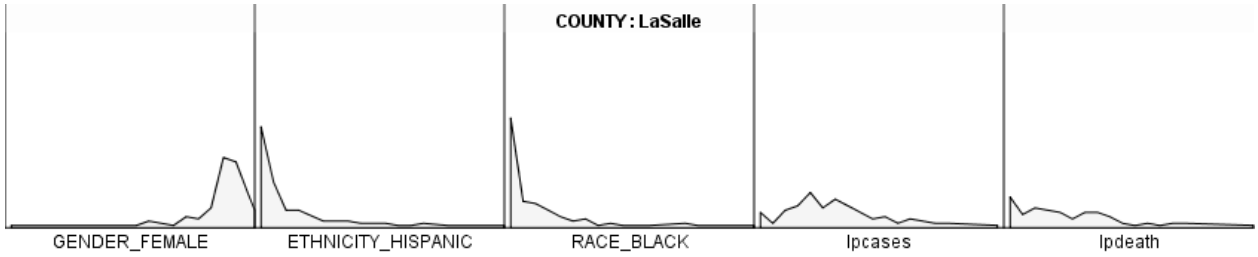

COUNTY : Kane
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

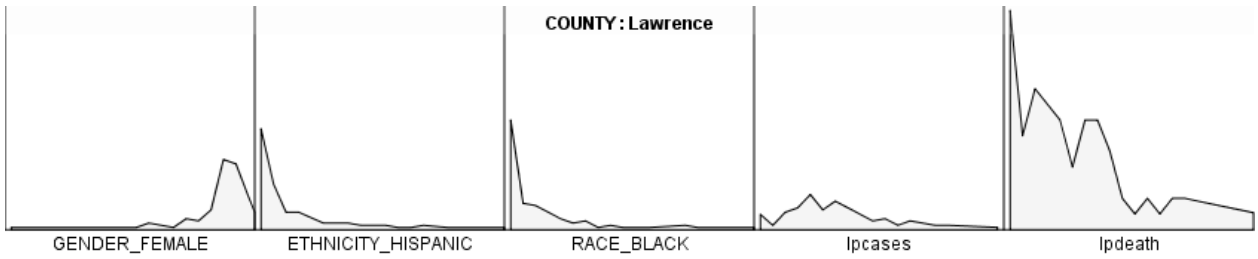

COUNTY : Kankakee
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

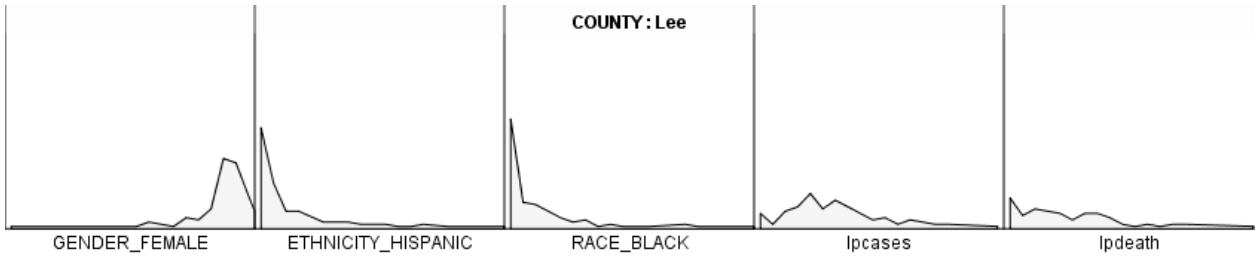

COUNTY : Kendall
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

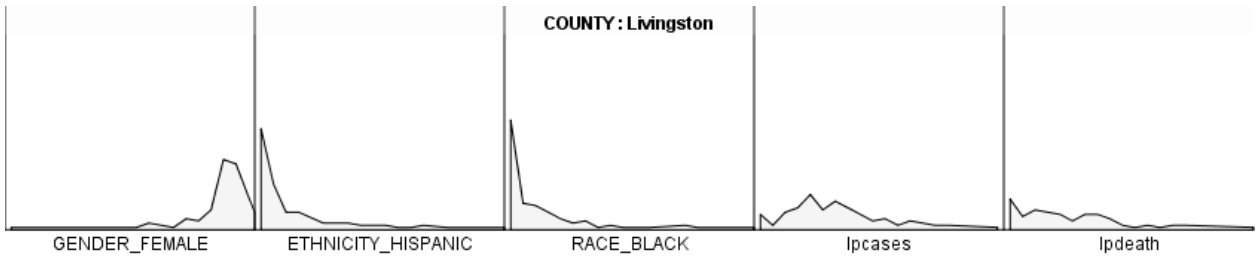

COUNTY : Knox
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

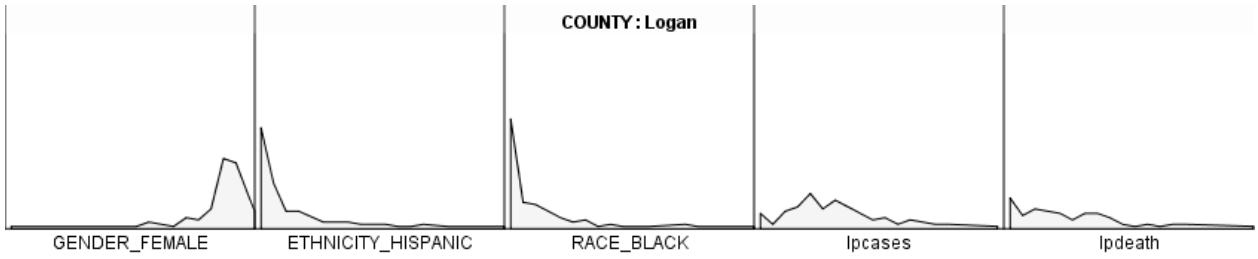

COUNTY : Lake
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

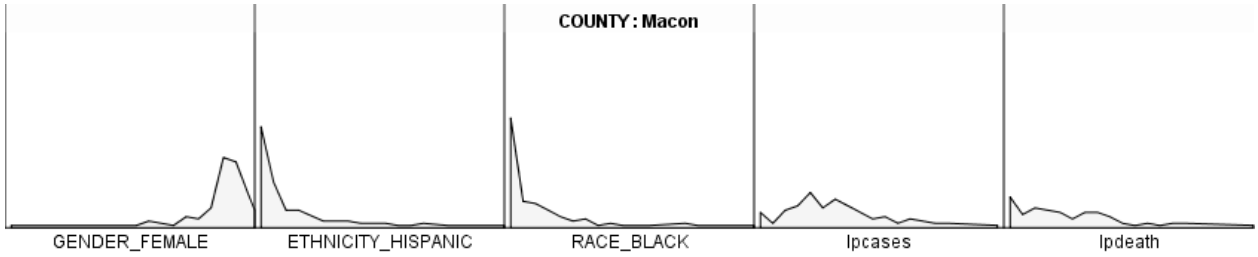

COUNTY : LaSalle
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

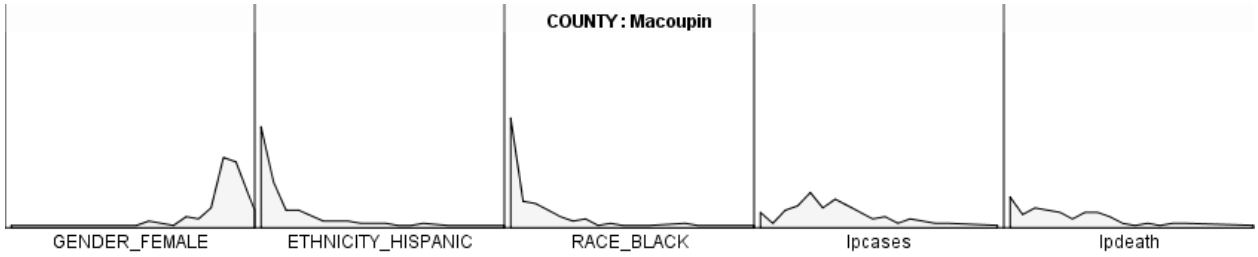

COUNTY : Lawrence
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

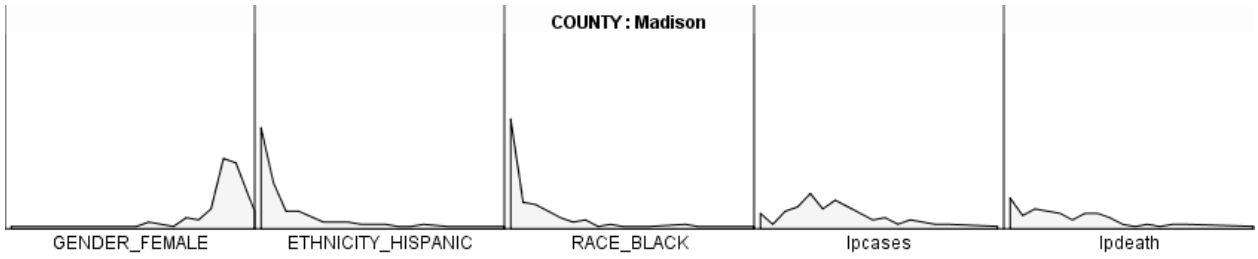

COUNTY : Lee
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

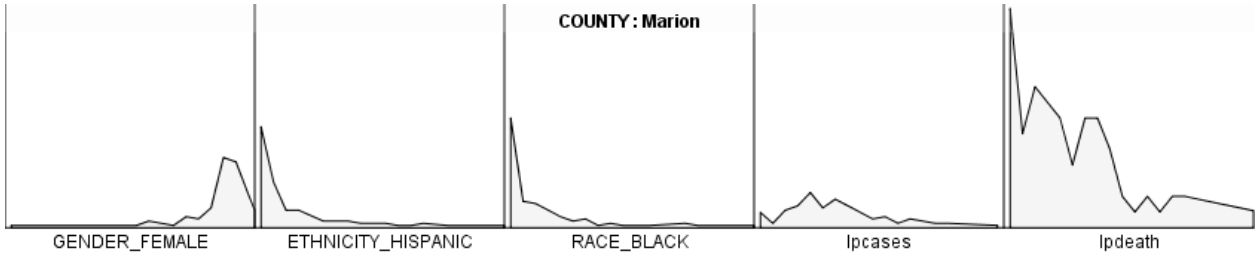

COUNTY : Livingston
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

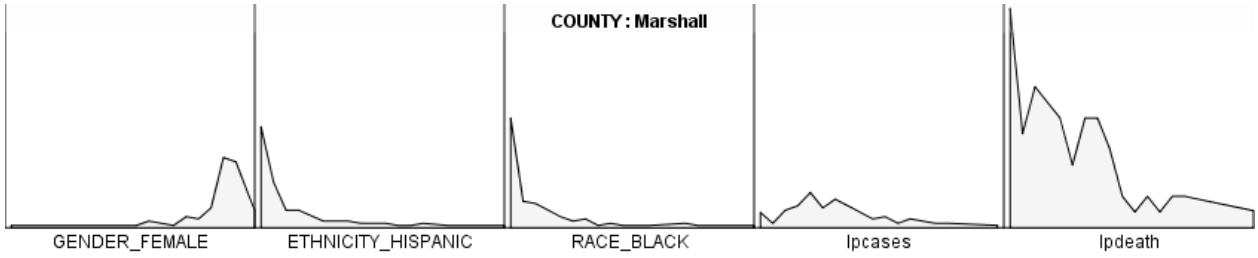

COUNTY : Logan
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

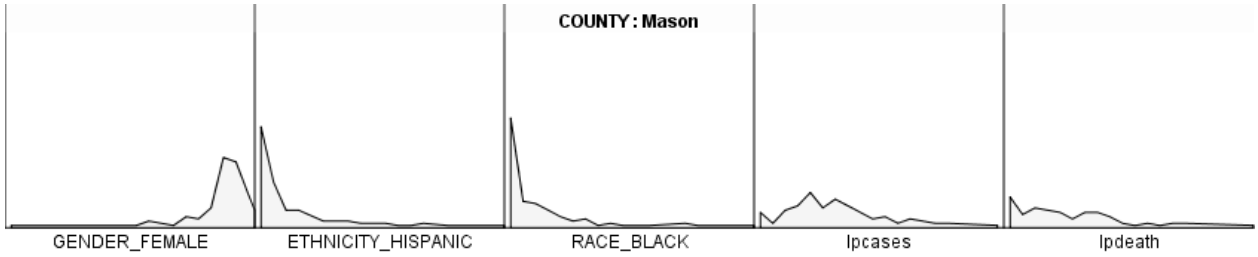

COUNTY : Macon
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

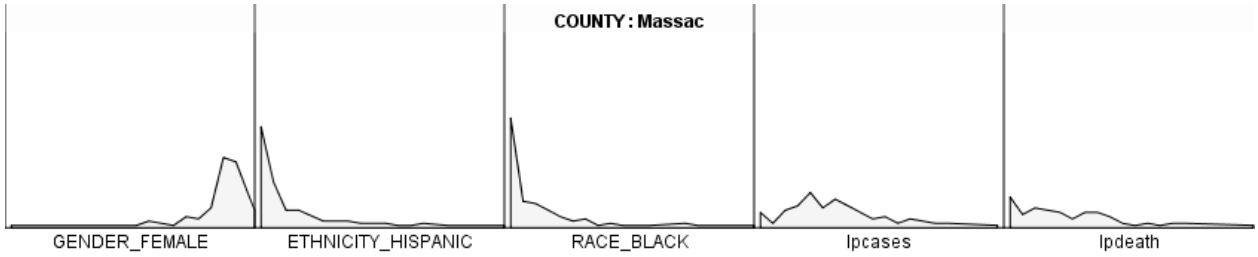

COUNTY : Macoupin
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

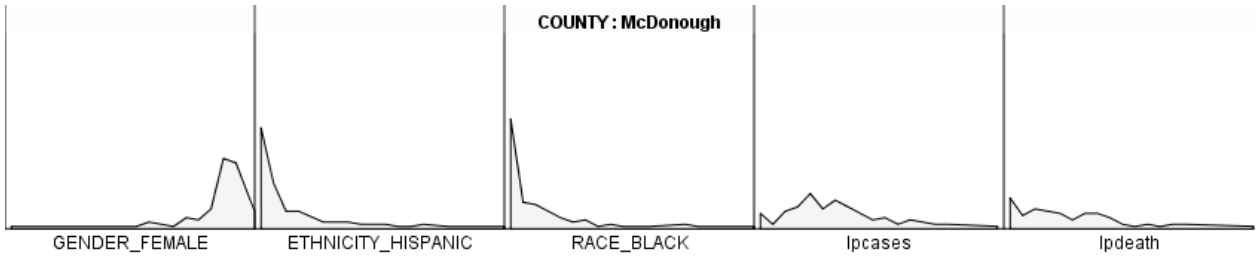

COUNTY : Madison
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

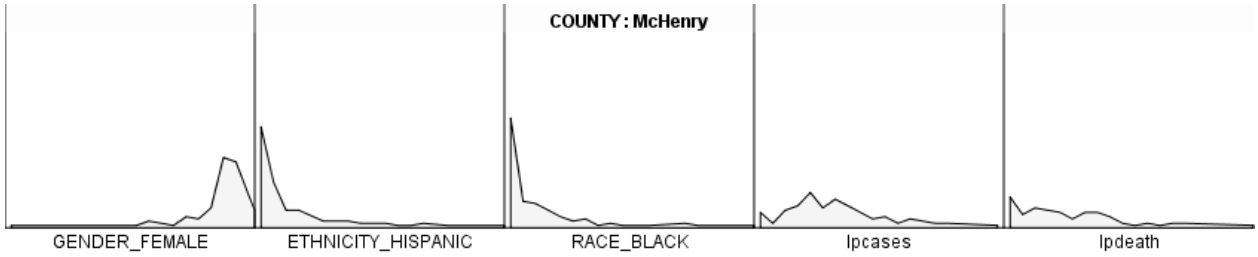

COUNTY : Marion
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

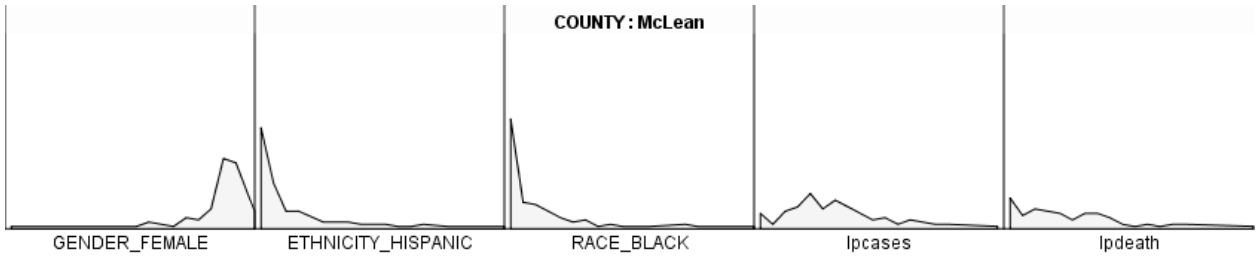

COUNTY : Marshall
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

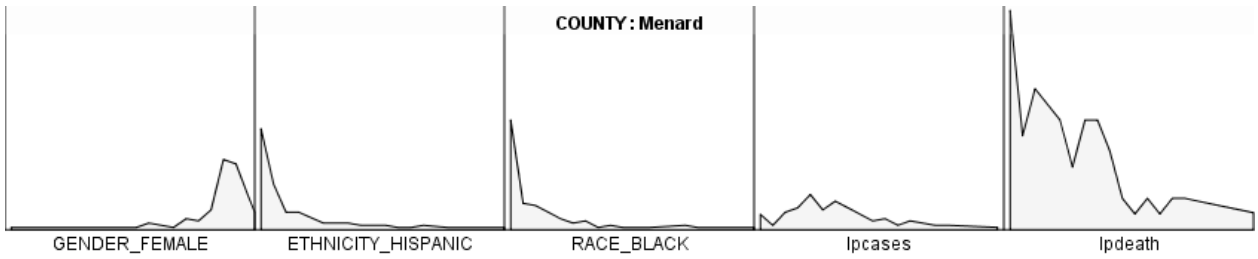

COUNTY : Mason
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath


COUNTY : Massac
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath


COUNTY : McDonough
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath


COUNTY : McHenry
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath


COUNTY : McLean
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath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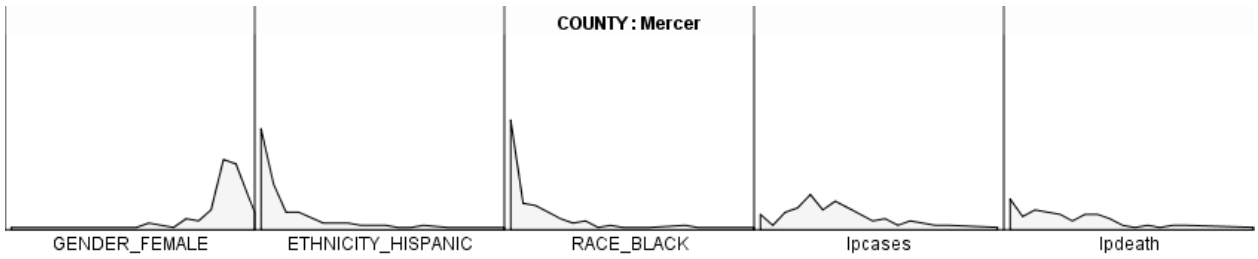
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath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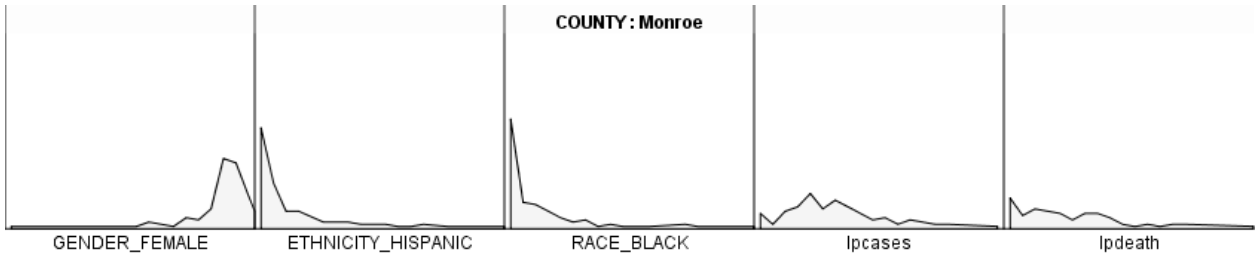
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath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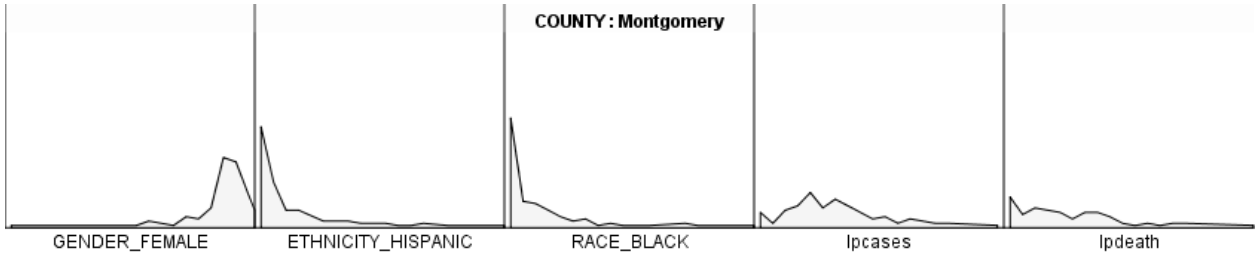
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath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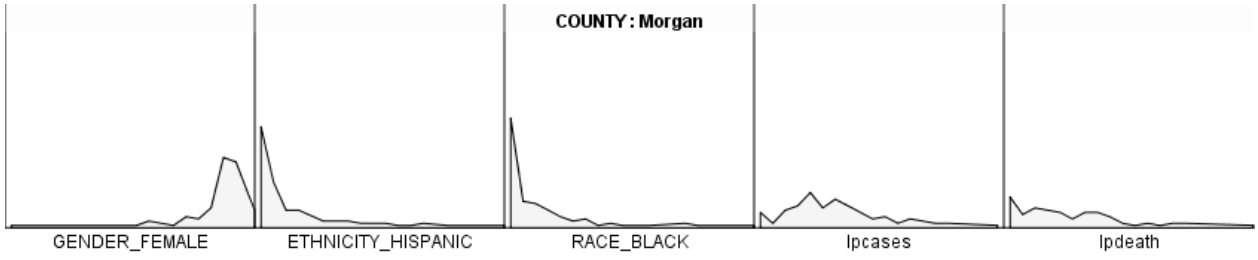
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath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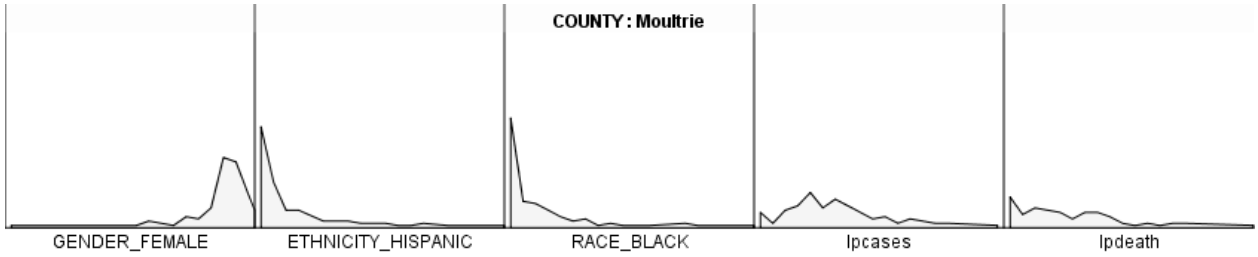
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath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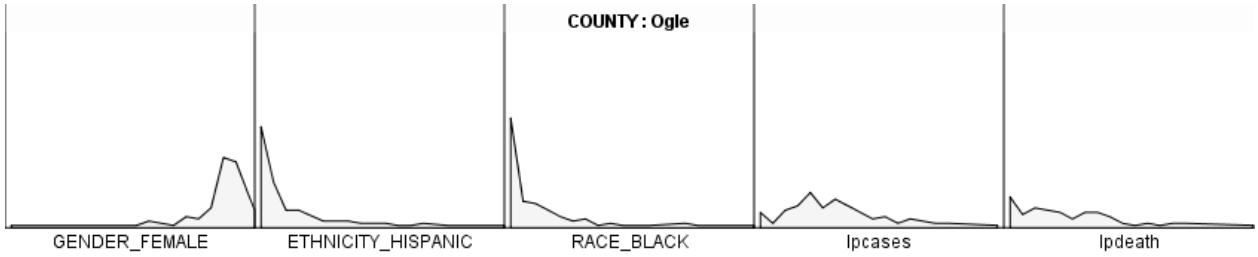
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath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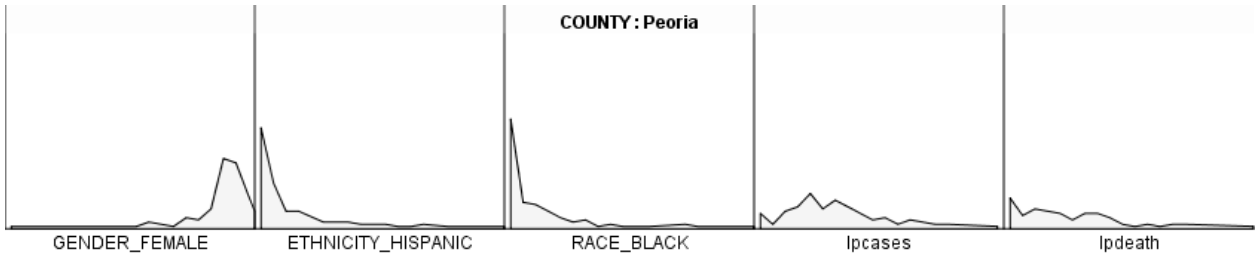
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath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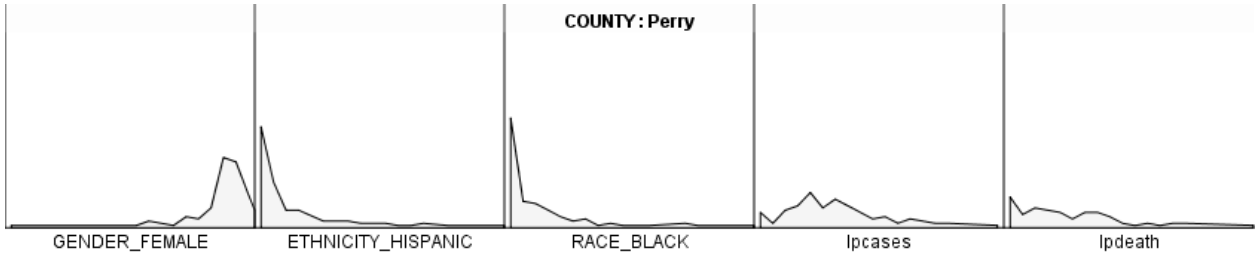
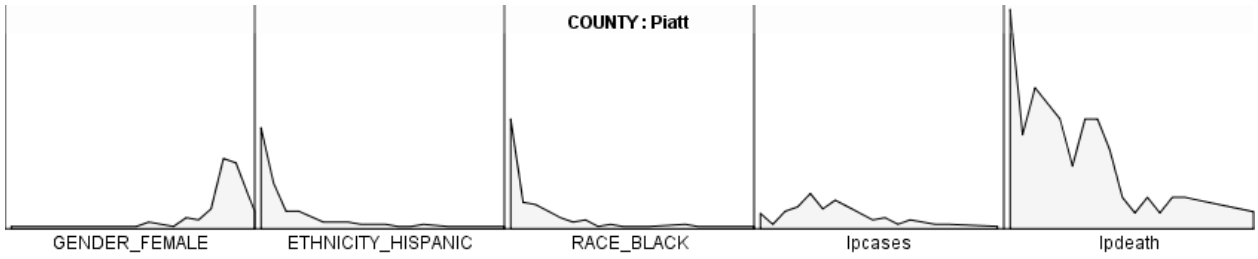
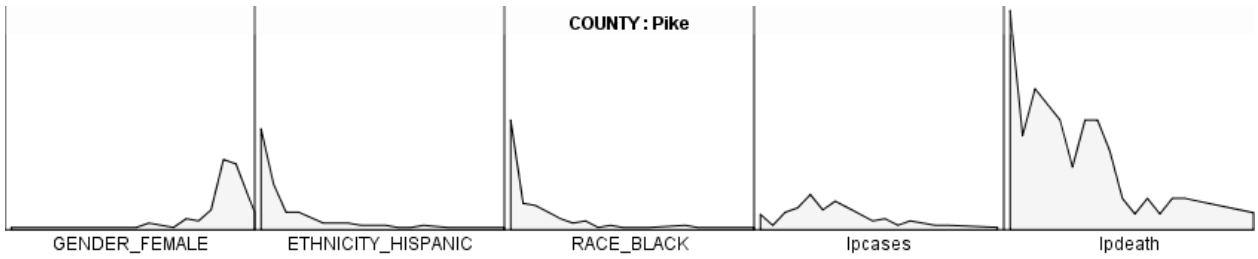
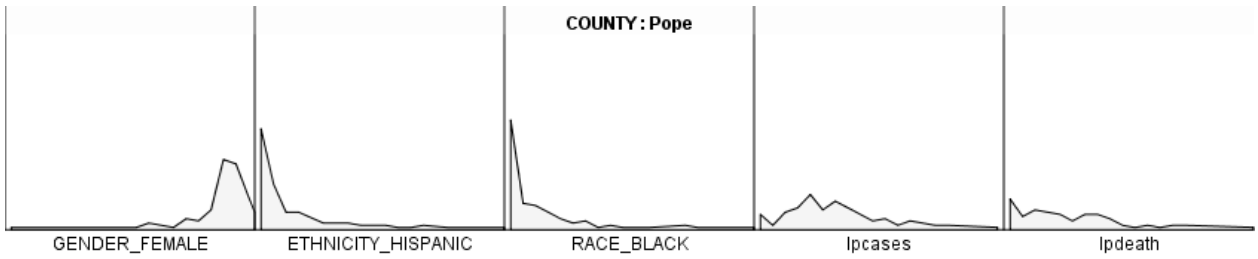
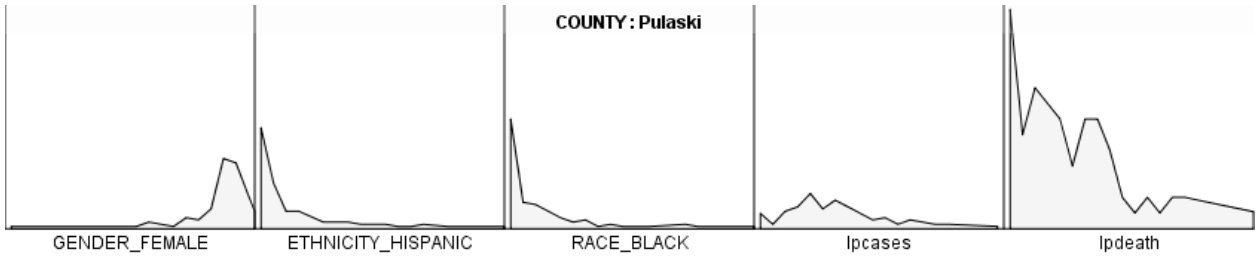
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

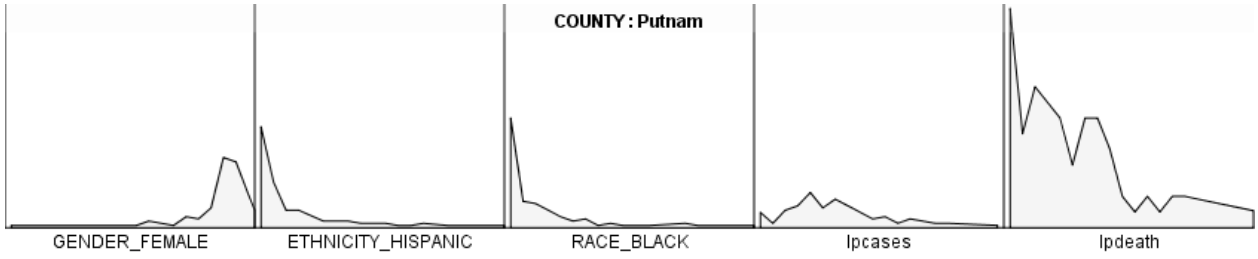

COUNTY : Perry
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

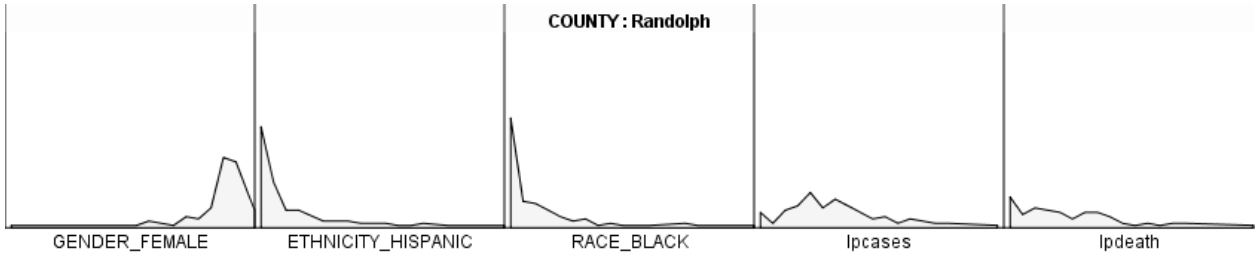

COUNTY : Piatt
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

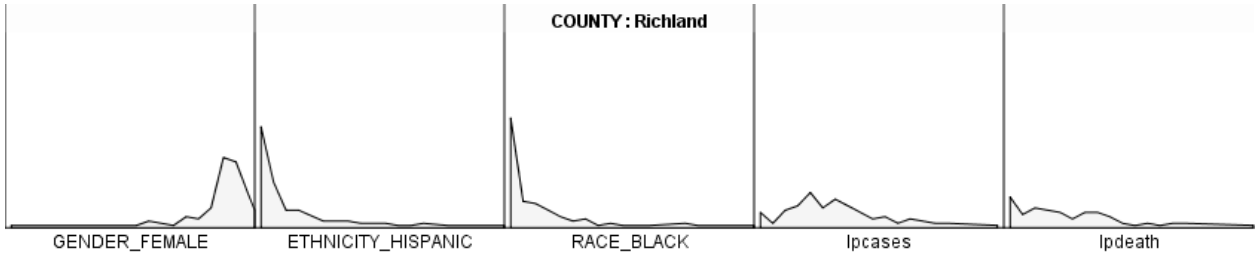

COUNTY : Pike
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

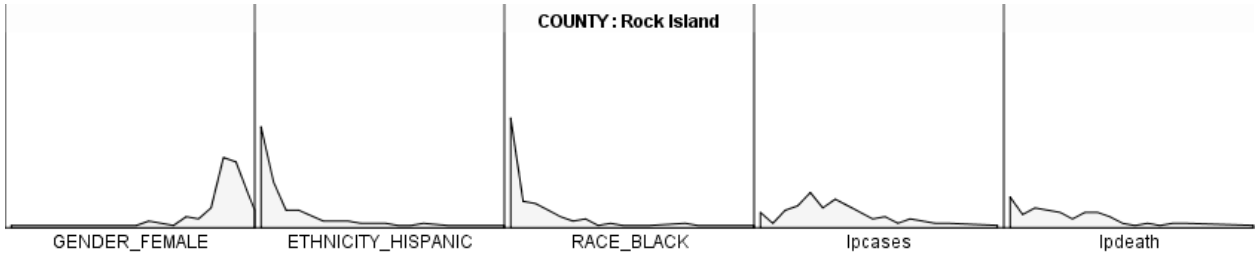

COUNTY : Pope
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

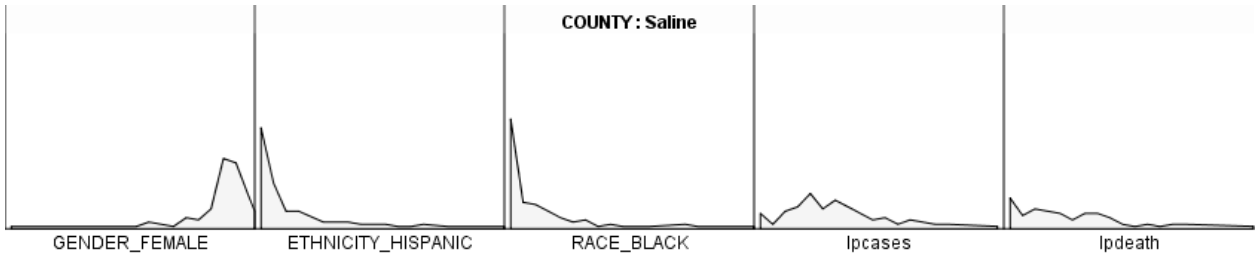

COUNTY : Pulaski
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

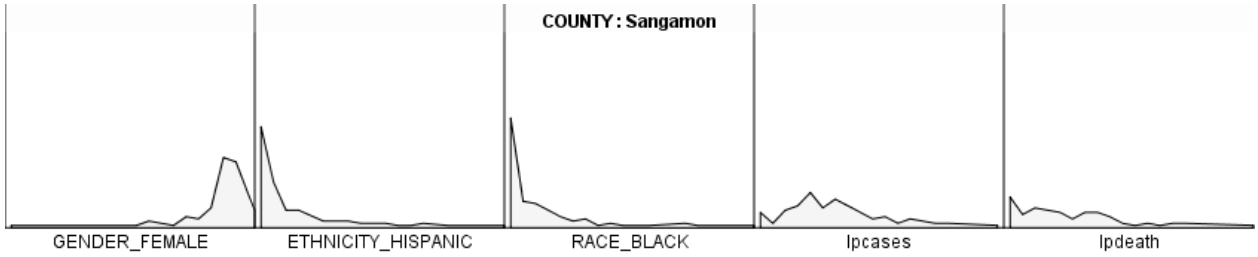

COUNTY : Putnam
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath


COUNTY : Randolph
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath


COUNTY : Richland
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath


COUNTY : Rock Island
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath


COUNTY : Saline
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath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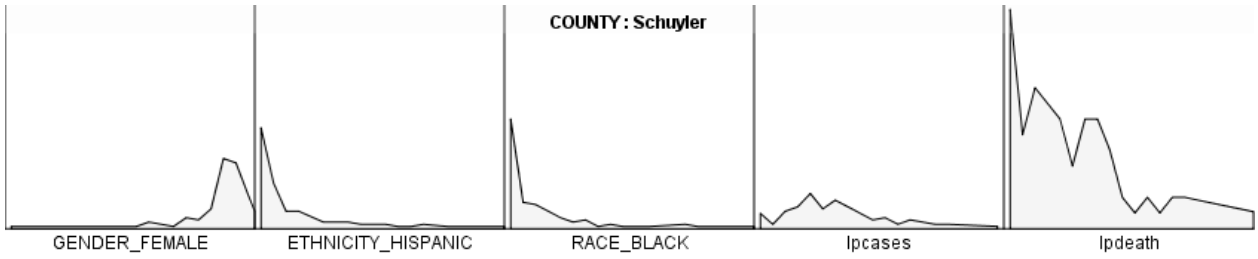
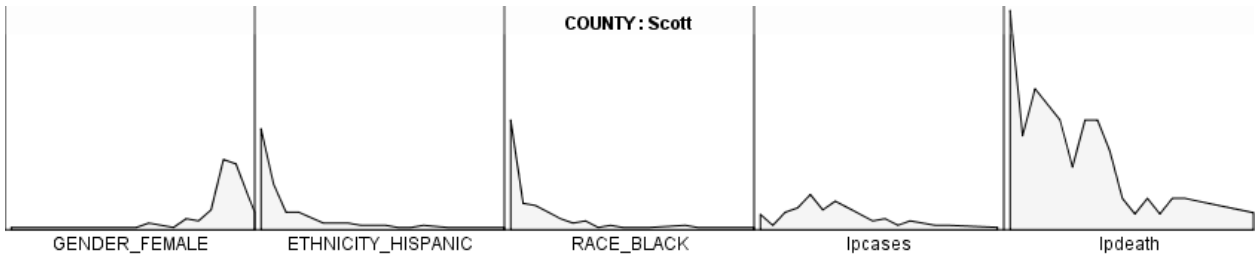
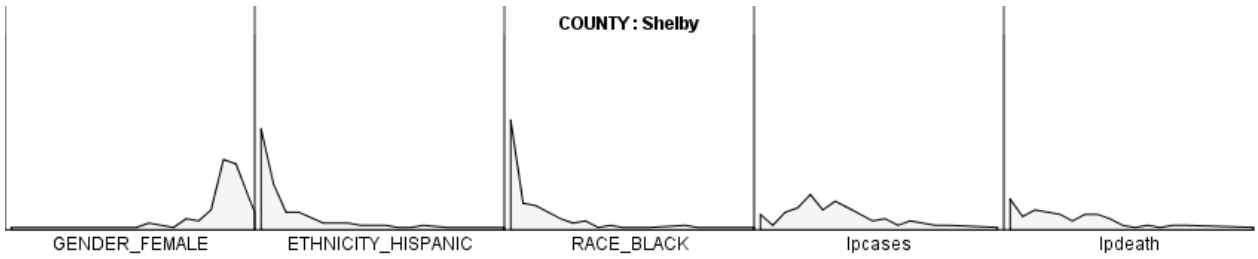
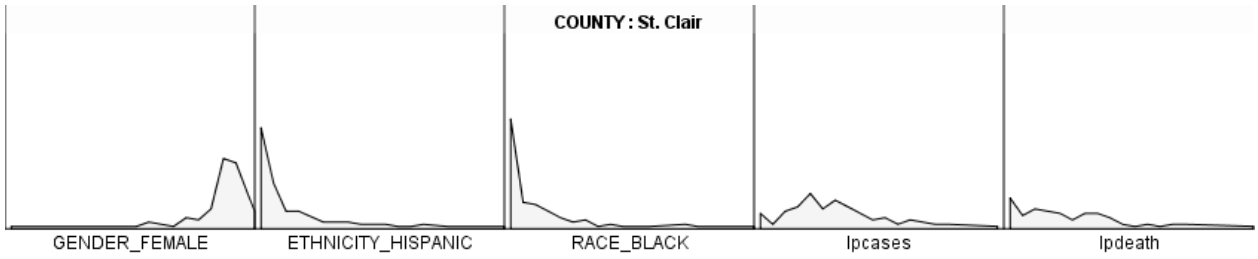
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath


COUNTY : Schuyler
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath


COUNTY : Scott
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath


COUNTY : Shelby
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath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GENDER_FEMALE
ETHNICITY_HISPANIC
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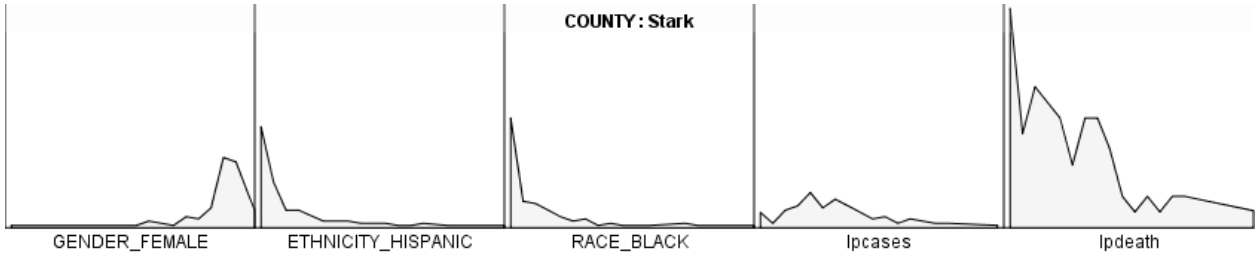
lpcases
lpdeath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GENDER_FEMALE
ETHNICITY_HISPANIC
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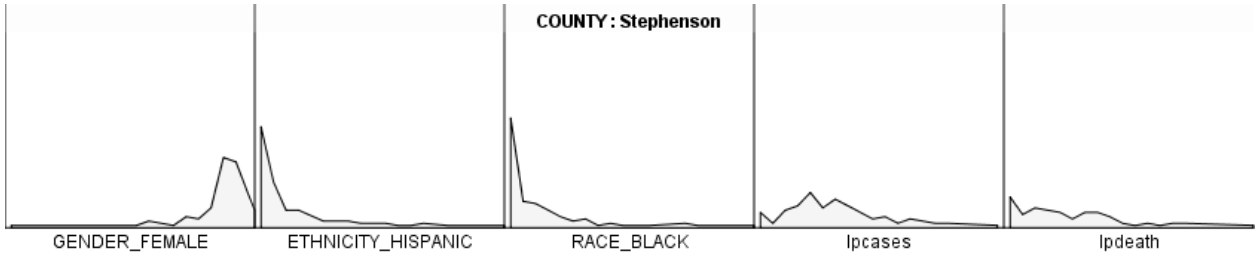
lpdeath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GENDER_FEMALE
ETHNICITY_HISPANIC
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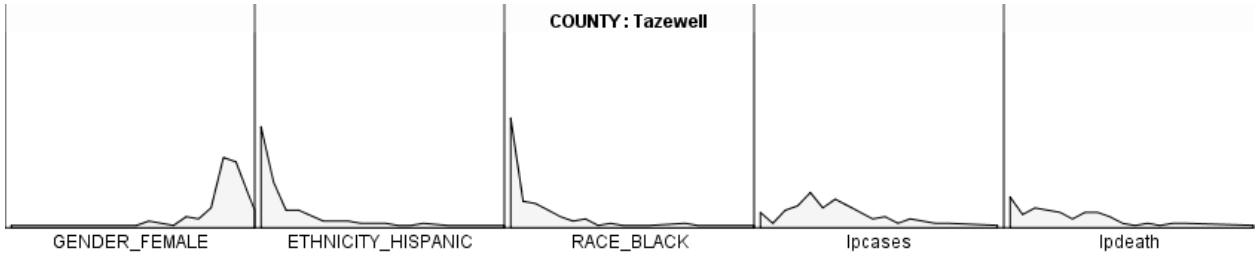
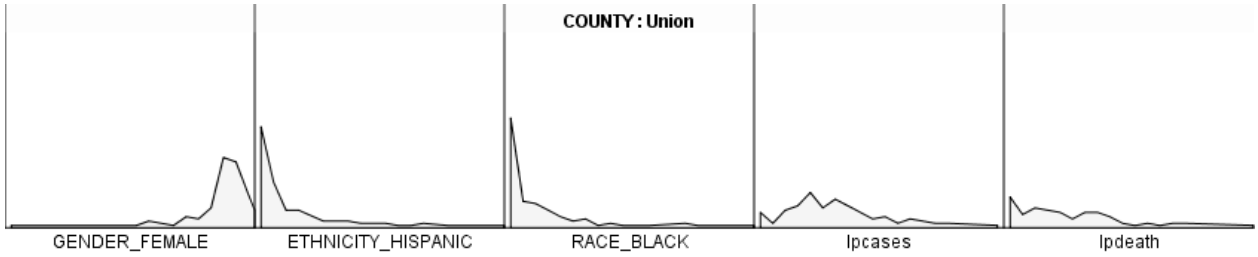
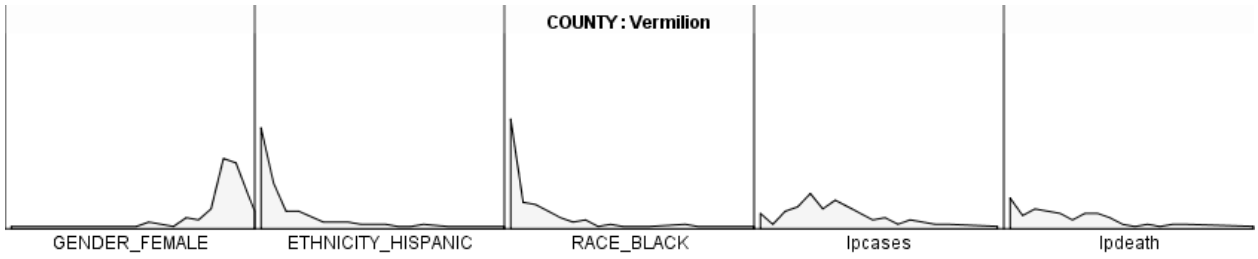
lpdeath


COUNTY : Tazewell
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath


COUNTY : Union
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath


COUNTY : Vermilion
GENDER_FEMALE
ETHNICITY_HISPANIC
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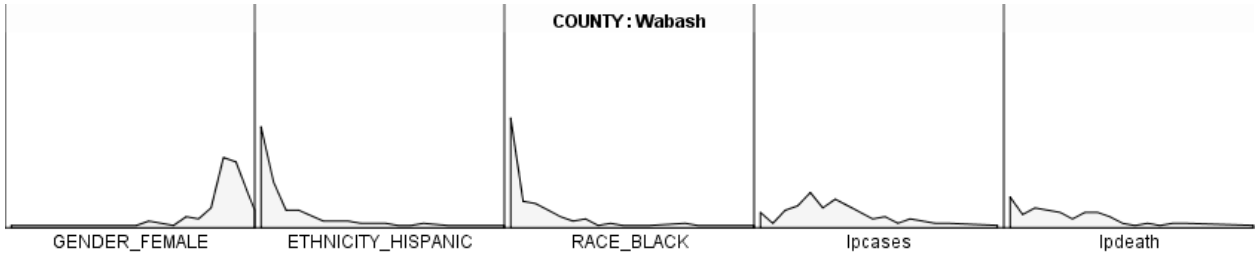
lpcases
lpdeath


COUNTY : Wabash
GENDER_FEMALE
ETHNICITY_HISPANIC
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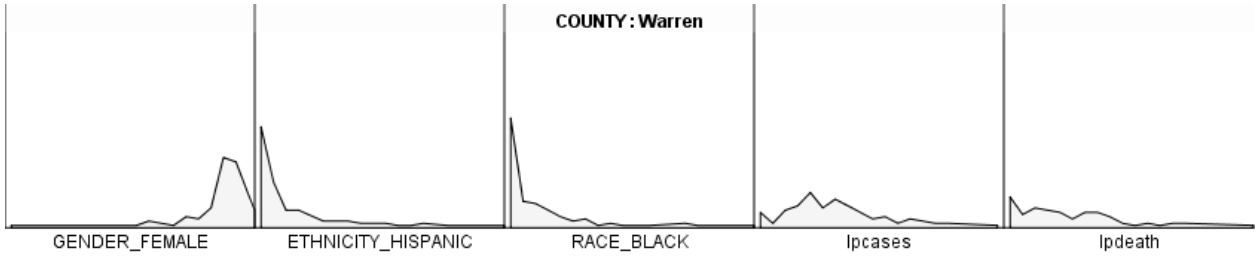
lpcases
lpdeath


COUNTY : Warren
GENDER_FEMALE
ETHNICITY_HISPANIC
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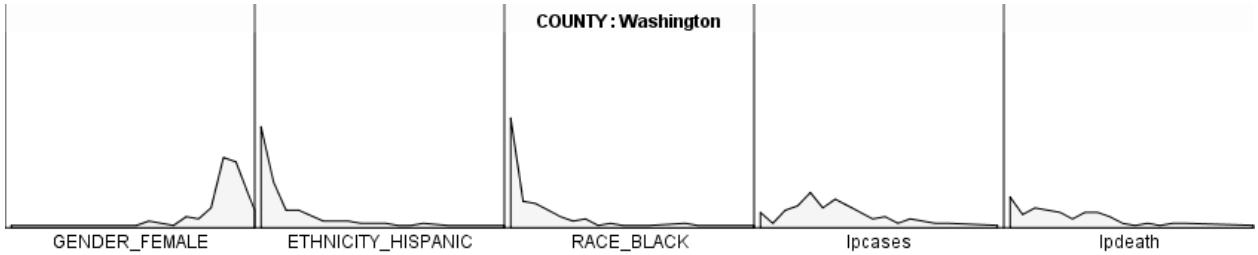
lpdeath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GENDER_FEMALE
ETHNICITY_HISPANIC
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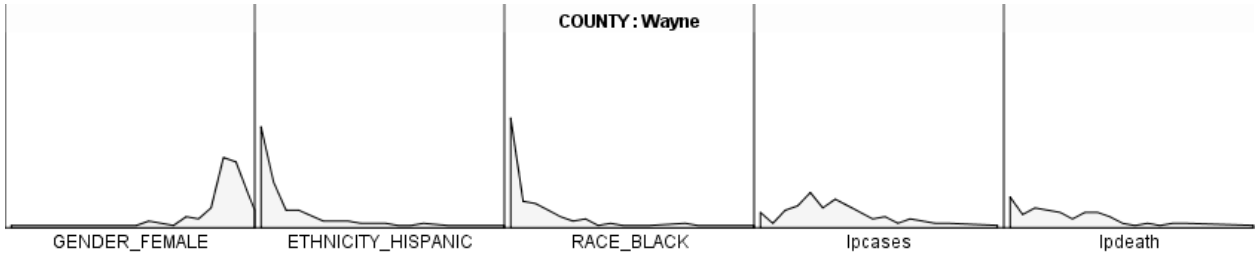
lpdeath


COUNTY : Wayne
GENDER_FEMALE
ETHNICITY_HISPANIC
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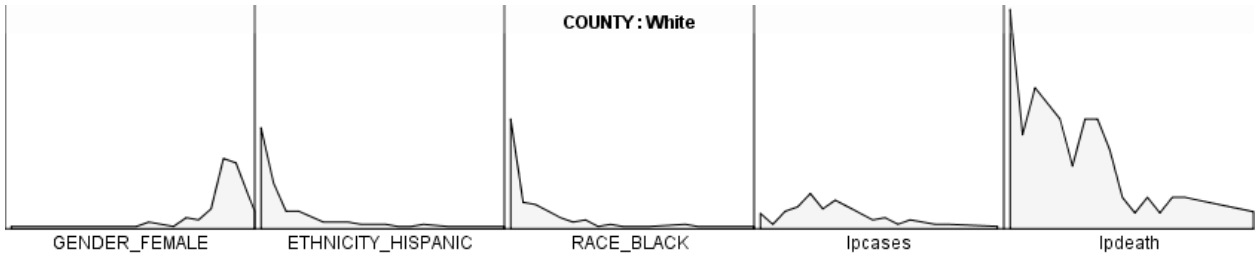
lpdeath


COUNTY : White
GENDER_FEMALE
ETHNICITY_HISPANIC
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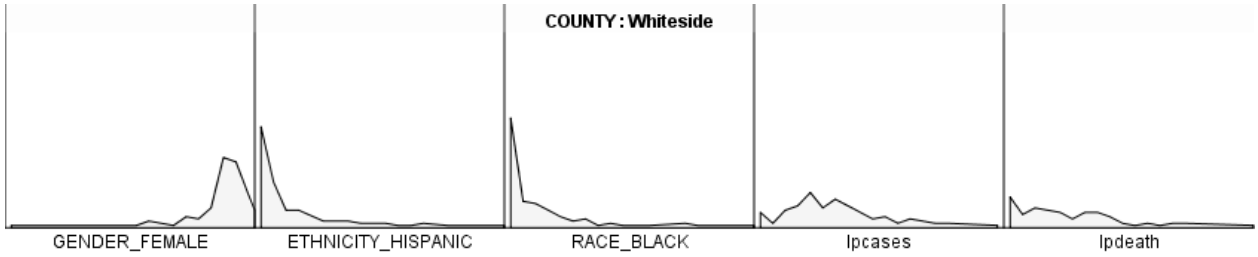
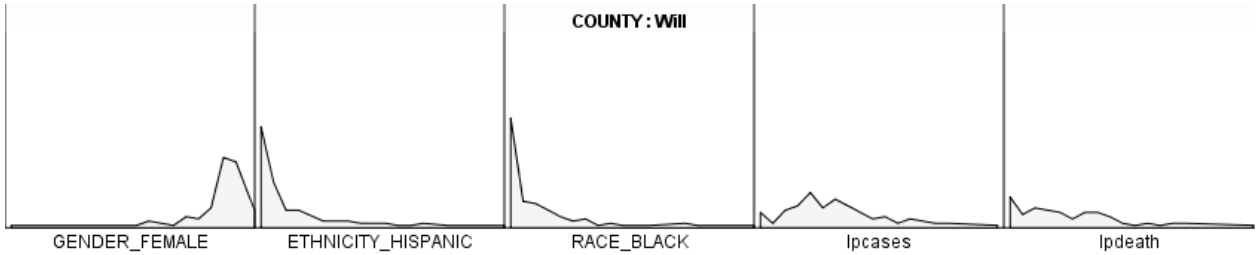
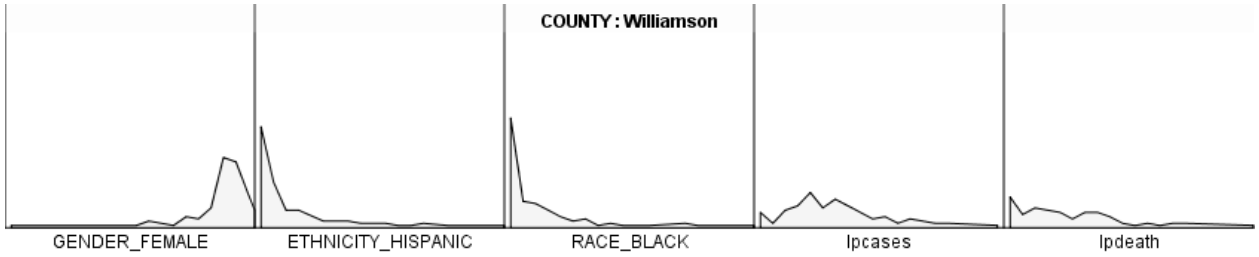
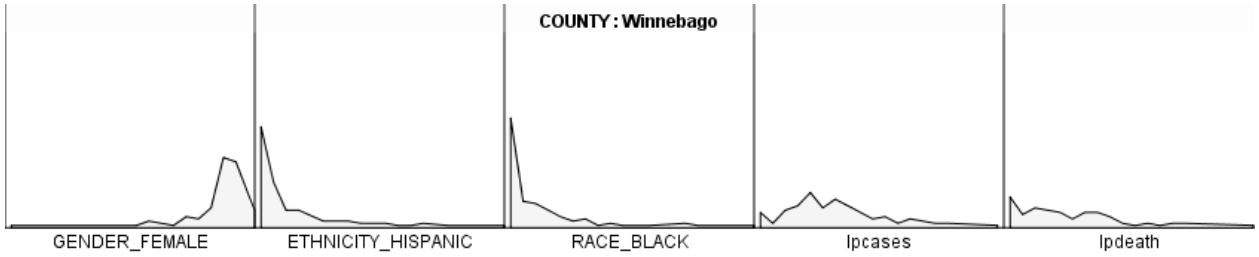
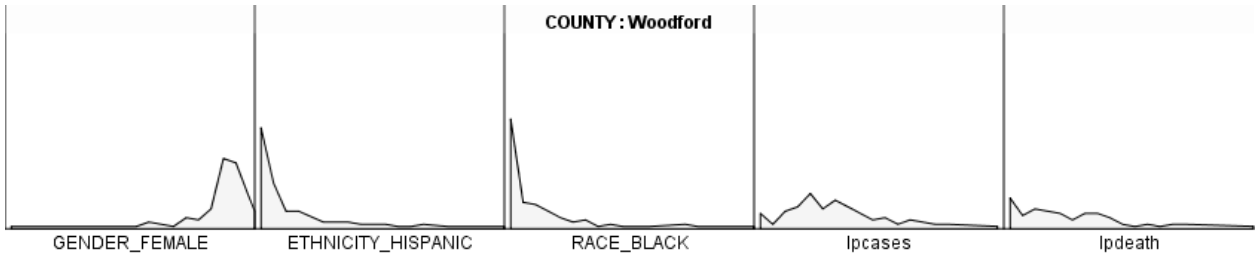
lpdeath


COUNTY : Whiteside
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath


COUNTY : Will
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath


COUNTY : Williamson
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath


COUNTY : Winnebago
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath


COUNTY : Woodford
GENDER_FEMALE
ETHNICITY_HISPANIC
RACE_BLACK
lpcases
lpdeath

APPENDIX C

IRB APPROVAL LETTER

GEORGIA SOUTHERN UNIVERSITY
RESEARCH INTEGRITY

Institutional Review Board (IRB)
Veazey Hall 3000
PO Box 8005 • STATESBORO, GA 30460
Phone: 912-478-5465
Fax: 912-478-0719
IRB@GeorgiaSouthern.edu

To:	Boone, Gloria; Shah, Gulzar
From:	Eleanor Haynes, Director, Research Integrity
Approval Date:	11/13/2020
Subject:	Institutional Review Board Exemption Determination - Limited Review

Your proposed research project numbered **H21142,** and titled **"The Association of Demographic Characteristics and Social Vulnerability with COVID - 19 Outcomes."** involves activities that do not require full approval by the Institutional Review Board (IRB) according to federal guidelines.

According to the Code of Federal Regulations Title 45 Part 46, your research protocol is determined to be exempt from full review under the following exemption category(s):

Exemption 4 Secondary research uses of identifiable private information or identifiable biospecimens, if at least one of the following criteria is met: The identifiable private information or identifiable biospecimens are publicly available; Information, which may include information about biospecimens, is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained directly or through identifiers linked to the subjects, the investigator does not contact the subjects, and the investigator will not re-identify subjects.

Any data use agreement or agreement change required by the data owner must be supplied to the IRB prior to execution for review. This approval is contingent upon researcher compliance with the conditions of the data use agreement (where required) and current institutional data security policy.

Any alteration in the terms or conditions of your involvement may alter this approval. *Therefore, as authorized in the Federal Policy for the Protection of Human Subjects, I am pleased to notify you that your research, as submitted, is exempt from IRB Review. No further action or IRB oversight is required, as long as the project remains the same. If you alter the project, it is your responsibility to notify the IRB and acquire a new determination of exemption. Because this project was determined to be exempt from further IRB oversight, this project does not require an expiration date.*