Pregnancy-related Deaths during the Pandemic: Reported New York Maternal Mortality Rates in 2020

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INTRODUCTION

Maternal mortality is a public health phenomenon where the death of a woman is in relation to or associated with her pregnancy. The determining characteristics of these deaths are that they occur during pregnancy, at delivery, or within the end of one year of pregnancy. According to the New York State Department of Health (NYDOH), the United States is one of the only countries in the world that has seen a rise in its maternal mortality rate since 2000. Even more concerning, the **Commonwealth Fund** reveals that in 2020, the US reported 24 maternal deaths per 100,000 live births – more than three times the rate in most other high-income countries. Furthermore, maternal mortality rates, when observed through the lens of race, show wide racial and ethnic disparities in mortality rates. For instance, Black women have more cases of maternal mortality than both White non-Hispanic and Latina women.

The data used for this analysis report is taken from **NYC Open Data** and provided by the Department of Health and Mental Hygiene (DOHMH). To help address this gap in the US healthcare system, the DOHMH and Maternal Mortality and Morbidity Review Committee (M3RC) worked to review a collection of vital records, medical examiner records, and hospital discharge data to conduct an in-depth assessment of pregnancy-associated death in the state of New York, from both a clinical and social health lens (**Pregnancy-Associated Mortality In New York City, 2020, 2023**)

T The DOHMH has released a series of data on maternal morbidity and deaths spanning five years, starting from 2016. This analysis uses the dataset published for 2020 and observes four variables: boroughs, pregnancy relation/association, race/ethnicity, and causes of death. The objective is to compare the commonness of deaths for each category within each variable. For this reason, a bar chart compares deaths between categories. Consequently, we get a better understanding of the leading causes of maternal death rates in New York, as well as a recognition of those within our population that are disproportionately affected.

Results illustrated for the variable b*orough*, which measures the maternal mortality counts reported for each borough in New York City, the Bronx had the highest number of deaths. Brooklyn had the second most reported deaths, with three deaths reported for that year. For the

variable *relation, which* measures how many deaths in New York were related to the patient's pregnancy, results found that most deaths recorded were pregnancy-related. The variable *race/ethnicity* measured the recorded maternal deaths of different racial and ethnic groups. After analysis, the gathered data demonstrated that Black women have the highest reported death toll among all other groups, their counts surpassing the average deaths calculated for all racial/ethnic groups for 2020. Finally, the variable *underlying cause* measured the number of deaths attributed to a patient's illness. Among all causes recorded, the highest reported cause of death was infection/sepsis and overdose (mental health condition). The second and third are suicide (mental health conditions), and homicide respectively.
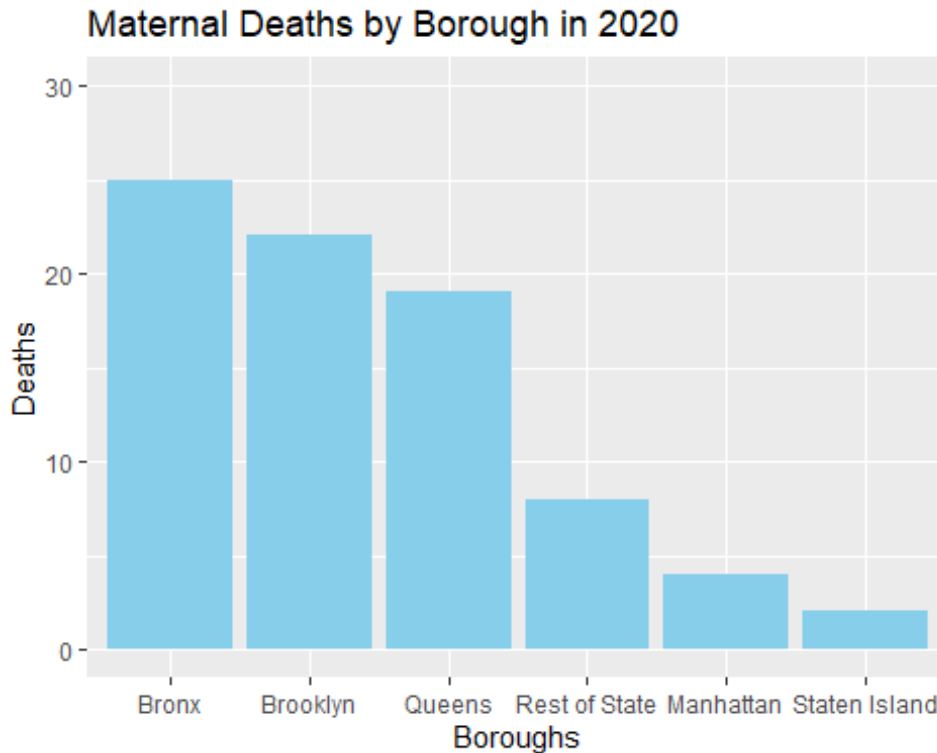
ANALYSIS

Bivariate

Boroughs

Below is a visualization of recorded deaths for each New York City borough in 2020 produced using R Studio.

The graph is in descending order for ease of comparison. For this analysis, it's established that the location of these deaths was determined by what had been the last known residence recorded on the patient's death certificate. This means for the category labeled as 'rest of state', these deaths were of patients that lived somewhere in the state of New York, but outside any of the NYC boroughs.

Objective

The objective of the study is to pinpoint areas that express the highest rates of mortality for pregnant patients. To do this, an approach that helps us to observe the data in a way that will allow for the comparison of death counts across the boroughs would be the most convenient. For this, a visualization of the data as a bar graph is used.

Maternal Deaths by Borough in 2020

Beginning with the visual analysis, we see almost immediately that the borough with the highest reported maternal mortality deaths is the Bronx, with Brooklyn coming in second by a small margin (The Bronx reports 25 deaths for the year while Brooklyn reports 22 deaths). Brooklyn, being the borough with one of the highest maternal deaths, is sensible when you consider that in an NYC.gov 2020 Census report, it was the most populous borough of New York City. However, this same census report tells us that the Bronx is the 4th most populous borough while reporting the highest death count for the year. This finding implies the number of deaths reported for the borough isn't proportional to the total Bronx population.

To truly understand the extent to which maternal deaths in New York consist of patients living in the Bronx, the average comes to 13.33 deaths, meaning that the maternal mortality rate in the Bronx is nearly double the average calculated for the entire state of New York, despite being behind Brooklyn, Queens, and Manhattan in population size.

FUTURE RESEARCH

Future research should look into other contributors to the high mortality count in the Bronx. For instance, comparing widely acknowledged social contributors to increased rates of maternal mortality like income, race/ethnicity, and educational attainment would be a good place to start. Data collected that looks at the total of those in the population who report having completed high school, the racial/ethnic population makeup, and the reported average income of each of these boroughs may uncover an issue that could be why the high mortality rates in the Bronx.

BIVARIATE – CONTINUOUS

Related

According to the NYC Open dataset dictionary for the dataset used in this analysis, the *related* variable refers to a "causal relationship between pregnancy and death categorized as pregnancy-related, pregnancy-associated but not related or unable to determine pregnancy-relatedness". The dictionary also defines the categories in the bar graph below.
For the death to be considered **pregnancy-related**, the cause of death would have to occur within one year from the end of pregnancy. Additionally, the death would have to have been due to a pregnancy complication, a chain of events initiated by pregnancy, or an unrelated condition aggravated by the physiologic effects of pregnancy. A death considered **pregnancy-associated but not related** occurs within one year from the end of pregnancy but is due to a cause unrelated to pregnancy. Finally, **unable to determine** is the category used to count the deaths whose cause could not be determined to be either. It is an important distinction to make, as the most common causes of pregnancy-related deaths are health conditions that become worse due to pregnancy, pregnancy complications (preeclampsia, typically after the 20th week of pregnancy), and giving birth treatment given during pregnancy pregnancy-related or pregnancy-associated but not related.

Objective

The objective of this analysis is to understand the most common cause of pregnancy-associated death (**Maternal Death and pregnancy-related death, 2021**). In most cases, these conditions are preventable with early initiation of prenatal care and continuous monitoring by health providers (**Preventing Pregnancy-Related Deaths, 2023**).

Finding out whether most maternal deaths in New York are pregnancy-related will help medical researchers, practitioners, and others involved in providing treatment to pregnant patients, to focus on developing an approach that focuses on the prevention of pregnancy-related morbidity.

The graph below is a representation of the reported deaths considered pregnancy-associated, not-related, and unable to be determined for 2020 in the state of New York.

Deaths Related to Pregnancy in 2020
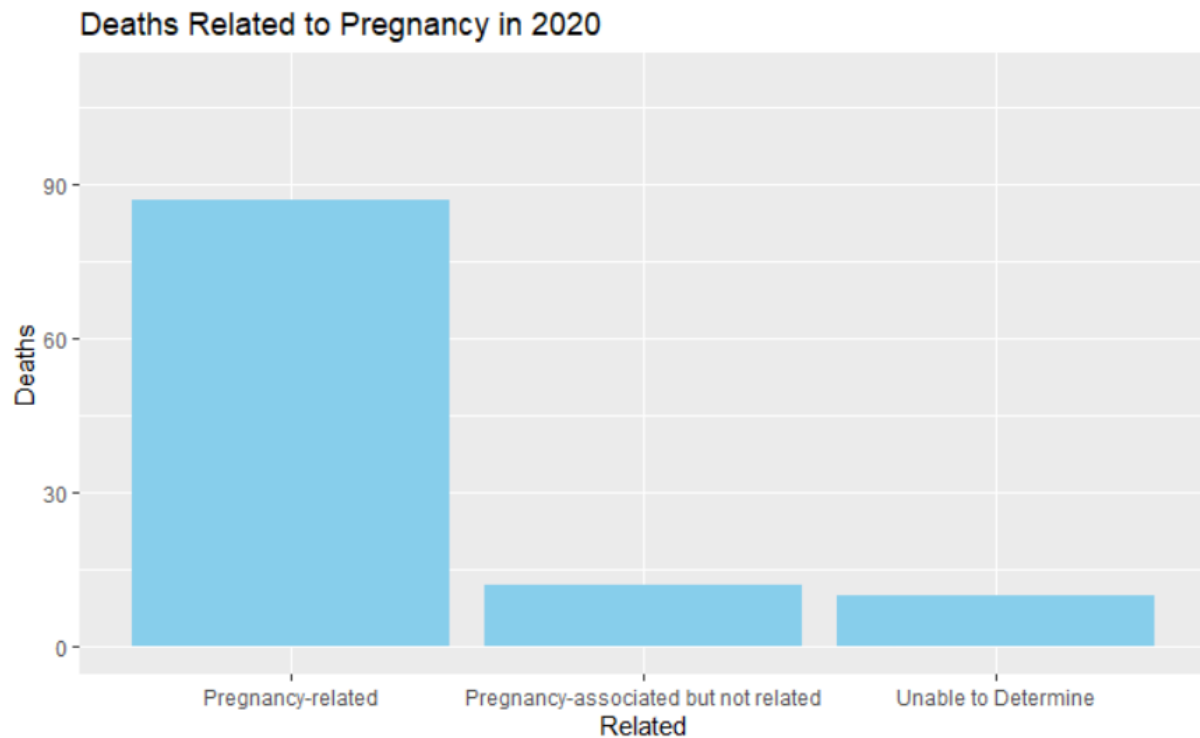
Immediately, we can see that the most reported cause of death is pregnancy-related. In addition, the average helps to determine how great the difference between pregnancy-related deaths and the two other categories. After calculating the total deaths reported for all three categories, the result is an average of about 36 deaths for the year. Pregnancy-related deaths made up two times the deaths reported for New York in 2020. In comparison, the categories for *associated but not related deaths* and *the inability to determine* both individually made only a third of the average deaths.

FUTURE RESEARCH

Due to most maternal deaths being pregnancy-related, future data collection should focus on the impact of different treatment methods for pregnancy-related morbidities. A study collecting data on the types of prevention measures taken in hospitals and medical centers with low maternal morbidity rates as opposed to those that see high rates would give insight into what methods of treatment increase maternal survivability. For example, most maternal mortality cases take place within a year after delivery. Patients who participate in a postpartum treatment plan covered by insurance and monitored closely by trusted clinical staff will likely show better maternal survival rates than those without access to such care. The DOHMH should study patients' engagement in postpartum care and its effects on maternal survival.

Bivariate – Continuous

Objective

For this analysis, we take the same approach as done with the previous variables.

Below is a bar graph representative of the number of deaths reported according to race and ethnicity in New York.

Rates of Maternal Death by Race/Ethnicity in 2020
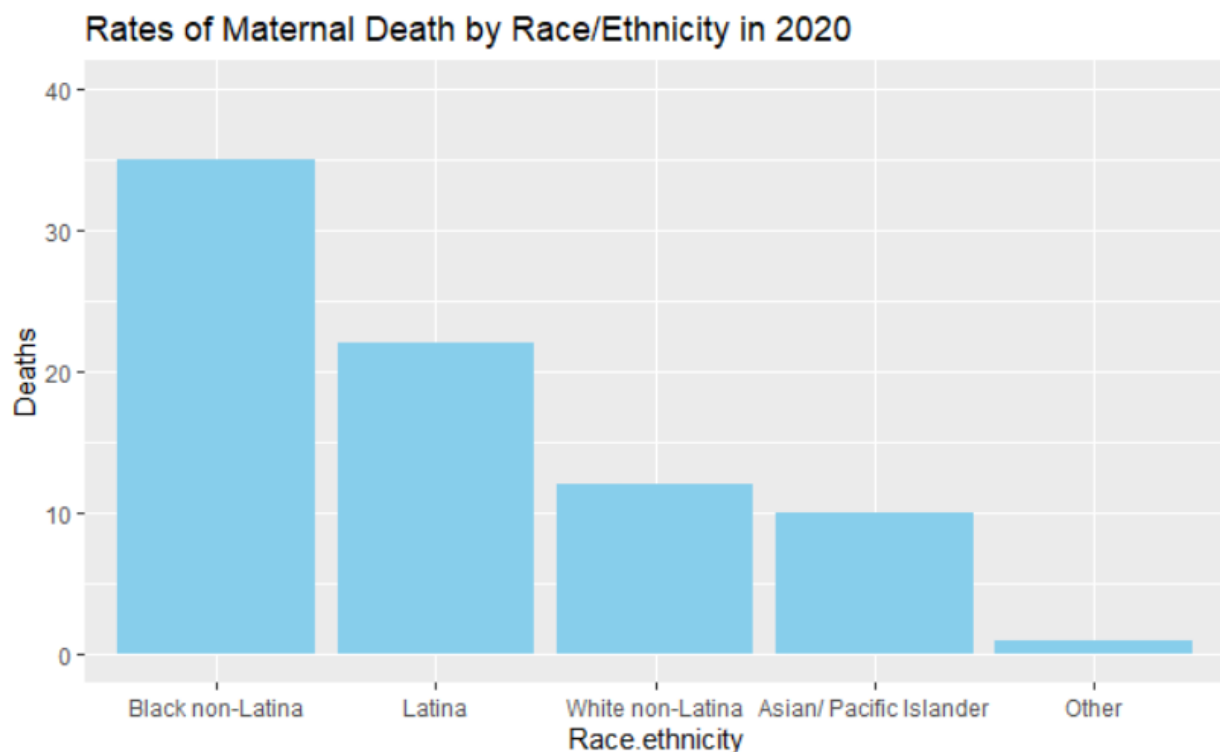
Previous research on racial disparities corroborates the data presented in the graph, with Black women making up most maternal deaths.

Calculating the average of the total deaths here also provides an understanding of how wide the gap is in terms of survival for Black pregnant patients in comparison to their peers. The average for the dataset is 16 deaths, with Black patients having died at more than twice the rate of the average calculated (35 deaths reported for that year). The next group with the most reported deaths is Latina women, reporting 22 deaths, still well above the average. The remaining groups report deaths below average, with White non-Latina reporting 12 deaths, Asian/Pacific Islander reporting 10 deaths and only 1 maternal death racially/ethnically categorized as Other.

FUTURE RESEARCH

Similar to previous research, the analysis of the 2020 dataset demonstrates that there is a large racial disparity when it comes to surviving pregnancy. Additionally, the research also shows that regardless of educational attainment or income, highly educated Black women are still at higher risk of maternal mortality than other races/ethnic groups who do not have more than a high school education. This means that leading cause of this is systemic racial discrimination in the healthcare system. What is needed to be addressed then, is how to train doctors and other medical personnel on how to identify their bias. A helpful way of observing the effect of maternal survivability is to study hospitals who have implemented bias training programs for staff. In addition, data collected on the impact of programs that assists women of color registering for insurance, as well as referrals for reproductive health centers should also be studied, as women of color are less likely to have access to such resources.

Bivariate – Continuous

Underlying Cause

This portion of the analysis observes the underlying cause variable, which looks at the number of maternal deaths attributed to the disease, injury, accident, or violence that initiated the chain of events leading to the death of the patient (**Data Dictionary, 2016 – 2020**). Determining the deaths assigned to an underlying cause is done by the NYC Maternal Morbidity Review Committee (MMRC).

Between the years 2017 to 2019, the CDC reported cardiovascular conditions as the most reported cause of pregnancy-associated deaths. However, an analysis of the underlying causes most reported by this dataset shows a drastic change from that trend in the year 2020.
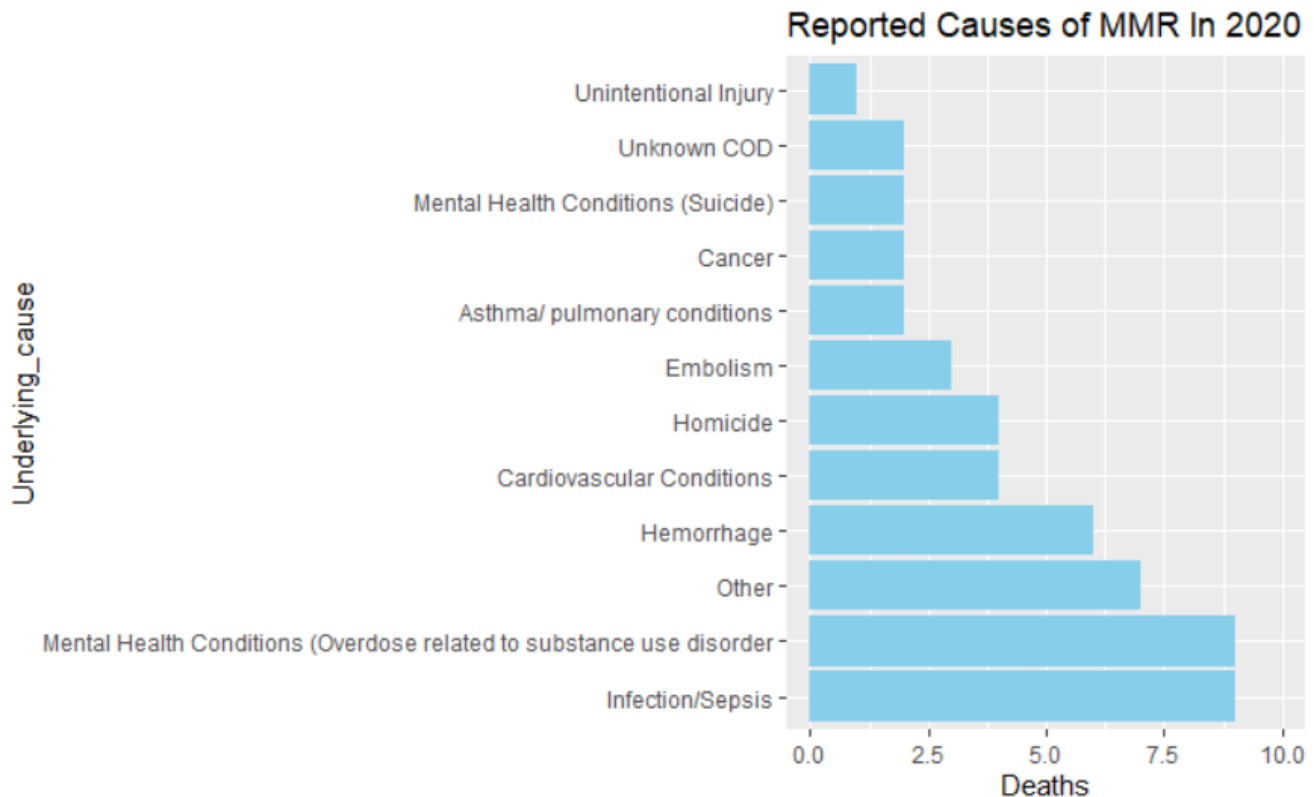
Upon looking at the graph, we see that the highest reported underlying cause for pregnancy-associated deaths was infection/sepsis. Sepsis is the body's response to the injury to its tissues and injury during pregnancy, post-abortion, or the postpartum period (**Maternal Sepsis**, n.d.). Sepsis ranks among the top five causes of maternal death in pregnancy and the postpartum period, causing life-threatening organ dysfunction due to obstetric infection (**Liu et. al, 2023**). It is one of the most common causes of maternal death in developed and developing nations.

Overdose, which reported the same number of cases observed in the dataset, was also a leading cause of death among pregnant people. According to a news release by the National Institutes of Health, death by overdose in association with the COVID pandemic is well documented, with studies showing that overdoses rose sharply during the pandemic. However, there is still little known about pregnancy-associated overdose mortality (**Overdose deaths increased in pregnant and postpartum women from early 2018 to late 2021, 2023**).

The third highest reported cause of death for the year was 'Other'. The exposition provided in the dataset dictionary does not specify how 'other' is defined. However, considering that it is one of the highest reported causes of death, this category may serve as a collection for conditions that didn't have enough reported cases to be classified individually. Since this may have been the case, for the sake of focusing attention on specific issues of pregnancy-related deaths, we will proceed with the inclusion of the next highest reported underlying cause, homicide.

Research has supported homicide as a leading cause of pregnancy-related deaths in the United States (**Campbell et al., 2021**). These cases are often circumstances of intimate partner violence (IPV), with the vulnerability of pregnant women making them likely targets of domestic abuse. Particularly young women, who were twice as likely to be at risk of homicide than non-pregnant women (Dietz, 1998, as cited in Campbell, 2021)

When calculating the average number of deaths reported by the dataset, the number comes to about 3. In comparison, the deaths by overdose and infection/sepsis are three times this (9 deaths). For homicide, the number is just over two times the reported average (7 deaths).

FUTURE RESEARCH

To urgently address issues of pregnancy-related death, future research should focus on the ways to prevent and treat sepsis/infection, provide pathways to rehabilitation for substance use disorder (SUD) patients, and outreach programs to patients dealing with domestic violence and IPV. Data collected on the impact of early detection programs, rehabilitation referral programs for SUD patients, and social services to patients who are at risk of domestic abuse would provide insightful data on how access to these programs affects the survival rates of pregnant patients.