

# *Severe Maternal Morbidity Nevada, December 2018-2020*

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*December 2020*



*Office of Analytics  
Department of Health and Human Services*

**Steve Sisolak**  
*Governor  
State of Nevada*

**Lisa Sherych**  
*Administrator  
Division of Public and Behavioral Health*

**Richard Whitley, MS**  
*Director  
Department of Health and Human Services*

**Ihsan Azzam, Ph.D., MD**  
*Chief Medical Officer  
Division of Public and Behavioral Health*

# Acknowledgements

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**Report Prepared by:**

**Jie Zhang, MS**

Maternal and Child Health Biostatistician  
Office of Analytics  
Nevada Department of Health and Human Services

**Editing, Review, and Comments:**

**Amy Lucas, MS**

Health Resource Analyst II  
Office of Analytics  
Nevada Department of Health and Human Services

**Jennifer Thompson, BS**

Behavioral Health Data Manager  
Office of Analytics  
Nevada Department of Health and Human Services

**Kyra Morgan, MS**

Chief Biostatistician  
Office of Analytics  
Nevada Department of Health and Human Services

**Vickie Ives, MA**

Maternal, Child and Adolescent Health Section Manager  
Division of Public and Behavioral Health  
Nevada Department of Health and Human Services

**Tami Conn**

Health Program Specialist II  
Division of Public and Behavioral Health  
Nevada Department of Health and Human Services

**Martha Framsted**

Public Information Officer  
Division of Public and Behavioral Health  
Nevada Department of Health and Human Services

**For Additional Information Contact:**

**Jie Zhang, MS**

Maternal and Child Health Biostatistician  
Office of Analytics  
Nevada Department of Health and Human Services

4126 Technology Way, Suite 200

Carson City, Nevada 89706

(775) 684-5933

[data@dhhs.nv.gov](mailto:data@dhhs.nv.gov)

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## Background

Maternal morbidity is a continuum from mild adverse effects to life-threatening events or maternal death (Figure 1).<sup>1</sup> Severe Maternal Morbidity (SMM) refers to conditions and diagnoses that indicate potentially life-threatening maternal complication, including unexpected outcomes of labor and delivery resulting in significant short- or long-term consequences to a woman's health.<sup>2</sup> SMM relates to higher risks of adverse pregnancy outcomes like preterm birth and infant death. With a high rate of preventability, SMM can be considered a near miss for maternal mortality because in some cases, without identification and treatment, conditions could lead to maternal death. Identifying SMM is important for preventing injuries leading to mortality and for highlighting opportunities to avoid repeat injuries.

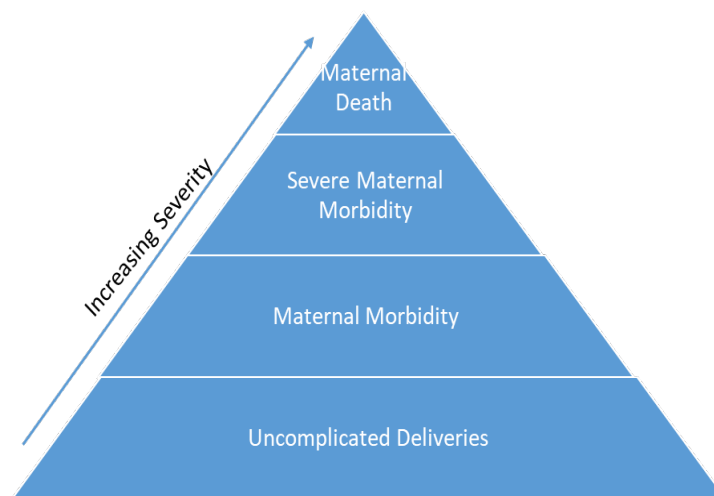


Figure 1. Continuum of Maternal Morbidity Showing Variation in Severity

The Health Resources Services Administration (HRSA) reports that SMM has increased by about 75% over the past decade<sup>3</sup>, while the Centers for Disease Control and Prevention (CDC) reports that it has been steadily increasing in recent years and affected more than 50,000 women in the United States in 2014.<sup>4</sup> The overall rate of SMM per 10,000 deliveries increased almost 200% over the years, from 49.5 in 1993 to 144.0 in 2014.<sup>4</sup> This increase has been mostly driven by blood transfusion.<sup>4</sup> A blood transfusion in this context refers to the procedure in which women are given donated blood around their delivery hospitalization. The rate of blood transfusions per 10,000 deliveries increased from 24.5 in 1993 to 122.3 in 2014.<sup>4</sup> After excluding blood transfusions, the rate of SMM per 10,000 deliveries increased by about 20% over time, from 28.6 in 1993 to 35.0 in 2014.<sup>4</sup>

# Methodology

## Data Sources

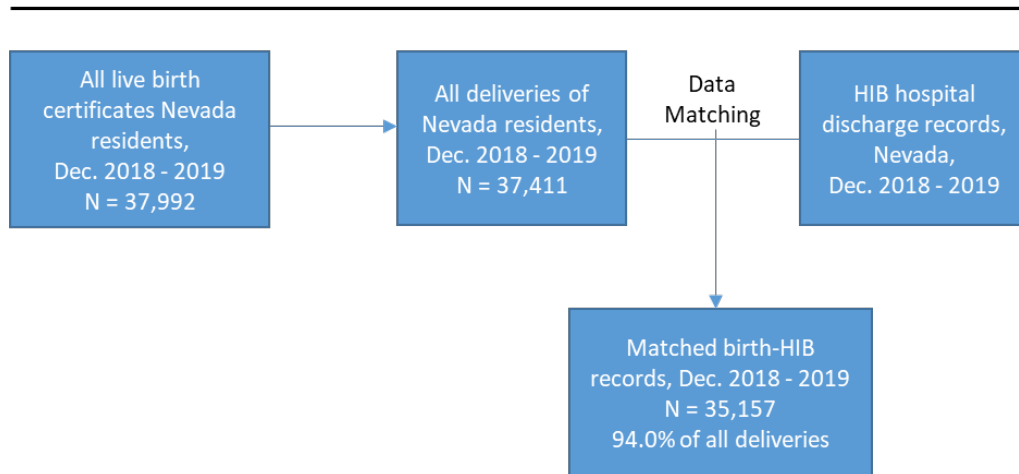
Nevada Electronic Birth Registry: Nevada Department of Health and Human Services, Division of Public and Behavioral Health, Office of Vital Records uses Web-enabled Vital Records Registry System (WEVRRS) to collect information on all live births in Nevada and issues birth certificates. The birth certificate contains demographic information, such as mother's age, race/ethnicity, and education, as well as information about the pregnancy, such as number of previous live birth (parity), prenatal care, and complications of labor and delivery.

Hospital Inpatient Billing (HIB) Data: The Hospital Inpatient Billing data provides health billing data for patients discharged from Nevada's non-federal hospitals. NRS 449.485 mandates all hospitals in Nevada report information as prescribed by the Director of the Department of Health and Human Services. The data are collected using a standard universal billing form. For patients who were admitted for at least 24 hours as an inpatient, but do not include patients who were discharged from the emergency room. The data includes demographics such as age, gender, race/ethnicity and uses the International Classification of Diseases-10-Clinical Modification (ICD-10-CM) diagnoses codes (up to 33 diagnoses respectively). In addition, the data includes billed hospital charges, procedure codes, length of hospital stay, and discharge status. The billing data information is for billed charges and not the actual payment received by the hospital.

## Data Matching

Nevada birth certificates were matched with the mother's delivery hospitalization record from Hospital Inpatient Billing (HIB) data. Multiple births (e.g. twins, triplets) were counted as one delivery, (only one birth certificate was matched per hospital discharge record, even when there was a multiple birth). The total number of live births to Nevada residents was 37,992 from December 2018 to December 2019. The total number of all live deliveries was 37,411, comprising all records from singleton births and one record per multiple births. Approximately 94% of all live deliveries were matched with a hospital discharge record. All analyses are based on matched data (n=35,157). Birth certificates and hospital discharge records were matched on mother's social security number, name, birth date, medical record number, and the facility of the delivery hospitalization. Non-matched birth certificates may be due to home births, missing social security number, misspelled names, etc.

Figure 2. Data Matching Process for Birth Certificates and HIB Records, Nevada, December 2018 - December 2019



## Identification of Severe Maternal Morbidity (SMM)

SMM events were identified during delivery hospitalizations using an algorithm developed by researchers at the CDC.<sup>5</sup> The algorithm used ICD-9/10-CM codes to identify 25 indicators of SMM that represent either serious complications of pregnancy or delivery, such as disseminated intravascular coagulation or eclampsia, or procedures used to manage serious conditions, such as blood transfusion or hysterectomy. The Alliance for Innovation on Maternal Health (AIM) methods were used to identify pregnancy deliveries and ICD-9 were converted to ICD-10 to identify SMM indicators. Four out of 25 ICD-9 indicators did not have corresponding ICD-10 codes. Of the 21 indicators remaining, 16 were identified using ICD-10 diagnosis codes and five were identified using ICD-10 procedure codes. A complete list of conditions and ICD-10 codes is listed in Appendix A.

To ensure that only the most severe cases of these 21 indicators during delivery hospitalizations were captured, these indicators were classified as SMM only if they additionally met one of the following criteria:

- The mother's length of stay was equal to or greater than the 90<sup>th</sup> percentile by delivery method.
- The mother was transferred before or after delivery to a different facility.
- The mother died during delivery hospitalization.
- At least one of the five procedure indicators was present.

## Analysis

All SMM rates were calculated per 10,000 live deliveries that successfully matched with a HIB record. Chi-square tests and bivariate logistic regression were used to test the significance of the association between maternal characteristics and SMM. The analyses in the report includes blood transfusion in the calculation of SMM unless otherwise noted. P-values less than 0.05 were deemed statistically significant.

Records with missing data on a variable of interest were not represented in the graph of SMM but are represented in the tables.

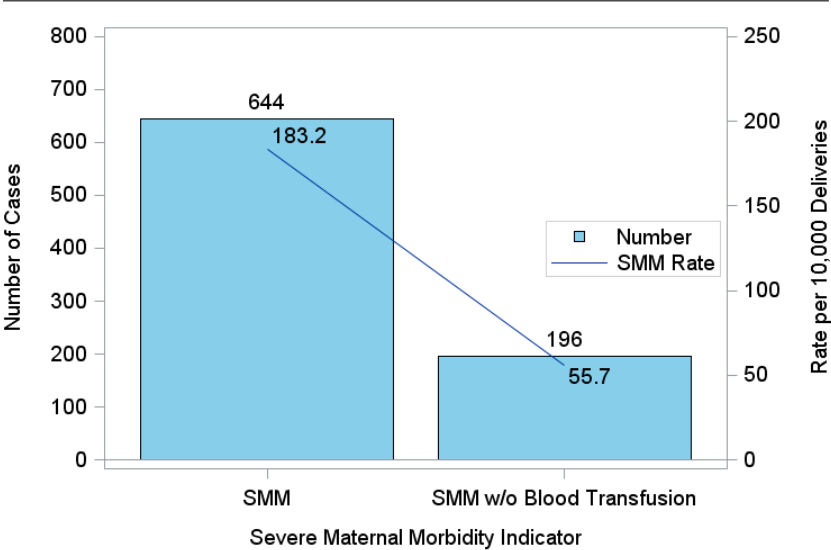
All analyses were conducted using SAS 9.4.

# Data of December 2018 to December 2019

## Leading Indicators

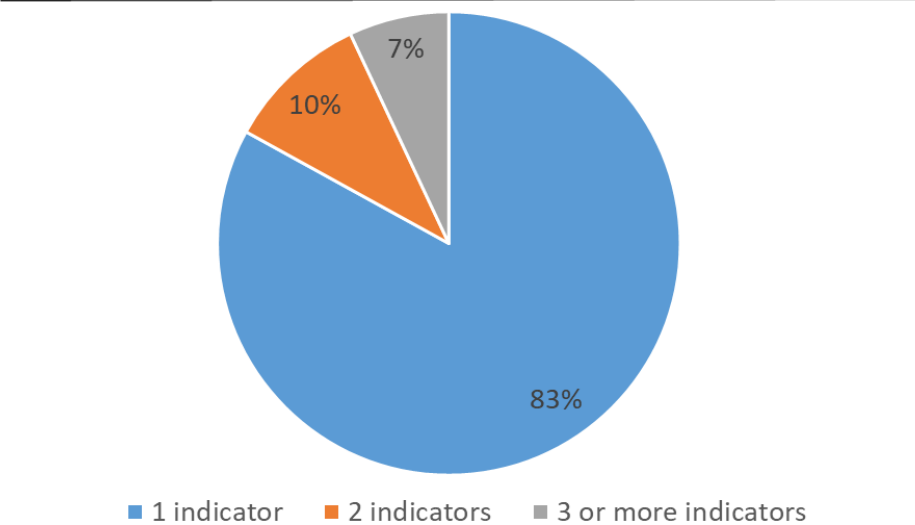
There were a total of 644 cases of SMM from December 2018 to December 2019 with rate of 183.2 per 10,000 deliveries. If blood transfusion was not included in the calculation, SMM cases dropped to 196 and rate dropped to 55.7 per 10,000 deliveries. The analyses in the report includes blood transfusion in the calculation of SMM unless otherwise noted.

**Figure 3. Severe Maternal Morbidity Rate per 10,000 Deliveries and Number of Cases, Nevada, December 2018 - December 2019**



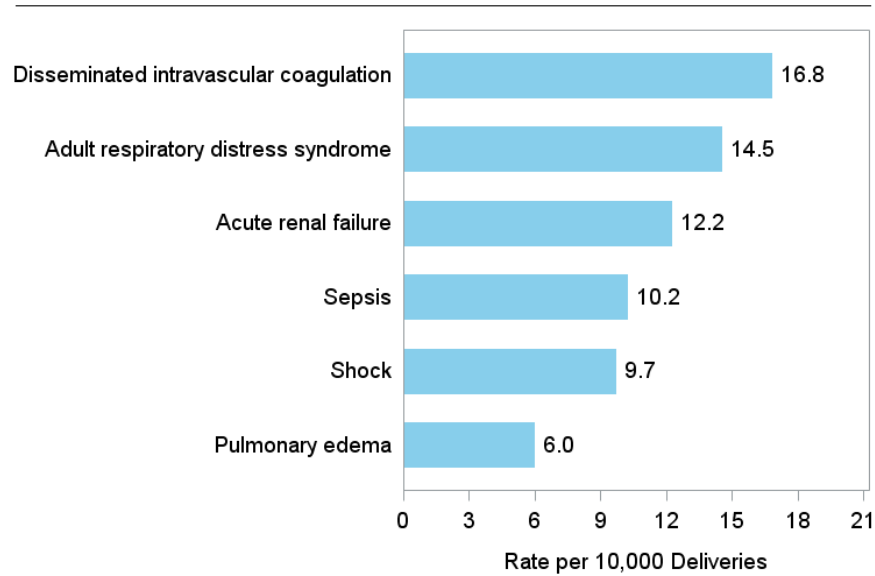
The majority of deliveries with SMM (83%) had one indicator (out of a total of 21 SMM indicators), ten percent of deliveries had two indicators and seven percent had three or more indicators present.

**Figure 4. Distribution of Severe Maternal Morbidity Indicators, Nevada, December 2018 - December 2019**



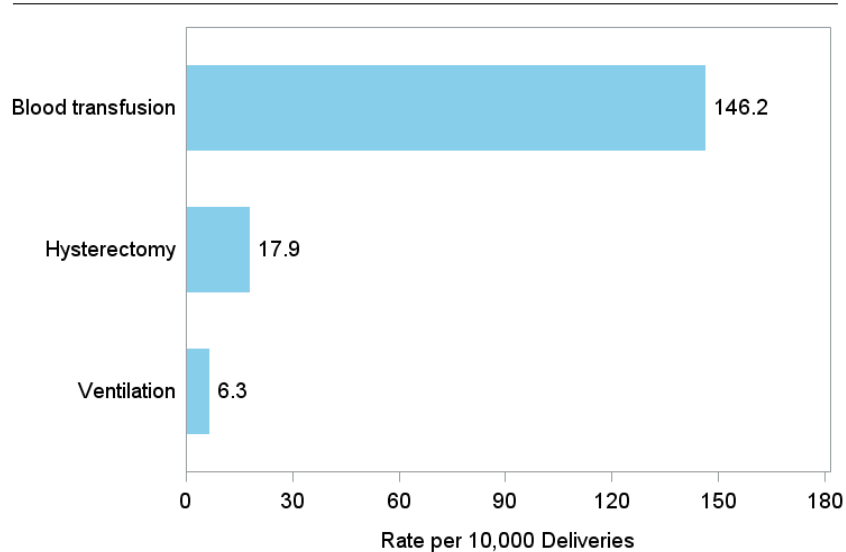
The leading diagnosis-based indicators of SMM were disseminated intravascular coagulation (16.8 per 10,000 deliveries), adult respiratory distress syndrome (14.5 per 10,000 deliveries), acute renal failure (12.2 per 10,000 deliveries), sepsis (10.2 per 10,000 deliveries), shock (9.7 per 10,000 deliveries) and pulmonary edema (6.0 per 10,000 deliveries). See Table 1 and Appendix A for a complete list and description of SMM indicators.

**Figure 5. Leading Diagnosis-Based Indicators of Severe Maternal Morbidity, Nevada, December 2018 - December 2019**



Leading procedure-based indicators of SMM were blood transfusion (146.2 per 10,000 deliveries), hysterectomy (17.9 per 10,000 deliveries) and ventilation (6.3 per 10,000 deliveries). See Table 1 and Appendix A for a complete list and description of SMM indicators.

**Figure 6. Leading Procedure-Based Indicators of Severe Maternal Morbidity, Nevada, December 2018 - December 2019**





**Table 1. Rate of Severe Maternal Morbidity Indicators per 10,000 Deliveries, Nevada, December 2018 – December 2019**

<b>SMM Indicator</b>	<b>Rate per 10,000 Deliveries</b>
<b>Diagnosis-based Indicators</b>	
Disseminated intravascular coagulation	16.8
Adult respiratory distress syndrome	14.5
Acute renal failure	12.2
Sepsis	10.2
Shock	9.7
Pulmonary edema	6.0
Eclampsia	5.1
Puerperal cerebrovascular disorders	4.3
Thrombotic embolism	3.1
Cardiac arrest/ventricular fibrillation	1.4
Acute myocardial infarction	0.3
Complications during procedure or surgery	0.3
Amniotic fluid embolism	0.3
Severe anesthesia complications	0.3
Sickle cell anemia with crisis	0.3
Intracranial injuries*	-
Internal injuries of the thorax, abdomen, and pelvis*	-
Heart failure during procedure or surgery	-
<b>Procedure-based Indicators</b>	
Blood transfusion	146.2
Hysterectomy	17.9
Ventilation	6.3
Conversion of cardiac rhythm	1.4
Temporary Tracheostomy	0.3
Cardio monitoring*	-
Operations on the heart and pericardium*	-
<b>SMM Rate Overall</b>	<b>183.2</b>

\* 4 indicators were not carried over to ICD-10 codes system.

## Maternal Demographic Characteristics

**Table 2. Severe Maternal Morbidity by Maternal Demographics, Nevada, December 2018 - December 2019**

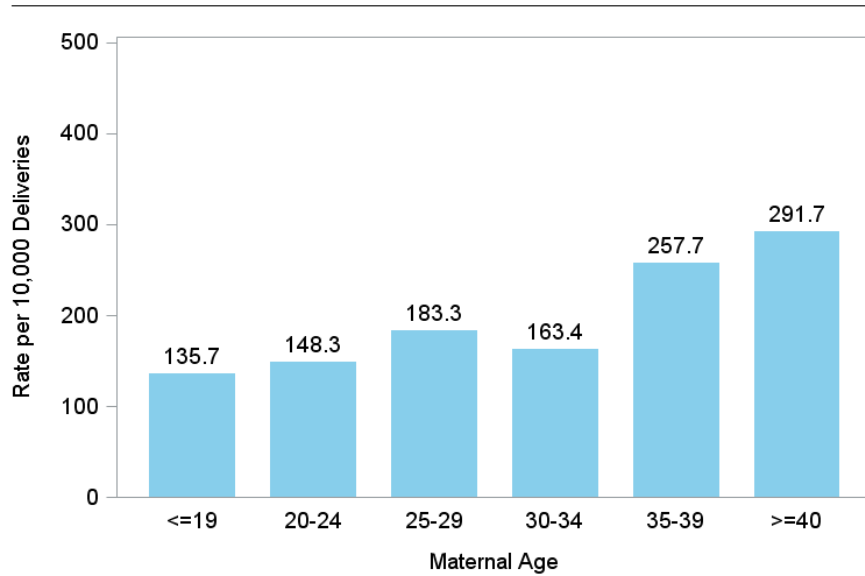
	SMM Cases	Rate per 10,000 Deliveries	Total Deliveries	Percent of Total Deliveries	Percent of SMM Cases	Chi-Square P-value
<b>Maternal Age</b>						
<=19	24	135.7	1,768	5.0%	3.7%	<.0001
20-24	106	148.3	7,148	20.3%	16.5%	
25-29	194	183.3	10,582	30.1%	30.1%	
30-34	152	163.4	9,302	26.5%	23.6%	
35-39	132	257.7	5,122	14.6%	20.5%	
>=40	36	291.7	1,234	3.5%	5.6%	
Unknown	0	0	1	0.0%	0.0%	
<b>Race/Ethnicity</b>						
White non-Hispanic	171	133.6	12,802	36.4%	26.6%	<.0001
Black non-Hispanic	140	271.1	5,165	14.7%	21.7%	
AI/AN non-Hispanic	7	231.0	303	0.9%	1.1%	
API non-Hispanic	81	245.2	3,304	9.4%	12.6%	
Hispanic	235	176.3	13,328	37.9%	36.5%	
Other	2	229.9	87	0.2%	0.3%	
Unknown	8	476.2	168	0.5%	1.2%	
<b>Education</b>						
Less than High School	106	199.2	5,321	15.1%	16.5%	0.0035
High School Graduate	242	210.6	11,490	32.7%	37.6%	
Some College	163	164.9	9,882	28.1%	25.3%	
College Graduate or Higher	103	144.0	7,153	20.3%	16.0%	
Unknown	30	228.8	1,311	3.7%	4.7%	
<b>Insurance<sup>^</sup></b>						
Medicaid	340	212.1	16,033	45.6%	52.8%	0.0008
Other Government	14	254.1	551	1.6%	2.2%	
Private	264	155.2	17,014	48.4%	41.0%	
Self-pay	20	190.7	1,049	3.0%	3.1%	
Other	4	85.5	468	1.3%	0.6%	
Unknown	2	476.2	42	0.1%	0.3%	

<sup>^</sup> Health insurance status indicates the primary payer for the delivery as recorded on hospital discharge form.

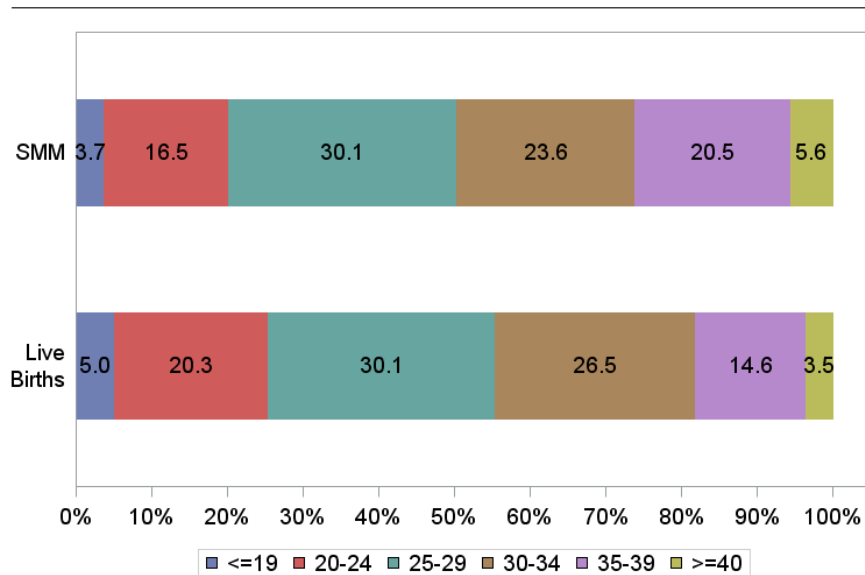
When considering the SMM rate including blood transfusions, the SMM is significantly associated with maternal age ( $p = <.0001$ ), maternal race and ethnicity ( $p = <.0001$ ), maternal education ( $p = 0.0035$ ), and health insurance status ( $p = 0.0008$ ).

Maternal age was a significant risk factor of SMM with blood transfusion ( $p = <.0001$ ), (Tables 2). Women aged 35 to 39 accounted for 14.6% of all deliveries but 20.5% of all SMM cases, (Table 2). Women 40 and older accounted for 3.5% of all deliveries but 5.6% of all SMM cases, (Table 2). SMM rates among women 40 and older (291.7 per 10,000 deliveries) and women 35 to 39 years old (257.7 per 10,000 deliveries) were higher than that of women 25 to 29 years old (183.3 per 10,000 deliveries).

**Figure 7. Severe Maternal Morbidity by Maternal Age, Nevada, December 2018 - December 2019**

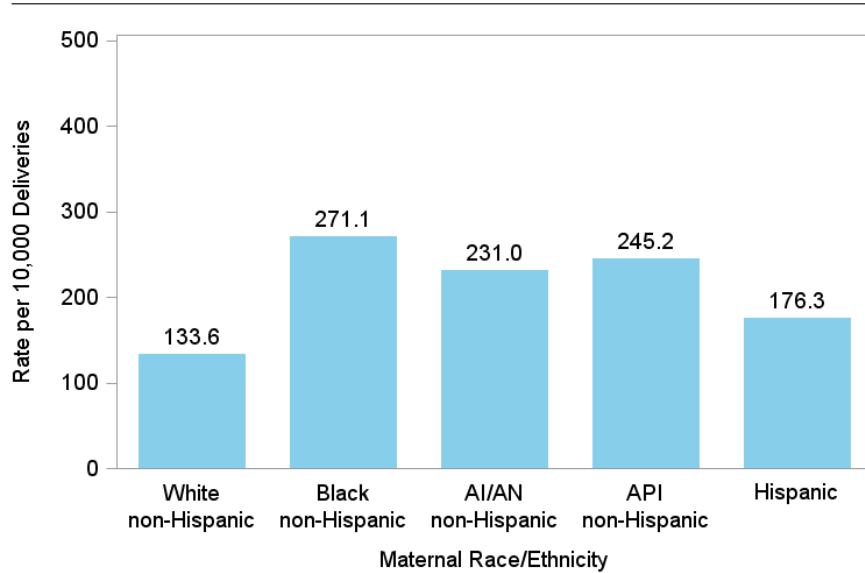


**Figure 8. Distribution of Live Births and Severe Maternal Morbidity by Maternal Age, Nevada, December 2018 - December 2019**

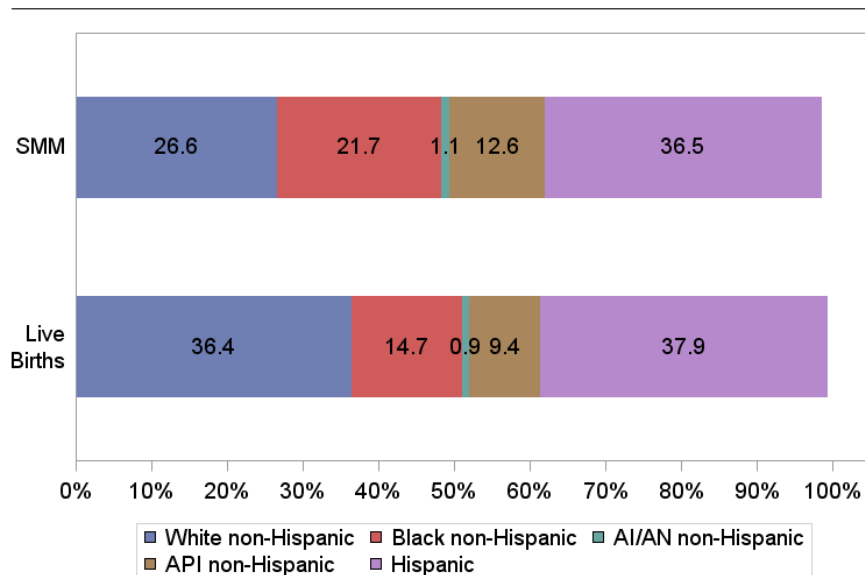


Mother's race/ethnicity is significantly associated with SMM rates with blood transfusion, with  $P = <.0001$ , (Table 2). The SMM rate among Black non-Hispanic women (271.1 per 10,000 deliveries) was higher than that of White non-Hispanic women (133.6 per 10,000 deliveries). Black non-Hispanic women accounted for 14.7% of all deliveries but 21.7% of SMM cases (Table 2). Asian Pacific Islander (API) non-Hispanic (245.2 per 10,000 deliveries) and Hispanic (176.3 per 10,000 deliveries) women also had higher SMM rate than White non-Hispanic women (133.6 per 10,000 deliveries).

**Figure 9. Severe Maternal Morbidity by Maternal Race/Ethnicity, Nevada, December 2018 - December 2019**

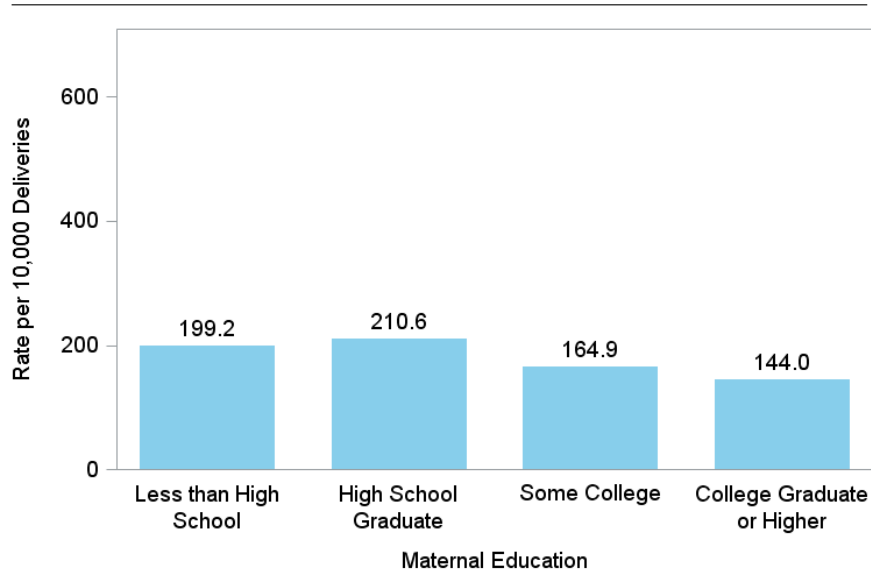


**Figure 10. Distribution of Live Births and Severe Maternal Morbidity by Maternal Race/Ethnicity, Nevada, December 2018 - December 2019**



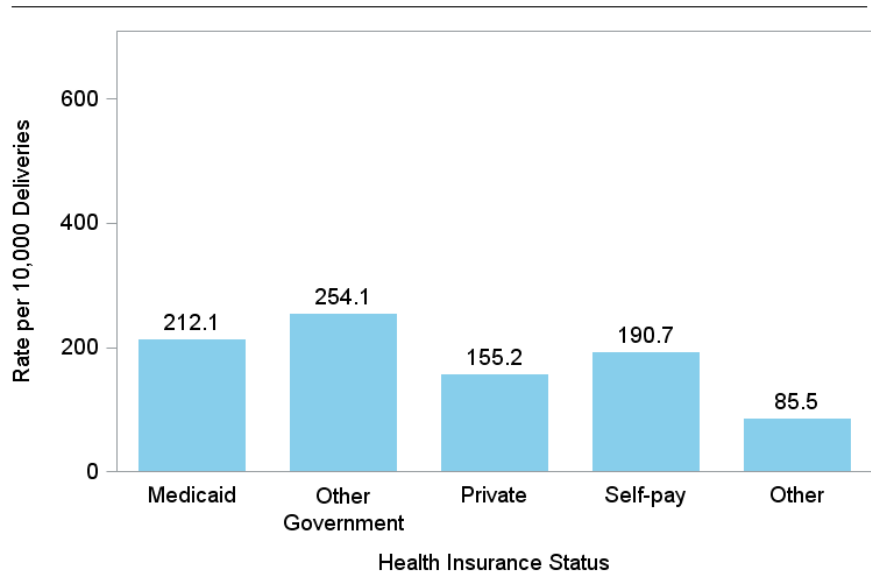
Maternal education is also significantly associated with SMM with blood transfusion ( $p = 0.0035$ ), (Table2). The SMM rates among women with education of some college (164.9 per 10,000 deliveries) or college graduate or higher (144.0 per 10,000 deliveries) were lower than that of women who were high school graduates (210.6 per 10,000 deliveries).

**Figure 11. Severe Maternal Morbidity by Maternal Education, Nevada, December 2018 - December 2019**



Health insurance status is another significant factor associated with SMM with blood transfusion. SMM rate among women with Medicaid insurance (212.1 per 10,000 deliveries) was higher than that of women with private insurance (155.2 per 10,000 deliveries). There was no significant difference of SMM rates among women with other government insurance and women with private insurance.

**Figure 12. Severe Maternal Morbidity by Health Insurance Status, Nevada, December 2018 - December 2019**



## Prenatal and Delivery Characteristics

**Table 3. Severe Maternal Morbidity by Prenatal and Delivery Characteristics, Nevada, December 2018 – December 2019**

	SMM Cases	Rate per 10,000 Deliveries	Total Deliveries	Percent of Total Deliveries	Percent of SMM Cases	Chi-Square P-value
<b>Prenatal Care Initiation</b>						
No Care	74	376.2	1,967	5.6%	11.5%	<.0001
First Trimester	389	158.8	24,502	69.7%	60.4%	
Second Trimester	84	160.9	5,222	14.9%	13.0%	
Third Trimester	30	269.1	1,115	3.2%	4.7%	
Unknown Start Date	12	215.1	558	1.6%	1.9%	
Unknown	55	306.7	1,793	5.1%	8.5%	
<b>Adequacy of Prenatal Care</b>						
Inadequate	69	181.7	3,797	10.8%	10.7%	<.0001
Intermediate	48	166.0	2,891	8.2%	7.5%	
Adequate	153	121.4	12,601	35.8%	23.8%	
Adequate Plus	233	202.5	11,508	32.7%	36.2%	
Data Missing/Unknown	141	323.4	4,360	12.4%	21.9%	
<b>Parity</b>						
0 Previous Live Births	229	172.5	13,278	37.8%	35.6%	<.0001
1 Previous Live Births	143	139.6	10,243	29.1%	22.2%	
2+ Previous Live Births	271	233.1	11,627	33.1%	42.1%	
Unknown	1	1,111.1	9	0.0%	0.2%	
<b>Method of Delivery*</b>						
Repeat Cesarean	201	363.1	5,535	15.7%	31.2%	<.0001
Primary Cesarean	224	363.5	6,163	17.5%	34.8%	
Vaginal	219	93.4	23,459	66.7%	34.0%	
<b>Plurality</b>						
Singleton Birth	612	176.7	34,626	98.5%	95.0%	<.0001
Multiple Birth	32	602.6	531	1.5%	5.0%	
<b>Pre-Pregnancy BMI~</b>						
Underweight (<18.5)	25	191.9	1,303	3.7%	3.9%	0.5212
Normal Weight (18.5- 24.9)	234	164.9	14,194	40.4%	36.3%	
Overweight (25.0 - 29.9)	164	181.5	9,038	25.7%	25.5%	
Class I (30.0 - 34.9)	88	170.3	5,166	14.7%	13.7%	
Class II (35.0 - 39.9)	45	179.6	2,506	7.1%	7.0%	
Class III (>=40)	38	229.2	1,658	4.7%	5.9%	
Unknown	50	387.0	1,292	3.7%	7.8%	
<b>Chronic Disease^</b>						
No Chronic Disease	602	175.8	34,236	97.4%	93.5%	<.0001
Any Chronic Disease	42	456.0	921	2.6%	6.5%	

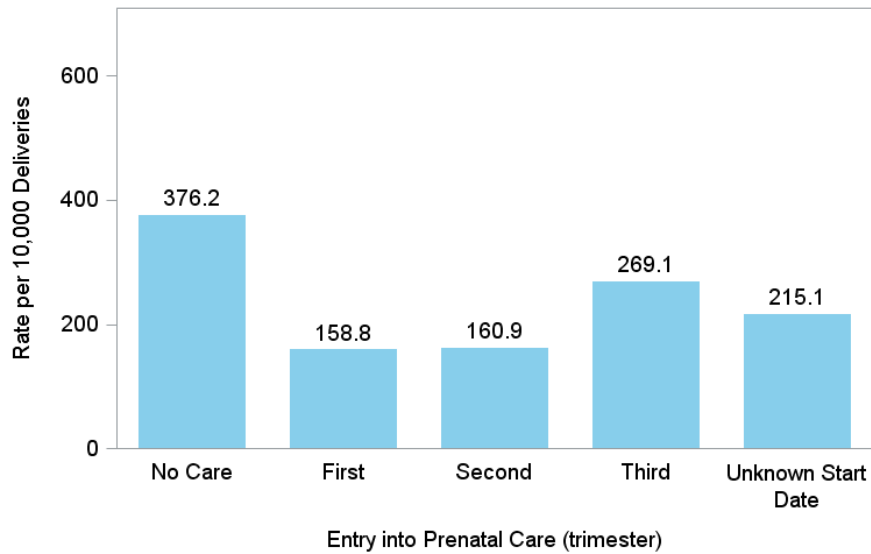
\* Method of delivery was identified from hospital discharge data using ICD-10 codes.

~ Pre-pregnancy BMI was calculated using formula (weight (lb.) / height (in)^2)x 703 with mother's weight and height as recorded on birth certificate.

^ Any chronic disease includes deliveries to women with chronic hypertension, pre-existing diabetes or chronic heart disease as recorded on birth certificate.

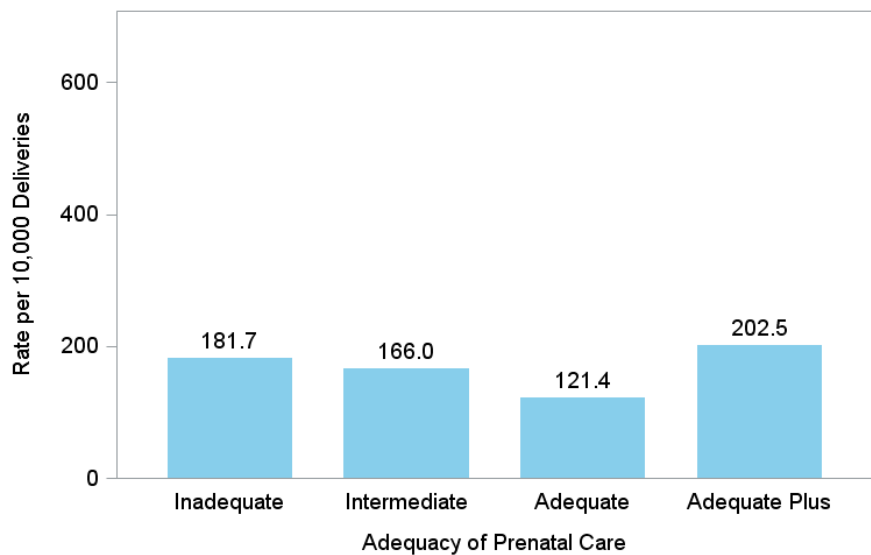
Women who received no prenatal care (376.2 per 10,000 deliveries) or entered prenatal care in third trimester (269.1 per 10,000 deliveries) had higher SMM rate than women who received prenatal care in first trimester (158.8 per 10,000 deliveries).

**Figure 13. Severe Maternal Morbidity by Time of Entry to Prenatal Care, Nevada, December 2018 - December 2019**



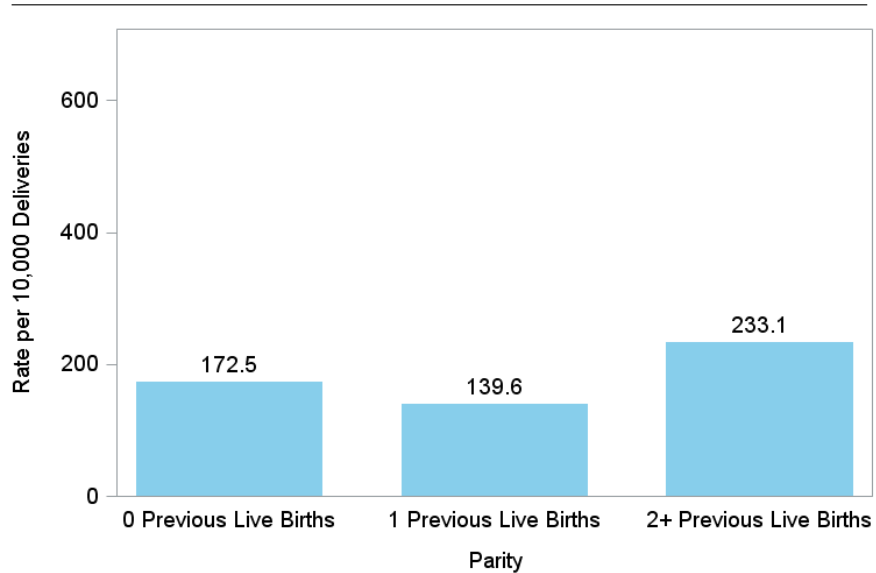
Women with inadequate and adequate plus prenatal care had highest SMM rates (181.7 and 202.5 per 10,000 deliveries, respectively) than women with adequate prenatal care (121.4 per 10,000 deliveries).

**Figure 14. Severe Maternal Morbidity by Adequacy of Prenatal Care, Nevada, December 2018 - December 2019**



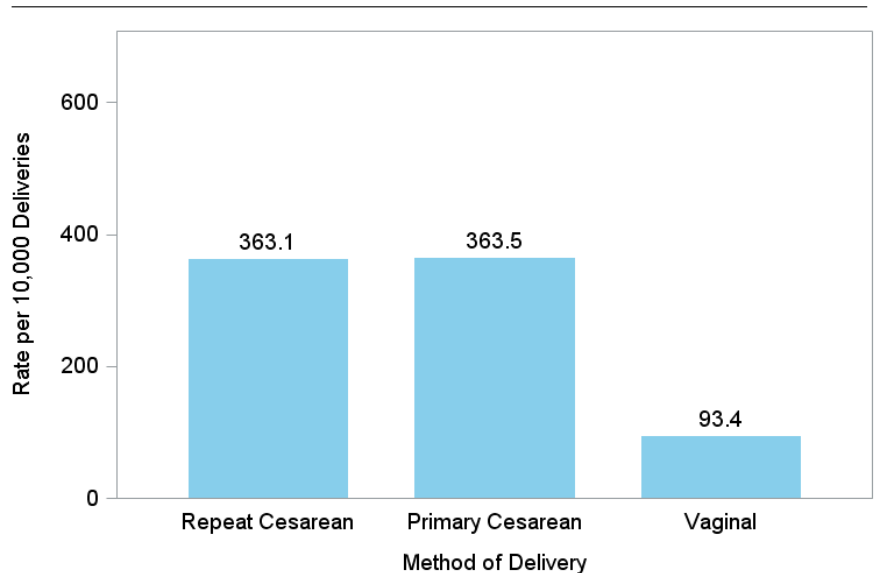
Women with zero previous live birth (172.5 per 10,000 deliveries) had higher SMM rates than women with one previous live birth (139.6 per 10,000 deliveries), but lower SMM rates than women with two or more previous live births (233.1 per 10,000 deliveries).

**Figure 15. Severe Maternal Morbidity by Parity, Nevada, December 2018 - December 2019**



Cesarean deliveries accounted for 33.2% of all live deliveries but 66.0% of SMM cases (Table 3). The SMM rate was higher among women with a repeated or primary cesarean (363.1 and 363.5 per 10,000 deliveries, respectively), compared to women with vaginal birth (93.4 per 10,000 deliveries). Results should be interpreted with caution, since it was difficult to differentiate between morbidity caused by cesarean delivery versus morbidity requiring a cesarean delivery.

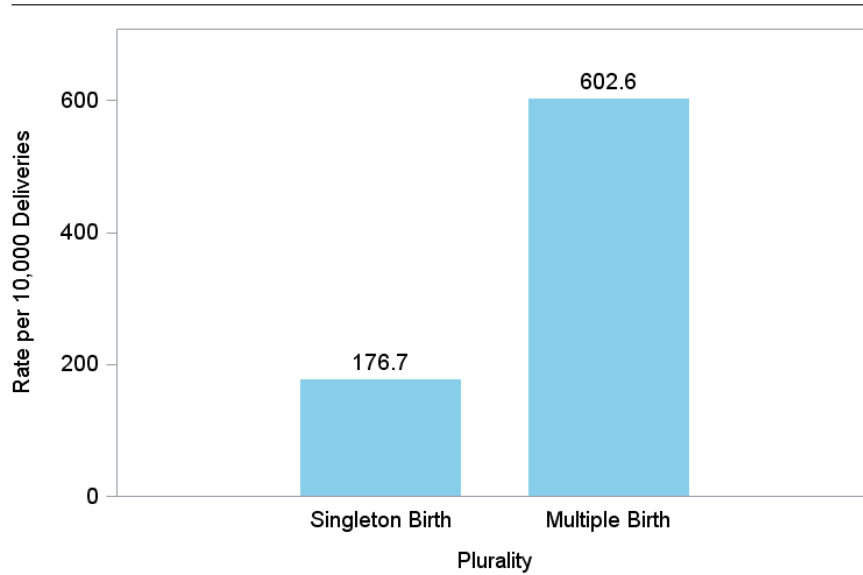
**Figure 16. Severe Maternal Morbidity by Delivery Type, Nevada, December 2018 - December 2019**





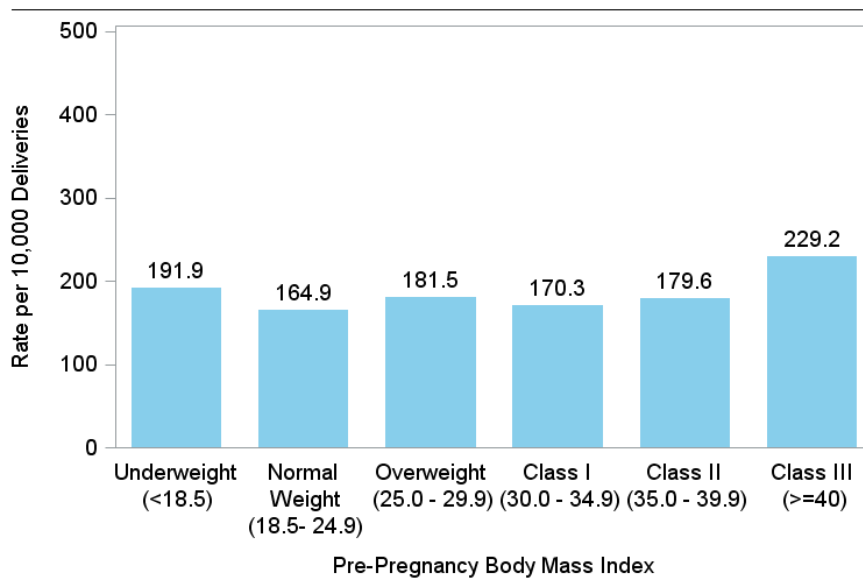
Multiple births accounted for 1.5% of all deliveries but 5.0% of SMM cases (Table 3). The SMM rate was over three times higher among women with multiple birth deliveries as among women with singleton births (602.6 versus 176.7 per 10,000 deliveries, respectively).

**Figure 17. Severe Maternal Morbidity by Plurality, Nevada, December 2018 - December 2019**



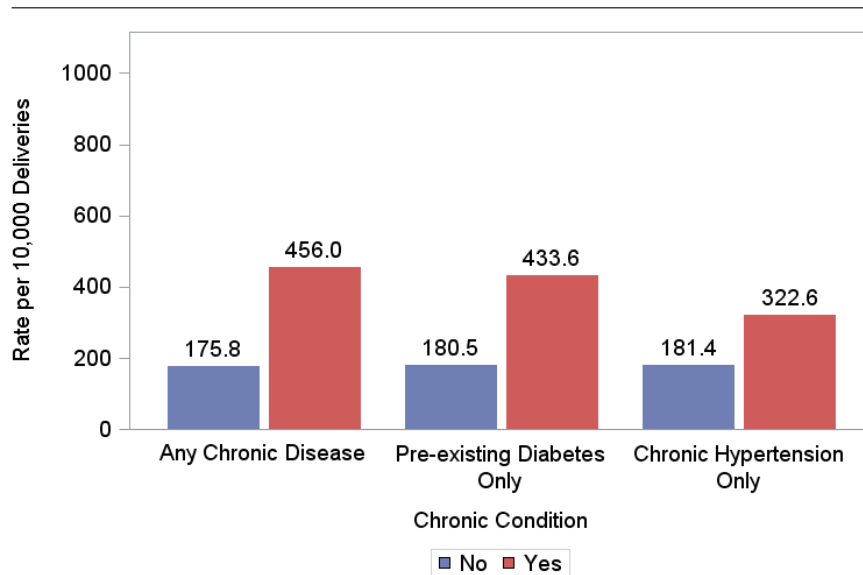
Pre-pregnancy body mass index was not significantly associated with SMM rate with blood transfusion ( $p = 0.5212$ , Table 3).

**Figure 18. Severe Maternal Morbidity by Pre-Pregnancy Body Mass Index, Nevada, December 2018 - December 2019**



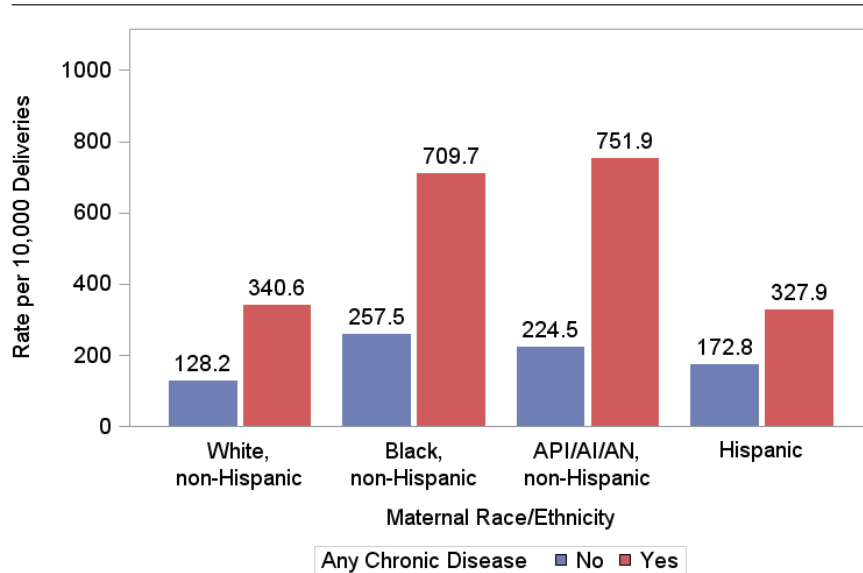
Women with pre-existing diabetes, chronic heart disease, or chronic hypertension were more than two times as likely to have SMM as women with none of these chronic conditions (456.0 versus 175.8 per 10,000 deliveries, respectively). Women with pre-existing diabetes only were more than two times as likely to have SMM as women without pre-existing diabetes (433.6 versus 180.5 per 10,000 deliveries, respectively). Women with chronic hypertension only were more than one time as likely to have SMM as women without chronic hypertension (322.6 versus 181.4 per 10,000 deliveries, respectively). When considering chronic heart disease independent from the other chronic diseases listed here, no significant association was found.

**Figure 19. Severe Maternal Morbidity by Chronic Condition, Nevada, December 2018 - December 2019**



Asian/Pacific Islander/American Indian/American Native (API/AI/AN), non-Hispanic women with any chronic disease (pre-existing diabetes, chronic heart disease, or chronic hypertension) were more than three times as likely to have SMM as API/AI/AN, non-Hispanic women with none of three chronic diseases (751.9 versus 224.5 per 10,000 deliveries, respectively). White, non-Hispanic or Black, non-Hispanic women with any chronic disease were more than two times as likely to have SMM as White, non-Hispanic or Black, non-Hispanic women without any chronic disease (340.6 versus 128.2 per 10,000 deliveries, respectively for White, non-Hispanic, and 709.7 versus 257.5 per 10,000 deliveries, respectively for Black, non-Hispanic). Hispanic women with any chronic disease were almost two times as likely to have SMM as Hispanic women without any chronic disease (327.9 versus 172.8 per 10,000 deliveries, respectively).

**Figure 20. Severe Maternal Morbidity by Any Chronic Disease and Maternal Race/Ethnicity, Nevada, December 2018 - December 2019**



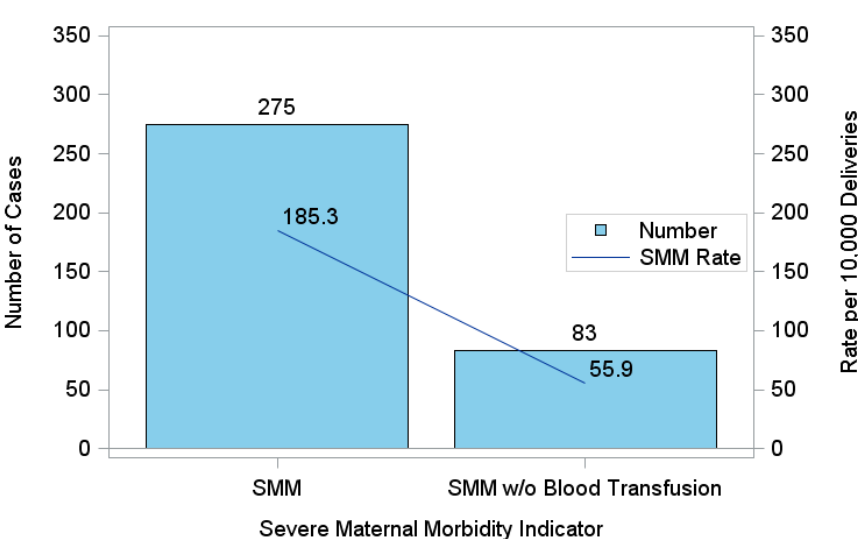
## Conclusions

The SMM rate for Nevada was 183.2 per 10,000 deliveries from December 2018 to December 2019. The leading indicators included blood transfusion, hysterectomy, disseminated intravascular coagulation, adult respiratory distress syndrome, acute renal failure, and sepsis. Mother’s age, race/ethnicity, education, and health insurance status are risk factors of SMM. Women aged 40 and older had the highest SMM rate. Black non-Hispanic women had a higher SMM rate than White non-Hispanic women. Women with college or higher degree had lowest SMM rate. SMM rate among women with Medicaid insurance was higher than that of women with private insurance. Prenatal and delivery characteristics such as prenatal care initiation, adequacy of prenatal care, parity, method of delivery, plurality, and chronic disease are all risk factors of SMM. Women with no prenatal care or entered prenatal care in third trimester had higher SMM rates than that of women entered prenatal care in first trimester. Women with inadequate and adequate plus prenatal care had higher SMM rates than women with adequate prenatal care. Women without previous live birth had higher SMM rates than women with one previous live, but lower SMM rates than women with two or more previous live births. Cesarean births had higher SMM rate than vaginal births. Women with multiple births are at higher risk to have SMM than women with single births. Women with an underlying chronic condition such as hypertension, diabetes or heart disease were more than two times as likely to have SMM as women with no chronic conditions.

# Data of 2020

There was a total of 275 cases of SMM in 2020 with rate of 185.3 per 10,000 deliveries. If blood transfusion was not included in the calculation, SMM cases dropped to 83 and rate dropped to 55.9 per 10,000 deliveries. In 2020 data are of the first two quarters of the year and are preliminary and subject to changes.

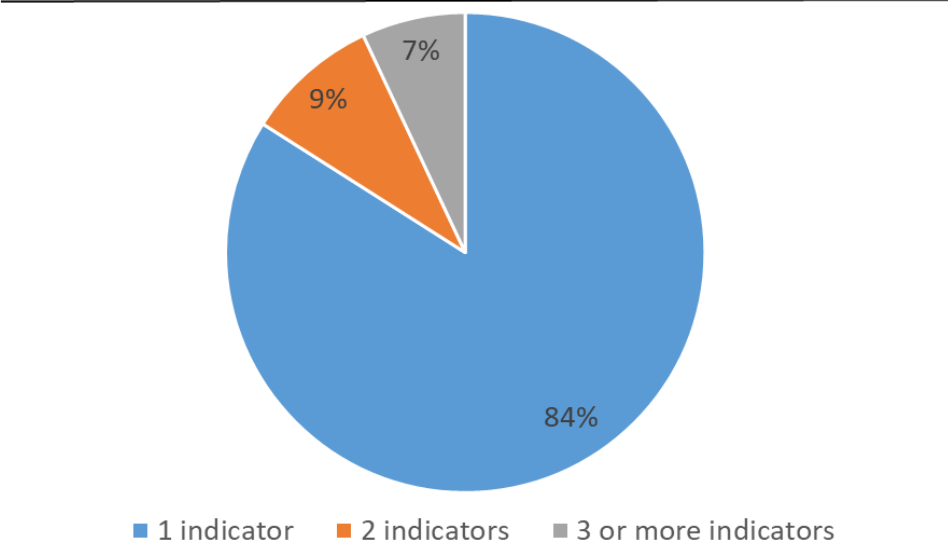
**Figure 21. Severe Maternal Morbidity Rate per 10,000 Deliveries and Number of Cases, Nevada, 2020**



*2020 data are preliminary and subject to changes.*

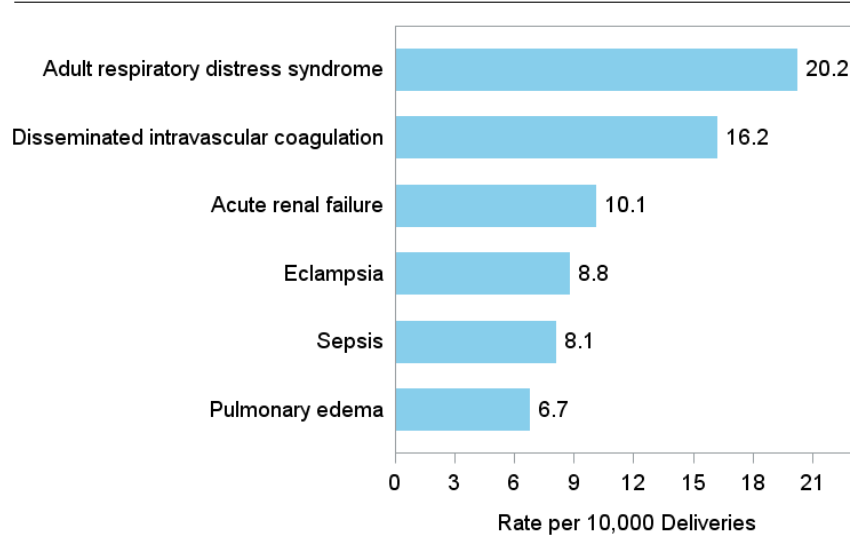
The majority of deliveries with SMM (84%) had one indicator (out of a total of 21 SMM indicators), nine percent of deliveries had two indicators and seven percent had three or more indicators present.

**Figure 22. Distribution of Severe Maternal Morbidity Indicators, Nevada, 2020**



The leading diagnosis-based indicators of SMM were adult respiratory distress syndrome (20.2 per 10,000 deliveries), disseminated intravascular coagulation (16.2 per 10,000 deliveries), acute renal failure (10.1 per 10,000 deliveries), eclampsia (8.8 per 10,000 deliveries), sepsis (8.1 per 10,000 deliveries) and pulmonary edema (6.7 per 10,000 deliveries). See Table 4 and Appendix A for a complete list and description of SMM indicators. Around 27% of adult respiratory distress syndrome cases were confirmed COVID-19 cases in 2020.<sup>6</sup>

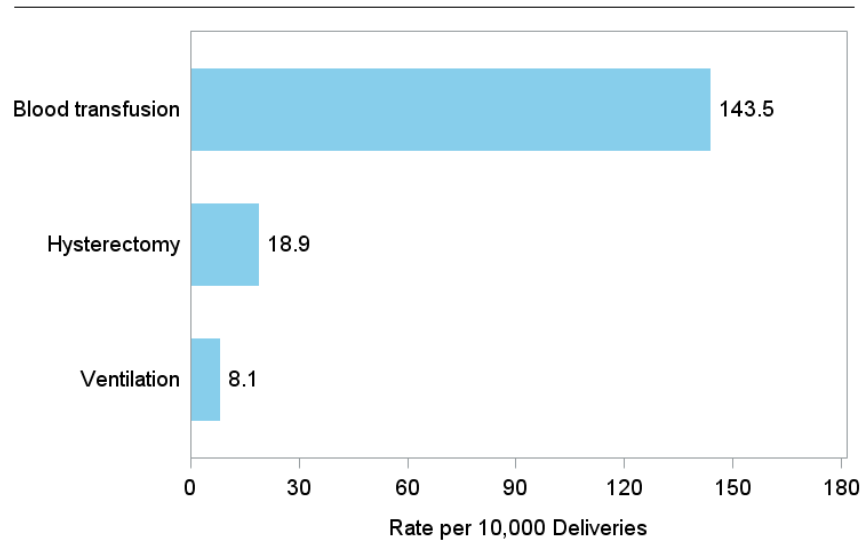
**Figure 23. Leading Diagnosis-Based Indicators of Severe Maternal Morbidity, Nevada, 2020**



*2020 data are preliminary and subject to changes.*

Leading procedure-based indicators of SMM were blood transfusion (143.5 per 10,000 deliveries), hysterectomy (18.9 per 10,000 deliveries) and ventilation (8.1 per 10,000 deliveries). See Table 4 and Appendix A for a complete list and description of SMM indicators.

**Figure 24. Leading Procedure-Based Indicators of Severe Maternal Morbidity, Nevada, 2020**



*2020 data are preliminary and subject to changes.*

**Table 4. Rate of Severe Maternal Morbidity Indicators per 10,000 Deliveries, Nevada, 2020\*\***

<b>SMM Indicator</b>	<b>Rate per 10,000 Deliveries</b>
<b>Diagnosis-based Indicators</b>	
Adult respiratory distress syndrome	20.2
Disseminated intravascular coagulation	16.2
Acute renal failure	10.1
Eclampsia	8.8
Sepsis	8.1
Pulmonary edema	6.7
Shock	6.1
Thrombotic embolism	4.7
Puerperal cerebrovascular disorders	2.0
Sickle cell anemia with crisis	2.0
Acute myocardial infarction	0.7
Amniotic fluid embolism	-
Cardiac arrest/ventricular fibrillation	-
Complications during procedure or surgery	-
Intracranial injuries*	-
Internal injuries of the thorax, abdomen, and pelvis*	-
Heart failure during procedure or surgery	-
Severe anesthesia complications	-
<b>Procedure-based Indicators</b>	
Blood transfusion	143.5
Hysterectomy	18.9
Ventilation	8.1
Temporary Tracheostomy	0.7
Conversion of cardiac rhythm	-
Cardio monitoring*	-
Operations on the heart and pericardium*	-
<b>SMM Rate Overall</b>	<b>185.3</b>

\* 4 indicators were not carried over to ICD-10 codes system.

\*\* 2020 data are preliminary and subject to changes.

**Table 5. Severe Maternal Morbidity by Maternal Demographics, Nevada, 2020\***

	SMM Cases	Rate per 10,000 Deliveries	Total Deliveries	Percent of Total Deliveries	Percent of SMM Cases	Chi-Square P-value
<b>Maternal Age</b>						
<=19	13	183.4	709	4.8%	4.7%	0.4774
20-24	46	153.0	3,007	20.3%	16.7%	
25-29	85	195.6	4,346	29.3%	30.9%	
30-34	73	177.6	4,110	27.7%	26.5%	
35-39	44	204.8	2,148	14.5%	16.0%	
>=40	14	267.7	523	3.5%	5.1%	
Unknown	0	0.0	0	0.0%	0.0%	
<b>Race/Ethnicity</b>						
White non-Hispanic	77	148.8	5,175	34.9%	28.0%	0.0081
Black non-Hispanic	62	280.2	2,213	14.9%	22.5%	
AI/AN non-Hispanic	2	163.9	122	0.8%	0.7%	
API non-Hispanic	27	198.7	1,359	9.2%	9.8%	
Hispanic	96	179.4	5,351	36.1%	34.9%	
Other	0	0.0	31	0.2%	0.0%	
Unknown	11	185.8	592	4.0%	4.0%	
<b>Education</b>						
Less than High School	47	228.3	2,059	13.9%	17.1%	0.2238
High School Graduate	88	180.2	4,883	32.9%	32.0%	
Some College	69	165.5	4,170	28.1%	25.1%	
College Graduate or Higher	49	154.6	3,170	21.4%	17.8%	
Unknown	22	392.2	561	3.8%	8.0%	
<b>Insurance<sup>^</sup></b>						
Medicaid	141	210.5	6,697	45.1%	51.3%	0.0177
Other Government	9	357.1	252	1.7%	3.3%	
Private	117	158.0	7,407	49.9%	42.5%	
Self-pay	8	219.2	365	2.5%	2.9%	
Other	0	0.0	119	0.8%	0.0%	
Unknown	0	0.0	3	0.0%	0.0%	

<sup>^</sup> Health insurance status indicates the primary payer for the delivery as recorded on hospital discharge form.

\* 2020 data are preliminary and subject to changes.

When considering the SMM rate including blood transfusions, the SMM is significantly associated with maternal race and ethnicity ( $p = 0.0081$ ), and health insurance status ( $p = 0.0177$ ).

**Table 6. Severe Maternal Morbidity by Prenatal and Delivery Characteristics, Nevada, 2020\*\***

	SMM Cases	Rate per 10,000 Deliveries	Total Deliveries	Percent of Total Deliveries	Percent of SMM Cases	Chi-Square P-value
<b>Prenatal Care Initiation</b>						
No Care	0	0.0	0	0.0%	0.0%	0.3951
First Trimester	176	160.5	10,967	73.9%	64.0%	
Second Trimester	44	208.3	2,112	14.2%	16.0%	
Third Trimester	10	212.8	470	3.2%	3.6%	
Unknown Start Date	2	181.8	110	0.7%	0.7%	
Unknown	43	363.2	1,184	8.0%	15.6%	
<b>Adequacy of Prenatal Care</b>						
Inadequate	27	180.2	1,498	10.1%	9.8%	0.0204
Intermediate	16	139.9	1,144	7.7%	5.8%	
Adequate	81	137.4	5,895	39.7%	29.5%	
Adequate Plus	106	212.2	4,995	33.7%	38.5%	
Data Missing/Unknown	45	343.2	1,311	8.8%	16.4%	
<b>Parity</b>						
0 Previous Live Births	113	197.0	5,735	38.6%	41.1%	<.0001
1 Previous Live Births	47	109.6	4,287	28.9%	17.1%	
2+ Previous Live Births	114	237.5	4,800	32.3%	41.5%	
Unknown	1	476.2	21	0.1%	0.4%	
<b>Method of Delivery*</b>						
Repeat Cesarean	77	318.1	2,421	16.3%	28.0%	<.0001
Primary Cesarean	101	411.9	2,452	16.5%	36.7%	
Vaginal	97	97.3	9,970	67.2%	35.3%	
<b>Plurality</b>						
Singleton Birth	256	175.3	14,605	98.4%	93.1%	<.0001
Multiple Birth	19	798.3	238	1.6%	6.9%	
<b>Pre-Pregnancy BMI~</b>						
Underweight (<18.5)	11	212.8	517	3.5%	4.0%	0.5798
Normal Weight (18.5- 24.9)	97	164.6	5,894	39.7%	35.3%	
Overweight (25.0 - 29.9)	66	171.3	3,853	26.0%	24.0%	
Class I (30.0 - 34.9)	48	206.2	2,328	15.7%	17.5%	
Class II (35.0 - 39.9)	24	227.5	1,055	7.1%	8.7%	
Class III (>=40)	11	154.7	711	4.8%	4.0%	
Unknown	18	371.1	485	3.3%	6.5%	
<b>Chronic Disease^</b>						
No Chronic Disease	258	179.1	14,407	97.1%	93.8%	0.0013
Any Chronic Disease	17	389.9	436	2.9%	6.2%	

\* Method of delivery was identified from hospital discharge data using ICD-10 codes.

~ Pre-pregnancy BMI was calculated using formula (weight (lb.) / height (in)^2)x 703 with mother's weight and height as recorded on birth certificate.

^ Any chronic disease includes deliveries to women with chronic hypertension, pre-existing diabetes or chronic heart disease as recorded on birth certificate.

\*\* 2020 data are preliminary and subject to changes.

When considering the SMM rate including blood transfusions, the SMM is significantly associated with adequacy of prenatal care (p = 0.0204), parity (p = <.0001), method of delivery (p = <.0001), plurality (p = <.0001), and maternal chronic disease status (p = 0.0013).



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## Appendix A. Complete List of SMM Indicators and Associated ICD-10-CM Code

Classification	Severe Maternal Morbidity Indicator	ICD-10/Procedure Codes
Diagnosis	Acute myocardial infarction	121.xx, 122.x
	Aneurysm	171.xx, 179.0
	Acute renal failure	N17.x, O90.4
	Adult respiratory distress syndrome	J80, J95.1, J95.2, J95.3, J95.82x, J96.0x, J96.2x, R09.2
	Amniotic fluid embolism	O88.1x
	Cardiac arrest/ventricular fibrillation	I46.x, I49.0x
	Disseminated intravascular coagulation	D65, D68.8, D68.9, O72.3
	Eclampsia	O15.x
	Heart failure/arrest during surgery or procedure	I97.12x, I97.13x, I97.710, I97.711
	Puerperal cerebrovascular disorders	I60.xx-I68.xx, O22.51, O22.52, O22.53, I97.81x, I97.82x, O873
	Pulmonary edema/Acute heart failure	J81.0, I50.1, I50.20, I50.21, I50.23, I50.30, I50.31, I50.33, I50.40, I50.41, I50.43, I50.9
	Severe anesthesia complications	O74.0, O74.1, O74.2, O74.3, O89.0x, O89.1, O89.2
	Sepsis	O85, O86.04, T80.211A, T81.4XXA, R65.20, A40.x, A41.x, A32.7
	Shock	O75.1, R57.x, R65.21, T78.2XXA, T88.2XXA, T88.6 XXA, T81.10XA, T81.11XA, T81.19XA
	Sickle cell disease with crisis	D57.0x, D57.21x, D57.41x, D57.81x
Air and thrombotic embolism	I26.x, O88.0x, O88.2x, O88.3x, O88.8x	
Procedure	Conversion of cardiac rhythm	5A2204Z, 5A12012
	Blood transfusion	30230H0, 30230K0, 30230L0, 30230M0, 30230N0, 30230P0, 30230R0, 30230T0, 30230H1, 30230K1, 30230L1, 30230M1, 30230N1, 30230P1, 30230R1, 30230T1, 30233H0, 30233K0, 30233L0, 30233M0, 30233N0, 30233P0, 30233R0, 30233T0, 30233H1, 30233K1, 30233L1, 30233M1, 30233N1, 30233P1, 30233R1, 30233T1, 30240H0, 30240K0, 30240L0, 30240M0, 30240N0, 30240P0, 30240R0, 30240T0, 30240H1, 30240K1, 30240L1, 30240M1, 30240N1, 30240P1, 30240R1, 30240T1, 30243H0, 30243K0, 30243L0, 30243M0, 30243N0, 30243P0, 30243R0, 30243T0, 30243H1, 30243K1, 30243L1, 30243M1, 30243N1, 30243P1, 30243R1, 30243T1
	Hysterectomy	0UT90ZZ, 0UT94ZZ, 0UT97ZZ, 0UT98ZZ, 0UT9FZZ, 0UT9OZL
	Temporary tracheostomy	0B110Z4, 0B110F4, 0B113Z4, 0B113F4, 0B114Z4, 0B114F4
	Ventilation	5A1935Z, 5A1945Z, 5A1955Z