

# **Severe Maternal Morbidity**

among in-hospital deliveries in New Mexico, 2016 – 2023

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## Introduction

Severe Maternal Morbidity (SMM) refers to a range of serious health complications that can occur during childbirth, potentially leading to significant short- or long-term health consequences, including maternal mortality 1. These conditions can have a profound impact on the physical and mental health of individuals and serve as important indicators of maternal health at the population level.

National analyses of SMM data reveal a concerning trend of increasing rates and worsening disparities across the United States 2. Findings also reinforce that the COVID-19 virus was linked to adverse maternal and infant health outcomes during the pandemic 3, and this report examines the impact of COVID-19 as well as other comorbidities, such as substance use disorder, during the delivery stay.

The report describes the rate of SMM among delivery hospitalizations in New Mexico from 2016 to 2023, using statewide in-patient hospital discharge data. It examines the prevalence of SMM among NM residents in all non-federal facilities within the state and explores statistical disparities among the patient population.

# Methodology

#### **Data sources**

Data were sourced from the New Mexico Hospital Inpatient Discharge Data (HIDD) system, which is managed by the New Mexico Department of Health (NMDOH). The dataset encompasses demographic and clinical information regarding all non-federal hospital discharges within New Mexico, including diagnoses and procedures that occurred during hospital admissions. Methods for case definition, hospital inclusion and measuring Severe Maternal Morbidity (SMM) were sourced from the Healthcare Cost and Utilization Project (HCUP) and the Centers for Disease Control and Prevention <sup>4</sup>.

#### **Case definition**

The selection criteria and case definition for severe maternal morbidity used in this report are consistent with those established by the Centers for Disease Control and Prevention 1 and followed by the Alliance for Innovation in Maternal Health (AIM). The CDC has identified 20 indicators (16 diagnoses and 4 procedures) that make up the measure of SMM calculated for records drawn from hospital discharges after delivery. Our report focuses solely on New Mexico residents. Since only NM residents were included in this analysis, comparisons to national SMM estimates and NM estimates in national reports may be different.

Only hospital delivery discharges were included in the analysis, so there are no data reflecting SMM among other birth centers or home births.

We followed the hospital selection criteria set by H-CUP which identified 154,206 hospital discharges for resident deliveries that took place in community hospitals in New Mexico between 2016 and 2023. While all selected hospitals had at least one delivery during the review period, four hospitals did not have a birthing unit, and one permanently closed its birthing unit in 2020.

Discharge events with an ICD-10 diagnosis or procedure code indicating a delivery are included, while discharges related to abortion or ectopic pregnancy are not. The focus of this report is the hospital discharge record following delivery, which is based on the date of discharge after delivery. Individuals who have multiple deliveries during the reference period may generate several records, one for each delivery. For inclusion in this study, discharged patients must be female, within the age range of 12 to 55 years, and must have given birth in a community hospital in New Mexico.

This analysis does not include hospitals that offer long-term care or federally-funded institutions. Therefore, Indian Health Services (IHS) facilities that provide maternity and obstetric services are not included in this analysis. The NMDOH works in partnership with Tribal Epidemiology Centers (TEC) and will incorporate data from IHS facilities in future analyses.

#### Methods

We described the birth population characteristics and distribution of hospital deliveries for the period 2016-2023 (Table 1). We calculated the rates of SMM for patient populations and included 2016 and 2021 comparisons, including rates for cases with and without COVID-19 diagnosis (Table 2).

We calculated a 3-year rolling average rate for these indicators to uncover underlying trends over time (Table 3). This method allows us to mitigate the effects of yearly fluctuations and enhances the reliability of our analysis. Furthermore, we computed the overall rolling average for each indicator spanning the years 2016 to 2023, calculating the deviation as a percentage difference between the most recent year and the overall rolling average to facilitate anomaly detection.

To assess differences in subpopulations, we utilized a machine learning algorithm for logistic regression, to estimate the probability of SMM events based on a range of patient characteristics (Figure 2). These characteristics included age, race, ethnicity, primary payer, residency, and the presence of opioid or substance use disorders. The model aimed to identify patterns which could explain factors independently associated with SMM. To assess the influence of each factor, we employed a statistical Wald test, establishing a p-value threshold of 0.05 for statistical significance.

# Distribution of non-federal delivery hospitalizations for NM residents in NM

Table 1. Patient characteristics of NM resident in-hospital deliveries, 2016-2023

Characteristics						
Discharge year	n	%				
2016	21549	13.97				
2017	20684	13.41				
2018	20080	13.02				
2019	19723	12.79				
2020	18878	12.24				
2021	18141	11.76				
2022	17958	11.65				
2023	17193	11.15				
Residence by DOH reg	ion					
DOH region	n	%				
Northwest	12958	8.40				
Northeast	20684	12.02				
Metro	20080	45.27				
Southeast	19723	15.81				
Southwest	18878	18.49				
Residence by populati	on density <sup>1</sup>					
Population density	n	%				
Metropolitan	69809	7.19				
Small Metro	33277	24.52				
Mixed Urban-Rural	45339	53.91				
Rural Counties	5780	14.38				
Age Group						
Patient age	n	%				
12-19 years	12958	8.40				
20-24 years	20684	12.02				
25-34 years	20080	45.27				
35-39 years	18180	11.79				
40 years and over	3991	2.59				

Race						
Patient Race	n	%				
American Indian or Alaskan Native	14863	9.64				
Asian & other Pacific Islander	3029	1.96				
Black or African American	3801	2.46				
White	110213	71.47				
Other or multiple race	17168	11.13				
Ethnicity						
Patient Ethnicity	n	%				
Non-Hispanic	76182	49.40				
Hispanic	78024	50.60				

The New Mexico Department of Health has adopted the 2013 National Center for Health Statistics (NCHS) system to classify the counties in the state into four groups based on urban and rural areas. The categories are Medium Metro, Small Metro, Micropolitan, and Noncore. In New Mexico, we have renamed these groups as Metropolitan, Small Metropolitan, Mixed Urban/Rural, and Rural 2013 NCHS classification.

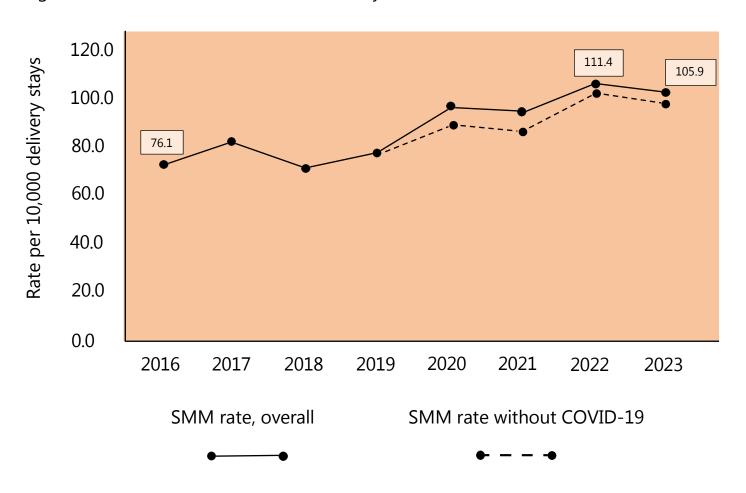
## Trends in rates of severe maternal morbidity (SMM), 2016-2023

Figure 1 shows the trends in delivery hospitalizations with Severe Maternal Morbidity (SMM) from 2016 to 2023. We analyzed the annual trends for inpatient stays involving SMM, considering the impact of the COVID-19 pandemic that began in 2020. Therefore, the rate is presented for the overall and for the delivery hospitalizations without a COVID-19 diagnosis since 2020.

From 2016 to 2022, the overall rate of SMM increased by approximately 46%, rising from 76.1 cases per 10,000 delivery stays in 2016 to 111.4 cases in 2022. However, in 2023, there was a decrease in the SMM rate of about 5% compared to the previous year.

For delivery stays without a COVID-19 diagnosis, the rate of SMM per 10,000 delivery stays also increased by 42% from 2016 to 2022. This subset also experienced a similar decrease of approximately 5% in 2023. The gap between the overall SMM rate and the SMM rate without a COVID-19 diagnosis was around 11% in 2021, but this gap has been narrowing over time.

Figure 1. Rate of Severe Maternal Morbidity (SMM), 2016 - 2023



# Patient characteristics of delivery stays with SMM in 2016 and 2021

Table 2. Number and rate of SMM per 10,000 delivery hospitalizations by patient characteristics and COVID-19 status, 2016 and 2021

	Number of SMM cases		SMM rate			
Patient Characteristics	2016	2021 overall	2021 without COVID-19	2016	2021 overall	2021 without COVID-19
Total	164	173	153	76.1	95.4	85.9
Age group						
Age 12 to 19 years	10	8	8	56.3	70.5	71.7
Age 20 to 24 years	43	32	30	74.8	75.6	72.7
Age 25 to 34 years	74	85	72	65.4	86.0	74.0
Age 35 to 39 years	37	48	43	137.2	165.9	150.8
Over 40 years	13	8	8	275.4	159.4	161.3
Race						
American Indian or Alaskan Native	27	29	21	132.3	171.1	126.3
Asian & other Pacific Islander^	2	4	3	58.7	108.7	82.2
Black or African American^	4	4	4	88.7	85.5	86.6
White*	115	113	105	70.7	87.3	82.5
Other or multiple race		18	15		85.1	72.5
Ethnicity						
Hispanic	80	76	67	89.4	78.0	70.1
Non-Hispanic	84	97	86	66.7	115.5	104.4
Primary payer						
Medicaid	100	100	86	82.6	100.7	88.6
Private insurance	21	28	26	75.3	110.1	103.2
Other public insurance	43	41	37	67.4	78.5	71.9
Self-pay	0	4	4	0.0	101.8	103.4

(Table continued on next page)

<sup>\*</sup> White race includes Hispanic and non-Hispanic ethnicity; ^Events with counts <5 may be unstable and subject to wide margins of error. A cell with '.'means data were suppressed or not available.

	Number of SMM cases		SMM rate			
Patient Characteristics	2016	2021 overall	2021 without COVID-19	2016	2021 overall	2021 without COVID-19
Patient resident population density						
Metropolitan	73	99	88	77.0	119.0	107.8
Small Metro	32	19	17	67.8	48.6	43.9
Mixed Urban-Rural	52	51	45	80.2	97.0	87.4
Rural Counties	7	4	3	81.9	61.5	47.5
Patient resident region						
Northwest	23	15	10	113.6	104.7	70.6
Northeast	25	21	19	97.1	96.1	88.0
Metro	73	99	88	77.0	119.0	107.8
Southeast	18	13	12	57.7	44.9	42.5
Southwest	25	25	24	62.8	75.6	73.7
Patient with SUD diagnosis 2 †						
Yes	13	14	13	237.7	299.1	286.3
No	151	150	140	71.9	90.0	80.6
Patient with OUD diagnosis \$						
Yes	12	10	10	329.7	330.0	336.7
No	152	163	143	71.8	91.4	81.6

<sup>†</sup> Substance use disorders (SUD) include those with diagnosis code for the use of opioids, sedatives, amphetamines, and cocaine. † OUD opioid use disorder was identified using ICD-10-DM codes including heroin, illegal use of prescription opioids, and the use of opioids as prescribed.

The data in Table 2 display number and rate of SMM, both with and without a COVID-19 diagnosis for the years 2016 (baseline) and 2021, the period that experienced the highest peak of COVID-19 cases during the pandemic 5. Rates were highest among patients with a SUD or OUD diagnosis, those over age 40, and for American Indian/Alaska Native persons.

When comparing the years 2016 and 2021, the overall rate of SMM increased significantly across various patient subpopulations. The largest increases were observed among deliveries for women aged 35 to 39 years (a 55% increase), Asian or other Pacific Islander women (an 85% increase^), and for non-Hispanic women (a 73% increase), while rates for Black/African-American patients were similar for the two years compared. The rate rose by 46% for those with private insurance and by 55% for women living in metropolitan areas.

When comparing the years 2016 and 2021, the overall rate of SMM increased significantly across various patient characteristics. The largest increases were observed among deliveries for women aged 25 to 34 years (a 31% increase), Asian or other Pacific Islander women (an 85% increase), and non-Hispanic women (a 73% increase).

Additionally, the rate rose by 46% for those with private insurance and by 55% for those living in metropolitan areas.

In 2021, the overall SMM rate for American Indian or Alaska Native women was 171.1 per 10,000 delivery stays, which is 50% higher than the rate for Black or African-American women, recorded at 85.5 per 10,000. In 2016, the SMM rate for American Indian or Alaska Native women was 55% higher than that of Black women, however small number observations for single years makes it hard to compare the populations.

In 2016, the severe maternal morbidity (SMM) rate for women living in rural counties was slightly higher than that for women in metropolitan areas, with a difference of 6%. However, by 2021, this trend reversed; the SMM rate for women in metropolitan areas was 48% higher than for those living in rural counties.

## Severe Maternal Morbidity Deliveries Disparities

Figure 2. Severe Maternal Morbidity (SMM) Adjusted odds by diagnosis of other factors or select demographic factors, 2016-2023

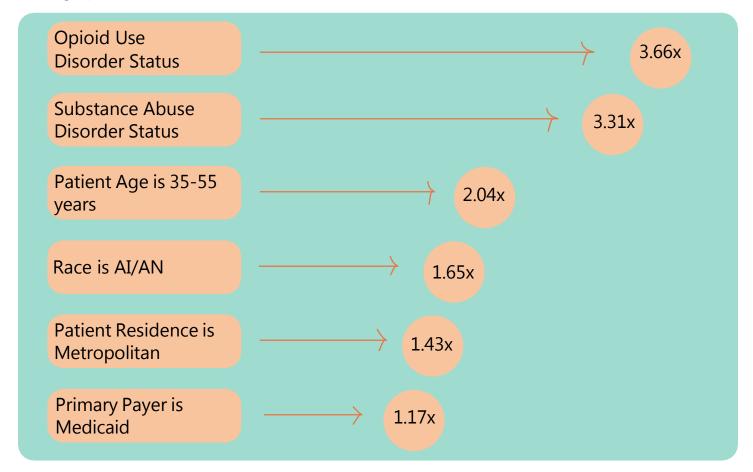


Figure 2 represents the relative impact of patient characteristics on severe maternal morbidity. Women with opioid use disorder or other substance use disorders diagnosis were 3.66 times and 3.31 times, respectively, more likely to experience severe maternal morbidity compared to those without the disorders. This suggests that better addressing substance use could significantly reduce the likelihood of severe maternal complications <sup>6,7</sup>.

Maternal age also influences severe morbidity outcomes. After adjustment for other factors, women ages 35-55 years were more than twice as likely to experience severe maternal morbidity compared to younger individuals, highlighting the need for closer monitoring and age-specific care strategies. SMM rates were double for women ages 35-39 compared to those ages 25-34 in 2016 and in 2021, with and without COVID-19 diagnosis (Table 2).

Differences in SMM among subpopulations were pronounced. Women recorded as American Indian or Alaska Native had a 1.65 times higher likelihood of SMM compared to all other NM residents. These findings could inform preventive measures, such as utilizing midwifery care and community care workers to provide personalized, culturally-appropriate advocacy and anti-racist care and support <sup>8</sup>.

Women living in metropolitan areas were 1.43 times more likely to experience SMM than those residing in rural and micropolitan areas. This reflects a shift from a rural to an urban disparity over time, and while we don't have a direct explanation, we will monitor the impact of patient residence going forward. Improving urban infrastructure to address housing instability and affordability could positively impact maternal mental health and enhance overall maternal outcomes <sup>9</sup>.

Medicaid also plays a significant role as a socioeconomic indicator impacting SMM. The report indicated that Medicaid beneficiaries were 1.17 times more likely to experience SMM than privately insured or self-pay individuals. To improve maternal health outcomes, some literature points to value-based care models, emphasizing the quality of care delivered to underserved populations rather than just measuring the quantity of services provided <sup>10</sup>.

# Severe Maternal Morbidity by hospital levels of maternal care

Figure 3 illustrates the rates of SMM categorized by Hospital Level of Maternal Care from 2016 to 2023. The Regional Perinatal Healthcare Center (Level IV), recognized as the most competent facility for managing complicated pregnancies in New Mexico, has consistently reported the highest rates of SMM throughout this period. Reflecting overall rates observed across the years, the disparity between the overall SMM rate and the SMM rate for patients at Level IV without a COVID-19 diagnosis was approximately 14% in 2021; however, this gap has progressively narrowed over time.

Hospitals designated for Specialty Care (Level II) have experienced fluctuations in SMM rates, which peaked at 83.2 cases per 10,000 deliveries between 2019 and 2020. In contrast, there has been minimal change in SMM rates among hospitals designated for Basic Care (Level I).

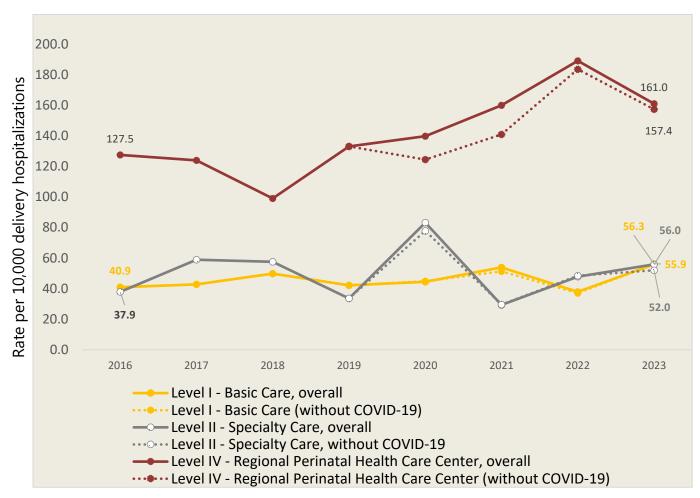


Figure 3. Rate of SMM by year, COVID-19, and by level of maternal care, 2016-2023

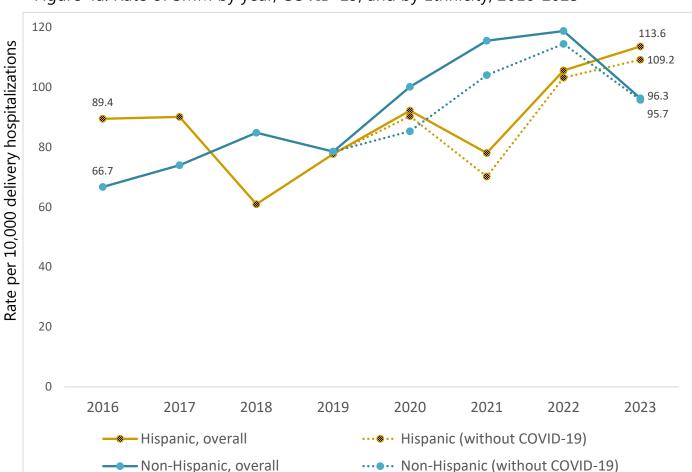


Figure 4a. Rate of SMM by year, COVID-19, and by Ethnicity, 2016-2023

In 2020, there was a 17% increase of SMM among non-Hispanic women among COVID-19 cases, which underscores the significant impact of the pandemic for that population. The impact of COVID-19 on SMM in Hispanic women revealed a disparity between those with COVID-19 and those without only in 2021, with an 11% difference (Figure 4a).

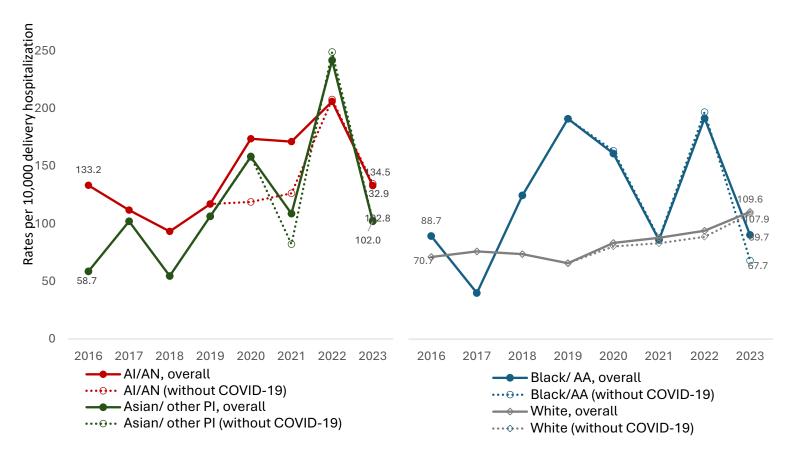
By 2022, this disparity decreased to 4%, indicating progress and improved health outcomes in Hispanic populations.

# Rate of Severe Maternal Morbidity by Year, COVID-19 and by Maternal Race, 2016-2023

Between 2022 and 2023, we observed significant declines in the overall rates of severe maternal morbidity among American Indian, Asian/Pacific Islander, and Black populations, with reductions of 35%, 58%, and 53% respectively (Figures 4b). However, the SMM rate for White (including Hispanic and non-Hispanic) individuals increased by 17.4%. The rates for Black/African-American women were subject to small numbers and change up or down for each year and may better be understood as an average rate when more years can be aggregated. Nevertheless, trends reveal a clear disparity between Black and White (Hispanic and non-Hispanic) birthing people.

American Indian residents were disproportionately affected by the COVID-19 pandemic since the onset in 2020, with an overall SMM rate of 173.7 per 10,000 delivery stays, in contrast to a rate of 126.3 when COVID-19 was not a factor.

Figures 4b. Rates of SMM by year and by maternal race, with and without COVID-19



## Trends for SMM indicators, 2016-2023 rolling averages

Table 3 displays the 3-year rolling average of 20 diagnosis or procedure indicators that make up the measure of severe maternal morbidity. The most recent rate (2023) was compared to the overall rate (2016-2023) to calculate percent change for each indicator.

Table 3. SMM indicator rate per 10,000 deliveries, rolling averages and percent change between 2023 and 2016-2023

Indicators for SMM	Overall Rate ▼	Current Rate vs Overall Rate	Rate trend
Acute Renal Failure	56.67	<b>▲</b> 93.0%	
Sepsis	31.1 <mark>9</mark>	▲ 32.9%	
Disseminated Intravascular Coagulation	24.38	<b>▲</b> 15.7%	
Hysterectomy	14.79	▼ -22.2%	
Adult Respiratory Distress Syndrome	14.00	<b>▲</b> 11.0%	
Shock	8.70	▲ 85.2%	
Eclampsia	7.49	▼ -7.8%	<b>\\\</b>
Pulmonary Edema / Acute Heart Failure	6.73	▲ 19.8%	
Air and Thrombotic Embolism	4.11	▼ -2.0%	
Ventilation	3.96	▲ 30.6%	
Puerperal cerebrovascular disorders	2.64	▲ 52.8%	
Cardiac Arrest / Ventricular Fibrillation	1.03	<b>▲</b> 11.3%	<b>/</b>
Severe Anesthesia Complications	1.00	▼ -42.3%	-
Acute Myocardial Infarction	0.89	<b>▲</b> 46.3%	
Amniotic Fluid Embolism	0.88	▼ -34.3%	
Conversion of Cardiac Rhythm	0.83	▼ -30.5%	
Aneurysm	0.56	▲ 2.2%	•
Temporary Tracheostomy	0.54	<b>▲</b> 7.4%	
Heart Failure or Arrest	0.52	<b>w</b> %	
Sickle Cell Disease with Crisis	0.49	<b>~</b> %	

Data presented in Table 3 indicate a general upward trend in the rates of several SMM indicators over time. Some conditions, such as Severe Anesthesia Complications, Conversion of Cardiac Rhythm, and Amniotic Fluid Embolism, did not increase or had decreased over time. Acute Renal Failure emerged as the most prevalent indicator of SMM. Should the current rates be applied to future projections, it is anticipated that Acute Renal Failure would be documented in approximately 119 births in 2024. The most recent rate showed a 93% deviation from the overall rate, signifying a substantial increase beyond prior trends.

Sepsis and Disseminated Intravascular Coagulation represent significant components of severe maternal morbidity, with rolling average rates of 31.2 and 24.4, respectively. Notably, anomaly detection identified deviations exceeding 20% from the overall rates for conditions such as Shock, Ventilation, and Puerperal Cerebrovascular Disorder, with percent changes at 85.2%, 30.6%, and 52.8%, respectively.

### Discussion and Recommendations

The analysis of severe maternal morbidity (SMM) trends from 2016 to 2023 reveals a troubling trend. The 46% increase in SMM rates from 2016 to 2022 highlights an escalating public health problem that cannot be ignored. While the slight decrease observed in 2023 offers a glimmer of hope, it also raises critical questions about the ongoing challenges that delivering women and healthcare providers face.

The notable rise in SMM, even among delivery hospitalizations without a COVID-19 diagnosis, underscores that the pandemic amplified pre-existing health disparities rather than generating them anew. The diminishing gap between the overall SMM rates and those without a COVID-19 diagnosis emphasizes the urgent need for comprehensive strategies to tackle the root causes of these maternal health challenges.

The comparison of SMM rates between 2016 and 2022 reveals stark disparities. Women aged 25-34, Asian or Pacific Islander women, and non-Hispanic (Black, AI/AN, White and Asian) women have experienced significant increases in SMM, particularly in metropolitan areas. This shift highlights the critical importance of addressing healthcare accessibility, particularly for those navigating the complex dynamics of urban settings.

The dramatic disparities among racial subpopulations demand focused action. American Indian or Alaska Native women bear the heaviest burden of SMM, followed by Black/African American women, revealing urgent gaps in the effectiveness of existing healthcare models for these communities. It is imperative that we implement culturally responsive and anti-racist care, as well as targeted interventions to address the unique obstacles faced by these populations.

The increased likelihood of SMM among women with substance use disorders, as well as older women, underscores vital intervention points. Tackling substance use not only has the potential to improve individual health outcomes but also serves as a critical step towards alleviating the broader systemic healthcare challenges we face.

Additionally, the relationship between Medicaid status and SMM emphasizes the profound impact of socioeconomic factors on maternal health. The finding that women enrolled in Medicaid are nearly 20% more likely to face severe complications calls for urgent policy reforms aimed at enhancing access to quality care for underserved populations. Prioritizing these efforts could yield significant improvements in maternal health outcomes.

In summary, these findings bring to focus the pressing need for multifaceted, proactive strategies to address the factors contributing to severe maternal morbidity. Enhancing access to prenatal and postnatal care, promoting community-driven interventions, and fostering collaborative efforts across sectors are essential steps toward improving the social determinants of health for diverse maternal populations. It is only through such concerted efforts that we can achieve meaningful improvements in maternal health and reduce the unacceptable disparities currently affecting mothers in New Mexico.

## **Next Steps**

NMDOH has developed data dashboards for Severe Maternal Morbidity (SMM) to support monitoring and improving maternal health outcomes in several ways:

- Real-Time Insights: A data dashboard for each hospital will provide quarterly data, enabling quick identification of areas that require intervention.
- Trend Visualization: By visualizing data such as rolling averages or trend lines—the dashboard helps identify patterns in SMM rates. This information can guide targeted interventions to address emerging issues.
- Tracking Quality Improvements: Healthcare organizations can use the dashboard to monitor the effectiveness of quality improvement initiatives, such as protocols for managing acute renal failure. It will also provide measurable outcomes to help assess whether interventions are successfully reducing SMM rates.
- Medicaid and NMDOH should work together to incentivize hospitals who implement impactful quality improvement models.
- Patient-centered measures and those addressing social drivers of health may help design upstream and clinical interventions. NMDOH should promote research to improve person-centered indicators in health care experiences.
- Data Stratification: stratify data by demographic factors such as race, ethnicity, geography, and socioeconomic status. This is crucial for developing equitable care strategies and addressing systemic inequities.
- Transparency and Accessibility: promotes transparency by making data accessible to healthcare teams, patients, community stakeholders, and policymakers. This will help them understand the scope and impact of SMM and enable them to take informed actions.

Data dashboards can be found here or by contacting the MCH Epidemiology Program: MCH Dashboards

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## Appendix- Indicators of Severe Maternal Morbidity (SMM)

### **DIAGNOSES**

Acute myocardial infraction (heart attack) Cardiac arrest/ventricular fibrillation Heart failure/arrest during surgery or procedure Pulmonary edema/acute heart failure Acute respiratory distress syndrome Air and thrombotic embolism Disseminated intravascular coagulation Amniotic fluid embolism Aneurysm Puerperal cerebrovascular disorders Eclampsia Sickle cell disease with crisis Sepsis Acute renal failure Shock Severe anesthesia complications

### **PROCEDURES**

Conversion of cardiac rhythm Temporary Tracheostomy Hysterectomy Ventilation

