

Severe Maternal Morbidity among Wisconsin Residents, 2010-2014

Introduction

Severe maternal morbidity (SMM) includes complications resulting from or exacerbated by pregnancy (e.g., renal failure, eclampsia, thrombotic embolism, sepsis). National data suggest that the burden of SMM is increasing, possibly due to demographic factors and pre-pregnancy health conditions.

How can these data be used?

Assessing SMM in Wisconsin may provide important context for our Maternal Mortality Reviews, can help us target areas for quality improvement in maternal care, and can identify maternal characteristics and health conditions associated with higher rates of SMM.



Data source and methods

Hospital discharge data (2010-2014) were used to calculate rates of SMM for delivery and postpartum hospitalizations for Wisconsin residents, including deliveries in Minnesota. Twenty-five conditions (see Appendix) were included as severe maternal morbidities. A severity recalculation was applied to non-procedural conditions to account for implausibly short hospital lengths of stay, which is standard in peer reviewed literature and estimates from the Centers for Disease Control and Prevention (CDC).

Data highlights

- While SMM is increasing nationally, rates of SMM have been stable in Wisconsin over time
- The rate of SMM in Wisconsin (2010-2014) was **100 for delivery hospitalizations** and **25 for postpartum hospitalizations** (each per 10,000 delivery hospitalizations). Thirteen percent of women (n=423) with SMM had more than one severe morbidity.
- SMM rates were highest for women younger than 20 years of age, women 35 years of age and older, non-Hispanic American Indian and Alaska Native women, and non-Hispanic Black women.
- SMM rates were highest among Wisconsin women delivering in Minnesota. SMM rates were lowest in the Western region, which may be due to high-risk Wisconsin residents delivering in Minnesota hospitals.
- The most common indicators of SMM for delivery hospitalizations in Wisconsin include:
 - Blood transfusion
 - Operations on the heart and pericardium
 - Hysterectomy
 - Disseminated intravascular coagulation
 - Heart failure during a procedure or surgery
 - Acute renal failure

For more information about the 25 severe maternal morbidity conditions presented in this report, please see <http://www.cdc.gov/reproductivehealth/MaternalInfantHealth/SevereMaternalMorbidity.html>. The production of this report was supported in part by the Title V Maternal and Child Health Block Grant Program of the Health Resources and Services Administration and by an appointment to the Applied Epidemiology Fellowship Program administered by the Council of State and Territorial Epidemiologists (CSTE) and funded by the Centers for Disease Control and Prevention (CDC) Cooperative Agreement Number 1U38OT000143-03.



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SMM has remained stable over time in Wisconsin

Table 1. Severe maternal morbidity by year, delivery hospitalizations 2010-2014

	2010	2011	2012	2013	2014	All years
Total delivery hospitalizations	66,625	65,892	65,387	64,573	64,383	326,860
Severe maternal morbidity	680	628	673	649	653	3,283
Rate per 10,000*	102	95	103	101	101	100

*p for trend not statistically significant ($p > 0.05$)

Blood transfusions and operations on the heart and pericardium are leading morbidities for delivery and postpartum hospitalizations

Leading SMMs for delivery and postpartum hospitalizations are listed in Table 2. Blood transfusion was the most common SMM for both delivery and postpartum hospitalizations. Operations on the heart and pericardium and acute renal failure were among the leading indicators for delivery and postpartum hospitalizations.

Table 2. Rates of the most common indicators of severe maternal morbidity, delivery hospitalizations 2010-2014

Delivery hospitalizations	Number with SMM	Rate per 10,000 delivery hospitalizations
Blood transfusion	2,248	69
Operations on the heart and pericardium	277	9
Hysterectomy	250	8
Disseminated intravascular coagulation	226	7
Heart failure during procedure or surgery	148	5
Acute renal failure	133	4
Postpartum hospitalizations	Number with SMM	Rate per 10,000 delivery hospitalizations
Blood transfusion	215	7
Thrombotic embolism	135	4
Adult respiratory distress syndrome	106	3
Acute renal failure	103	3
Sepsis	88	3
Operations on the heart and pericardium	77	2

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Delivery hospitalization charges increase with increasing number of SMM indicators

While most women with SMM typically experience only one indicator of SMM, 13% of Wisconsin mothers experienced two or more SMM. Women experiencing multiple SMM may have complications that require high-cost medical intervention. Table 3 shows the median charges for delivery hospitalizations by the number of SMM experienced. Median delivery charges increased nearly two-fold for each increase in the number of SMMs experienced.

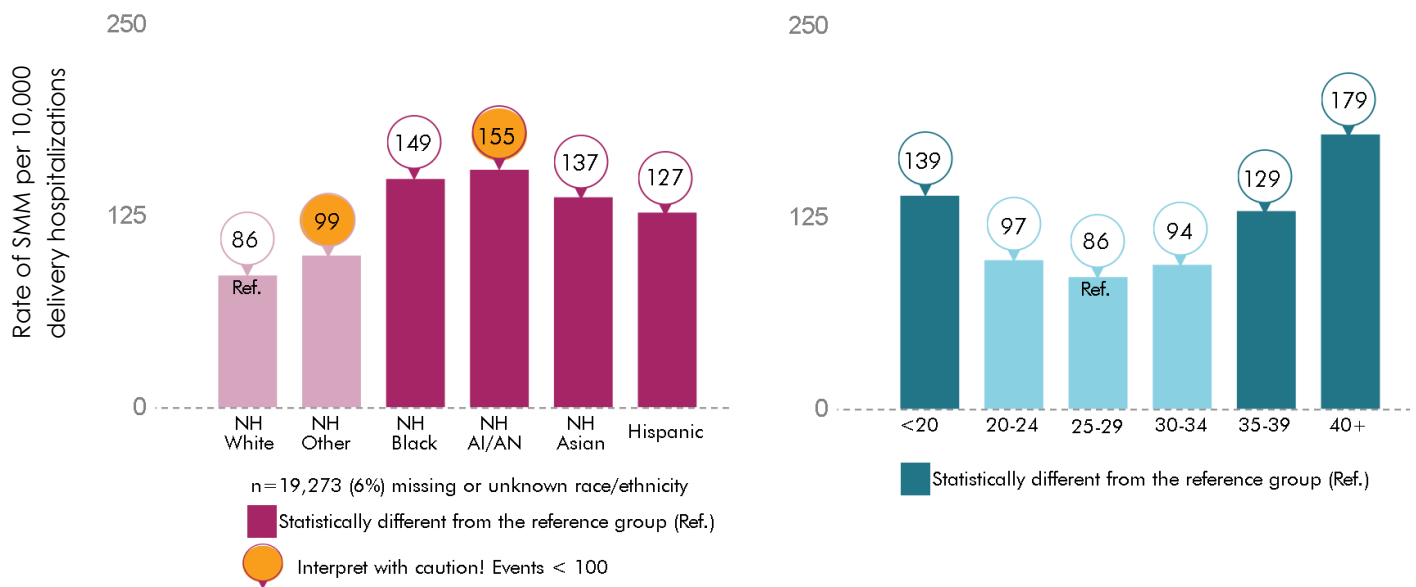
Table 3. Median hospital charges by number of SMM indicators, 2010-2014

0 SMM	1 SMM	2 SMM	3+ SMM
\$8,964	\$18,924	\$35,701	\$66,366

SMM is higher for Wisconsin's minority mothers as well as youngest and oldest mothers

SMM by age and race/ethnicity was examined to understand disparities between groups. Teenage women (<20 years) and older women (≥35 years) had higher rates of SMM compared to women ages 25 to 29 years. Non-Hispanic American Indian and Alaska Native women had the highest rate of SMM (155 per 10,000 delivery hospitalizations), while Non-Hispanic White women had the lowest rate of SMM (86 per 10,000 delivery hospitalizations).

Figure 1. Rates of SMM, delivery hospitalizations 2010-2014, by race and ethnicity and age



Do we see the same age and race and ethnicity disparities in maternal mortality?

Maternal mortality shows similar disparities by race and ethnicity and age. An analysis of pregnancy-related deaths in Wisconsin from 2006 to 2010 showed that the maternal mortality rate among non-Hispanic black women was more than four times the rate for non-Hispanic white women. Maternal mortality was also higher in women less than 20 years of age and women 35 years of age or more.

To learn more about maternal mortality in Wisconsin, see the following report:

[A review of pregnancy-related maternal mortality in Wisconsin--2006-2010. \(Schellpfeffer et al., Wisconsin Medical Journal. 2015; 114\(5\): 28-33\).](#)

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SMM varies by public health region of delivery facility

The figure below shows each public health region and Minnesota, with darker colors indicating higher rates of SMM at facilities within those regions. Table 4 shows SMM rates for the leading maternal morbidities in Wisconsin. Blood transfusion was the most common SMM across all facility regions. Table 5 shows the total number of deliveries, the number of hospitals with delivery hospitalizations, the number of hospitals providing Level III neonatal care, and the percent of all births in hospitals providing Level III neonatal care.

Wisconsin resident women delivering in Minnesota had the highest rate of SMM, while women delivering in the Western region had the lowest rate of SMM. The Western region's low SMM rate may be due to high-risk women living in that region delivering in Minnesota hospitals.

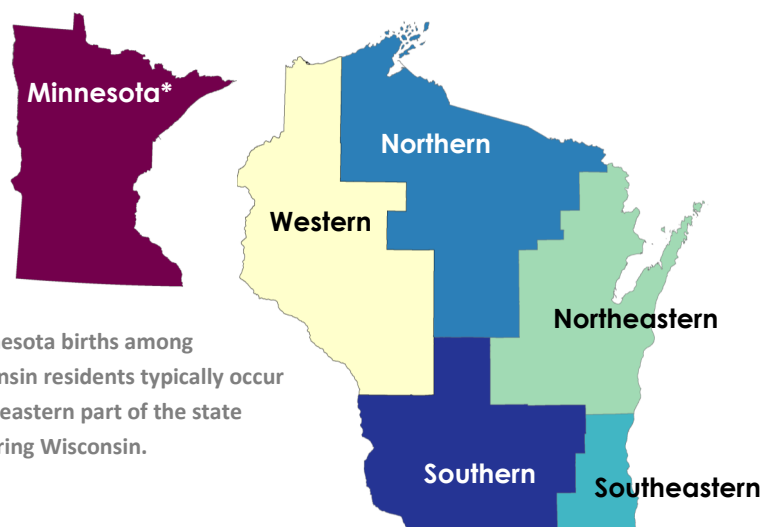


Table 4. Rates of SMM by facility region, 2010-2014, per 10,000 delivery hospitalizations

Indicator of severe maternal morbidity	Western	North-eastern	South-eastern	Northern	Southern	Minnesota
Blood transfusion	40	85	66	85	77	76
Operations on the heart and pericardium	5	6	11	8	8	14
Hysterectomy	4	7	7	12	9	7
Disseminated intravascular coagulation	4	5	7	6	10	9
Heart failure during procedure or surgery	3	2	4	6	8	11
Acute renal failure	2	3	6	3	5	4
Total rate of SMM	65	98	102	111	114	124

Table 5. Delivery hospitalizations and hospital information by facility region, 2010-2014

Delivery hospitalizations and facilities	Western	North-eastern	South-eastern	Northern	Southern	Minnesota
Number of delivery hospitalizations	38,518	65,983	126,953	26,138	63,706	5,562
Number of hospitals with a delivery hospitalization	24	23	25	11	26	49
Number of hospitals providing Level III neonatal care	2	3	5	2	2	5
Births in Level III neonatal hospitals (percent)	30%	28%	51%	43%	55%	33%

Appendix: Wisconsin and US Rates by Individual Maternal Morbidities

Severe maternal morbidity rates for delivery hospitalizations, Wisconsin and United States (per 10,000 delivery hospitalizations)

Maternal morbidity	ICD-9 codes	Wisconsin (2010-2014)	United States* (2008-2009)
Acute myocardial infarction	410.xx	0.1	0.2
Acute renal failure	584.x, 669.3x	4.1	4.5
Adult respiratory distress syndrome	518.5, 518.81, 518.82, 518.84, 799.1	3.9	6.2
Amniotic fluid embolism	673.1x	0.4	0.4
Aneurysm	441.xx	0.1	0.1
Blood transfusion	99.0x	68.8	96.4
Cardiac arrest or ventricular fibrillation	427.41, 427.42, 427.5	0.4	0.6
Cardio monitoring	89.6x	0.9	0.9
Conversion of cardiac rhythm	99.6x	0.4	0.6
Disseminated intravascular coagulation	286.6, 286.9, 666.3x	6.9	12.5
Eclampsia	642.6x	2.6	4.8
Heart failure during procedure or surgery	669.4x, 997.1	4.5	9.9
Hysterectomy	68.3x-68.9	7.6	9.1
Internal injuries of thorax, abdomen and pelvis	860.xx—869.xx	0.4	0.6
Intracranial injuries	800.xx, 801.xx, 803.xx, 804.xx, 851.xx-854.xx	0.2	0.1
Operations on heart and pericardium	35.xx, 36.xx, 37.xx, 39.xx	8.5	4.6
Puerperal cerebrovascular disorders	430, 431, 432.x, 433.xx, 434.xx, 436, 437.x, 671.5x, 674.0x, 997.2, 999.2	1.1	1.7
Pulmonary edema	428.1, 518.4	0.9	1.4
Sepsis	038.xx, 995.91, 995.92	1.9	3.1
Severe anesthesia complications	668.0x, 668.1x, 668.2x	0.3	0.7
Shock	669.1x, 785.5x, 995.0, 995.4, 998.0	2.5	3.0
Sickle cell anemia with crisis	282.62, 282.64, 282.69	0.6	0.6
Temporary tracheostomy	31.1	0.0	0.3
Thrombotic embolism	415.1x, 673.0x, 673.2x, 673.3x, 673.8x	0.8	1.4
Ventilation	93.90, 96.01-96.05, 96.7x	3.2	6.3

*Callaghan, et al. Severe Maternal Morbidity Among Delivery and Postpartum Hospitalizations in the United States. *Obstet Gynecol.* 2012; 120(5): 1029-36.