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## An Analysis of the 2014 Medicaid Expansion on New York and California's Maternal Mortality Rate

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AN ANALYSIS OF THE 2014 MEDICAID EXPANSION ON NEW YORK  
AND CALIFORNIA'S MATERNAL MORTALITY RATE

by

RESHANNA JAGROO

A thesis submitted in partial fulfillment of the requirements  
for the Honors in the Major Program in Economics  
in the College of Business Administration  
and in the Burnett Honors College  
at the University of Central Florida  
Orlando, Florida

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Thesis Chair: Melanie Guldi, Ph.D.

## **Abstract**

This thesis seeks to investigate the 2014 Medicaid expansion's effect on maternal mortality rates for New York and California. The CDC reported in 2019 that maternal mortality rates have been increasing. These findings are concerning for mothers and are a problem for developed nations like the United States with improved healthcare. Furthermore, women of color are disproportionately affected relative to white women. Previous research has indicated that healthcare expansions positively affect decreasing death rates among pregnant women.

In this study, I investigate how increased access to healthcare through the 2014 Medicaid expansion under the Affordable Care Act affects maternal mortality for New York and California. I utilize the publicly available CDC Wonder Underlying Cause of Death 1999-2020 data to conduct my research for this analysis. For my analysis, I chose to observe the years 2006-2016. I plotted each state's mortality rates by year to observe any visual trends or changes in reported data and then after ran regressions of each race on deaths. The results exhibited that women of color tend to experience higher maternal mortality ratios. When observing how deaths have changed post-expansion, the coefficients were not statically significant to a degree that would allow me to make confident conclusions that mortality rates had improved. This study contributes to the literature that women of color are more likely to suffer worse maternal health outcomes than white women. It brings to light the importance of attaining a solution to this issue.

## **Acknowledgements**

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## Introduction

Maternal mortality has been thoroughly measured for decades, and in comparison, to previous generations, the United States has accomplished a great deal in reducing rates among mothers (*US Vital Statistics Volumes 1900-1968*, n.d.). In developed nations, maternal mortality rates have greatly lessened, which has been an indicator of how far they have improved compared to developing countries that still have higher maternal death rates. However, there has been a troubling rise in maternal mortality rates in recent years in the United States. In their Nine Maternal Mortality Review, the CDC reported that "nearly 50% of all pregnancy-related deaths were caused by hemorrhage, cardiovascular and coronary conditions, cardiomyopathy, or infection." (CDC, 2021). Along with the rise in maternal mortality is the increase in maternal morbidity. Creanga et al. (2014) describe maternal morbidity as "physical and psychological conditions that result from or are affected by pregnancy and have an adverse effect on a woman's health."

According to the Centers for Disease Control and Prevention's report on Maternal Mortality from Nine Review Committees (CDC, 2018), they approximated that every year in the United States, 700 women die due to pregnancy-related complications. From that, 60% of those deaths could have been prevented. Despite the advancements in healthcare annually, more pregnant women suffer from adverse effects related to their pregnancy. Another troubling takeaway from these reports is that pregnant women of color suffer higher mortality rates than their white counterparts. This thesis aims to investigate this health subject and find ways to reduce maternal death and morbidity by investigating social safety nets' effects on rates. The more prevalent these assistance programs (Medicaid and the Earned Income Tax Credit) are, the

better the maternal and infant health outcomes. (Guglielminotti et al. 2021), Hamad and Rehkopf, 2015, Hoynes et al. 2015, Markowitz et al. 2017).

The United States is ranked number two in developed nations for having one of the best care processes, despite the fact that our maternal mortality rate has been increasing. (Commonwealth Fund, 2021). The CDC reported that in 2019, there was a significant increase in the maternal mortality rate from the previous year. They identified that the total maternal mortality rate increased from 17.4 in 2018 to 20.1 in 2019. In comparison to other developed nations, in 2018, the United States maternal mortality rate surpassed the United Kingdom, Australia, and Canada, making us the global leader with the highest maternal mortality rate among developed nations.

A key trend that has been identified when observing maternal mortality rates in the United States has been the increase in maternal death rates exhibited by Black and Hispanic mothers. Compared to white mothers, the CDC reports that Black and Hispanic women are more likely to suffer from a pregnancy-associated death. Specifically, in 2018, Non-Hispanic black women exhibited a maternal mortality rate of 37.3 compared to the Non-Hispanic White rate of 14.9, more than double the amount. This health disparity poses the question as to why Black and Hispanic women are reported to suffer from higher maternal mortality rates more than their white counterparts.

An important term in the realm of maternal health is severe maternal morbidity (SMM), defined as "an unexpected outcome of labor and delivery resulting in a life-threatening diagnosis or the need to undergo a life-saving procedure" (Guglielminotti et al. 2021). The CDC has stated that SMM has been on the rise in recent years. To further emphasize the magnitude of this issue, they reported that in 2014, more than 50,000 women were affected by severe maternal mortality

within the United States. In a recent study conducted by Guglielminotti et al. (2021), they studied the state of New York's 2014 Medicaid expansion. Their investigation produced positive results, indicating that the social safety net of Medicaid and its eligibility expansion can improve maternal health outcomes. Another crucial finding from their study on the Medicaid expansion was the differences in SMM among races. When observing low-income women and high-income women from before the 2014 Medicaid expansion period to post-expansion, their results indicated that racial and ethnic minorities were more positively affected by the increase in income eligibility.

As the 2014 Medicaid expansion was also exhibited in numerous other states, this leads to the question of whether New York's findings are valid in other states across the United States? In order to address this question, I replicated the Guglielminotti et al. (2021) New York study for another densely populated and diverse state, California. California has demonstrated itself as one of the only states to have decreased their maternal mortality rates. They have implemented countless efforts by launching investigative studies into the causes of such high maternal deaths. California's research on preventative measures allowed them to create evidence-based tool kits to address common pregnancy-related health issues such as hemorrhaging and preeclampsia, allowing them to develop improvement initiatives to lower their maternal mortality rate (MacDorman et al. 2016). Not only that, but California is similar to New York as their populations are quite large and diverse, allowing for a better analysis of the effects that SMM has on minorities and low-income mothers. This assumption does not necessarily mean that the findings from the Guglielminotti et al. (2021) study are transferable to California since there may be underlying reasons that can provide different results.

A difference between the research I performed is that the data used to analyze was not from the same source. Maternal mortality was observed and analyzed but, severe maternal mortality was missing from my results as it is not a factor recorded from the CDC. Furthermore, other variables such as income level and education was missing from the dataset I chose to use.

## **Literature Review**

Maternal mortality rates have experienced a substantial change from the past to the present. According to a study conducted in the U.S. on maternal mortality rates, 48 states and the District of Columbia experienced increased maternal deaths from 2000 to 2014 (MacDorman et al. 2016). These recent trends of increasing maternal mortality rates are subjects of concern. Alongside the rise in maternal deaths, there have been increased risks in minority women, such as black and low-income women. This literature review will highlight contributing factors that may improve the rise in maternal mortality rates the United States has experienced in the past few years. Social safety nets such as the Earned Income Tax Credit (EITC) and Medicaid offer opportunities for pregnant women to receive healthcare coverage which may positively affect their birth outcomes. When addressing maternal mortality rates, we cannot ignore race and how different minorities are more likely to experience worse postpartum outcomes. Additional factors such as insurance churn reduce the medical care access that mothers have postpartum, potentially leading to a lack of health resources after giving birth. In developed countries, the rise in maternal mortality rates is no longer due to a lack of proper living conditions or technology but a new set of contributory factors that must be further investigated if we want to reduce these incidents.

### **Earned Income Tax Credit**

Aside from Medicaid expansions, another substantial benefit offered to pregnant mothers in the United States is the Earned Income Tax Credit, also known as EITC. The Earned Income Tax Credit (EITC) helps low-to-moderate-income workers and families get a tax break (Earned Income Tax Credit (EITC) | Internal Revenue Service, n.d.). Markowitz et al. (2017) sought to investigate the effects of the state-level EITC laws in the U.S. on maternal health behaviors and

infant outcomes. The study spanned the period of 1994 to 2013, and they specifically investigated individual birth records gathered from the Vital Statistics Natality Files. They utilized a difference-in-difference regression specification and found that states that offered the EITC benefits observed positive effects on average birth weight, especially in more generous states. Overall, Markowitz et al. (2017) found an association between an improvement in maternal health and the state-level benefit of the EITC, which adds to the literature on income and health, specifically for pregnant women.

### **Severe Maternal Mortality and Race**

Race is a characteristic that cannot be ignored when studying maternal mortality and morbidity. When observing the risk factors that may lead to adverse health effects during and after pregnancy, distinguishing between races is crucial. According to the CDC's report from Nine Maternal Mortality Review Committees, African American women are three to four times more likely to die from pregnancy complications than their white counterparts (Report from Nine Maternal Mortality Review Committees, 2021). Also, from this report by the CDC, they found that Hispanic women were trailing behind African American women in a proportion of pregnancy-associated deaths. Several studies have been able to identify that certain races are more likely to suffer from a particular adverse health effect, and determining why that is the case is crucial. In a study on the incidence of severe maternal morbidity (SMM) during hospital deliveries in the United States, researchers were able to identify that SMM was more likely to occur if a woman underwent a C-section, had more than one baby, and if their race was black (specifically Medicaid recipients). The study utilized multivariate logistic regression modeling to identify results extracted from MarketScan databases from U.S. regions (Black et al. 2021). A similar outcome in which race played a role in SMM cases was identified in another study

conducted in New York City from 2010-2014 using discharge and birth certificate datasets (Howell et al. 2021). They were able to control for maternal sociodemographic variables, medical history, and current conditions, along with risk factors. Their results concluded that SMM was higher among Black and Latina women than their White counterparts by utilizing a logistic regression approach. To be more specific, SMM was more prominent in Medicaid users than commercially insured patients.

### **Insurance Churn**

A potential contributing factor to the adverse effects encountered by pregnancy is the churn of insurance that several women experience after giving birth. Doctors emphasize the importance of the postpartum period and how it is crucial to have regular doctor visits, but it is difficult without healthcare coverage. The federal minimum requirement for Medicaid coverage postpartum is 12 weeks; this may not be enough time to treat some mothers after they give birth (Ranji et al. 2021).

Although the study conducted by Dave et al. (2015) highlighted adverse effects associated with Medicaid eligibility expansion, those outcomes observed could be combated by the authors' suggestions through preventative measures and investigative studies like what the state of California is currently tackling to improve maternal health outcomes. Along with that, there are other considerations associated with Medicaid and women's health outcomes that potentially explain why the United States lacks maternal health improvements. The differences and inconsistency between states in administering Medicaid are a factor in coverage "churn" around pregnancy and childbirth. Many women only become eligible for Medicaid once they become pregnant and can utilize the resources and services provided to them during that time. Still, once they give birth, women in certain states can only keep their coverage two months after

and need to find another source of insurance, according to the federal minimum requirement (Ranji et al. 2021). This "churn" or change in insurance postpartum can potentially pose adverse effects on new mothers. The period that the Medicaid coverage will last varies at the state level, making observing churn difficult. A study conducted by Daw et al. (2017) investigated churn using the Medical Expenditure Panel Survey- Household Component (MEPS-HC). Using logistic regression to analyze the data for 2005 through 2013, they found that women experienced high rates of insurance transition postpartum, particularly women utilizing public assistance insurance like Medicaid or CHIP. Another key finding was that many postpartum women experienced a spell of being uninsured within six months after childbirth, highlighting the issue of churning and no other affordable insurance options once these women are no longer pregnant. This is concerning as the period after giving birth is very significant for women postpartum. According to the American College of Obstetricians and Gynecologists (2021), they advise pregnant women to get checked up post-delivery no later than 12 weeks. They refer to this time of life postpartum as the "fourth trimester" as health care and checkups are still very important to monitor to avoid post-pregnancy complications. In extending the Medicaid coverage for women postpartum, the United States may potentially reduce the maternal mortality rates that we see rise every year.

### **Possible Adverse Effects of Medicaid**

A study conducted by Dave et al. (2015) sought to investigate the effects of Medicaid on prenatal health behaviors. They studied the income effect consequences that expanded Medicaid coverage had on pregnant mothers through whether they utilized the extra income to purchase goods that would benefit their health or harm themselves. Something interesting from this study specifically was their coverage of ex-ante moral hazard. Medicaid covered pregnant women by

assessing behavior during pregnancy, such as smoking, gaining weight, or being diagnosed with pregnancy-related health conditions that could negatively impact themselves and the fetus. The researchers created equations to model a woman's expected utility, budget constraint, constrained choice problem, and medical care within this study. They examined birth records from Vital Statistics Natality Files (N.F.) data, which provided analysis. They utilized data from 1989 to 1997 because pregnant women and children experienced the most significant expansion of Medicaid eligibility during this period. With the data, researchers conducted a difference-in-difference regression specification and concluded that Medicaid eligibility was positively associated with smoking and reduced weight gain in pregnant low-educated mothers. As previously mentioned, the study sought to investigate ex-ante moral hazard and income effects posed by the expansion of Medicaid in the United States. Researchers observed that with the increase in household income, smoking rose by 8.7%. Furthermore, the study finds that Medicaid eligibility expansions might have increased risky behavior among low-educated pregnant women, along with the income effect brought on by insurance coverage. Although these results from this study are relatively negative regarding maternal and infant health, the authors did suggest that physicians must encourage visits and promote healthy behaviors and preventative measures to pregnant women to avoid these adverse effects.

### **The 2014 Medicaid Expansion**

In the study conducted by Guglielminotti et al. (2021), the researchers investigated the Medicaid expansion of 2014 in New York under the Affordable Care Act. They utilized data from the 2006-2016 New York State Inpatient Database to identify severe maternal mortality (SMM) during delivery hospitalizations from discharge records. Their approach identified two groups of women: low-income and high-income women based on the quartile of median

household income obtained from the residential zip code. Their findings indicate that with the 2014 Medicaid expansion in New York, there was a small but significant reduction in the severe maternal mortality incidence in low-income women compared to women of high-income. The 2014 Medicaid expansion increased the income eligibility threshold for pregnant women to 223% (previously 200%) of the Federal Poverty Level. The researchers investigated the prevalence of severe maternal mortality among the groups studied by estimating temporal trends before and after the expansion. As anticipated, after the expansionary period, they found an increase in the proportion of Medicaid beneficiaries from 42.9% to 48.1%.

One of the most notable findings was that low-income women exhibited a higher incidence of severe maternal mortality (2.6%) in contrast with the high-income group of mothers (1.9%). Guglielminotti et al.'s (2021) study on the 2014 Medicaid expansion in New York provided vital information on severe maternal mortality in the United States, given the recent increase in mortality rates we have seen.

A similar study by Eliason from 2020 on the Medicaid expansion of 2014 investigated the effects of the Affordable Care Act expansion on maternal mortality rates in states that expanded in comparison to states that did not. Eliason utilized the mortality data from the CDC Wonder Database to conduct their analysis on the effects of the Medicaid expansion. Eliason conducted an adjusted difference-in-difference regression estimate which yielded results suggesting that the 2014 expansion was significantly associated with 7.01 fewer maternal deaths per 100,000 live births in comparison to states that did not expand. Specifically for non-Hispanic Black mothers, their results indicated that the Medicaid expansion was significantly associated with a lower total maternal mortality rate of 16.27 per 100,000 live births. Their findings suggest that the 2014 expansion could be contributing to lower maternal mortality rates for states that

have expanded relative to non-expansion states. Furthermore, when it came to different races, effects were concentrated among non-Hispanic Black mothers. This further contributes to the literature that racial disparities are present within the maternal health realm and expanding healthcare is a potential remedy to this growing issue.

The advancements in medical care, living conditions, and technology have vastly improved maternal mortality rates that concerned us generations ago. However, maternal deaths have been increasing recently, even in one of the most developed nations (CDC, 2019). It is imperative to fully grasp what factors contribute to maternal deaths and morbidity if we have advanced medical care. Access to medical care through social safety nets such as Medicaid and the Earned Income Tax Credit (EITC) has been notable in the literature to reduce maternal mortality rates. Guglielminotti et al. (2021) sought to investigate how access to medical care contributes to lowering severe maternal mortality (SMM) rates. Their research on the 2014 Medicaid expansion in New York State found a small but significant decrease in SMM for low-income women compared to the pre-expansion period. This study highlights that access to medical care does play a role in maternal mortality rate reduction, which is vital to further understanding how to lessen the increasing maternal mortality rates even more in the United States. Using CDC Wonder data, Eliason (2020) investigated the 2014 Medicaid expansion's effects throughout different states in the country and found similar results. But, even though Medicaid expansions have been associated with a decrease in maternal deaths, rates are still increasing in the United States as reported by the CDC. What both studies do is bring to light the contribution that Medicaid expansions have on reducing maternal mortality rates.

# Data

## Overview

The dataset utilized to conduct this research was gathered from the CDC Wonder Underlying Cause of Death 1999-2020 data. This dataset specifically gathers county-level data based on United States resident death certificates. The data extracts for New York includes thirty observations and thirty-three for California. These observations are quite low, but death counts are grouped by year, and some are suppressed by the CDC for privacy concerns.

This dataset is different from previous studies as it only gathers basic characteristics associated with an individual's death. For instance, the variables utilized from my extraction to conduct my analysis included *State, Year of Death, Race, Hispanic Origin, Underlying Cause of Death, and Deaths*. Furthermore, the variable for an individual's cause of death to measure maternal mortality fell under the ICD-10 codes A34 (Obstetrical tetanus) and O00 - O99 (Chapter XV Pregnancy, childbirth, and the puerperium). For simplicity purposes, these two groups of cause of death were combined as "pregnancy-related deaths."

For confidentiality reasons, the CDC suppresses death counts for sub-national data ranging from the numbers zero to nine. This was a hindrance when it came to observing Asian and Pacific Islander deaths, as they tended to experience lower death counts which led to a greater amount of data suppression. For this reason, I decided to omit this race group from the analysis and only observe Black or African American women, White Hispanic or Latino women, and White Non-Hispanic or Latino women for my study.

In Figures 1 and 2, I plotted the raw data for the number of deaths for New York and California. These plots show the reported deaths from 2006 to 2016 for Black or African

American women, White-Hispanic women, and White Non-Hispanic women. For Figure 1, which graphically depicts the reported deaths by race for the state of New York, Black or African American women experienced a decrease in death counts after 2014, the year that the Medicaid expansion was enacted. Similar results can be observed in Figure 2 for California, in which Black or African American women and White Non-Hispanic women experienced a decrease in reported death counts post-expansion. Something worth noting in California's plot is that White Hispanic women actually experienced a spike in reported death counts post-expansion. The differences in states can possibly be due to the difference in types of population concentration between New York and California. Furthermore, as previous studies such as Eliason's 2020 study found, Black or African American women experienced greater effects of the 2014 Medicaid expansion which aligns with Figures 1 and 2 which displays a decrease in reported death count.

For my analysis, *Death Rate*, was the outcome I had interest in measuring against my independent variables, *Race*, which was broken down into three sub-categories for better analysis: Black or African American women, White-Hispanic or Latino women, and White Non-Hispanic or Latino women. With the breaking down of the independent variable, *Race*, it allows for a more in-depth analysis of how maternal mortality death counts change after the year 2014, the year Medicaid was expanded for New York and California. *Death Rate* was a variable created by taking the death count for a state's given year according to race, divided by the given state population, multiplied by 100,000.

In order to investigate the difference in mortality count between the pre-expansion years (2006-2013) versus the post-expansion years (2014-2016), I created additional variables to use in my estimation. First, a dummy variable, *After*, was created which would be 0 if the reported

death was in a pre-expansion year or 1 if it was in a post-expansion year. Next, interaction variables were created to account for the difference in death rate once the expansion occurred. *BlackxAfter* and *HispxAfter* accounted for the difference in reported deaths between the two observed races, Black or African American and White-Hispanic or Latino, relative to White Non-Hispanic or Latino.

Located on Tables 1 and 2, summary statistics were created for each variable. Some notable takeaways from these tables is the difference in average populations between each state observed, with California having a much larger average population than New York. Death Rate is greater for New York than California. For example, the reported maximum Death Rate is 2.239 for New York in comparison to California's maximum Death Rate of 1.684. Additionally, after observing the raw data extract, it looks like for some years, there were no reported death counts for White-Hispanics in New York.

## Summary Statistics

Variable	N	Mean	Std. Dev.	Min	Pctl. 25	Pctl. 75	Max
State	30						
... New York	30	100%					
Year	30	2010.967	3.222	2006	2008.25	2013.75	2016
Black.or.African.American	30	0.367	0.49	0	0	1	1
White.Hispanic.or.Latino	30	0.3	0.466	0	0	1	1
White.Non.Hispanic.or.Latino	30	0.333	0.479	0	0	1	1
Deaths	30	20.133	7.016	10	14	26.5	35
Population	30	2922993.533	2101323.62	1240464	1428273.25	5770866.25	5968856
Death.Rate	30	1.01	0.609	0.235	0.392	1.483	2.239
After	30	0.267	0.45	0	0	0.75	1
BlackxAfter	30	0.1	0.305	0	0	0	1
WhiteHispxAfter	30	0.067	0.254	0	0	0	1
WhiteNonHispxAfter	30	0.1	0.305	0	0	0	1

Table 1: New York Summary Statistics by Variable

Variable	N	Mean	Std. Dev.	Min	Pctl. 25	Pctl. 75	Max
State	33						
... California	33	100%					
Year	33	2011	3.211	2006	2008	2014	2016
Black.or.African.American	33	0.333	0.479	0	0	1	1
White.Hispanic.or.Latino	33	0.333	0.479	0	0	1	1
White.Non.Hispanic.or.Latino	33	0.333	0.479	0	0	1	1
Deaths	33	26.606	11.289	12	19	32	56
Population	33	5143883.182	2890747.685	1187649	1223144	7734375	7969628
Death.Rate	33	0.776	0.5	0.231	0.325	1.254	1.684
After	33	0.273	0.452	0	0	1	1
BlackxAfter	33	0.091	0.292	0	0	0	1
WhiteHispxAfter	33	0.091	0.292	0	0	0	1
WhiteNonHispxAfter	33	0.091	0.292	0	0	0	1

Table 2: California Summary Statistics by Variable

## Visualizing the Data

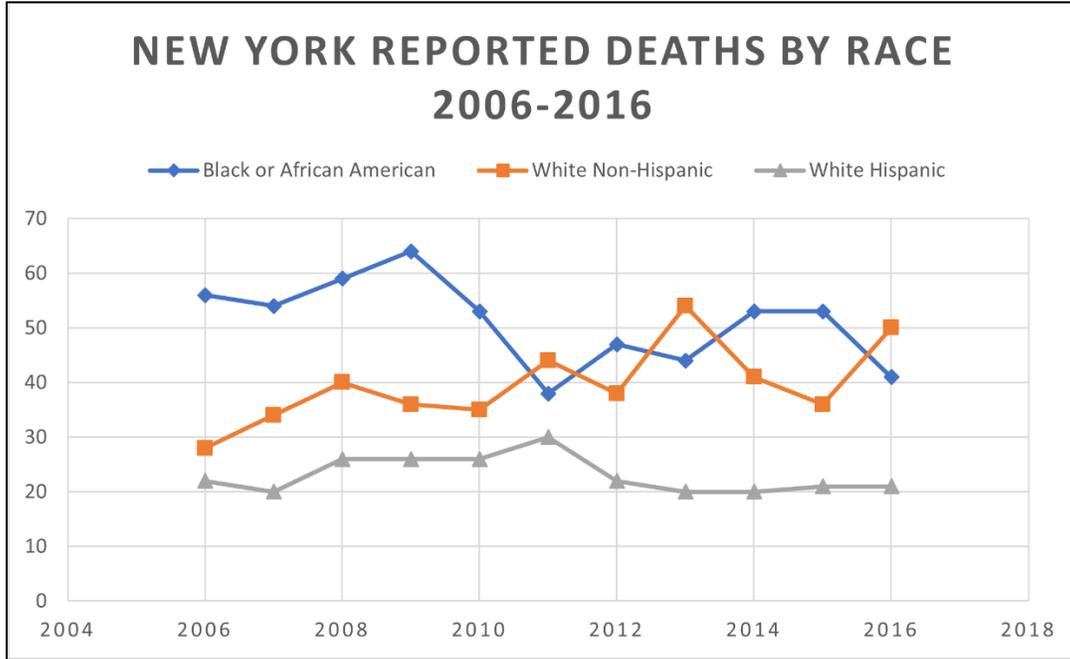


Figure 1: Plot of New York's Death Count by Race

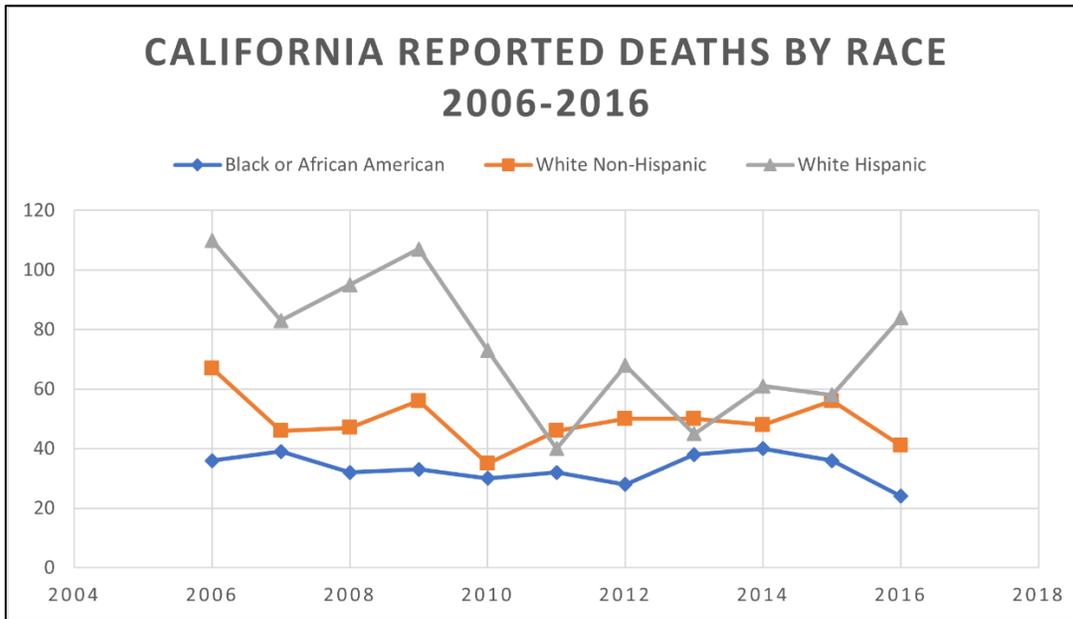


Figure 2: Plot of California's Death Count by Race

# Methodology

## Overview

For both New York and California, the model specifications were the exact same but their respective data extracts were used to generate their corresponding summary statistics. Initially, Asian or Pacific Islander was included as a variable in regression analysis but after consideration, it was omitted from both state's analysis due to the very small and sometimes missing reported death counts which may be attributed to the CDC's privacy constraints in public data. I estimate each of the regressions described below for New York and then for California.

## First Regression

The first regression performed was to investigate whether there is a difference between races or ethnicity in death rate relative to the White Non-Hispanic or Latino women group. This simple multivariable regression includes the dependent variable, *Death Rate*, representing the death count divided by a given population multiplied by 100,000.  $B_1$  and  $B_2$  are coefficients for the dummy variables. Each dummy variable is an indicator is equal to one when the death rate is from the named group and 0 otherwise.  $B_1$  and  $B_2$  are the coefficients of interest. If there are differences by race and ethnicity, then the estimates are expected to be different from zero.

$$\text{Death Rate} = B_0 + B_1 (\text{Black or African American}) + B_2 (\text{White Hispanic or Latino})$$

## Second Regression

The second regression performed includes a new independent variable, *After*, a dummy variable equal to 1 if the observation is reported in years after the Medicaid Expansion in 2014. With the inclusion of this new variable, we can identify whether there is a difference in reported death rate after the expansion versus before. The new variable, *After*, is a dummy variable that equals 0 if the year of reported deaths are from a pre-expansion year and 1 if the year is post-expansion.  $B_1$  is the coefficient of interest. If there is a change after the expansion, this coefficient would be statistically different from zero.

$$\text{Death Rate} = B_0 + B_1 (\text{After})$$

## Third Regression

The third regression includes the independent variable, *After*, that was included in the second regression model along with new variables created by interacting *After* with the different race or ethnicity dummies described for the first equation. In doing so, the model estimates the difference in reported death rate between the races relative to the White Non-Hispanic or Latino race group we are comparing against considering the post-expansion period. These new interaction covariates will be equal to 0 if the death rate is not from that race group and 1 if it is from that race group and if the year observed is after the 2014 expansion.  $B_4$  and  $B_5$  are the coefficients of interest. If there are differences by race and ethnicity after the expansion, then the estimates are expected to be different from zero.

*Death Rate=B\_0+ B\_1 (Black or African American)+B\_2 (White Hispanic or Latino)+B\_3 (White Hispanic or Latino)+ B\_4 (BlackxAfter)+ B\_5 (HispanicxAfter)*

## Results

### Results of Regression 1: New York

<i>Regression 1 Summary:</i>	
	Dependent Variable: <i>Deaths</i>
<i>Black or African American</i>	1.343*** (0.092)
<i>White Hispanic or Latino</i>	0.570*** (0.097)
<i>Constant</i>	0.346*** (0.067)
<i>Observations</i>	30
<i>R2</i>	0.889
<i>Adjusted R2</i>	0.881
<i>Residual Std. Error</i>	0.210 (df = 27)
<i>F Statistic</i>	107.908*** (df = 2; 27)
<i>Note:</i>	* $p < 0.1$ ; ** $p < 0.05$ ; *** $p < 0.01$

*Table 3: New York Regression Results for estimated races*

The first regression model for the state of New York included the two races we were estimating, Black or African American and White Hispanic or Latino. The results indicated that compared to White Non-Hispanic or Latino women, maternal death rates of Black or African American women are 1.343 higher. Furthermore, maternal death rates for White-Hispanic or Latino women are 0.570 higher compared to their Non-Hispanic or Latino counterparts. Both coefficients were strongly significant for this model.

With these results, I can confidently say that a racial disparity is present between the race or ethnicity groups I observe. Black or African American women experience the highest maternal death rates, while those for White Non-Hispanic or Latino women were the lowest. Rates for White-Hispanic or Latino women are in the middle.

## Results of Regression 2: New York

<i>Regression 2 Summary:</i>	
	Dependent Variable: <i>Deaths</i>
<i>After</i>	-0.115 (0.255)
<i>Constant</i>	1.041*** (0.132)
<i>Observations</i>	30
<i>R2</i>	0.007
<i>Adjusted R2</i>	-0.028
<i>Residual Std. Error</i>	0.617 (df = 28)
<i>F Statistic</i>	0.205*** (df = 1; 28)
<i>Note:</i>	* $p < 0.1$ ; ** $p < 0.05$ ; *** $p < 0.01$

Table 4: New York Regression Results for *After* dummy variable

The second regression model for the state of New York only included the dummy variable, *After*. With this variable, we can observe how maternal death rates have changed post-expansion. Unfortunately, the coefficient for this variable is not significant so we cannot make just conclusions on the difference in death rate after the Medicaid expansion versus before. Although the coefficient is negative, indicating that after the 2014 expansion there have been a decrease in maternal deaths, it is not statistically significant to a degree that would allow me to make confident conclusions that a change after the expansion has occurred.

### Results of Regression 3: New York

<i>Regression 3 Summary:</i>	
	Dependent Variable: <i>Deaths</i>
<i>After</i>	0.036 (0.147)
<i>Black or African American</i>	1.394*** (0.110)
<i>White Hispanic or Latino</i>	0.623*** (0.114)
<i>BlackxAfter</i>	-0.183 (0.206)
<i>WhiteHispxAfter</i>	-0.225 (0.225)
<i>Constant</i>	0.336*** (0.081)
<i>Observations</i>	30
<i>R2</i>	0.899
<i>Adjusted R2</i>	0.877
<i>Residual Std. Error</i>	0.213 (df = 24)
<i>F Statistic</i>	42.543*** (df = 5; 24)
<i>Note:</i>	* $p < 0.1$ ; ** $p < 0.05$ ; *** $p < 0.01$

Table 5: New York Regression Results for estimated races post-expansion

The final regression model for the state of New York included the new dummy variables, *After*, *BlackxAfter*, *WhiteHispxAfter*, and the two original race covariates. The coefficient estimates are -0.183 for Black or African American women and -0.225 for White Non-Hispanic women. The reported coefficients did decrease post-expansion, suggesting that the 2014 Medicaid expansion might have decreased maternal deaths for New York. Unfortunately, the estimates were not statistically significant, so we cannot confidently conclude that the difference in deaths for these groups have changed after the 2014 Medicaid expansion relative to before.

## Results of Regression 1: California

<i>Regression 1 Summary:</i>	
	Dependent Variable: <i>Deaths</i>
<i>Black or African American</i>	1.093*** (0.075)
<i>White Hispanic or Latino</i>	0.280*** (0.075)
<i>Constant</i>	0.318 *** (0.053)
<i>Observations</i>	33
<i>R2</i>	0.884
<i>Adjusted R2</i>	0.876
<i>Residual Std. Error</i>	0.176 (df = 30)
<i>F Statistic</i>	114.293*** (df = 2; 30)
<i>Note:</i>	* $p < 0.1$ ; ** $p < 0.05$ ; *** $p < 0.01$

Table 6: California Regression Results for estimated races

The first regression model for the state of California included the two races we were estimating, Black or African American and White Hispanic or Latino. The results indicated that compared to White Non-Hispanic or Latino women, Black or African American women death rates are 1.093 higher. Furthermore, White Hispanic or Latino women are 0.280 higher relative to their Non-Hispanic or Latino counterparts. Both coefficients were strongly significant for this model, and we can make confident conclusions that a racial disparity is present between Black or African American women and White-Hispanic or Latino women. Furthermore, these results are similar to New York's Regression 1 results in which Black or African American women experienced the highest maternal death rates, suggesting a racial disparity is present.

## Results of Regression 2: California

<i>Regression 2 Summary:</i>	
	Dependent Variable: <i>Deaths</i>
<i>After</i>	-0.070 (0.198)
<i>Constant</i>	0.795 *** (0.104)
<i>Observations</i>	33
<i>R2</i>	0.004
<i>Adjusted R2</i>	-0.028
<i>Residual Std. Error</i>	0.507 (df = 31)
<i>F Statistic</i>	0.125 *** (df = 1; 31)
<i>Note:</i>	* $p < 0.1$ ; ** $p < 0.05$ ; *** $p < 0.01$

Table 7: California Regression Results for *After* dummy variable

The second regression model for the state of California only included the new dummy variable, *After*. With this new variable, we test whether maternal death rates have changed post-expansion. Although the coefficient is negative with a value of -0.070, indicating that post-expansion there may have been a decrease in maternal deaths, it is not statistically significant to a degree where confident conclusions can be drawn for this model.

### Results of Regression 3: California

<i>Regression 3 Summary:</i>	
	Dependent Variable: <i>Deaths</i>
<i>After</i>	-0.004 (0.122)
<i>Black or African American</i>	1.111*** (0.090)
<i>White Hispanic or Latino</i>	0.316*** (0.090)
<i>BlackxAfter</i>	-0.067 (0.173)
<i>WhiteHispxAfter</i>	-0.132 (0.173)
<i>Constant</i>	0.319*** (0.064)
<i>Observations</i>	33
<i>R2</i>	0.890
<i>Adjusted R2</i>	0.870
<i>Residual Std. Error</i>	0.180 (df =27)
<i>F Statistic</i>	43.870*** (df = 5; 27)
<i>Note:</i>	* $p < 0.1$ ; ** $p < 0.05$ ; *** $p < 0.01$

Table 8: California Regression Results for estimated races post-expansion

The final regression model for the state of California included the new dummy variables, *After*, *BlackxAfter*, *WhiteHispxAfter*, and the two original race covariates. The coefficient estimates are -0.067 for Black or African American women and -0.132 for White-Hispanic or Latino women after the Medicaid expansion. The reported coefficients are lower for the post-expansion period, suggesting that the 2014 Medicaid expansion might have decreased maternal deaths for California. Unfortunately, the estimates for the new variables were not statistically significant, so we cannot confidently conclude that the difference in deaths for these groups have changed after the 2014 Medicaid expansion relative to before.

## Discussion

After examining maternal mortality counts for the state's New York and California utilizing the CDC Wonder Data from the years 2006 to 2016, my analysis does not confidently support the hypothesis that maternal deaths have decreased post-Medicaid expansion. I do observe that women of color, specifically non-Hispanic Black or African American women suffer worse maternal mortality outcomes than their white counterparts but, my results post-expansion do not produce significant levels of data to conclude that death rates improved when Medicaid expanded for each state.

As previous studies have depicted, Medicaid expansion has had small but significant effects on maternal mortality. A difference in the source of data, lack of examination years post-expansion, and greater resources could have improved the examination for this study. The regression results do indicate that there were changes in maternal deaths after the 2014 expansion, but the coefficients did not exhibit statistical significance to make a confident conclusion. This means we are unable to draw strong conclusions from these estimates.

The first limitation of the study is the suppressed death counts from the CDC Wonder's Underlying Cause of Death data. For privacy reasons, death counts below nine are omitted from the data which limits the number of observations to study and hindered me from analyzing Asian or Pacific Islanders due to their very low death counts available. This led to having very small sample sizes for both states observed (New York having 30 observations and California 33).

Secondly, another potential limitation is the lack of covariates to be included in my analysis. Due to my data source limitations, variables such as education, income, and pre-existing conditions were not included for a more detailed analysis. This poses the question as to

whether my results would have been significant if I included more variables to the model? Other studies have gone into greater depths using multiple sources to investigate such facets (example, Guglielminotti et al. 2021). This suggests that it may be potentially an important shortcoming of my data source utilized.

Despite the lack of additional variables used for my study, similarities can be found between Guglielminotti et al.'s and mine in terms of results. A racial disparity was observed among the observed ethnic groups, for example, Black or African American women experienced worse maternal health outcomes relative to other races. Income groups could not be observed with my study, which was one of the biggest differences between our observations.

Both states, New York and California, exhibited similar trends in terms of racial disparities between the different ethnic groups observed. Moreover, Black or African American women experienced greater effects of the Medicaid expansion than any other race for both states. After the Medicaid expansion, the regression results indicated that death rates decreased, but I could not confidently confirm due to coefficients being statistically insignificant.

Despite the fact that this study did not show with statistical confidence that the 2014 Medicaid expansion contributed to a decrease in maternal mortality for New York and California, this study does bring to light the importance of women's health in developed nations. As the CDC has reported in their Maternal Mortality Review in 2019, the United States is experiencing a rise in maternal deaths and is a growing area of concern.

## Conclusion

With the rise in maternal mortality in the United States, it's imperative that awareness, greater research, and efforts be made to combat this issue. This thesis seeks to analyze the effects that the 2014 Medicaid expansion has had on maternal mortality in New York and California by using publicly available CDC data. The findings of this thesis do suggest that women of color do experience worse maternal health outcomes than their non-Hispanic white counterparts. For New York, Black or African American women are more likely to suffer maternal deaths relative to White Non-Hispanic women. White-Hispanic or Latino women are also more likely to experience instances of maternal mortality in comparison to their Non-Hispanic or Latino counterparts, but slightly less so than Black or African American women. The patterns were similar in California and New York, although the disparities were slightly lower in California. With my analysis, I was able to provide evidence that there is a disparity between the different races observed and that Black or African American women suffer worse maternal health outcomes which was in line with previous literature (Eliason, 2020). The increase in access with the Medicaid expansion was expected to decrease instances of maternal mortality, but my analysis could not significantly prove this hypothesis that post-expansion rates would decrease. I do hope with my examination that it does bring awareness to this growing issue in order to pave way to reducing maternal mortality.

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