

# Bundle of Joy™ Maternal & Infant Health Trends

## About the Bundle of Joy™ Campaign

In April 2019, Premier® launched the [Bundle of Joy campaign](#) to test and scale measurable improvement in the quality, safety and cost of care for mothers and babies in the United States. The campaign builds on Premier alliance's long-standing commitment to providing safe care to help ensure healthy mothers and babies across its network of more than 4,000 hospitals, provider collaboratives and partnerships with employers and other industry organizations.

[Bundle of Joy](#) is organized to tackle issues that data prove continue to be associated with maternal and infant health-care. With data from 45 percent of all U.S. hospital discharges, Premier can analyze standardized data to gain meaningful insights for providers and the industry. This data includes more than 1.2 million annual hospital births, as of 2018. These research and analytic capabilities provide a source of truth that enables stakeholders across the industry to identify, target and monitor critical quality and safety improvement opportunities.

Premier provides the following resources for healthcare organizations to join its campaign to improve maternal and infant health. To learn more, please [contact us](#) by visiting the [Bundle of Joy](#) website.

- + **Data-driven Insights:** The maternal and infant health trends analysis leverages the [Premier Healthcare Database](#) and is used to help hospitals and the nation better understand and target solutions to this national problem. Premier's analytic capabilities and data assets are used to study specific therapeutic interventions and assess clinical efficacy over time to implement new solutions for unmet medical needs. This is the first of several analyses on maternal and infant health trends.
- + **Maternal & Infant Outcomes Dashboard:** The industry's only integrated [analytics dashboard](#) enables a comprehensive analysis of an organization's select perinatal and neonatal data sets, including peer-level and regional benchmarks and individualized reports assessing quality and outcomes. Premier continues to develop innovative analytics solutions to enable hospitals and health systems to benchmark and assess performance against its comprehensive maternal and infant database.
- + **Performance Improvement Services:** Premier provides one-to-one [consulting support](#) as well as [collaborative initiatives](#) to advance and scale national efforts to improve maternal and infant health. In July 2019, Premier announced it is working with 10 leading hospitals on a [Perinatal Collaborative](#) designed to reach zero preventable maternal and neonatal harm and deaths. Learnings from the collaborative will be shared nationally. In January 2020, the QUEST® quality improvement collaborative will launch a new perinatal specialty network to further test and adopt evidence-based strategies to improve care and the overall experience for women, infants and their families.
- + **New Payment Models and Policy:** Premier [is working](#) with private and public organizations to test and scale new payment models and reforms to improve maternal healthcare.



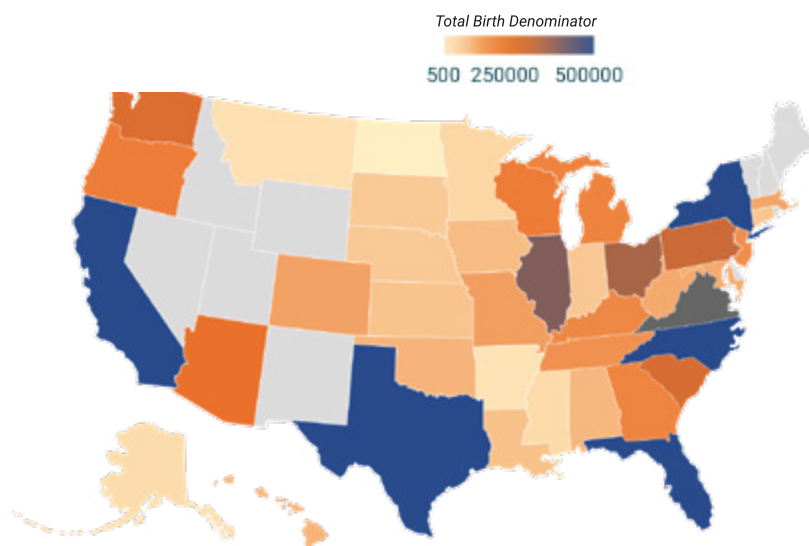
## Premier Maternal & Infant Analysis: Key Findings

In July 2019, Premier conducted a national trend analysis to explore maternal and infant health outcomes in the hospital, at the time of delivery. The analysis leveraged the nationally representative Premier Healthcare Database and included standardized inpatient data from 8.9 million births that occurred in 903 hospitals across 45 states between 2008-2018. The data in the Premier analysis represent approximately 25 percent of all U.S. in-hospital births and were comparable in patient and hospital demographics to the data used by the Centers for Disease Control and Prevention (CDC) in its *Vital Signs* report on pregnancy-related deaths.

Comprised of nearly 20 years of de-identified inpatient data, Premier's best-in-class database is more current and standardized than the CDC's data. Therefore, Premier data can help provide policymakers and clinicians with additional insights into hospital performance on maternal health. This is Premier's first analysis of maternal and infant mortality and morbidity, with additional analyses forthcoming.

Patient demographics and clinical outcomes were measured using the CDC's methodology for severe maternal morbidity (SMM), which includes the birth admission definition as the denominator and the numerator, as well as additional standardized national methodologies. Note that as hospitals switched from ICD-9 to ICD-10 mid-way through 2015, changes in documentation and coding may have affected year 2015 trending in comparison with previous years.

**Figure 1:** Total Inpatient Birth Volume by State

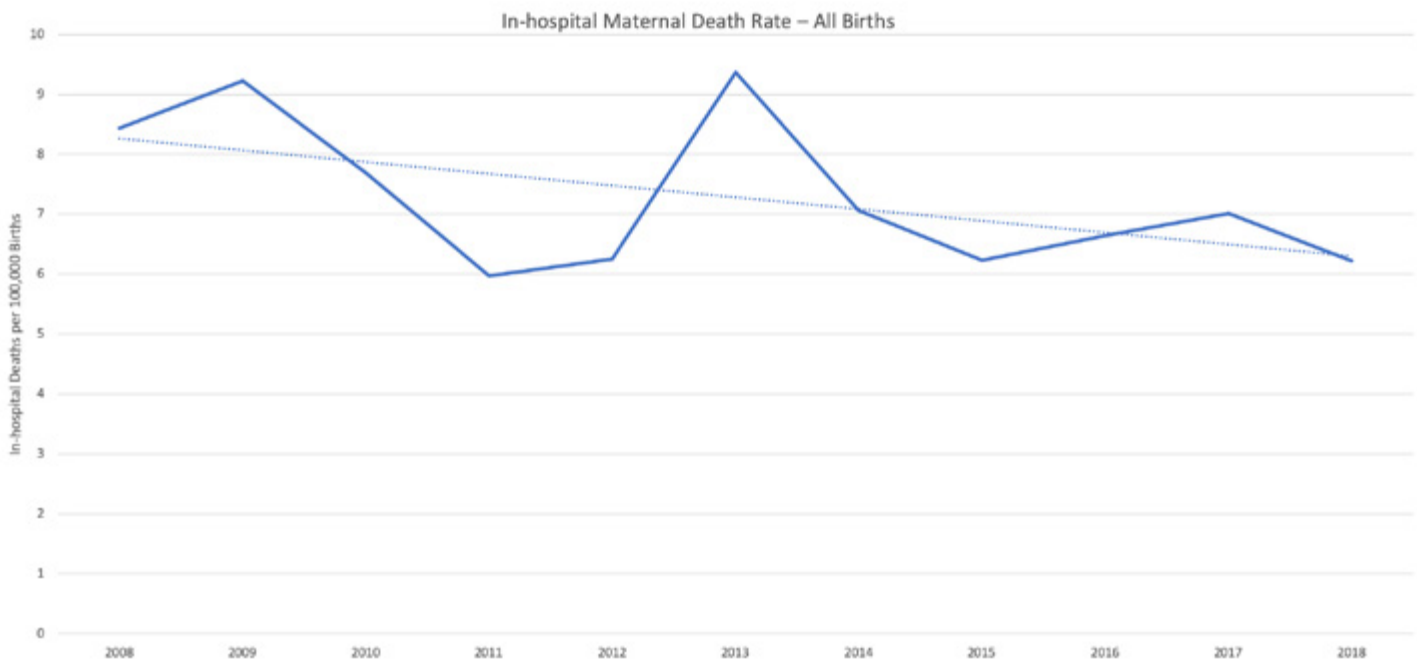


## U.S. hospitals are demonstrating a dramatic decrease in delivery-related maternal deaths

Overall, Premier found that U.S. hospitals showed a 24 percent decrease in delivery-related maternal deaths between 2008-2018 (Figure 2).

This trend suggests that progress is being made in the hospital at the time of delivery. However, the analysis did not explore maternal deaths occurring outside of delivery in the hospital or preventability of these deaths. Additional occurrences of maternal mortality across the continuum of pregnancy will be explored in a later analysis.

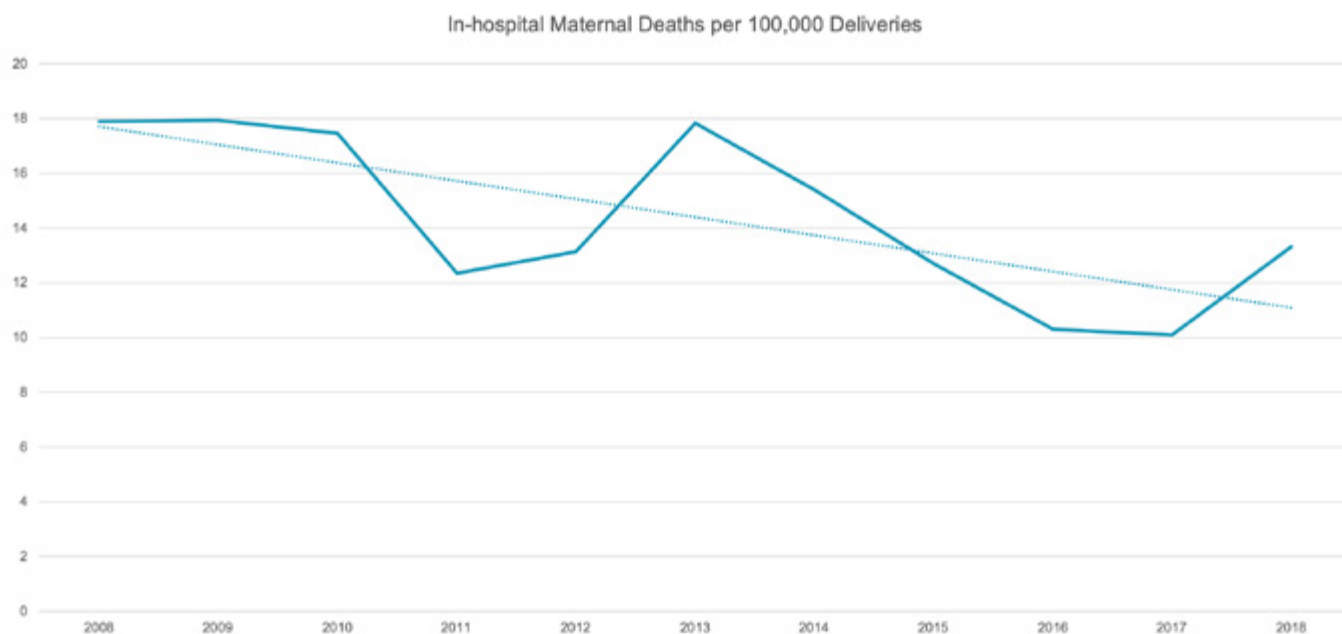
**Figure 2:** : In-Hospital, Delivery-Related Death Rate Trend



Premier worked closely with the CDC to ensure the methodology used in this analysis was aligned with and complemented their data. However, there are several differences and details in Premier’s findings compared to the CDC. For instance, Premier’s analysis shows a reduction in delivery-rated maternal mortality rates within the hospital. This is because Premier’s data is more current, going through 2018 while the CDC’s most recent mortality trends end in 2015. Premier’s analysis was also conducted using standardized inpatient data, which allows for greater specificity when exploring trends happening within the hospital, at the time of delivery. These insights, however, are based only on inpatient stays. In comparison, the CDC uses mortality data from the [National Vital Statistics System](#), death certificates from each state and the [Pregnancy Mortality Surveillance System](#). The CDC defines a [pregnancy-related death](#) as the death of a woman during pregnancy or within one year of the end of pregnancy from a pregnancy complication, a chain of events initiated by pregnancy, or the aggravation of an unrelated condition by the physiologic effects of pregnancy.

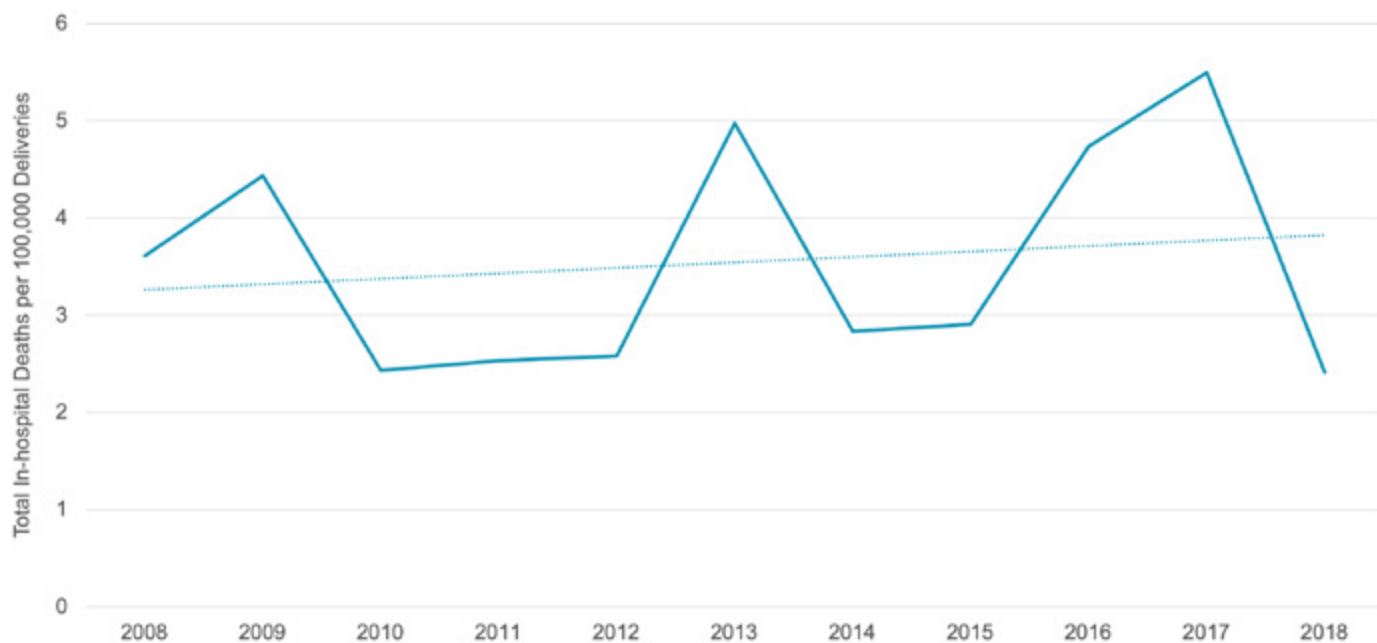
While Premier’s analysis was limited to delivery-related hospitalizations and the CDC tracks maternal death outside of the hospital, the [CDC has stated](#) that “errors in reported pregnancy status on death certificates have been described, potentially leading to overestimation of the number of pregnancy-related deaths.” Premier’s in-hospital measure provides a more consistent assessment of facility performance.

**Figure 3:** Inpatient Maternal Death Rate for Cesarean Delivery

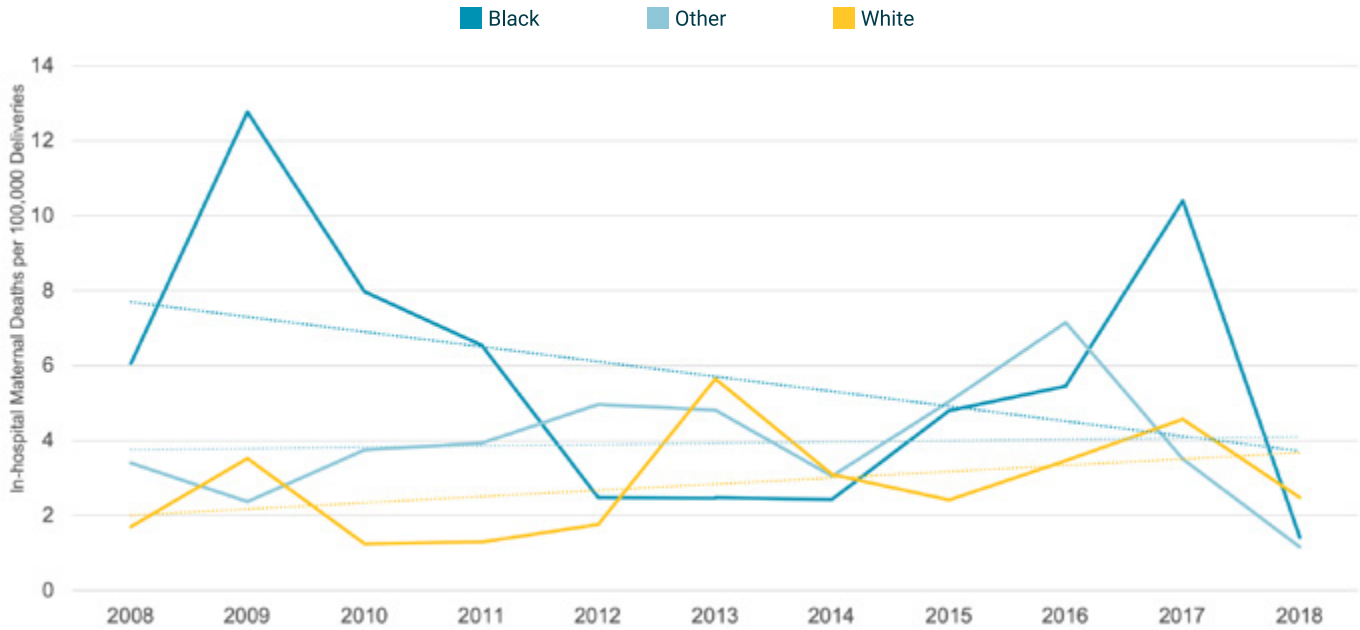


When comparing women who had a cesarean versus a vaginal delivery, Premier identified a slight increase in delivery-related maternal mortalities for vaginal deliveries (Figures 3 & 4).

**Figure 4:** Inpatient Maternal Death Rate for Vaginal Delivery

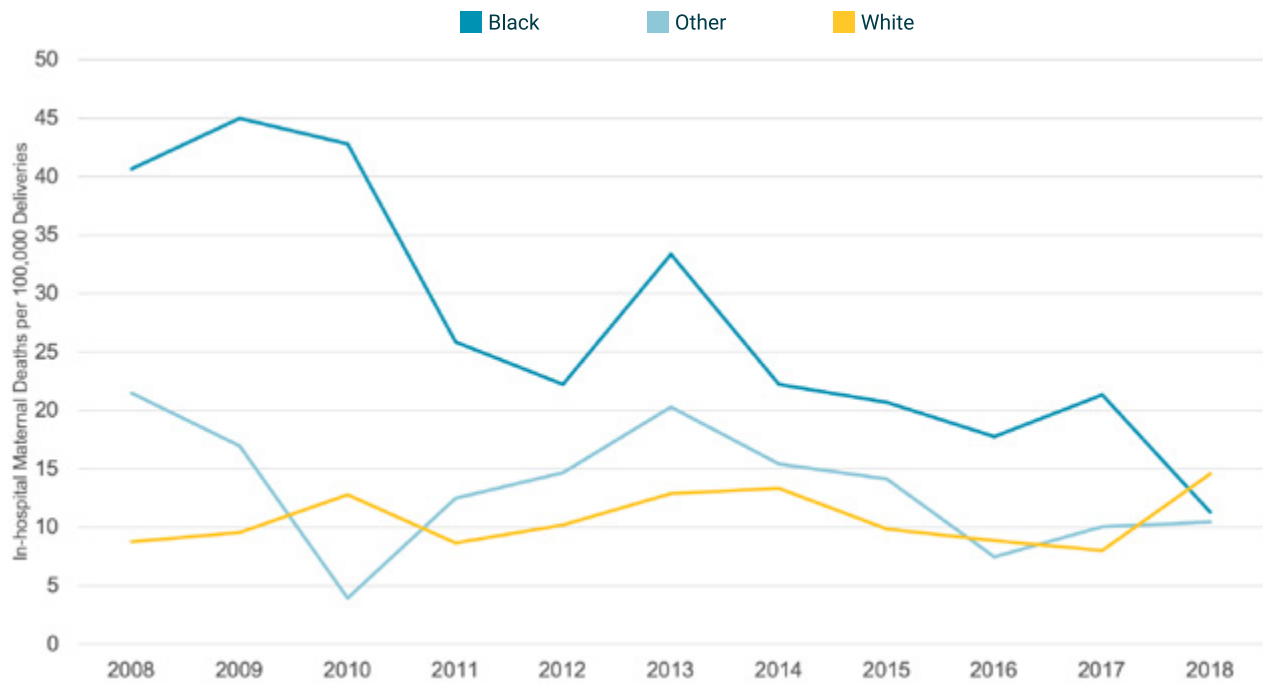


**Figure 5:** *Inpatient Maternal Death Rate After/During Vaginal Delivery by Race*



Notably, the disparity gap between black women and all other races for inpatient delivery-related deaths has substantially declined. Premier identified an 80 percent decrease in maternal mortality for black women between 2008-2018 (Figures 5 & 6).

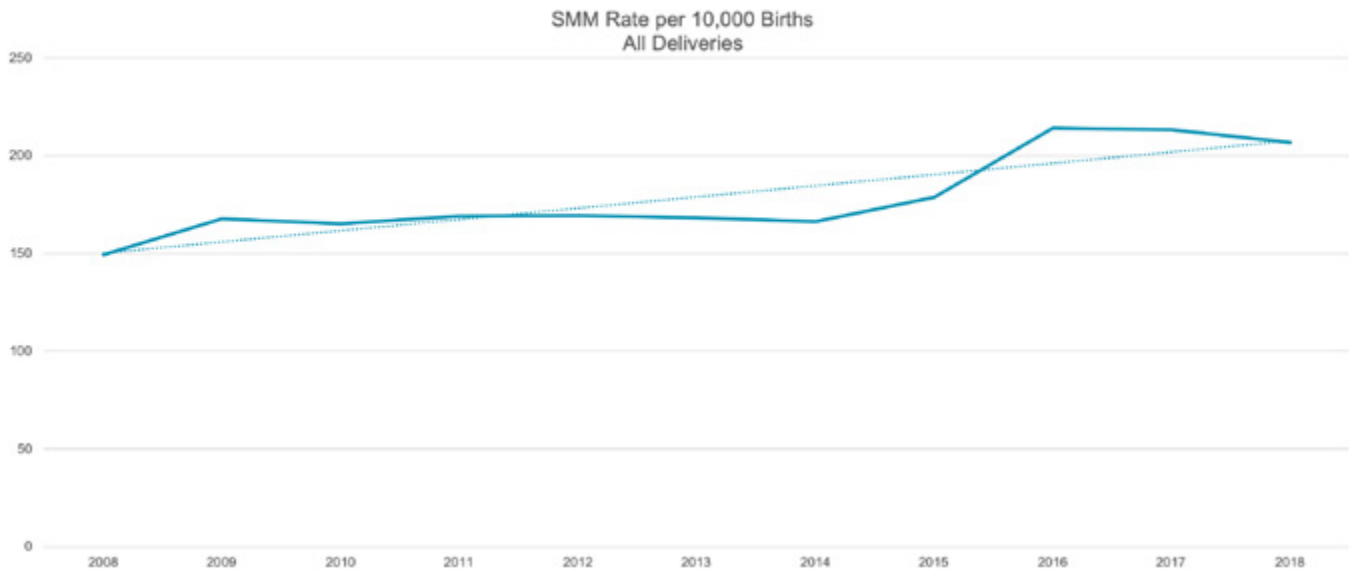
**Figure 6:** *Inpatient Maternal Death Rate for Cesarean Delivery by Race*



## Severe maternal morbidity has increased

While inpatient maternal mortality has decreased, the analysis showed an increase of 36 percent in severe maternal morbidity (SMM) between 2008-2018, and a 14 percent increase from 2015 through the end of 2018 (Figure 7). SMM includes unexpected outcomes of labor and delivery that result in significant short-or long-term health effects, including eclampsia, cardiac arrest and sepsis.

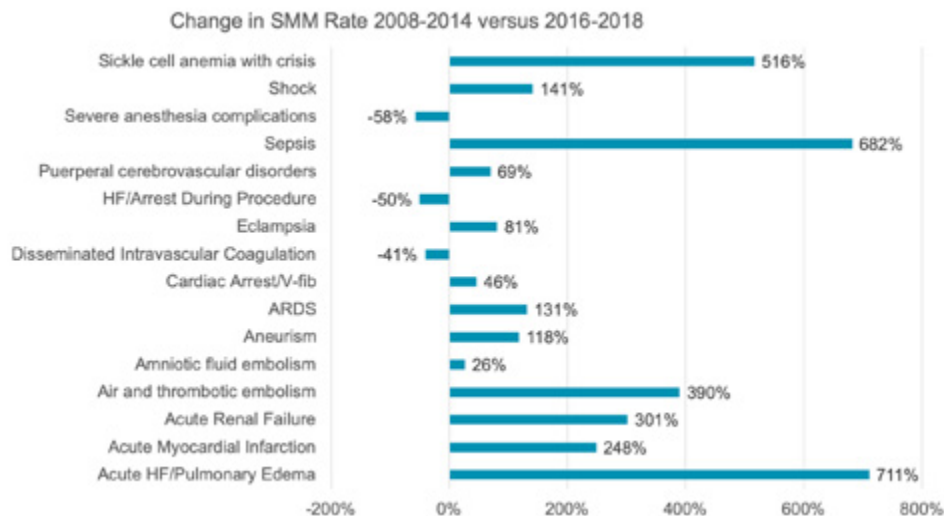
**Figure 7:** Overall SMM Rate



The increase in SMM rates could be due to several factors outlined below, including changes in coding, age, race, payer, type of delivery, substance use, region, hospital type and other factors.

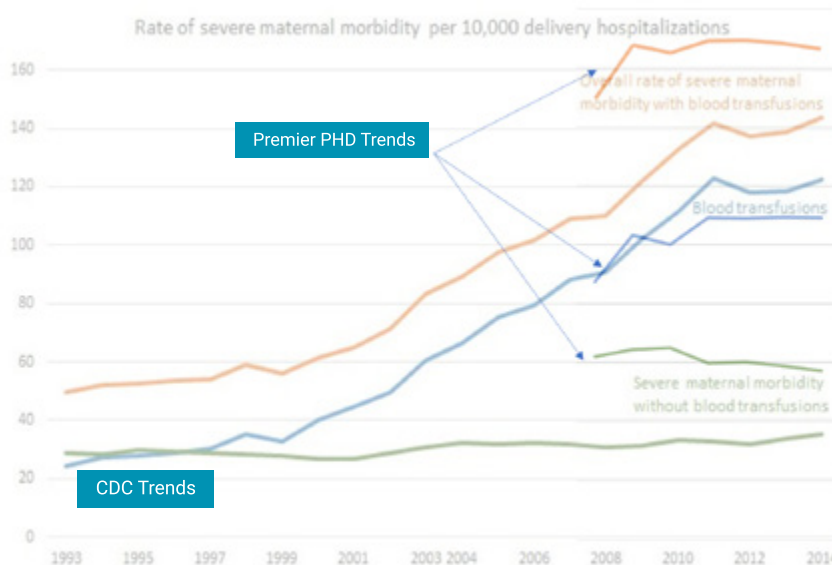
As illustrated in Figure 8, the change from ICD-9 to ICD-10 may have affected the accuracy of SMM rates in year 2015. In other words, part of the increase may be attributable to coding and documentation changes. However, the Premier analysis showed a higher SMM rate than what was reported by the CDC for the same time period. This suggests that there may have been an increase in SMM rates regardless of the transition to ICD-10.

**Figure 8:** SMM Rate Change: ICD-9 versus ICD-10



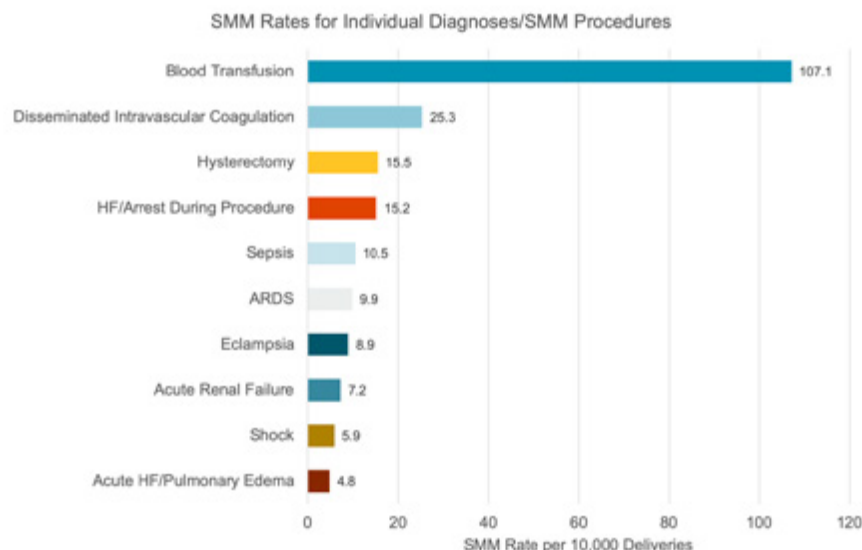
Viewing by year, SMM rates increased by 14 percent between 2008-2012, then remained flat or even slightly decreased in 2013 and 2014. As illustrated in Figure 9, these findings are closely aligned with the CDC's findings over this same time period. However, the CDC's SMM data is only available through 2014. In contrast, Premier's analysis shows a slightly higher rate post ICD-10 implementation (2015) than what was observed by the CDC. Of note is the large increase in SMM rate in 2016 (19 percent) and the decrease in SMM rate (3 percent) in 2018.

**Figure 9:** Overall SMM Rate Comparison to CDC Data



Overall, blood transfusions, disseminated intravascular coagulation, hysterectomy, heart failure and sepsis were the top factors associated in patients who experienced a SMM as defined by the CDC (Figure 10). Blood transfusion incidence in this analysis is 34 percent higher compared to all other conditions and complications that constitute SMM. It is well recognized that blood transfusions are associated with women who have a [higher risk](#) of SMM and mortality. Transfusions are often used as a lifesaving measure in obstetrical hemorrhaging patients and other critical events. The clinical conditions triggering these transfusions and direct relationship to clinical outcomes have not been well described and provide an opportunity for further study.

**Figure 10:** Top 10 Diagnoses and Procedures Associated with SMM

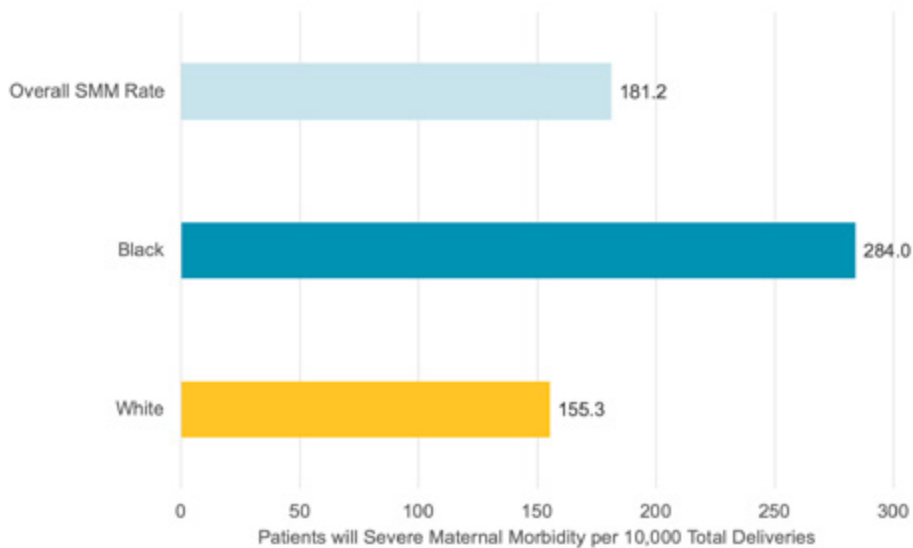


Premier's analysis also identified the proportion of maternal complications attributable to various direct causes of SMM, which include cardiovascular conditions (21.3 percent), obstetric hemorrhage (24.6 percent), hypertensive disorders (11.4 percent), sepsis (6.4 percent), stroke (2.1 percent) and embolism (4.5 percent). Further study to determine indirect causes, such as preexisting conditions, maternal mental health and substance use, will be conducted in later Premier analysis.

**The race disparity gap remains open for SMM**

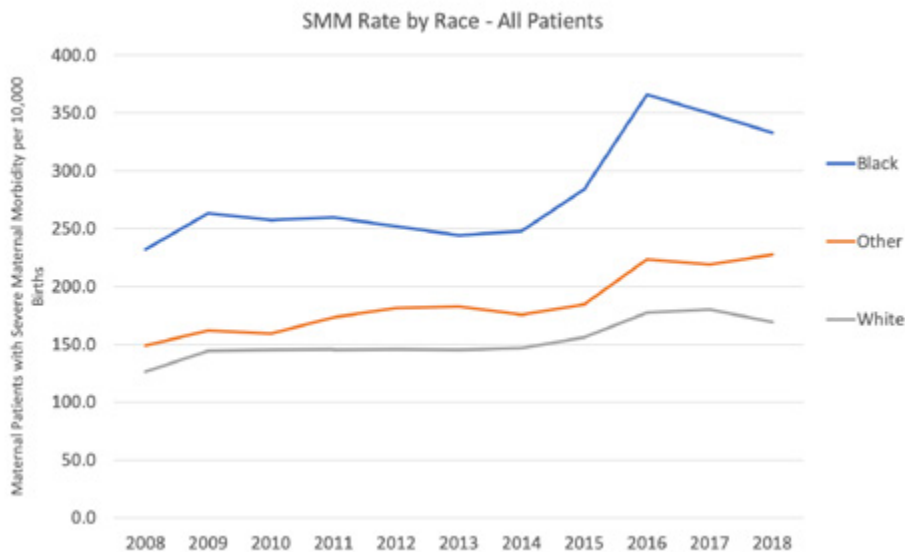
Black women had a 79 percent higher SMM rate than white women (Figure 11). Specifically, black women had higher SMM rates for heart failure, acute respiratory distress syndrome, eclampsia, acute renal failure and sepsis. Black women also have a 94 percent higher rate of blood transfusions than white women.

**Figure 11:** Overall SMM Rate by Maternal Race



Disparities among black women compared to all other populations is evident. More research is needed to understand the specific attributes affecting the variation in hospital performance and SMM rates associated with these disparities.

**Figure 12:** Overall SMM Rate by Maternal Race

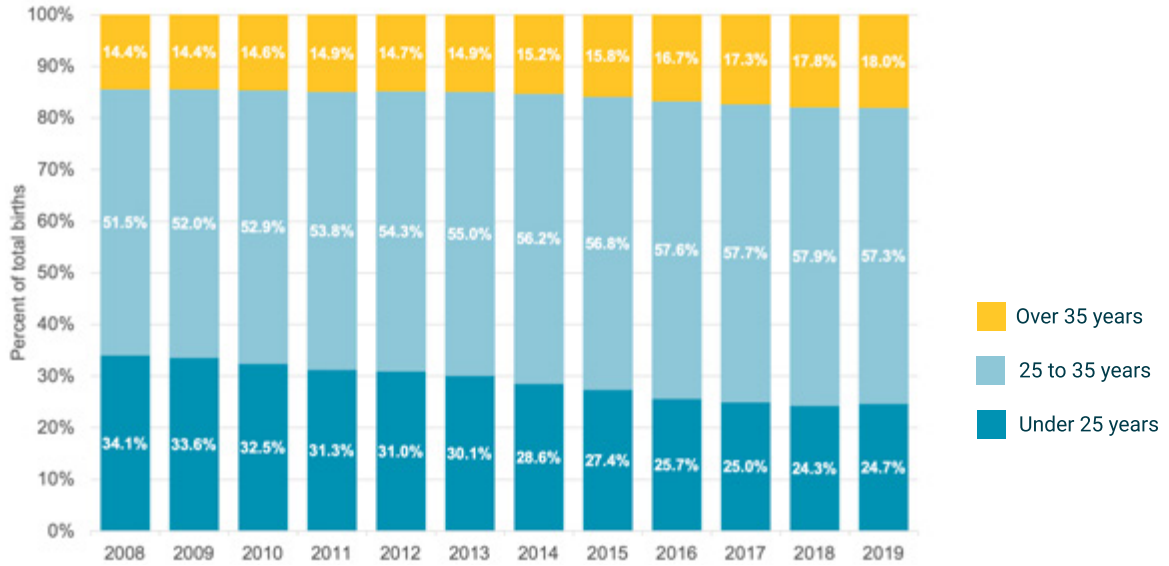




### The maternal population is aging

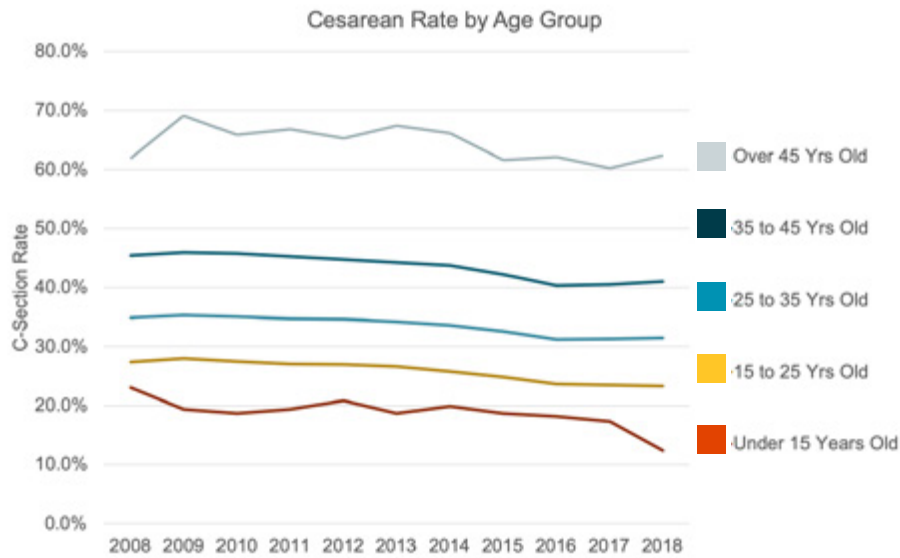
Another consistent trend in the analysis is the aging of the U.S. maternal population. The percent of women giving birth who are older than 35 years of age increased by 24 percent and by 12 percent for mothers 25-35. Women giving birth under the age of 25 decreased by 29 percent (Figure 13).

**Figure 13:** Overall Inpatient Maternal Age Distribution



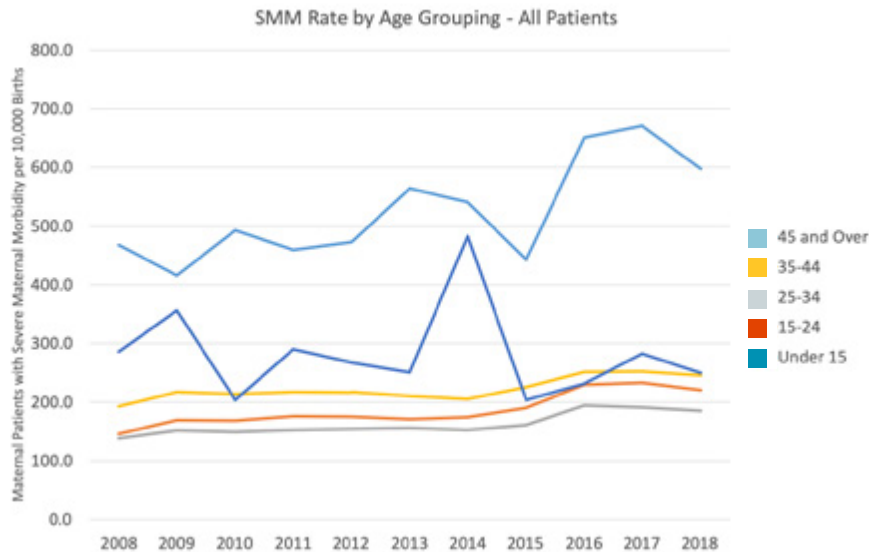
Mothers older than 35 tend to have a higher rate of cesarean sections as illustrated in Figure 14. Cesarean deliveries, which can increase the risk of complications, are 41 percent more common for women older than 35 as compared to women younger than 35.

**Figure 14:** Cesarean Deliveries by Age Group



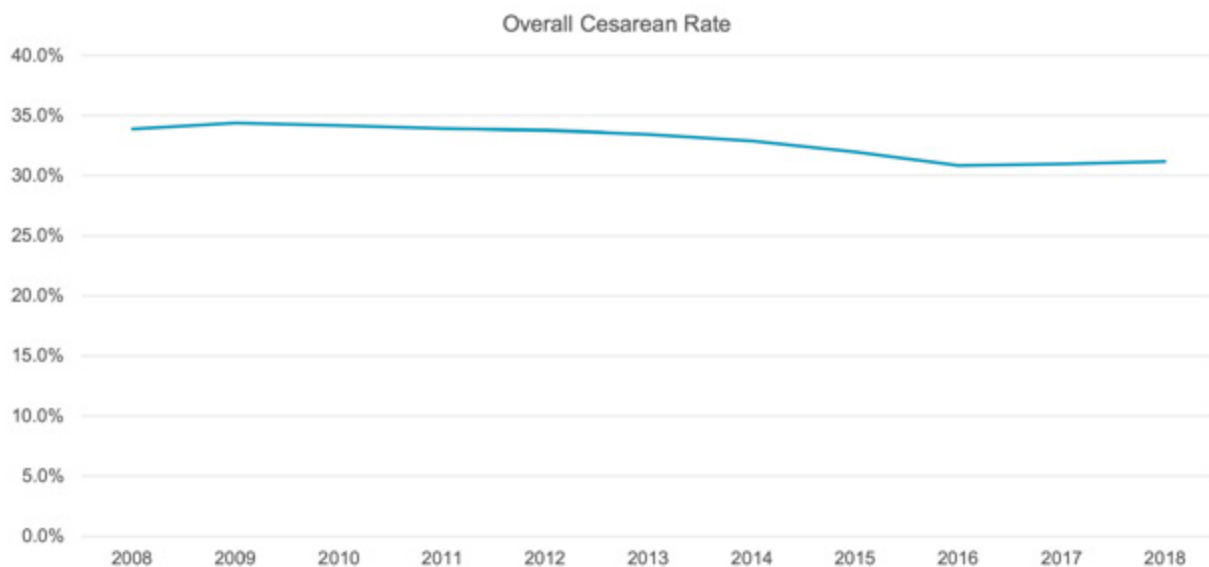
Overall, the SMM rate for patients aged 35 and older is 32 percent higher than those younger than 35. Although mothers older than 45 years demonstrate the highest risk for SMM, women between the ages of 15 – 24 experienced the greatest increases in SMM rates with a 51 percent increase, followed by those 25 – 34 at 35 percent, and a 28 percent increase for mothers ages 35 – 44. Those under the age of 15 demonstrated a 13 percent decrease in SMM (Figure 15).

**Figure 15:** Overall SMM Rate by Maternal Age Group

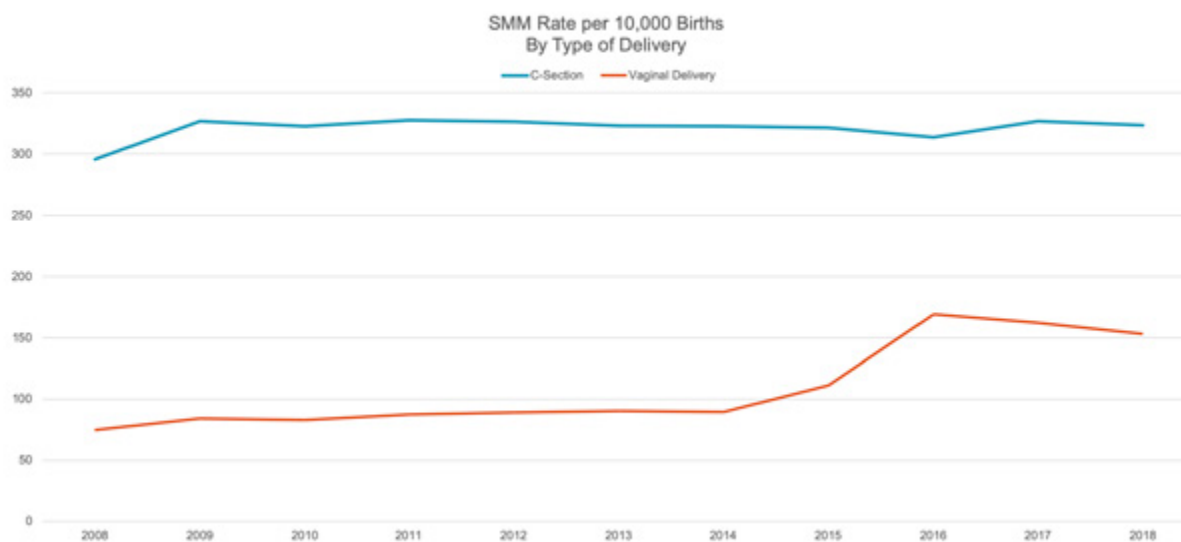


Premier’s analysis confirmed that SMM rates for cesareans are higher than for vaginal deliveries. However, SMM rates for vaginal deliveries have increased by 67 percent since 2015 (Figure 16). Note that much of this increase could be attributed to coding changes. The actual SMM rate decreased in 2017 and 2018 over 2016, after three full years of ICD-10.

**Figure 16:** Overall Cesarean Rate Trend



**Figure 17:** Overall SMM Rate by Type of Delivery

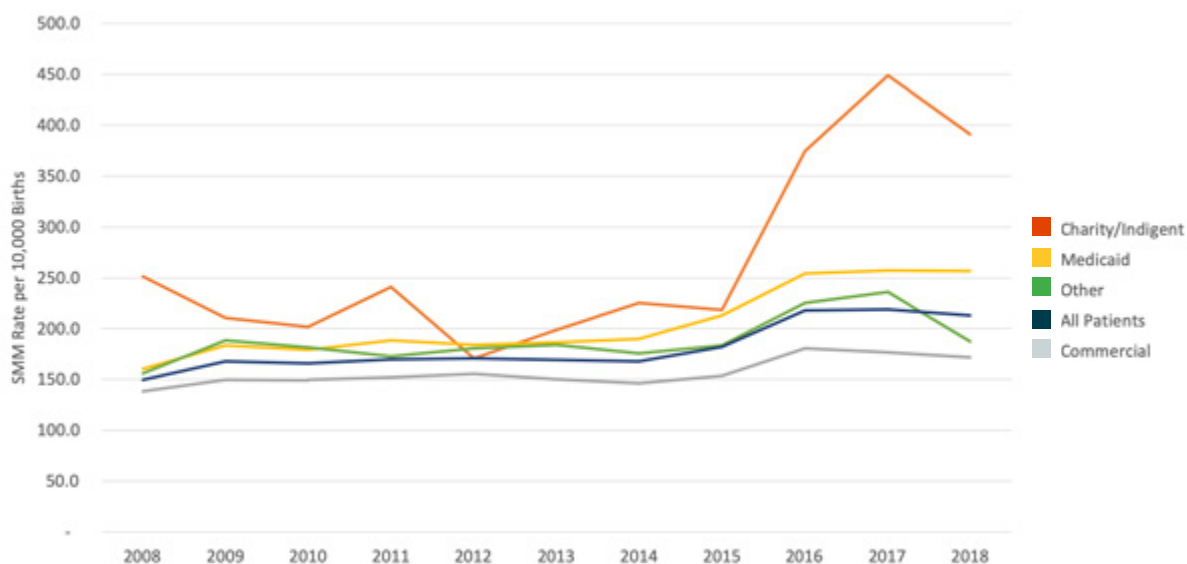


Due to the differences between Premier’s and the CDC’s findings for SMM trends, additional analyses and research are needed to identify how coding changes may contribute to the SMM trend. For example, the changes in coding may demonstrate an enhanced capability to identify complications and SMM at a greater level of accuracy, thus enabling a better understanding of preventable harm and complications associated with pregnancy.

**Patients with commercial insurance have the lowest SMM rates**

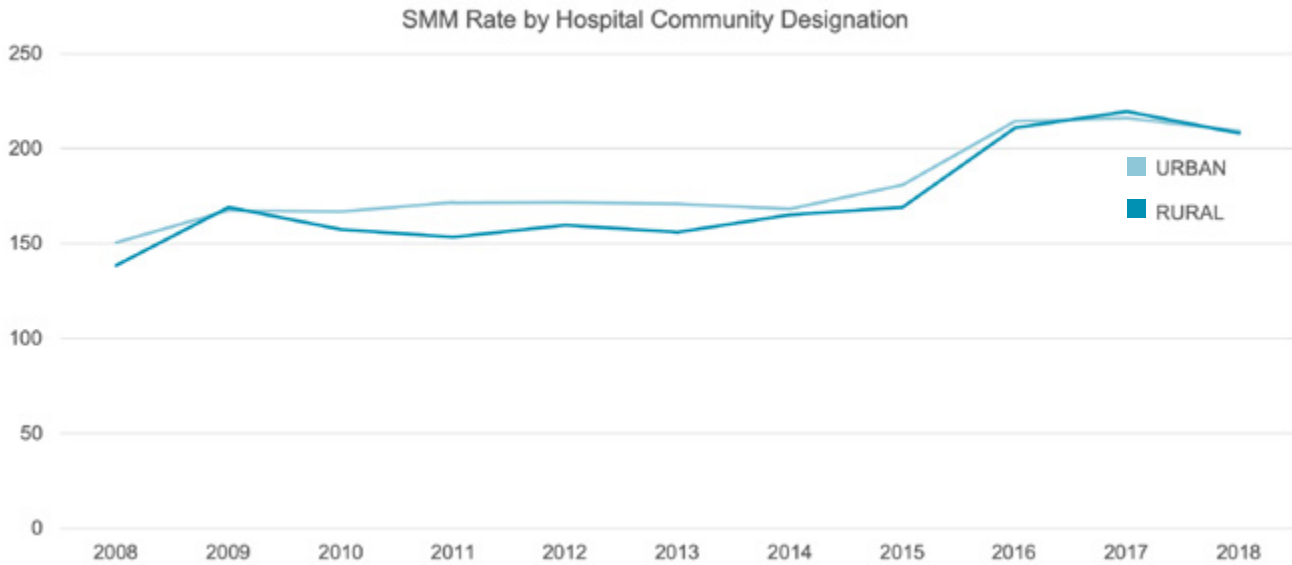
Women with commercial insurance had the lowest SMM rates. Mothers with charity/indigent coverage had the highest SMM rates – a 71 percent higher SMM rate than commercial insurance carriers. Mothers with Medicaid had the second highest SMM rate – 32 percent higher than commercial carriers (Figure 18). In Premier’s analysis, 42 percent of women were covered by Medicaid and 50 percent by commercial insurance. The remaining 8 percent were covered through charity, indigent or other payment sources.

**Figure 18:** Overall SMM Rate by Type of Payer



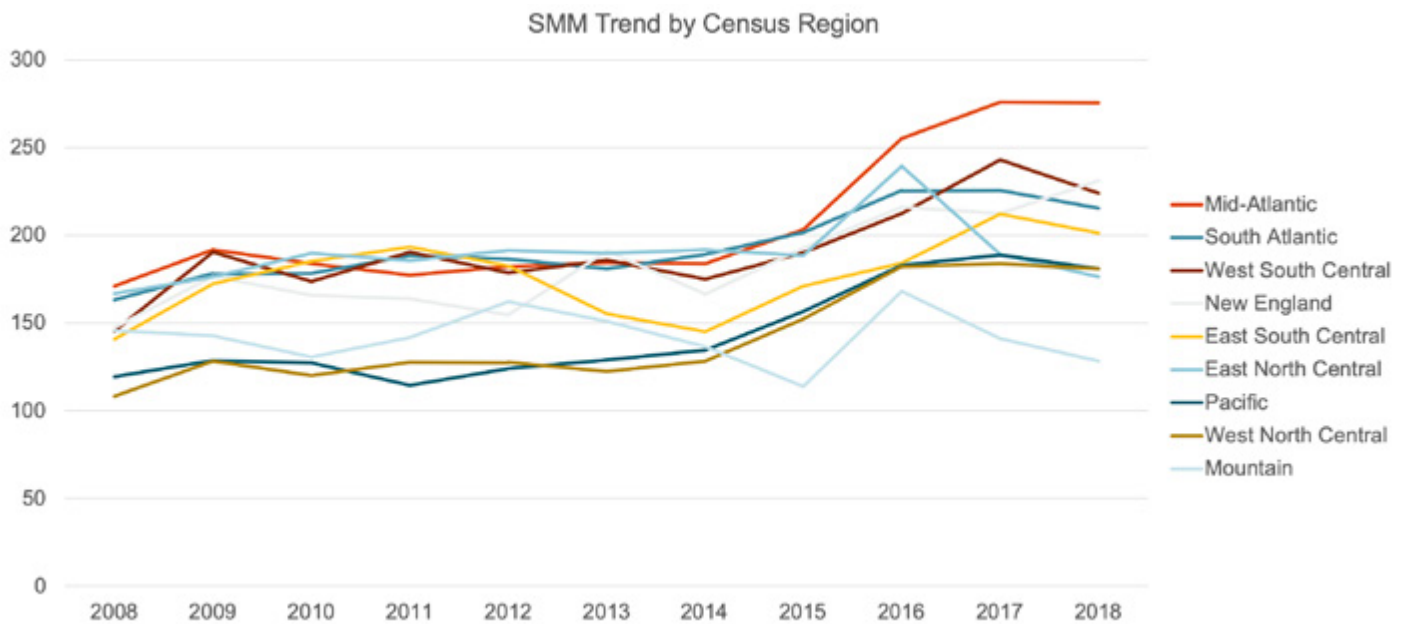
Comparing rural to urban hospitals, SMM rates remained relatively the same, with a 50 percent increase for rural and 39 percent increase for urban hospitals from 2008 – 2018 (Figure 19).

**Figure 19:** SMM Rates for Rural VS Urban Hospitals



Comparing SMM rate by census region, hospitals in the Mid-Atlantic region had the highest SMM rates over the past four years. Hospitals in the Mountain region had the lowest rates over the past four years (Figure 20).

**Figure 20:** SMM Rates by Census Region



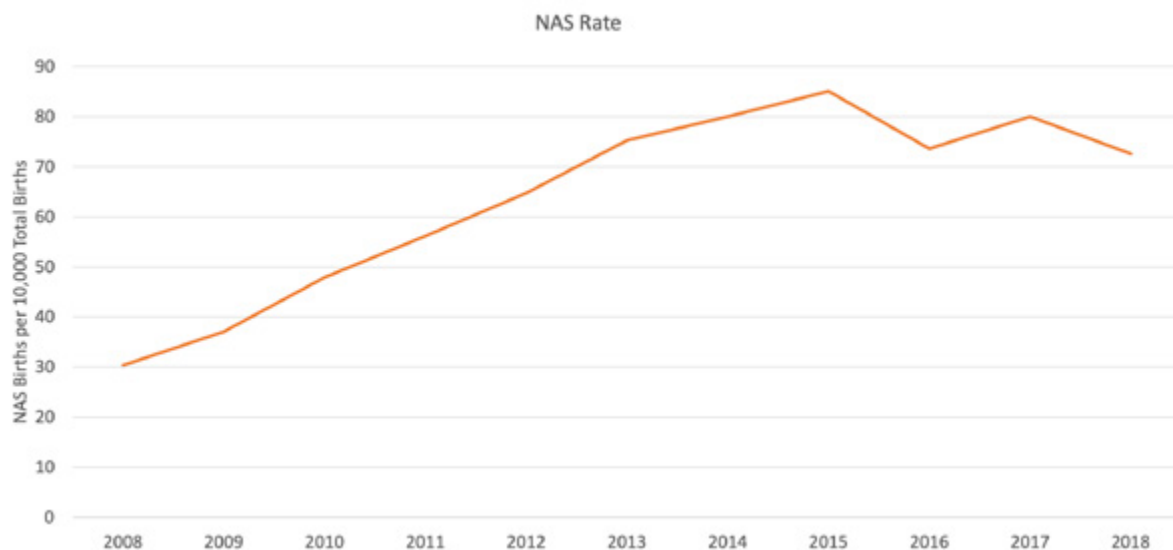


There are several other factors that could have influenced the increase in SMM rates. Premier plans to perform follow-up analyses to identify the key drivers, as well as how age, race, payer, type of delivery, region, hospital type, substance use and other key factors may be influencing SMM rates.

### **Maternal Substance Use and Neonatal Abstinence Syndrome**

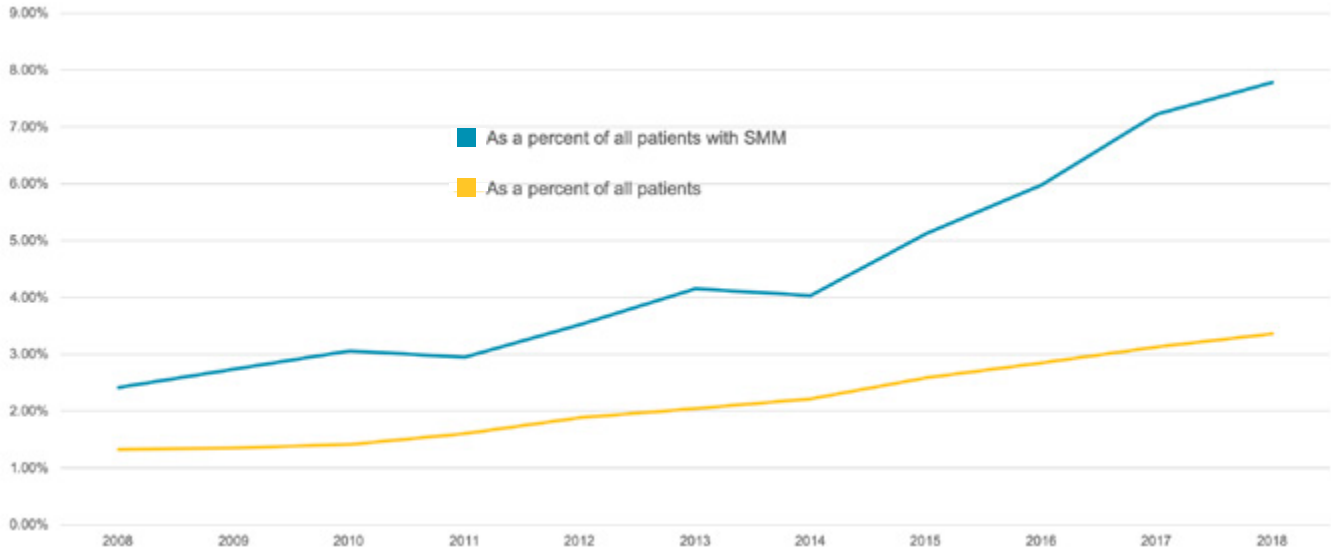
Alarming, the rate of infants born with neonatal abstinence syndrome (NAS) has increased by 140 percent since 2008 (Figure 21).

**Figure 21:** *Rate of Babies born with Neonatal Abstinence Syndrome in the Hospital*



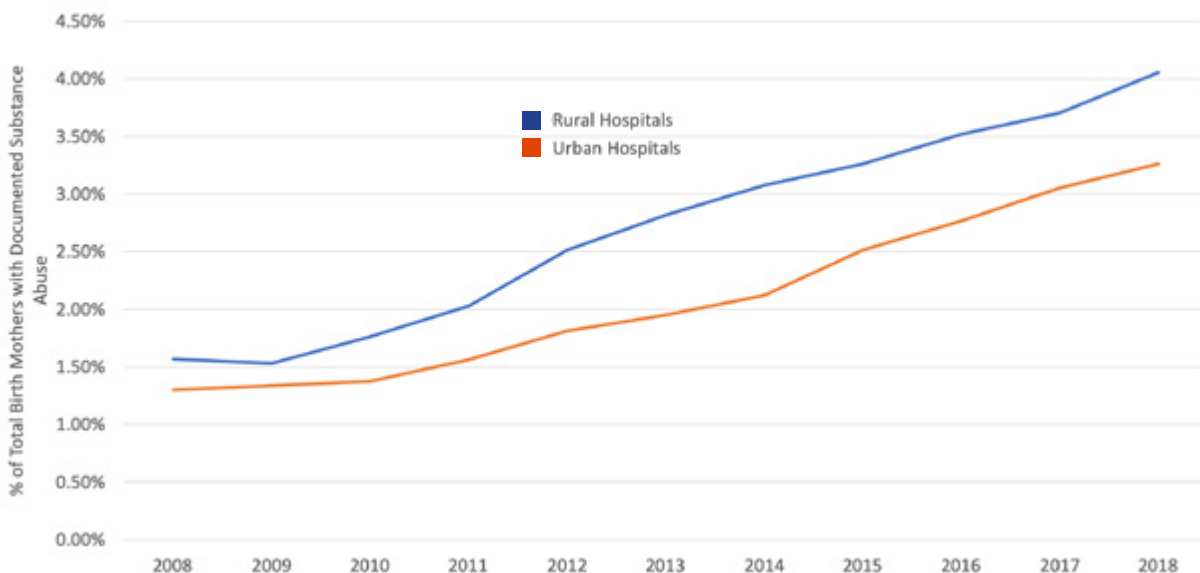
The increasing rate of NAS aligned closely with an increased trend for birth mothers with documented substance use, which has increased by 153 percent since 2008 overall. Additionally, these mothers are 221 percent more likely to experience a SMM (Figure 22).

**Figure 22:** *Inpatient Birth Mothers with Documented Substance Use*



When comparing rural to urban hospitals, rural hospitals had a 34 percent higher rate of maternal patients with substance misuse (Figure 23).

**Figure 23:** *Rate of Substance Use by Hospital Location*



## Conclusions

In the United States, we have a limited understanding of why women are dying, or nearly dying, during pregnancy and childbirth. Unfortunately, state departments of health have limited sources of consistent, detailed data required to conduct accurate population-level analyses of maternal and infant health outcomes.

Premier's analysis showed that hospitals are making progress in reducing maternal deaths. It also showed that the disparity gap has been narrowed for maternal mortality among black women at the time of delivery, in the hospital setting. However, SMM rates have increased, likely a result of multifactorial causes that will require additional detailed analyses. This will include deeper study of the migration to ICD-10 and how that change affected the calculation of quality measures. The disparity gap for SMM remains wide when comparing black women to all other races. Additionally, the maternal population is aging and demonstrating a higher rate of cesarean sections and complications. Cesarean delivery rates are decreasing, although they continue to have higher associated SMM rates than vaginal deliveries.

Substance misuse remains a serious public health concern, and has been linked to harmful maternal and infant outcomes. Premier's analysis demonstrates substantial increases in substance use among women who are pregnant, and subsequently an alarming increase in the number of babies born with NAS. The analysis confirmed SMM is significantly higher among women with substance use disorders.

There are several factors that occur outside of the hospital during pre- and post-natal care that could be influencing overall maternal mortality and morbidity trends identified in Premier's analysis. The U.S. healthcare system continues to be fragmented in the way it cares for pregnant women, new mothers and infants. A more integrated approach to the care expectant and new mothers receive before, during and after delivery is needed in order to improve overall maternal and infant health in the United States.

Comprised of nearly 20 years of de-identified inpatient data, Premier's database is best-in-class and provides focused insights and are more specific than what has been reported by the CDC. Premier will continue to leverage the scale and depth of its database, which offers healthcare providers, patients, policymakers and industry organizations authoritative guidance on improving the quality, safety and efficiency of care delivered across the continuum.

About Premier Inc.

Premier Inc. (NASDAQ: PINC) is a leading healthcare improvement company, uniting an alliance of more than 4,000 U.S. hospitals and health systems and approximately 175,000 other providers and organizations to transform healthcare. With integrated data and analytics, collaboratives, supply chain solutions, and consulting and other services, Premier enables better care and outcomes at a lower cost. Premier plays a critical role in the rapidly evolving healthcare industry, collaborating with members to co-develop long-term innovations that reinvent and improve the way care is delivered to patients nationwide. Headquartered in Charlotte, N.C., Premier is passionate about transforming American healthcare. Please visit Premier's news and investor sites on [www.premierinc.com](http://www.premierinc.com); as well as Twitter, Facebook, LinkedIn, YouTube, Instagram and Premier's blog for more information about the company.