EFFECTS OF RACIAL AND ETHNIC BACKGROUND ON MATERNAL HEALTH IN THE U.S.

Carissa Villanueva
Faculty Mentor: Dr. Mary Vermilion, Ph.D.
Saint Louis University

Abstract
This research project aims to look both qualitatively and quantitatively at maternal care and maternal mortality in the American healthcare system, specifically examining the relationship between racial and ethnic background, quality of care, and fatalities. For the quantitative research, data regarding births, maternal deaths, and demographic information of the mothers was collected from individual states in America. The data was analyzed, using statistical software, to examine different relationships between race, ethnicity, and maternal death. For the qualitative research, information regarding social infrastructure that may contribute to poor maternal health, such as access to insurance and familial wealth, is also considered, and examines the differences between ethnic groups in regard to these social factors. The project will explore some ways in which demographics affect maternal health in America statistically, and examine some of the social and medical aspects that are likely to be contributing factors to maternal health disparities and the high rate of maternal mortality in the United States.

Qualitative Section

Introduction

In recent years, there has been renewed interest and cause for alarm regarding the American healthcare system, and in recent months in particular there has been concern over the low ranking of the United States in terms of maternal care, especially regarding maternal mortality. Maternal mortality is most commonly defined as the death of a woman while pregnant, during birth, or within the first 12 months after giving birth. Internationally, there has been an extensive history of difficulty in tracking maternal deaths, though death in childbirth has long been known to often be the leading cause of death for women of childbearing age. While death during childbirth has decreased considerably with the advent of modern medicine, there are still vast discrepancies between death rates in higher income countries versus lower income countries. Though it is these intercountry discrepancies that are often highlighted in studies, within individual nations there also often exist very drastic discrepancies, specifically along ethnic and socioeconomic lines.

This past year, the United has come under fire, primarily from its own citizens, for the increase in maternal mortality, placing the U.S. far lower than most high-income nations, such as Canada and Norway. At the same time, narratives discussing the negative experiences of women of color have increased, including prominent figures, such as renowned athlete Serena Williams, who had a complication after the birth of her child that led to blood clots in her arteries that almost killed her. In the United States, the Center for Disease Control (CDC) has determined that black women are three times more likely to die from a complication with childbirth than white women.

Along with these issues in the healthcare system, there has also been a change in the

demographics of mothers in America. The change most commented on is the increasing age of mothers, both first time mothers as well as with later births. More and more women are putting off having children, often citing career advancement or financial stability as a factor. This means an increasing number of women are having children into their 30s or 40s, which often increases the risk of complications surrounding pregnancy. There has also been talk of how the opioid crisis is affecting young women and mothers, particularly in rural and predominantly white areas of the country. There is a fear that opioids are making pregnancy riskier, both for mother and child, and these deaths contribute to the rising numbers.

The trend that I am interested in, however, is the demographic shift that is sweeping across America. There has been much apprehension following the revelation of the fact that the demographics of the United States are predicted to radically shift in the upcoming decades. By approximately 2040-2050, or mid-century, white Americans will make up less than 50 percent of the population (Pew Research Center) and, if current growth rates continue, by the end of the 21st century Hispanic/Latino Americans will be the majority. While the population at large is left to ponder these approaching trends and what they mean, in the delivery rooms of America these demographics are not approaching trends, but the current norms. According to some of the most recent estimates, white babies constituted fewer than half the babies born in 2013; however, this has been long in the making as today only 51 percent of Americans under the age of 18 are white (Cohn 2016).

These demographic changes have been of interest to researchers and examined thoroughly. However, there has been limited examination of the intersection of these trends. My research attempts to explore the possibility that these trends not only correlate, but interact and drive each other. So far, there has been the general assumption that the healthcare system has been getting worse across the board, not only for one particular group, but for the whole nation. I am looking into the possibility that is it not entirely due to the worsening of healthcare, in general, but to the changing demographics driving up the maternal death rate in our country. It is understood that women of color in this country are more likely to receive less than adequate care than their white counterparts. There is the possibility that everyone is receiving the same level of care they would have ten or fifteen years ago, yet as white women become a smaller portion of the women giving birth, the plight of women of color, especially black women become more pronounced and notable in the national averages.

Statement of purpose

The goal of this research is to examine maternal healthcare in the United States through the lens of racial and ethnic disparities as well as to examine the effects. The aim is to explore possible correlations between the changing demographics of mothers to the gap in American healthcare in relation to other developed nations. It will also investigate some possible cultural causes for the high maternal death rates in the United States over all as well as specific demographics, such as disparities in access to healthcare and pre-existing conditions. It will also attempt to look at the intersectionality of these factors and what happens when they compound.

Literature Review

Prenatal health and pre-existing conditions
There are several pre-existing health conditions, that have been exacerbated by demographic differences. The first notable one is the opioid crisis. These health complications, often associated with an addiction to opioids, are impacting specific communities more than others. The fast majority of cases related to opioids and pregnancy complications are occurring in rural, predominantly white, and low socio-economic backgrounds. There have been some claims and studies suggesting that the opioid crisis might be having an effect on the increasing maternal mortality rate, prompting some states to examine this (Texas Health and Human Services). However, for the purposes of this research this line of examination is not particularly useful. It has been shown that white Americans disproportionately suffer from opioid abuse, and opioid related deaths (Center for Disease Control). Thus, the opioid crisis if anything, may appear to close the gap between minorities and white women's death rates in the U.S., though for this reason it is possible that the gap is even larger than previously observed.

One important concept that has to be discussed in order to understand some if this information is the Hispanic Paradox. While the topic is a heated point of contention among many researchers it cannot be discounted, especially when it comes to birth. The Hispanic Paradox refers to the unusual data which shows that, despite more health risks, less access to healthcare, and generally lower socio-economic status, Hispanics (or Latinos) frequently have better health outcomes than their white counterparts. While there have been many studies and suggestions to ascertain why this is, from lower rates of smoking to higher community support systems, there has yet to be a definitive answer as to the factors behind these trends. These trends are pronounced in maternal mortality. Hispanics/Latinos are at a increased rate of obesity and of having type 2 diabetes, yet still seem to have death rates comparable to their typically healthier white counterparts.

Even with this confounding variable of the rising Hispanic/Latino population, it is important to examine the effects and discrepancies of pre-existing condition in the United States. Recent research indicates there has been a noticeable increase in pre-existing conditions that raise the chances of negative side effects and health issues for mothers and children (Admon 2017). These have been particularly marked in women from the lowest income quartile and from rural areas, as well as from mothers whose insurance plan is Medicaid.

These pre-existing conditions (e.g. asthma, hypertension, substance abuse and diabetes) had seen a sharp rise between 2006 and 2014. In the same time frame the number of white mothers decreased, from approximately 56 percent to 49 percent, while the number of Hispanic mothers increased, from around 20 percent to 24 percent, and most other groups stayed relatively unchanged (US Census Bureau). Black and Latino communities, especially women, tend to have higher rates of some of these conditions such as diabetes, hypertension, and poorly controlled asthma.

While a lower income has long been linked to worse healthcare, including having a higher risk of death (Marmot 2002) or a negative perception of health (Hero 2017), this has been especially pronounced in the United States. This is a factor that is being compounded in maternity wards because of

demographic changes. As of 2016, black Americans had a median household income of $39,000, Latinos $48,000, whites had $65,000 (US Census Bureau). These numbers mean a greater portion of black and Latino families fall in the lower half and lowest quartile of income than their white counterparts. Thus, an increased share of women giving birth will be doing so within the context of lower wages and less wealth than before.

There is also a real wealth disparity in American families. Wealth is monetary value the family has saved or stored in assets such as real estate and vehicles. The 2008 recession hit all American families hard, particularly in the lower- and middle-income brackets. While most families have seen a resurgence of wealth, it has not been equal across racial and ethnic groups. Black and Latino families in both the middle- and lower-income ranges have seen themselves fall behind their white counterparts. In both groups, Latino families on average have one third and black families one fourth of the wealth of white families of equal income (Pew Research Center). This leads to particularly pronounced differences: middle income black families have wealth of around $38,000 while white middle income families have $155,000 in wealth. This difference in available funds influences what kind of care families are able to procure for pregnant women or mothers when there are complications during or after delivery, or even whether they can afford quality prenatal care.

About half of all pregnancies in this country are unplanned, with poor women now five times more likely than higher-income women to have an unplanned pregnancy, and six times more likely to have an unplanned birth (Guttmacher Institute). Given the economic disparities previously discussed, it is reasonable to say many of the unplanned births are occurring to minority mothers. Unplanned pregnancies add risks for mother and child, such as lower rates of early neonatal care for either, because the woman does not know she is pregnant, and the high likelihood that the family is not financially prepared to expand.

There is also a continuing disparity between rates of teenage pregnancy in different communities. In the past two decades, there have been gains in decreasing teenage pregnancy, with a nationwide total decline of about 60% (Pew research center). While most groups experienced a drop very close to this, these drops did not correlate with equal number of births by racial or ethnic group. Within the teenage group, (defined as 15-19), Latina girls had a rate of 42 births per 100,000, compared to white teens whose rate was 19 per 100,000. Teen pregnancy is almost always unplanned and can pose serious health risks. The most common issues in teen pregnancy are anemia, increased risk of hypertension, the risk of the baby's head being larger than the pelvic opening, an issue more prevalent in teenage pregnancy (americanpregnancy.org). These risks combined with the differences in rate of occurrence, are most certainly a factor in the overall higher rates of maternal mortality and morbidity between racial and ethnic groups in this country.

Insurance

The American healthcare system is notoriously expensive and places much of the expense on the patient or their family. It is for this reason that insurance is so vital to American families and the outcome of their healthcare. Even so, many in America do not have healthcare, are underinsured, or pay steep premiums to maintain their coverage. Minorities have had lower rates of being insured. Even with the creation of the

Affordable Care Act (ACA or Obamacare), minorities particularly Latinos remain significantly under insured. Even today about 22 percent of Latinos are uninsured (U.S. Census); however, the number of Latino children uninsured is significantly lower, at around 8 percent, still twice as high as white children at 4 percent.

This lack of insurance affects where individuals can seek treatment, and the quality of treatment they can access. It is also necessary to examine the types of insurance to which different groups may have access. When the ACA went into effect, it had a serious impact on filling gaps in insurance in minority communities. For Latinos, its implementations saw 4 million additional people insured, in the black community it was an additional 1.8 million, and Asian-Americans saw their uninsured rate drop from 15 percent down to just 7 percent. These are strong and important gains for coverage in America; however, this coverage is not equal, because an unequal number of minority individuals and families are covered under Medicaid.

It is important to note that since the implementation of the ACA act, it is now required that women have healthcare for pregnancy included in standard insurance packages. Prior to this it was not required that insurance companies provide this kind of insurance and pregnancy was even treated as a pre-existing condition, and could be a reason for insurance companies not to cover women who were or had been pregnant. Even with these improvements there has not been a standardization of insurance and the coverage that Medicaid will offer differs between states.

"Because there is no formal federal definition of what services states must cover for pregnant women beyond inpatient and outpatient hospital care, states have considerable discretion to determine the specific scope of maternity care benefits" (Kaiser Family Foundation). Because of the broad scope of coverage that can meet this definition, not all states or individuals have equivalent access. In a large study of states and Medicaid data, it was found that 45% of all births were covered by Medicaid in 2010 (Markus, 2013) and that number has most likely been going up since. "Most, but not all, of the 41 surveyed states report that they cover basic prenatal services such as ultrasounds and vitamins, prenatal genetic testing, home visits, delivery in birth centers, postpartum visits, and breast pumps for nursing mothers" (Gifford, 2017). Overall many programs do make a concerted effort to provide comprehensive services to mothers, though when it comes to unexpected complications that lead to maternal mortality or morbidity, there is significantly less information or preparation.

Hospitalization

In analyzing previous studies on racial differences in medicine it appears unlikely that the majority of discrepancies in numbers of deaths are simply prejudice from individual hospitals or providers, but something more systemic. It has been shown that minority groups often have worse health outcomes, even when in the same or very similar situations to white Americans (Maddox, 2017). It has also been shown that many minority groups disproportionately have pre-existing conditions that might make a pregnancy riskier, such as diabetes (Spanakis, 2013) or heart disease (Kurian, 2007). It is for these reasons that it is important to examine pre-existing conditions or predisposition to health issues as a factor in different mortality rates. The main causes of maternal death, though varying slightly in percentages between states and over time, were cardiovascular diseases, non-

cardiovascular diseases, cardiomyopathy, thrombotic pulmonary embolism, infection, hemorrhaging, or a hypertensive disorder. In any given woman, developing any one of these issues is a major risk, and some populations are at an increased risk for development; however, even with those heightened risks outcomes are not as expected.

The leading causes of death and complications come from cardiovascular disease and issues associated with it. This is most certainly a strong factor in disparities because minorities, and more specifically African Americans, are disproportionately at risk for these issues. "Cardiovascular diseases are the leading cause of death in the United States, and disproportionate rates are seen in racial and ethnic minority populations" (Cardadelli, 2007).

Hemorrhaging and infection or sepsis, together account for approximately 1 out of 5 deaths (CDC), and these are risks which are heavily associated with also having Cesarean delivery. It has been shown that in the United States black women are consistently more likely to have their child/children delivered via Cesarean section. They are also particularly more likely to have unplanned Cesarean sections. Both black and Asian American women are about 20% more likely to have a C-section than white women (Getahun, 2009). Having C-sections is riskier and often causes a longer healing time, and increasing risks of not waiting long enough before restarting normal activity.

The reason all these factors are important is because minority women have higher rates of maternal morbidity even when they do not die. It is estimated that for every instance of maternal mortality there are 100 cases of maternal morbidity, defined as a life risking complication (which does not necessarily result in death) (Callaghan, 2003). There is also a clear correlation with minority women, particularly black women, experiencing these instances at a much higher rate than the rest of the population. A particularly poignant study found that institutions that predominantly serve black women have significantly higher rates of maternal morbidity per 100,000 women.

Discussion

Patterns

Overall it was observed that pre-existing circumstances and conditions by their very nature were contributing to disparities. Many of these risks were compounding in minority communities before women had even conceived their children. The economic gap is widening between the poorest and richest Americans, as well as increasing drastically between white and non-white families. Diminished financial security has been linked to worse health outcomes and, as the minority population shifts to the majority, these issues will exacerbate the frequency of negative maternal health outcomes.

The Hispanic Paradox did have significant effects on outcomes. While many of the pre-existing social and health conditions were similar in both black and Latino communities, Latinos routinely fared better in mortality rates, even when both groups had high rates of morbidity. There is also significant room in this field to try and examine differences within the Latino community. Though I did not have much time to dwell on the disparities, I did note that in the New York City Maternal Morbidity report the Latina mothers were split into different groups and those that were likely to have a darker complexion, or

more likely to identify as racial black tended to see worse outcomes.

There were also a host of issues which, while appearing more prominently in communities of color are also affecting white mothers and will most likely become more apparent in the near future. The issue of abnormally high rates of Cesarean delivery in the U.S which, by nature of being an invasive surgery, includes higher risks is most prominent in black mothers, but does affect everyone. In examining the high economic disparities and rates of unintended pregnancy in different socioeconomic groups as mentioned, it is also evident that white mothers with lower socioeconomic backgrounds are also experiencing an increase of mortality inducing issues.

All in all, mothers with pre-existing conditions, be it biological, financial, or socially related are becoming the new norm rather than outliers. The American healthcare system needs to prepare and train for the prevalence of pre-existing conditions in mothers across the nation.

Critique of Sources

One of the largest difficulties in looking at the discrepancies between different groups in the United States is the way demographic data is collected. Because race is a social construct, there is no way to definitively place anyone into one category. In most cases, racial identity is collected by self-identification, which even in the best of cases is not always fully clear. In a country like the United States, which has been a hotbed of ethnic mixing, very few people are truly one "race." However, because this study is looking at social rather than medical interactions, "race" is more useful because it is more linked to the experiences people are likely to have within the medical world, beyond simply biology, especially in a society that is racially coded.

A significant problem in examining the demographic discrepancies is the rise of Latino/Hispanic Americans. American society is very racially oriented, and the differences and distinctions between racial groups is often emphasized and Latino/Hispanic Americans pose a problem to these strict divisions and fluctuation in the data. Because Hispanic/Latino is classified as an ethnic group, this means that the person is allowed to mark this category as well as any other racial group they want which can skew results. There is an issue of what race Hispanics/Latinos would mark, as many are a combination of European, African, and Native American ancestors. Many Hispanics/Latinos also will opt to not mark any race at all, feeling they do not align with any option.

Within the Hispanic/Latino group, there is also a wide range of racial differences which often go unexamined. For example, women who are Afro-Latino (black and Latino) are most likely going to have worse mortality statistics than Latinos that identify as racially white, but there is very little data regarding this because they are either combined by ethnicity or divided by race. There is also the issue of discrimination in treatment or the relevance of pre-existing condition when some locations do not differentiate by this ethnic distinction.

There is also a change in the classification of Hispanics/Latinos, the term being used as an umbrella definition only gaining popularity in the mid-twentieth century and is still evolving. More frequently, it is being used as a racial classification both by internal structures as well as by individuals. Many people will only mark the ethnic category or opt to mark 'other' on the racial category.

Many states will only record data from its most populous groups. For example, a state like Georgia whose population has long been primarily made up of only white and black citizens may not properly record information on its Asian or Hispanic/Latino citizens, despite the fact that these two groups are the fastest growing populations in the United States. While on the other hand, states like Arizona will record information on white, Latino and Native Americans, yet place black mothers into the "other" category. Most states in fact have an "other" category, yet very few expand on who this other category is representing, and often the people in this category vary from region to region.

Another racial group that is causing confusion is Asian Americans. In the past few years, Asian Americans have surpassed Latinos in terms of birth rate, and are becoming an ever-increasing share of mothers and children throughout the United states, yet many states still place them in an "other" category.

Quantitative Section

Introduction

The aim of the quantitative section was to compare how demographic changes might affect maternal mortality. While it is most certainly true that over the past decades there has been an increase in maternal mortality, at the same time there has been a demographic shift in many states to having more babies and mothers who are minorities. The main goal was to see if there appeared to be any correlation between the two trends.

Methods

Data Collection

For this research, following a trend of many other articles and reports, I have opted to exclude the data of California and Texas. While this most certainly raises an issue in terms of examining Latino trends, Texas and California being the two states with the most Latinos, the data in these states is difficult to draw into the equation. California, to its benefit, has seen a vast improvement over the past decade, with decreases in maternal mortality, contrary to that of the rest of the United States, so would not make a good option to show trends. The other state being left out is Texas. Texas recently made headlines about having an extremely high rate of maternal mortality. However, there have been a host of articles that have come out criticizing the data collection methods and have revised the data resulting in several different conclusions. Ultimately, this conflicting data makes Texas's data even more unreliable than most, to the point of being too convoluted to be useful.

In 2003, the United States created a new small questionnaire on death certificates to attempt to better collect data on maternal mortality. It provides a check box asking if the deceased woman was pregnant within 42 days before death, or within a year before death. This idea was submitted because prior to this many states had differing systems or did not have any pregnancy related question. However, there were some difficulties surrounding this new question, because many states did not immediately adopt it (Declercq, 2017). Part of the increase in maternal mortality in the U.S. was due in part to this improved collection method. This is also part of the reason the CDC decided to not put out yearly reports because, as this question was implemented over the past decade, many states began to

have drastically different rates of mortality. In an attempt to mitigate these discrepancies, I chose states all of which had implemented this question within a certain time range, in an attempt to keep the data jumps in certain year groups.

I collected data from the CDC's Wonder tool. It provides data on the number of maternal deaths, broken down by both race and Hispanic origin. It also has the record of births in an individual state or group of states. Although we have high rates of maternal mortality, due to a relatively limited population size, death from a pregnancy-related cause is actually numerically small. When numbers are small they create unstable statistical analysis, and become unreliable. In order to have large enough numbers to be useful I collected data combined from several years, using Wonder's system. These numerical gaps were either 3 or 4 years, because unfortunately the years were not easily divisible by 4. Fortunately for this project, I was examining rates and percentages, so the numerical differences between 3 and 4 years was mostly canceled out.

I initially began with 27 states and the District of Columbia, that had implemented the new pregnancy question between 2003 and 2009. These states were Arkansas, Connecticut, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Kansas, Michigan, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, South Dakota, Utah, Washington, Wyoming, and Washington D.C. Within these states, some had too few births and deaths to be used for analysis, and so were removed. These states included Delaware, New Hampshire, North Dakota, Rhode Island, South Dakota, Wyoming, and Washington D.C. This brought my number of states down to 21, just a few below half of the U.S. geographically. However, even using these methods rates of mortality still demonstrated a very large range between states.

The year ranges I used were 1999-2002, 2003-2006, 2007-2009, 2010-2013, 2013-2016. The first two were provided that way by Wonder because natality was separated into three pages, 1995-2002, 2003-2006, and 2007-2016. While the differences in number of years between categories make plain numerical comparison difficult, this project aims to examine the information by percentages and rates, so the differences numerically should be generally mitigated by this.

Then, using the CDC WONDER system, data from each state was pulled in each subsection of years. The data consisted of the individual number of women whose cause of death was linked to a pregnancy related issue, individual number of births, and the demographic breakdowns of both groups. The rate of maternal mortality was calculated per 100,000 women by dividing the number of deaths by the number of births. This was broken down into the categories of overall death per 100,000 by white, black, Latino, Asian, and Native American, though it is important to note that because of a lack of data Asian and Native American, rates of mortality were not used for analytical purposes. The other categories calculated were the percentage of babies born from each group, and finally the difference between the rate of mortality between black and white women in each state.

Data Analysis

The primary method of analysis was comparison of categories and linear regression models to examine their

correlation. The methodology was fairly straight forward. Using the programing tool Rstudio the different categories previously mentioned (such as percent of mothers who were white, the rate of mortality for Latino mothers), were compared to examine possible links between demographics and different outcomes. The base R-code used to create these models and their linear regressions is shown below.

```
ggplot(data = cdcdata2) +
geom_point(mapping = aes(y =  ________,
x = ________, color = state))+
geom_smooth(method = lm, aes( y =
______ , x =  ________))
```

After graphing the different combinations, the summary statistics were pulled, with the intercepts, slope, and deviations. This was done by assigning the linear regression data of one of the comparisons to a shorter call name, Mod1 through Mod13, and then the summary was examined. A sample of code for this method is shown below, and the summary statistics are included with the graphs of all the different models.

```
> mod7 <- lm( Overall.Death.Rate ~
percent.latino , data = cdcdata2)
> summary(mod7)
```

The summary then produces important statistical numbers related to the linear regression, the most important for this use being *Coefficient - Pr(>t), r-squared, and the F-statistic.*

The *Coefficient - Pr(>t)* is important because it allows us to reject the null hypothesis, which in all cases would be the idea that the two variables are unrelated. This is looking to see if what we observed could be random or just a coincidence. It is generally accepted to say that less than 5 percent, .05, is a good judge to say the connection is not due to chance.

R-squared is important because it displays how correlated all the data points are to the line of regression, so the higher the number the better the data fits the line. In essence, it is examining the percent of variance in one variable that can be explained by the other variable. Thus, the closer to 1 the better.

The F-statistic again looks at how good of an indicator of how well the predictor variable (x-axis) is at affecting the response variable (y-axis) the higher the number the better. The F-statistics should be greater than 1 to determine if we can reject the null hypothesis (which is always that there is no relation between the variables.

Results

The graphs were created using the code above in Rstudio, with the tool ggplot. Each state was given an individual color, however data between years was not emphasized on the graph for purposes of clarity. Below is the color chart for each different state. They are included here and not next to each graph for organization purposes.

Figure 1: Cities Color Chart

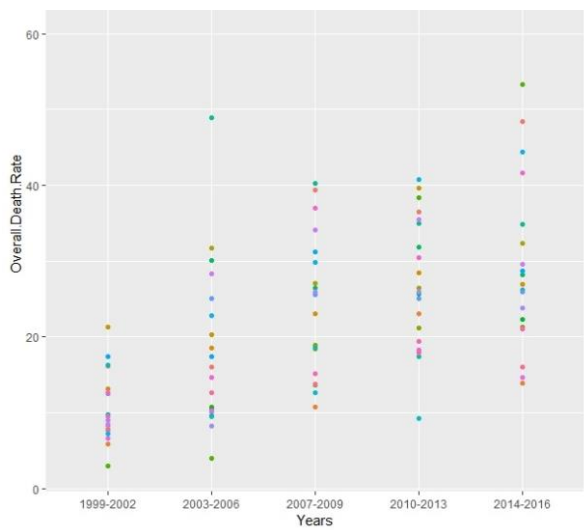

Figure 2: Overall Death Rate per 100,000 births by Year. This figure easily displays how in general the rate of death in the different states has appeared to "increase" as data collection methods have become more accurate. Unfortunately for an unknown reason the linear regression models would not run on this model.
Coefficients: Estimate Std. Error t value Pr(>|t|)
(Intercept) 15.5511 4.9150 3.164 0.00217 *
White.Death.Rate 0.9813 0.2071 4.738 8.7e-06 *
Residual standard error: 23.36 on 84 degrees of freedom(16 observations deleted due to missingness)
Multiple R-squared: 0.2109,
Adjusted R-squared: 0.2015
F-statistic:22.45 on 1 and 84 DF,p-value: 8.703e-06

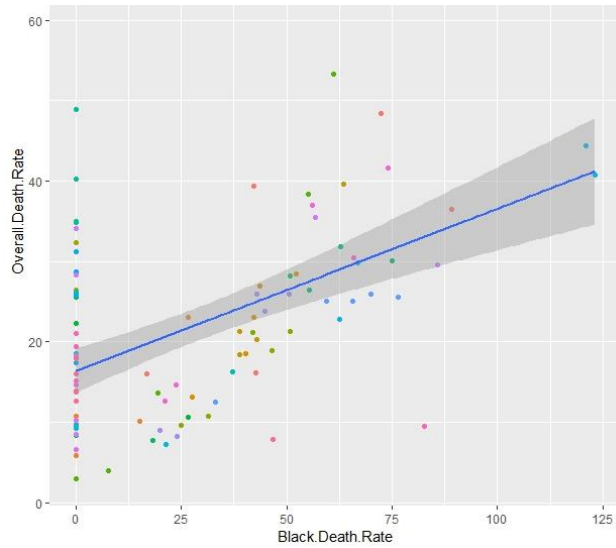

Figure 3: Rate of Overall Mortality vs Rate of White Mortality
Coefficients: Estimate Std. Error t value Pr(>|t|)
(Intercept) 16.35509 1.41022 11.598 < 2e-16 **
Black.Death.Rate 0.20179 0.03346 6.031 2.88e-08 **
Residual standard error: 10.38 on 98 degrees of freedom (2 observations deleted due to missingness)
Multiple R-squared: 0.2707, Adjusted R squared: 0.2633
F-statistic: 36.38 on 1 and 98 DF, p-value: 2.884e-08

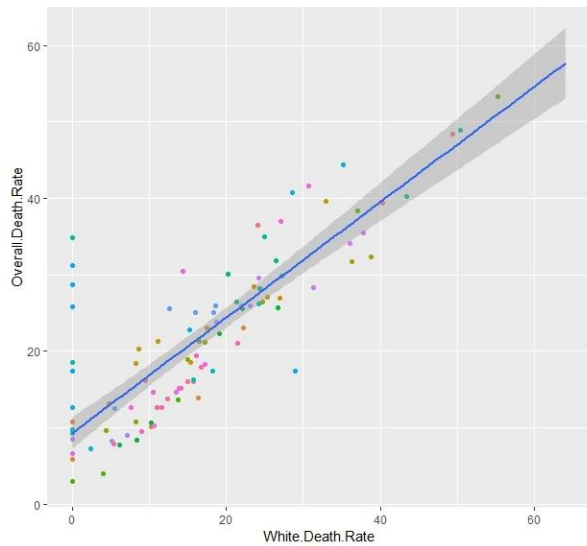

Figure 4: Rate of Overall Mortality vs Rate of Black Mortality
Coefficients: Estimate Std. Error t value Pr(>|t|)
(Intercept) 16.35509 1.41022 11.598 < 2e-16 **
Black.Death.Rate 0.20179 0.03346 6.031 2.88e-08 **
Residual standard error: 10.38 on 98 degrees of freedom (2 observations deleted due to missingness)
Multiple R-squared: 0.2707, Adjusted R-squared: 0.2633
F-statistic: 36.38 on 1 and 98 DF, p-value: 2.884e-08

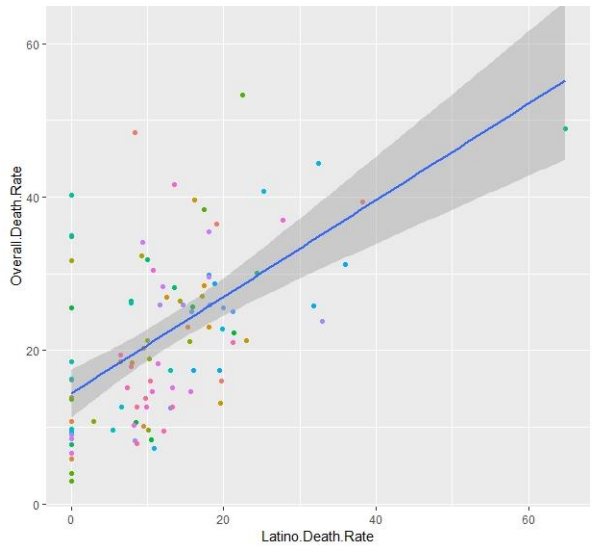

Figure 5: Rate of Overall Mortality vs Rate of Latino Mortality

Coefficients: Estimate Std. Error t value Pr(>|t|)
(Intercept) 26.38852 5.49037 4.806 5.42e-06 ***
percent.white -0.06587 0.08541 -0.771 0.442
Residual standard error: 12.04 on 100 degrees of freedom
Multiple R-squared: 0.005912, Adjusted R-squared: -0.004029
F-statistic: 0.5947 on 1 and 100 DF, p-value: 0.4424

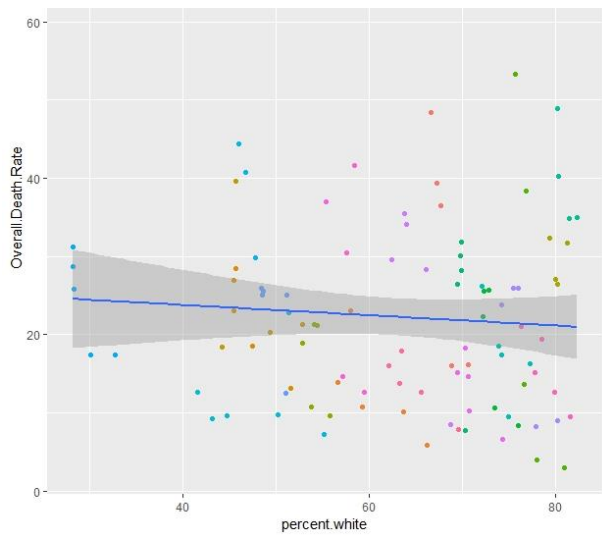

Figure 6: Overall Mortality Rate vs Percent of Mothers who were White

Coefficients: Estimate Std. Error t value Pr(>|t|)
(Intercept) 18.9836 1.9526 9.722 4.02e-16 ***
percent. Black 0.2616 0.1249 2.094 0.0388 *
Residual standard error: 11.82 on 100 degrees of freedom
Multiple R-squared: 0.042, Adjusted R-squared: 0.03242
F-statistic: 4.384 on 1 and 100 DF, p-value: 0.03881

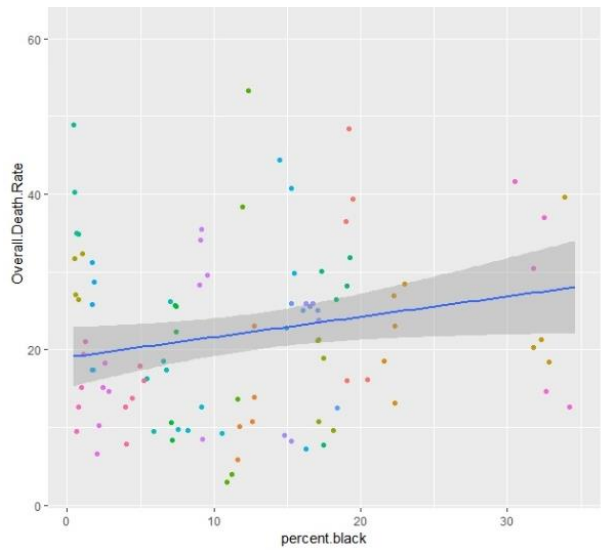

Figure 7: Overall Mortality Rate vs Percent of Women who were Black

Coefficients: Estimate Std. Error t value Pr(>|t|)
(Intercept) 24.4125 2.1813 11.192 <2e-16 ***
percent. latino -0.1221 0.1036 -1.179 0.241
Residual standard error: 12 on 100 degrees of freedom
Multiple R-squared: 0.01371, Adjusted R-squared: 0.003845
F-statistic: 1.39 on 1 and 100 DF, p-value: 0.2412

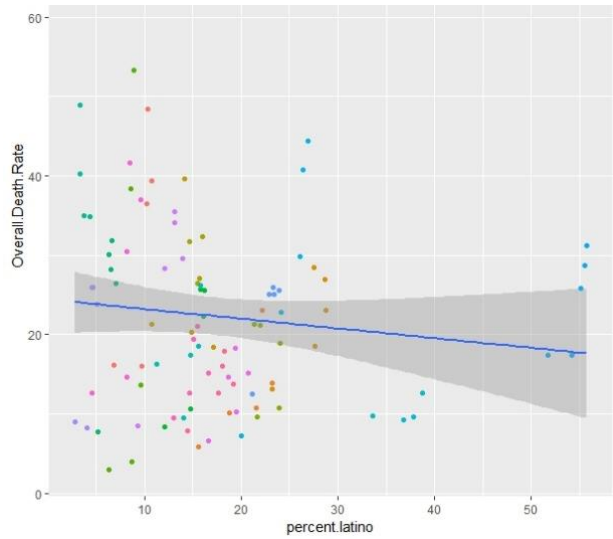

Figure 8: Overall Mortality Rate vs Percent of Women who were Latina

Coefficients: Estimate Std. Error t value Pr(>|t|)
(Intercept)11.65800 1.65961 7.025 2.86e-10 ***
Black. Death. Rate 0.18394 0.03937 4.672 9.52e-06 **
Residual standard error: 12.21 on 98 degrees of freedom
(2 observations deleted due to missingness)
Multiple R-squared: 0.1821, Adjusted R-squared: 0.1738
F-statistic: 21.82 on 1 and 98 DF, p-value: 9.52e-06

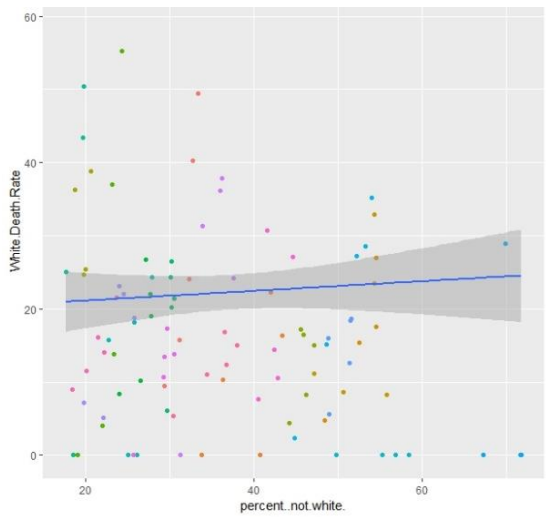

Figure 9: Rate of Mortality for White Mothers vs Rate of Mortality for Black Mothers

Coefficients: Estimate Std. Error t value Pr(>|t|)
(Intercept) 23.16820 3.76468 6.154 1.57e-08 **
percent.not.white.-0.16074 0.09463 -1.699 0.0925 .
Residual standard error: 13.34 on 100 degrees of freedom
Multiple R-squared: 0.02804, Adjusted R-squared: 0.01832
F-statistic: 2.885 on 1 and 100 DF, p-value: 0.0925

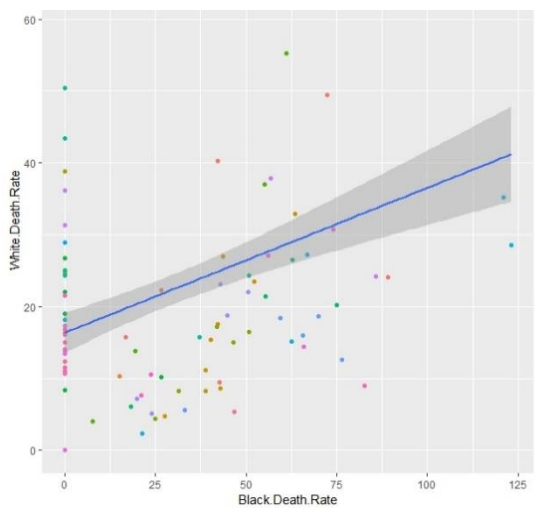

Figure 10: Rate of Mortality for White Mothers vs Percent of Non-White Mothers

Coefficients: Estimate Std. Error t value Pr(>|t|)
(Intercept) 14.9285 2.2175 6.732 1.07e-09 ***
percent.black 0.1800 0.1419 1.269 0.207
Residual standard error: 13.43 on 100 degrees of freedom
Multiple R-squared: 0.01584, Adjusted R-squared: 0.006
F-statistic: 1.61 on 1 and 100 DF, p-value: 0.2075

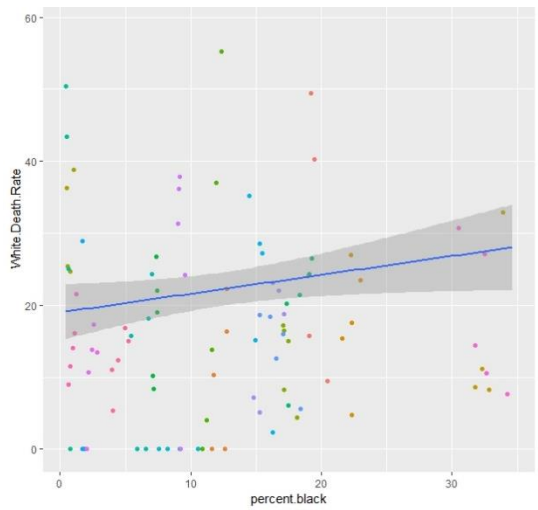

Figure 11: Rate of Mortality for White Mother vs Percent of Black Mothers

Coefficients: Estimate Std. Error t value Pr(>|t|)
(Intercept) 23.3620 2.3482 9.949 < 2e-16 ***
percent.latino -0.3500 0.1115 -3.139 0.00223 **
Residual standard error: 12.91 on 100 degrees of freedom
Multiple R-squared: 0.08968, Adjusted R-squared: 0.08058
F-statistic: 9.852 on 1 and 100 DF, p-value: 0.00223

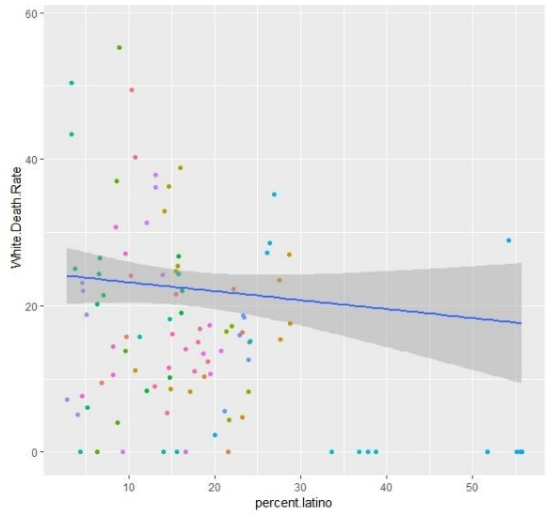

Figure 12: Rate of Mortality for White Mothers vs Percent of Latina Mothers

Coefficients: Estimate Std. Error t value Pr(>|t|)
(Intercept) 27.9408 4.8569 5.753 4.02e-07 ***
White.Death.Rate 0.1429 0.2092 0.683 0.497
Residual standard error: 20.26 on 55 degrees of freedom
(45 observations deleted due to missingness)
Multiple R-squared: 0.008409,Adjusted R-squared: -0.00962
F-statistic: 0.4664 on 1 and 55 DF, p-value: 0.4975

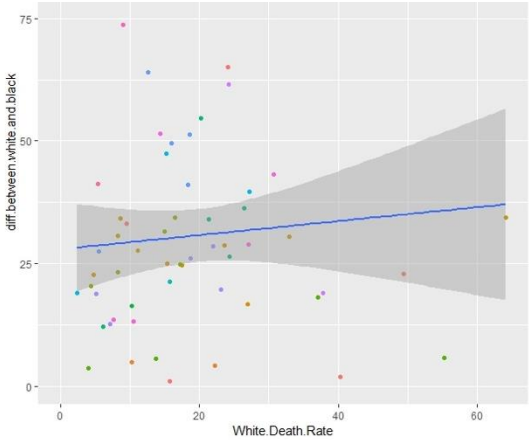

Figure 13: Difference in Mortality Between White and Black Mothers vs White Mortality

Coefficients: Estimate Std. Error t value Pr(>|t|)
(Intercept) -3.94662 3.14537 -1.255 0.215
Black.Death.Rate 0.69220 0.05634 12.286 <2e-16 **
Residual standard error: 10.51 on 55 degrees of freedom
(45 observations deleted due to missingness)
Multiple R-squared: 0.7329, Adjusted R-squared: 0.7281
F-statistic: 151 on 1 and 55 DF, p-value: < 2.2e-16

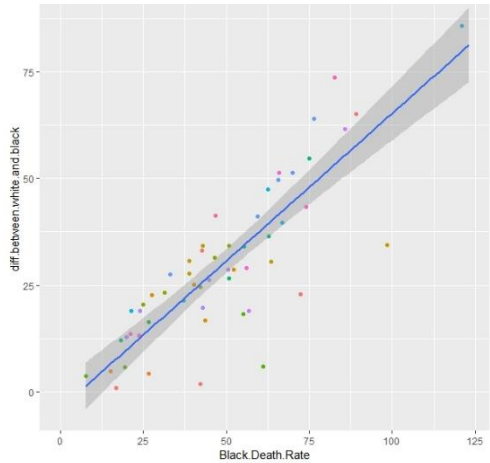

Figure 14: Difference in Mortality Between White and Black Mothers vs Black Mortality

Discussion

The CDC has an agreement with most states to not produce a site or official document with nationwide statistics or comparisons. This seems to be for several reasons, primarily the lack of agreement on how to put together this information. Many states do not communicate with each other on the methods they use to collect their information.

It is important to note that due to the aforementioned pregnancy associated death question developed in 2003, many states will have inevitably witnessed jumps in their data when the question is implemented. While I attempted to correct my data for these unequal applications, by controlling for the year range in which these changes occurred, different states inevitably had different levels of increase from their prior data collection methods.

There is also the issue of "other" or "unknown" categories in racial or Hispanic origin information. With Wonder's data, this is fortunately a somewhat small percentage of the individuals recorded. In any given state, the percent of individuals whose race or Hispanic origin was unknown typically only ranged from .5 percent to 2.5 percent, heavily skewed towards lying between .5 percent and 1 percent, at least in the states that were part of my data set.

However, it is pretty evident based on the graphs above that the data does not particularly lend itself to strong numerical links. Many of the graphs fall into the zone of statistical significance, meaning the likelihood that the two categories are completely unrelated is low, but the correlation is so low that it also would be nowhere valuable enough to demonstrated a causation or contributing factors.

While the correlations found among some of the different categories were intriguing and some could offer interesting insight in the future, the results here should generally be considered inconclusive. As sighted by other groups and organizations the discrepancies between data collection methods in different states renders the correlations and comparisons between different states statistically useless.

With the prior statements in mind, there is however one finding, which I believe is very revealing. The information is in the 13th and final model displayed above. On the Y-axis, it has the numerical difference between the rate of maternal mortality of black mothers, and the rate for white mothers, and on the X-axis, it displays the rate of maternal mortality per 100,000 women for black mothers. What this shows is that there is an important racial element to the disparities of black mothers. If race played no part in the differences, then white women and black women should be doing equally well or equally poorly. Take for example Arkansas and Kansas on the graph, both are between 40-60 deaths per 100,000 for black women, relatively poor rates by any means, but the difference between black and white women is very low, meaning while the states have difficulty with maternal mortality rate, it is not likely to have race as a compounding factor in these issues. This comparison has an extremely high correlation rate and statistical significance. In the qualitative side of the data I was not looking for such exacerbated racial differences within the same state, and so I cannot pinpoint what might be causing these racial differences. This would be the most interesting finding, and would have been something I examined more carefully during this research had I known before starting.

Conclusion

Though the results of the analysis were numerically inconclusive, the quantitative elements in conjunction with the qualitative section point to an emerging issue in the United States that currently lacks in-depth examination, but could soon hold vital information. Even with the inconclusive evidence, the quantitative elements hint at the problem that qualitative sources have thus far been better at revealing, which is that there are real issues and disparities in maternal health. In the qualitative research a picture emerges of increasing risks to mothers, and a higher percentage of births to minority women and women in lower economic settings, often both.

This research project began as a way to try and determine if the changing demographics in America were correlated with the rapid increase in maternal mortality in the country. The most important finding the research unveiled is the concept that deaths in the United States do not seem to be increasing at the alarming rate often touted in news sources. It turns out that the main cause of increase is in fact the standardization of data collection rather than a sudden spike in deaths. However, the research has revealed that as the process of collecting information about maternal mortality is standardized, the numbers will reveal the serious gaps that seem to exist in this country, specifically regarding disparities between different ethnic, racial, and socioeconomic groups that do pose a real problem in maternal care in the coming decades.

The standardization of data collection of maternal mortality in the United States is a truly pressing issue that needs to be resolved as soon as possible. At the current time the data is not collected in such a way that allows the insights we need to fully understand the nuance of the current situation. We most certainly have a problem with maternal mortality in this country, and now that the collection process has become more standardized it needs to be addressed.

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