

Patient Safety Tip of the Week

February 7, 2017 Maternal Safety Bundles

It has been almost 7 years since the (now retired) Joint Commission Sentinel Event Alert on Maternal Deaths” (see our February 2010 What's New in the Patient Safety World column “[Joint Commission Sentinel Event Alert on Maternal Deaths](#)”). It cited studies putting the percentage of preventable maternal deaths at between 28 and 50%. Prior studies of preventable maternal deaths have identified issues such as inadequate attention to blood pressure management, inadequate management of pre-eclampsia, inadequate attention to vital signs after C-section, hemorrhage after C-section, and pulmonary embolism.

There has been attention recently to maternal safety issues on several fronts. In October last year the APSF (Anesthesia Patient Safety Foundation) had an article on maternal safety bundles ([Banayan 2016](#)). Then in December the Pennsylvania Patient Safety Authority (PPSA) had a review of serious maternal events reported to the Pennsylvania Patient Safety Reporting System ([Wallace 2016](#)).

The Banayan article notes a study showing that the US is the only developed nation where maternal mortality has increased since 1990 ([Kassebaum 2014](#)). And while the most common causes of maternal mortality historically have been hemorrhage, hypertensive disorders, thromboembolic events and infection, there has been a trend in recent years for more deaths attributable to cardiovascular diseases and other co-existing medical conditions ([Creanga 2015](#), [Berg 2010](#)). The average age of parturients is also increasing but that is also happening in other countries where rates of maternal death are decreasing.

The Banayan article goes on to describe quality improvement initiatives in California and New York that have addressed maternal safety. The California initiative was a collaborative that created multiple toolkits and resulted in a significant reduction in maternal mortality. In New York the [ACOG District II Safe Motherhood Initiative \(SMI\)](#) similarly developed “bundles” of safety tools to address maternal safety. The National Partnership for Maternal Safety (NPMS) has similarly developed bundles for hemorrhage, hypertension in pregnancy, and VTE and others and published their materials on the Council on Patient Safety in Women’s Healthcare [Safe Healthcare for Every Woman website](#).

The bundles on the [ACOG District II Safe Motherhood Initiative \(SMI\)](#) website are arranged into sections: Readiness, Recognition and Prevention, Response, and Reporting/System Learning. For example, the bundle for VTE discusses risk assessment scoring tools and recommendations regarding mechanical and pharmacological

prophylaxis, including dosing protocols and recommendations about the timing of neuroaxial anesthesia events in relation to pharmacological prophylaxis. The hemorrhage bundle includes risk assessment, checklists, massive transfusion protocols, and other tools. The hypertension bundle includes risk assessment, multiple checklists, recommendations for when to treat and which agents to use (first line and subsequent agents), monitoring, escalation process, etc. Each bundle includes a slide set, checklists, other educational tools, and links to other valuable resources.

The December Pennsylvania Patient Safety Authority (PPSA) review of serious maternal events reported to the Pennsylvania Patient Safety Reporting System from 2011 to 2015 ([Wallace 2016](#)) updated a prior PPSA review ([PPSA 2009](#)). The update included 537 events and the top 5 categories were:

1. Unanticipated blood transfusion
2. Laceration of the birth canal
3. Unplanned transfer to the ICU
4. Postpartum hemorrhage
5. Bladder injuries

This review was simply a snapshot and did not go into lessons learned or recommendations. The 2009 PPSA review had a similar short “snapshot” but also had a companion articles on preventing maternal and fetal injuries during vacuum assisted vaginal deliveries ([PPSA 2009b](#)) and on medication errors in labor and delivery ([PPSA 2009c](#)). The most common medication error event types associated with this area were dose omission (22.5%) and wrong drug (10.7%). Almost half (46.4%) of wrong-dose/overdosage errors and 55.2% of wrong-rate errors involved high-alert medications (eg. oxytocin, magnesium sulfate, opioids). Some of the strategies to prevent medication errors and patient harm were:

- standardizing the dosing and administration protocols
- standardizing the concentrations and dosing units of drug infusions
- adopting a policy that all infusions be administered with an infusion pump

That article also had good recommendations about labeling all lines, storage of medications, look-alike/sound-alike (LASA) medication pairs, double checks, verbal orders, and monitoring.

Speaking of high-alert medications, a period of both fetal and maternal vulnerability occurs when a decision is made to perform an emergency cesarean delivery. Such patients often have IV and epidural infusion pumps and other IV lines. In our November 3, 2015 Patient Safety Tip of the Week “[Medication Errors in the OR - Part 2](#)” we discussed an excellent article on medication safety issues when obstetric patients to the OR are transferred to the OR for emergency cesarean deliveries ([Kacmar 2015](#)). It notes that during such emergency transfers there may be inadvertent administration of some of the high-risk medications (eg. oxytocin, magnesium, insulin) a patient may have had infusing prior to the transfer. See the Kacmar article for details and excellent recommendations about which ones to discontinue prior to transport and other issues.

Note that ACOG (American College of Obstetricians and Gynecologists) and SMFM (Society for Maternal-Fetal Medicine) have not yet created or endorsed a single,

comprehensive definition of severe maternal morbidity. But they did publish a consensus statement with some recommendations ([ACOG 2016](#)). While that document does provide an example list of diagnoses and complications that could be considered severe maternal morbidity, it suggests that at a minimum organizations screen for severe maternal morbidity by identifying cases either of the following:

- Transfusion of 4 or more units of blood
- Admission of a pregnant or postpartum woman to an ICU

Cases meeting either of those criteria should be reviewed in detail to determine potential preventability and opportunities for system change and improved future performance.

We mentioned that an increasing burden of chronic diseases in parturients has been suggested as a reason for higher maternal morbidity and mortality rates in the US compared to other countries. Parellel with the obesity epidemic we have seen increasing rates of obstructive sleep apnea. In our May 13, 2014 Patient Safety Tip of the Week “[Perioperative Sleep Apnea: Human and Financial Impact](#)” we noted a study that demonstrated an association between OSA and maternal mortality in pregnancy ([Louis 2014](#)). The rate of OSA increased from 0.7 in 1998 to 7.3 in 2009, an average annual increase of 24%. After controlling for obesity and other potential confounders, OSA was associated with increased odds of preeclampsia, eclampsia, cardiomyopathy, and pulmonary embolism. **Women with OSA experienced a more than fivefold increased odds of in-hospital mortality.** The adverse effects of OSA on selected outcomes were exacerbated by obesity. Just as we have recommended screening pre-op patients for OSA, it would probably be wise to screen obstetrical patients for OSA with a simple tool like the STOP-Bang questionnaire. Particularly since many women may receive drugs that may cause respiratory depression or aggravate OSA before, during, or after labor and delivery, it is important to recognize those at risk so that appropriate monitoring is done.

One of the likely reasons for higher rates of maternal morbidity and mortality in the US is our high rate of cesarean deliveries. About a third of births in the United States occur with cesarean delivery. So efforts to reduce the rate of cesarean deliveries that lack a medical indication should be a way to improve our maternal morbidity and mortality rates. A multi-strategy approach at Boston’s Beth Israel Deconess Medical Center successfully reduced its NTSV (nulliparous term singleton vertex) cesarean delivery rate from 35% to 21% over eight years ([Vadnais 2017](#)). Their total cesarean delivery rate declined as well from 40.0% to 29.1%. These rates of improvement exceeded any state or national trends for the same period.

Their multi-strategy approach included provider education, provider feedback, and implementation of new policies to target the five key factors that may influence the NTSV cesarean delivery rate: interpretation and management of fetal heart rate tracings, provider tolerance for labor, induction of labor, provider awareness of NTSV cesarean delivery rate, and environmental stress.

And the reduced rates were largely without unintended consequences. There was an increase in meconium aspiration but the mean 5-minute Apgar score and the rate of NICU admission for more than 24 hours were stable throughout the study period and they

could not detect a difference in the rate of neonatal demise. There was also a slight increase in the maternal transfusion rate. The amount of time patients occupied beds in the Labor and Delivery Unit increased, largely because of longer labors compared to those where cesarean deliveries were done.

In several of our columns we've mentioned the MORE^{OB} Program (Managing Obstetrical Risk Efficiently). The [MORE^{OB} Program](#) focuses on communication and teamwork building, skill building, culture of safety, emergency skill drills, education, and use of patient safety tools like RCA, FMEA, near miss reviews, audits, etc. The program has reduced NICU admissions and resulted in fewer neonates with respiratory distress, sepsis, CNS hemorrhage, and a variety of other neonatal and maternal outcomes. In our September 7, 2010 Patient Safety Tip of the Week "[Patient Safety in Ob/Gyn Settings](#)" we noted multiple hospitals in Alberta participating in the 3-year long MORE^{OB} Program saw that severe newborn morbidity was significantly reduced and maternal outcomes (reduced third- and fourth-degree tears and reduced lengths of stay) were also improved ([Thanh 2010](#)).

And, of course, we are always big fans of drills and exercises that help prepare teams for emergencies. Fortunately, ob/gyn has been a pioneer in **simulation programs** that use team-based interdisciplinary training for events like post-partum hemorrhage and other obstetrical emergencies. Many academic medical centers put on such simulation programs for interested parties to attend. We are familiar with the one put on by the [University of Rochester Medical Center](#). These simulations can be quite comprehensive. There's even one module in which there is simulation of the expectant father fainting in the delivery room!

A couple other observations also keep popping up: the "weekend effect" and disparities in outcomes between rural and urban hospitals.

We've discussed the "**weekend effect**" (and "**after hours effect**") in multiple columns and discussed many of the factors likely contributing to the phenomenon (see the list at the end of today's column). Several studies have found increased maternal and/or neonatal mortality on weekends compared to weekdays. A UK study found that performance across four of seven measures of maternal and neonatal outcomes was significantly worse for women admitted, and babies born, at weekends ([Palmer 2015](#)). No consistent association between outcomes and staffing was identified other than a slightly lower rate of perineal tears in sites that complied with recommended levels of consultant presence. But two studies recently presented at the 37th Annual Meeting of the Society for Maternal Fetal Medicine: The Pregnancy Meeting had contradictory findings. Moaddab and colleagues, using data on over 45 million deliveries from 2 large CDC databases, found that maternal mortality rates were highest on Saturday and Sunday ([Moaddab 2017](#)). They also found that stillbirths and fetal mortality rates were higher on weekends. The authors note these findings occur despite a likely systematic bias toward admission and delivery of more complex patients on weekdays. On the other hand, Einerson and colleagues ([Einerson 2017](#)) analyzed 208,695 deliveries and found that composite maternal adverse events and death did not differ between the daytime and

night/weekend groups. Composite neonatal adverse events and perinatal mortality were less common in the daytime group. But in the subgroup of spontaneously laboring patients, there was no difference in composite maternal or neonatal adverse events and no difference in maternal death or perinatal mortality. The authors felt that scheduling of “low-risk” inductions and cesareans may account for lower risk of adverse obstetric outcomes observed during weekdays. An editorial accompanying the Palmer study ([Snowden 2015](#)) discusses potential factors that might contribute to a “weekend effect” in obstetrics. We’ve also discussed the multiple factors that contribute to the “weekend effect” in our several columns on the phenomenon (see full list below).

A recent Canadian study looked at differences in maternal morbidity between rural and urban settings, noting that most prior similar studies focused on infant outcomes ([Lisonkova 2016](#)). They found that rates for eclampsia, obstetric embolism, and uterine rupture or dehiscence were **twice as common in rural settings**. Though there was no difference in neonatal mortality, there was higher neonatal morbidity in rural settings as well. The authors suggest that maternity care providers in rural regions need to be aware of potentially life-threatening maternal and perinatal complications requiring advanced obstetric and neonatal care. Though this was a Canadian study we suspect we’d find similar patterns in the US. We often see referral for “high risk” pregnancies based upon fetal factors and fetal risk and less often for maternal risk. It’s probably not just the driving distance to the hospital or even the density of obstetricians that is the critical factor. One study found that the density of maternal-fetal medicine specialists is significantly and inversely associated with maternal mortality ratios, even after controlling for state-level measures of maternal poverty, education, race, age, and their significant interactions ([Sullivan 2005](#)). An abstract presented last year ([Guglielminotti 2016](#)) found in 605,534 discharges in 139 hospitals in New York state severe maternal morbidity increased from 1.1% in 2009 to 1.4% in 2011. The 3 most frequent severe maternal morbidity were severe postpartum hemorrhage (35%), disseminated intravascular coagulation (27%), and heart failure (16%). Interestingly, neighborhood characteristics were not associated with severe maternal morbidity but four hospital characteristics were associated with decreased rate of severe maternal morbidity: urban location, low proportions of minority patients and high-risk pregnancies, and higher cesarean delivery rate. So any rural/urban disparity may more a problem in matching maternal risk with hospitals best prepared to handle patients with those risks.

And then there are some rarer threats to maternal health. We described one very interesting phenomenon in our December 4, 2012 Patient Safety Tip of the Week “[Unintentional Perioperative Hypothermia: A New Twist](#)” that needs to be recognized to avoid maternal morbidity. There appears to be a syndrome related to cases (most often obstetrical) in which **spinal anesthesia with morphine** is used and patients develop **hypothermia with paradoxical sweating**. Most cases in the literature have followed cesarean deliveries. Prompt recognition of this syndrome is important because **the syndrome often responds to benzodiazepines**. You need to amend your hypothermia management protocols to take this phenomenon into account. Specifically there should be **a prompt to consider the phenomenon** if the expected improvement in hypothermia is not occurring within a reasonable amount of time after conventional warming procedures

have been instituted. Perhaps even a prompt at the beginning of your protocol to look for signs you would not expect with hypothermia (i.e. sweating, hot feeling, vasodilation) might suggest this unusual etiology for the hypothermia. See that December 4, 2012 Patient Safety Tip of the Week “[Unintentional Perioperative Hypothermia: A New Twist](#)” for details.

Some “**never events**” may also threaten maternal safety. One rare preventable cause of maternal morbidity is a **surgical fire**. While we usually think about high risk for surgical fires with chest or head/neck surgery, we’ve described surgical fires during cesarean deliveries in Israel (see our January 2011 What’s New in the Patient Safety World column “[Surgical Fires Not Just in High Risk Cases](#)”) and New Zealand (see our April 24, 2012 Patient Safety Tip of the Week “[Fire Hazard of Skin Preps Oxygen](#)”). As a result, in New Zealand some hospitals abandoned the use of alcohol-based skin preps for ob/gyn procedures, moving instead to aqueous-based skin preps, especially in view of lack of a clearcut difference in surgical site infections by skin prep type for such ob/gyn procedures.

And don’t forget about the possibility of **retained surgical items (RSI’s)** in obstetrics (see our August 19, 2014 Patient Safety Tip of the Week “[Some More Lessons Learned on Retained Surgical Items](#)”). A substantial proportion of retained surgical items have been reported in Ob/Gyn procedures, including cesarean and vaginal deliveries ([Stiller 2010](#)). The [Minnesota Hospital Association](#) and [ICSI](#) also have focused on Ob/Gyn procedures in their efforts to prevent retained foreign objects. Like most cases of RSI’s, surgical sponges are the items most commonly left behind but there have been increasing reports of retained instruments and other objects including - you guessed it – a cellphone ([Moran 2015](#))!

And since many women during labor have both intravenous and epidural infusions, don’t forget the potential for **mistaken infusion into the wrong line**. In our April 2010 What’s New in the Patient Safety World column “[RCA: Epidural Solution Infused Intravenously](#)” we discussed a case of such a tragic mistake that led to a maternal death.

Though they are technically not related to maternal safety, we’ve also listed below our columns related to events that can transpire after delivery, such as infant abductions, switched babies, breastfeeding and breastmilk mixups.

Some of our previous columns on maternal and ob/gyn issues:

February 5, 2008	“ Reducing Errors in Obstetrical Care ”
February 2010	“ Joint Commission Sentinel Event Alert on Maternal Deaths ”
April 2010	“ RCA: Epidural Solution Infused Intravenously ”
July 20, 2010	“ More on the Weekend Effect/After-Hours Effect ”
August 2010	“ Surgical Case Listing Accuracy ”
September 7, 2010	“ Patient Safety in Ob/Gyn Settings ”
January 2011	“ Surgical Fires Not Just in High Risk Cases ”

February 8, 2011	“Inducing Too Early”
April 2011	“Ob/Gyn Patient Safety Programs”
April 24, 2012	“Fire Hazard of Skin Preps Oxygen”
July 2012	“WHO Safe Childbirth Checklist”
December 4, 2012	“Unintentional Perioperative Hypothermia: A New Twist”
September 2013	“Full-Time Laborists Reduce C-Section Rates”
October 2013	“Challenging the 39-Week Campaign”
November 2013	“The Weekend Effect: Not One Simple Answer”
January 2014	“It MEOWS But Doesn’t Purr”
May 13, 2014	“Perioperative Sleep Apnea: Human and Financial Impact”
August 19, 2014	“Some More Lessons Learned on Retained Surgical Items”
November 3, 2015	“Medication Errors in the OR - Part 2”

Some of our prior columns related to identification issues in newborns:

November 17, 2009	“Switched Babies” ,
December 20, 2011	“Infant Abduction”
September 4, 2012	“More Infant Abductions” .
December 11, 2012	“Breastfeeding Mixup Again” .
April 8, 2014	“FMEA to Avoid Breastmilk Mixups”
August 2015	“Newborn Name Confusion”
January 19, 2016	“Patient Identification in the Spotlight”
July 19, 2016	“Infants and Wrong Site Surgery”

Some of our previous columns on the “weekend effect”:

- February 26, 2008 [“Nightmares....The Hospital at Night”](#)
- December 15, 2009 [“The Weekend Effect”](#)
- July 20, 2010 [“More on the Weekend Effect/After-Hours Effect”](#)
- October 2008 [“Hospital at Night Project”](#)
- September 2009 [“After-Hours Surgery – Is There a Downside?”](#)
- December 21, 2010 [“More Bad News About Off-Hours Care”](#)
- June 2011 [“Another Study on Dangers of Weekend Admissions”](#)
- September 2011 [“Add COPD to Perilous Weekends”](#)
- August 2012 [“More on the Weekend Effect”](#)
- June 2013 [“Oh No! Not Fridays Too!”](#)
- November 2013 [“The Weekend Effect: Not One Simple Answer”](#)
- August 2014 [“The Weekend Effect in Pediatric Surgery”](#)
- October 2014 [“What Time of Day Do You Want Your Surgery?”](#)
- December 2014 [“Another Procedure to Avoid Late in the Day or on Weekends”](#)
- January 2015 [“Emergency Surgery Also Very Costly”](#)
- May 2015 [“HAC’s and the Weekend Effect”](#)
- August 2015 [“More Stats on the Weekend Effect”](#)

- September 2015 “[Surgery Previous Night Does Not Impact Attending Surgeon Next Day](#)”
- February 23, 2016 “[Weekend Effect Solutions?](#)”
- June 2016 “[Weekend Effect Challenged](#)”

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ACOG District II Safe Motherhood Initiative (SMI) website

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Safe Healthcare for Every Woman website
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