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California Maternal
Quality Care Collaborative

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Improving Health Care Response to Obstetric Hemorrhage, V3.0

A CMQCC Quality Improvement Toolkit

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Notes on Terminology

Throughout the Toolkit, the terms “mother” or “maternal” or “she” or “her” are used in reference to a person who is pregnant or has given birth. We recognize not all people who become pregnant and give birth identify as mothers or women. We believe all persons are equally deserving of patient-centered care that helps them attain their full potential and live authentic, healthy lives

The term “family” is used to refer to any persons the pregnant or postpartum patient designates as such (alternatives: partners, husbands, wives, support persons, loved ones).

The term “clinician” is used to denote nursing and medical staff, whereas the term providers refers to clinicians with diagnosing and prescribing authority.

“Obstetric hemorrhage” is often referred to as maternal hemorrhage or postpartum hemorrhage in the medical and scientific literature. All terms are referring to the same complication.

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Conflict of Interest:

The contributing authors do not have any affiliations or financial involvement that conflict with the material or recommendations presented in this Toolkit.

Disclosure:

David Lagrew, MD, has not received any financial reimbursement for his inclusion on the original patent of the Alydia Jada device. He has no financial relationship with the company at the present time. As a CMQCC Task force co-lead member, he did not participate in discussions and/or development of the content in the Toolkit that involved this device. He is not currently associated with colorimetric devices, its current development or marketing, and does not hold any financial interest, either currently or in the past for these devices.

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Executive Summary

David Lagrew, MD, Providence St. Joseph Health

The California Maternal Quality Care Collaborative (CMQCC) and multidisciplinary volunteers have reviewed and updated the Toolkit “Improving Health Care Response to Obstetric Hemorrhage V3.0” to address causes of maternal morbidity and mortality due to obstetric hemorrhage. This Toolkit continues to incorporate the latest evidence and best practices to address obstetric hemorrhage, as well as the recently released Joint Commission Standards for Maternal Safety.¹

Managing healthcare response to obstetric hemorrhage remains a key priority. Globally, hemorrhage remains a leading cause of maternal mortality, despite a decline in the overall mortality ratio.² In California and the U.S., obstetric hemorrhage continues to be a leading and preventable cause of severe maternal morbidity (SMM) and mortality.³ A study examining U.S. trends noted that obstetric hemorrhage accounted for a significant fraction of severe maternal morbidity from complications associated with hypovolemic shock and

resuscitation, including coagulopathy, acute respiratory failure and renal failure.⁴

The U.S. rate of obstetric hemorrhage increased by 50 percent along with a 270 percent increase in blood transfusions, with both hemorrhage and transfusions correlated with the rise in cesareans.⁵ The risk is higher for prior cesarean deliveries because there is an increased risk of placental implantation abnormalities such as placenta previa and placenta accreta in future pregnancies.⁶

Black and Indigenous women experience higher rates of cesareans, maternal morbidity, and mortality than women of other races/ethnicities. We highlight the voices of women and their experiences with obstetric hemorrhage in an effort to increase the awareness of these troubling inequities among maternity clinicians. It is critical that clinicians who care for pregnant women and birthing people recognize and respond to obstetric hemorrhage quickly using standardized best practices.⁸⁻¹²

Melissa's story

Melissa Price, the patient representative on a prior CMQCC Hemorrhage Task Force, experienced a late postpartum hemorrhage after the birth of her twins, which resulted in 12 units of blood transfused and an unwanted hysterectomy. After seeing blood clots at 8 days postpartum, she drove herself to the emergency department (ED) at an academic medical center rather than the community hospital where she gave birth. While in the ED, Melissa recalled asking the nurses how they could tell how much blood she was losing as the blood was never weighed, but rather dumped from a bed pan into the toilet. After the OB got the initial bleeding to stop, she was left alone behind a curtain and infrequently checked on. Melissa tells of feeling sheer panic when the bleeding started up again with “enormous clots...I screamed and I will never forget the look on the nurse's face when she lifted up that blanket. After that, ED staff were running around everywhere--rushing to call my OB, rushing to get an OR suite, rushing to figure out how to get my insulin pump turned off. I just kept thinking 'God give them more time. They need more time to save me.' With

my OB right next to me, I grabbed his hand and said to him, ‘Get me to the other side of this,’ And he said, ‘Melissa, I will do everything I can to get you there.’ **It haunts me to this day that if I had passed out and not been able to scream and advocate for myself, things would likely have turned out very, very differently.”**

Years later, Melissa discovered CMQCC and the first hemorrhage Toolkit. She realized then where there were gaps in her care, such as not quantifying her blood loss during the event, not informing her of her risk for hemorrhage prenatally, or before discharge when she asked for an assessment of a mass in her lower body and was told it was likely a hernia. Her self-advocacy during that severe event led her to become a CMQCC volunteer and bring the patient experience into the maternal quality Toolkit to improve maternal outcomes due to postpartum hemorrhage. (Story and name used with permission of Melissa Price.)

Toolkit revision and components

The revised content of the Toolkit has been aligned with:

- ▶ National Partnership for Maternal Safety Hemorrhage Bundle⁷
- ▶ Quality Improvement framework 4Rs: Readiness Recognition, Response and Reporting
- ▶ The Joint Commission Standards for Maternal Safety¹

In 2021, The Joint Commission Standards for Maternal Safety introduced a standardized approach to identify and manage hemorrhage and other perinatal conditions. The Maternal Safety bundle is comprised of seven elements of performance (EPs) that can function as a checklist for perinatal leaders to guide implementation of the Toolkit and help birth facilities meet TJC accreditation requirements.¹

While the objectives of the original Toolkit remain unchanged, this revision of the Obstetric Hemorrhage Toolkit clarifies and updates certain recommendations based on new data and includes emerging, potentially promising technologies and techniques. The Task Force acknowledges that some of these tools require

more research to confirm the place, role and timing of utilization in obstetric hemorrhage management.

This Toolkit highlights current best practices, workable solutions and recommendations for optimal care for obstetric hemorrhage. Topics range from risk assessment to appropriate implementation of accepted medical therapy, while recognizing institutional limitations in providing care for patients. In addition, the Toolkit has been modified to address the role health inequity contributes to morbidity and mortality for non-Hispanic Black and Indigenous women⁸⁻¹² and suggests ways to curb implicit bias, revise protocols to address gaps and special needs that will enable caregivers to help vulnerable patients.

Nurse’s experience with implementing the toolkit

One of the major informal leaders came up to me and she said, ‘You know, every time you make us do a hemorrhage drill, I know I roll my eyes but I think it really saved my patient’s life yesterday and I’m never going to roll my eyes at you again.’

Summary of key changes in this edition

- ▶ **NEW Section! Implementing and Sustaining Maternal Quality, Safety and Performance Improvement for Obstetric Hemorrhage**
Outlines a guided approach to systematically incorporating Toolkit elements into birth facilities to align with The Joint Commission Standards for Maternal Safety
- ▶ **NEW Section! Using the Electronic Health Record (EHR) to Improve the Management of Obstetric Hemorrhage**
Underscores how EHR can be utilized to enhance prompt hemorrhage recognition and allows clinicians to easily implement standard protocols
- ▶ **Obstetric Hemorrhage Risk Factor Assessment**
Parameters added for ongoing risk assessment at admission, the start of the 2nd stage of labor, transfer to postpartum care, and as the patient's status changes during the birth hospitalization
- ▶ **NEW Section! Management of Iron Deficiency Anemia**
Highlights the importance of prenatal iron optimization
- ▶ **Definition, Early Recognition and Rapid Response to Obstetric Hemorrhage Using Triggers**
Emphasizes the importance of assessment for concealed hemorrhage
- ▶ **Best Practice Techniques to Assess Quantitative Cumulative Blood Loss**
Underscores strong support for Quantitative Blood Loss, along with clarification of definitions
- ▶ **Medications for Prevention and Treatment of Postpartum Hemorrhage**
Outlines changes in the recommendation for misoprostol and updated recommendations for use of tranexamic acid (TXA) as an adjunctive therapy
- ▶ **Blood Product Replacement: Obstetric Hemorrhage**
Discusses further decrease in enthusiasm for rFactor VIIa
- ▶ **NEW Section! Secondary Obstetric Hemorrhage and Readmission**
Addresses women's experiences and psychological needs after an unexpected event both in the hospital and after discharge
- ▶ **NEW Section! Using Outcome Metrics for Hemorrhage Related QI Projects**
Overviews reporting recommendations, including outcome metrics and coding guidelines
- ▶ **NEW Content! Equity and Respectful Care**
Summarizes resources to address equity in care to help clinicians provide respectful care for all patients who experience obstetric hemorrhage

In summary, this Toolkit provides an update to the management of obstetric hemorrhage. It is meant to be a practical guide for the systemic response to these life-threatening events using quality and process improvement techniques. The Toolkit is not meant to be a comprehensive textbook but rather background and rationale of the techniques and procedures used in clinical practice. It is hoped that widespread implementation of this and other Toolkits and techniques for timely response to leading causes of maternal morbidity and mortality will lead to improvements in outcomes for all birthing women/persons and reduce racial disparities associated with these conditions.

References

1. Joint Commission. Provision of care, treatment, and services standards for maternal safety. https://www.jointcommission.org/-/media/tjc/documents/standards/r3reports/r3_24_maternal_safety_hap_9_6_19_final1.pdf2019.
2. GBD 2015 Maternal Mortality Collaborators, Kassebaum, NJ, Barber, R, Bhutta, ZA, et al. Global, regional, and national levels and causes of maternal mortality during 1990–2015: A systematic analysis for the global burden of disease study 2015. *Lancet*. 2016(08 October 2016).
3. California Department of Public Health. The California Pregnancy-Associated Mortality Review. Report from 2002 - 2007 maternal death reviews. 2019.
4. Reale SC, Easter SR, Xu X, Bateman BT, Farber MK. Trends in postpartum hemorrhage in the United States from 2010 to 2014. *Anesthesia and Analgesia*. 2020;130(5):e119-e122.
5. Kuklina E, Meikle SF, Jamieson DJ, et al. Severe obstetric morbidity in the United States: 1998-2005. *Obstetrics and Gynecology*. 2009;113(2):293-299.
6. Knight M, Kurinczuk JJ, Spark P, Brocklehurst P. Cesarean delivery and peripartum hysterectomy. *Obstetrics and Gynecology*. 2008;111(1):97-105.
7. Bernstein PS, Martin JN, Jr., Barton JR, et al. National Partnership for Maternal Safety: Consensus bundle on severe hypertension during pregnancy and the postpartum period. *Obstetrics and Gynecology*. 2017;130(2):347-357.
8. Centers for Disease Control and Prevention. Severe maternal morbidity in the United States. Division of Reproductive Health, National Center for Chronic Disease Prevention and Health Promotion. <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/severematernalmorbidity.html>. Published 2021. Accessed 2/18/2021.
9. Tanner LD, Chen HY, Sibai BM, Chauhan SP. Racial and ethnic disparities in maternal and neonatal adverse outcomes in college-educated women. *Obstetrics and Gynecology*. 2020;136(1):146-153.
10. Parchem JG, Gupta M, Chen HY, Wagner S, Mendez-Figueroa H, Chauhan SP. Adverse infant and maternal outcomes among low-risk term pregnancies stratified by race and ethnicity. *Obstetrics and Gynecology*. 2020;135(4):925-934.
11. Leonard SA, Scott KA. Racial and ethnic disparities in maternal and neonatal adverse outcomes in college-educated women. *Obstetrics and Gynecology*. 2020;136(5):1062-1063.
12. Kozhimannil KB, Interrante JD, Tofte AN, Admon LK. Severe maternal morbidity and mortality among indigenous women in the United States. *Obstetrics and Gynecology*. 2020;135(2):294-300.

Introduction

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The Joint Commission (TJC) has instituted Standards for Maternal Safety in an effort to reduce the likelihood of harm related to maternal hemorrhage.¹ This updated maternal quality improvement Toolkit addressing obstetric hemorrhage has been revised in part to address these TJC requirements and to provide assistance and guidance to hospital leaders who must ensure compliance. (See Section: Implementing and Sustaining Maternal Quality, Safety and Performance Improvement for Obstetric Hemorrhage on page 20.) For a complete list of updates, see the Executive Summary on page 9.

The contribution of obstetric hemorrhage to maternal and neonatal morbidity and mortality

Hemorrhage remains a leading cause of maternal mortality, despite a decline in the overall mortality ratio.² The United States (U.S.) maternal mortality rate has been increasing since 2000, and in 2018, there were 17 maternal deaths for every 100,000 births in the U.S., more than double that of other high-resource countries.³ The Centers for Disease Control and Prevention reports that the overall rate of severe maternal morbidity (SMM) per 10,000 births increased almost 200%, from 49.5 in 1993 to 144.0 in 2014.⁴ This increase has been mostly driven by blood transfusions, which, according to another study, increased 45% from 101.3 in 2006 to 146.6 in 2015.⁵ After excluding blood transfusions, the rate of SMM increased by 24% from 33.8 in 2006 to 41.9 in 2015.⁴

A study examining U.S. trends in obstetric hemorrhage between 2010 and 2014 found

that the rate increased by 13% overall (from 2.9% to 3.2% of births), with uterine atony causing nearly 80% of all hemorrhages.⁶ Obstetric hemorrhage, particularly with transfusion, during the birth hospitalization is also associated with increased likelihood of readmission.⁷

Increased hemorrhage and transfusion rates correlate with the rise in cesareans.⁸ The increase in cesareans has also been associated with hospital readmission in the first 30 days postpartum.⁹ The association between hemorrhage and cesarean remains whether the cesarean was planned or unplanned during labor.¹⁰ Severe maternal morbidity risk is considerably higher for patients with prior cesareans due to an increased risk of placental implantation abnormalities such as placenta previa and placenta accreta in future pregnancies, carrying with them a greater risk of catastrophic hemorrhage and hysterectomy.¹¹

Research shows that racism, not race, impacts health care, health, and health outcomes

While a few studies have found higher rates of hemorrhage in one racial or ethnic group or another, it is important to acknowledge that race/ethnicity are not biologic constructs and do not make a person physiologically at higher risk for hemorrhage. However, several studies have noted higher rates of morbidity among Black and Native American women¹² and, most concerning, higher case fatality rates among Black women.¹³ Among women with a diagnosis of hemorrhage, non-Hispanic Black and Hispanic women were 4.7 and 3.7 times more likely to die than were white

women.¹⁴ This difference is not explained by biological factors but is most likely due to inequitable quality of care (e.g., not listening to patient’s concerns or not responding in as timely a manner). The importance of vigilance for patient concerns and clinical signs was highlighted in the California Pregnancy-Associated Maternal Mortality Review where delayed response by providers was the most common factor in deaths due to maternal hemorrhage.¹⁵

System-wide protocols and care providers’ practices should be evaluated to determine if and to what extent care quality differs according to patients’ race or ethnicity. This information will allow quality gaps to be identified and targeted interventions for reducing disparities in care to be introduced. Maternity clinicians need to receive education about structural and institutional racism which is embedded in medicine.¹⁶⁻²⁰ This is such an important issue that implicit bias training for all providers and staff, and its relationship to and impact on maternal and infant morbidity and mortality, is now required by California Senate Bill 464, [California Dignity in Pregnancy and Childbirth Act](#). Equitable healthcare requires the recruitment and retention of diverse members of the clinical and leadership team. Individuals from different backgrounds are necessary to fulfill an institution’s mission to fully serve all who present to care.²¹

Our experience in California has shown that implementation of the CMQCC hemorrhage safety bundle reduced rates of severe maternal morbidity due to hemorrhage for all races and, importantly, reduced the outcome disparities between Black and white women by more than 50% as measured by severe maternal morbidity and transfusion rates.²²

Toolkit structure

The Toolkit algorithms are straightforward and focus on critical action. They are flexible and intended for use by the wide variety of practitioners who are likely to encounter individuals experiencing obstetric hemorrhage. The focus of the Toolkit is on the continuum of care from the prenatal period through birth and postpartum. An associated professional slide deck can be utilized for training purposes as needed. Each section of the Toolkit is structured as follows:

- ▶ Key Principles
- ▶ Educational Tools and Sample Resources (if applicable)
- ▶ Background
- ▶ Evidence Grading
- ▶ Recommendations
- ▶ References

Throughout the sections you will find tags to other sections that contain associated content located elsewhere in the Toolkit for easy reference.

Note that any reference to level of care throughout the Toolkit is in reference to ACOG’s Levels of Maternal Care consensus statement.²³

The authors of this Toolkit adopted the Classification of Evidence Grading that is in alignment with the American College of Obstetricians and Gynecologists (ACOG) to assess the type of study or evidence on which the recommendations were made. (See Appendix A: Classification of Evidence Grading on page 186.)

4R framework for the toolkit

The revised Toolkit introduces guidelines on best practices for obstetric hemorrhage and is organized using the 4R principles of Readiness, Recognition, Response, and Reporting to align with national maternal safety bundles from the Alliance for Innovation in Maternal Health (AIM).²⁴

Readiness

All birthing facilities must have a plan for managing patients experiencing obstetric hemorrhage. This domain contains the following sections:

- ▶ Implementing and Sustaining Maternal Quality, Safety and Performance Improvement for Obstetric Hemorrhage
- ▶ Obstetric Hemorrhage Risk Factor Assessment
- ▶ Management of Iron Deficiency Anemia
- ▶ Placenta Accreta Spectrum: Incidence, Risks, Diagnosis, Counseling and Preparation for Birth
- ▶ Inherited Bleeding Disorders in Pregnancy
- ▶ Planning for Patients Who May Decline Blood and Blood Products
- ▶ Obstetric Hemorrhage Carts, Kits and Trays
- ▶ Obstetric Hemorrhage Simulations and Drills
- ▶ Using the Electronic Health Record (EHR) to Improve the Management of Obstetric Hemorrhage
- ▶ Hemorrhage Preparedness Considerations for Small and Low-Resource Hospitals

Recognition

The potential for obstetric hemorrhage and active hemorrhage should be recognized early. This domain contains the following sections:

- ▶ Active Management of Third Stage Labor
- ▶ Definition, Early Recognition and Rapid Response for Obstetric Hemorrhage Using Triggers
- ▶ Best Practice Techniques to Assess Quantitative Cumulative Blood Loss

Response

Organized treatment protocols based on best practices are integral in the care of birthing people. This domain contains the following sections:

- ▶ Medications for Prevention and Treatment of Postpartum Hemorrhage
- ▶ Blood Product Replacement: Obstetric Hemorrhage
- ▶ Uterine Tamponade for Postpartum Hemorrhage: Internal Balloons and External Compression Stitches
- ▶ Uterine Artery Occlusion and Embolization
- ▶ Communicating with and Supporting Women, Birthing People and Families After an Obstetric Hemorrhage
- ▶ Secondary Postpartum Hemorrhage and Readmission

Reporting/Systems Learning

In addition to improvement of care delivery that offers optimal outcomes and support for patients, most U.S. hospital leaders in birth facilities are required to document fidelity to The Joint Commission Maternal Safety Standards. This domain contains the following sections:

- ▶ Debriefs and Multidisciplinary Case Review Guidelines
- ▶ Using Outcome Metrics for Hemorrhage-Related QI Projects

There are several appendices containing resources that can be directly adopted or used as examples to develop customized versions that work well within the setting and account for available resources or existing frameworks. Please see the Table of Contents on page 8 for a full list of appendices.

Lessons from the field - quality improvement implementation

End-users of CMQCCC collaboratives and the literature on safety, quality improvement and implementation science identify several principles for successful implementation.

It takes a broad team to implement systematic change

Sites with the greatest success in implementing the recommended practices in this Toolkit have recognized the need to engage all stakeholders in the project. It is important to think through who the stakeholders are in specific institutions. For example, some settings have operating rooms run and staffed by surgical services rather than labor and delivery. In these settings, it is important to bring surgical partners on board early on in the quality improvement process. Similarly, most units will need to engage the Information Technology department and electronic health record programmers to achieve optimal workflow integration with documentation systems.

Easy wins are important

Demonstrating some early, straightforward successes builds confidence and enthusiasm for continued improvement. What constitutes an easy win will vary by institution, but implementation of hemorrhage carts and oxytocin at birth for active management of third stage of labor have often been ideal starting points.

Goals and timelines are very useful

An internal review of the experiences of hemorrhage collaborative participants revealed that highly motivated teams developed implementation plans with specific goals and timelines. Structuring work in this way and assigning deliverables gave teams a sense of progress and momentum that was encouraging. These observations are consistent with quality

improvement and implementation literature.

Small tests of change are critical

A key principle of implementation science is that fit between intervention and context is crucial.²⁵ The core elements of an effective hemorrhage response plan are outlined in the [National Hemorrhage Bundle](#). The exact manner in which these elements are deployed in a given institution needs to be adapted to each unit/birth facility. Development and field testing of these local adaptations is most effectively accomplished through small tests of change using quality improvement principles such as the Model for Improvement or FOCUS-PDSA.^{26,27}

Data are needed to know if the changes are important

Data are needed to test changes, provide feedback and answer the essential question, “How do we know the change was an improvement?” However, having extensive and difficult data collection processes can inhibit progress by draining the team’s energy and increasing the team’s frustration without adding much benefit. Langley, et al. recommend no more than six measures for an improvement project. Facilities should select a limited number of the highest quality meaningful and *feasible* measures available to them, monitor these measures frequently, and provide the team with *regular feedback* on progress and performance.^{26,28,29} (See Section: Using Outcome Metrics for Hemorrhage-Related QI Projects on page 174.)

Administrative support is essential

Teams that made the greatest progress had high-level administrative support. Successful bundle implementation requires staff time and budgetary resources for equipment, training and data collection. Implementation teams may need administrative support in identifying organizational stakeholders and resources, purchasing supplies,

moving order sets and protocols through committees, and obtaining compliance with agreed-upon practices. Facilities also need to provide resources and staff support for developing and streamlining data collection systems.

It takes time and persistence to get systems running smoothly

The scope of full implementation of the hemorrhage Toolkit involves the careful coordination of multiple clinicians and departments. Therefore, everyone should realize that, while there will be some “quick wins”, overall success will often take significant time. In addition, developing systems, refining them and sustaining gains are always works in progress. Staying the course requires steady pressure by committed leaders.

Champions are essential

Formal leaders, opinion leaders and early adopters are important to overall success since the changes can be uncomfortable and take a long time. Champions, however, are essential. Champions are individuals who actively associate with the project and dedicate themselves to driving implementation.³⁰ Both nursing and physician champions are core components of successful implementation of the hemorrhage bundle. Nursing champions typically play a central role in testing, implementing, coordinating and disseminating clinical changes. Physician champions are particularly important since they make the definitive diagnostic and treatment decisions and are visible stakeholders. Careful selection, clear identification and motivation are critical to success of these leaders, whether they are administrative, physician, nursing or other clinicians.

References

1. Joint Commission. Provision of care, treatment, and services standards for maternal safety. https://www.jointcommission.org/-/media/tjc/documents/standards/r3-reports/r3_24_maternal_safety_hap_9_6_19_final1.pdf2019.
2. GBD 2015 Maternal Mortality Collaborators, Kassebaum NJ, Barber R, Bhutta ZA, et al. Global, regional, and national levels and causes of maternal mortality during 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*. 2016(08 October 2016).
3. Tikkanen R, Gunja MZ, FitzGerald M, Zephyrin L. Maternal Mortality and Maternity Care in the United States Compared to 10 Other Developed Countries 2020.
4. Centers for Disease Control and Prevention. Severe Maternal Morbidity in the United States. Division of Reproductive Health, National Center for Chronic Disease Prevention and Health Promotion. <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/severematernalmorbidity.html>. Published 2021. Accessed 2/18/2021.
5. Fingar KF, Hambrick MM, Heslin KC, Moore JE. Trends and Disparities in Delivery Hospitalizations Involving Severe Maternal Morbidity, 2006-2015. *HCUP Statistical Brief #243*. In: Agency for Healthcare Research and Quality, ed. Rockville, MD2018.
6. Reale SC, Easter SR, Xu X, Bateman BT, Farber MK. Trends in Postpartum Hemorrhage in the United States From 2010 to 2014. *Anesth Analg*. 2020;130(5):e119-e122.
7. Fein A, Wen T, Wright JD, et al. Postpartum hemorrhage and risk for postpartum readmission. *Journal of Maternal-Fetal and Neonatal Medicine*. 2021;34(2):187-194.
8. Kuklina E, Meikle SF, Jamieson DJ, et al. Severe Obstetric Morbidity in the United States: 1998-2005. *Obstetrics and Gynecology*. 2009;113(2):293-299.
9. Lu MC, Fridman M, Korst LM, et al. Variations in the incidence of postpartum hemorrhage across hospitals in California. *Maternal Child Health Journal*. 2005;9(3):297-306.

10. Main EK, Morton CH, Hopkins D, Giuliani G, Melsop K, Gould JB. Cesarean deliveries, outcomes, and opportunities for change in California: Toward a public agenda for maternity care safety and quality. Palo Alto, CA: California Maternal Quality Care Collaborative;2011.
11. Knight M, Kurinczuk JJ, Spark P, Brocklehurst P. Cesarean delivery and peripartum hysterectomy. *Obstetrics and Gynecology*. 2008;111(1):97-105.
12. Kozhimannil KB, Interrante JD, Tofte AN, Admon LK. Severe Maternal Morbidity and Mortality Among Indigenous Women in the United States. *Obstetrics and Gynecology*. 2020;135(2):294-300.
13. Tucker ML, Berg CJ, Callaghan WM, Hsia J. The black-white disparity in pregnancy-related mortality from 5 conditions: Differences in prevalence and case-fatality rates. *American Journal of Public Health*. 2007;97(2):247-251.
14. Rosenberg D, Geller SE, Studee L, Cox SM. Disparities in mortality among high risk pregnant women in Illinois: a population based study. *Annals of Epidemiology*. 2006;16(1):26-32.
15. Seacrist MJ, VanOtterloo LR, Morton CH, Main EK. Quality Improvement Opportunities Identified Through Case Review of Pregnancy-Related Deaths From Obstetric Hemorrhage. *Journal of Obstetric, Gynecologic, and Neonatal Nursing: JOGNN*. 2019;48(3):288-299.
16. Bailey ZD, Krieger N, Agenor M, Graves J, Linos N, Bassett MT. Structural racism and health inequities in the USA: evidence and interventions. *Lancet*. 2017;389(10077):1453-1463.
17. Chambers BD, Arabia SE, Arega HA, et al. Exposures to structural racism and racial discrimination among pregnant and early post-partum Black women living in Oakland, California. *Stress Health*. 2020;36(2):213-219.
18. Hardeman RR, Karbeah J, Kozhimannil KB. Applying a critical race lens to relationship-centered care in pregnancy and childbirth: An antidote to structural racism. *Birth*. 2020;47(1):3-7.
19. Hardeman RR, Medina EM, Kozhimannil KB. Structural Racism and Supporting Black Lives - The Role of Health Professionals. *New England Journal of Medicine*. 2016;375(22):2113-2115.
20. Scott KA, Britton L, McLemore MR. The Ethics of Perinatal Care for Black Women: Dismantling the Structural Racism in "Mother Blame" Narratives. *Journal of Perinatal and Neonatal Nursing*. 2019;33(2):108-115.
21. Piggott DA, Cariaga-Lo L. Promoting Inclusion, Diversity, Access, and Equity Through Enhanced Institutional Culture and Climate. *Journal of Infectious Disease*. 2019;220(220 Suppl 2):S74-S81.
22. Main EK, Chang SC, Dhurjati R, Cape V, Profit J, Gould JB. Reduction in racial disparities in severe maternal morbidity from hemorrhage in a large-scale quality improvement collaborative. *American Journal of Obstetrics and Gynecology*. 2020;223(1):123 e121-123 e114.
23. ACOG. Levels of maternal care. *Obstetric Care Consensus No. 2 of the American College of Obstetricians and Gynecologists*. *Obstetrics and Gynecology*. 2015;125(2):502-515.
24. Main, EK, Goffman, D, Scavone, BM, Low, LK, et al. National Partnership for Maternal Safety: Consensus Bundle on Obstetric Hemorrhage. *Obstet Gynecol*. Correction in: 2019 Jun;133(6):1288.
25. Tansella M, Thornicroft G. Implementation science: Understanding the translation of evidence into practice. *British Journal of Psychiatry*. 2009;195(4):283-285.
26. Langley GJ, Nolan KM, Nolan TW, Norman CI, Provost LP. *The Improvement Guide*. San Francisco: Jossey-Bass; 1996.
27. Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. *Implementation Science*. 2009;4:50.
28. Taylor MJ, McNicholas C, Nicolay C, Darzi A, Bell D, Reed JE. Systematic review of the application of the plan-do-study-act method to improve quality in healthcare. *BMJ Quality and Safety*. 2014;23(4):290-298.
29. Ogrinc G, Shojania KG. Building knowledge, asking questions. *BMJ Quality and Safety*. 2014;23(4):265-267.
30. Shields LE, Smalarz K, Reffigee L, Mugg S, Burdumy TJ, Propst M. Comprehensive maternal hemorrhage protocols improve patient safety and reduce utilization of blood products. *American Journal of Obstetrics and Gynecology*. 2011;205(368):e1-e8.



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Readiness

This domain contains critical information all birthing facilities need to plan for managing patients experiencing obstetric hemorrhage. Information and tools are provided to ensure all clinicians are trained on how to best manage obstetric hemorrhage emergencies. The Joint Commission Maternal Safety Standards and its alignment with the Toolkit is highlighted.

In this section you will find the following:

- ▶ Implementing and Sustaining Maternal Quality, Safety and Performance Improvement for Obstetric Hemorrhage
- ▶ Obstetric Hemorrhage Risk Factor Assessment
- ▶ Management of Iron Deficiency Anemia
- ▶ Placenta Accreta Spectrum: Incidence, Risks, Diagnosis, Counseling and Preparation for Birth
- ▶ Inherited Bleeding Disorders in Pregnancy
- ▶ Planning for Patients Who May Decline Blood and Blood Products
- ▶ Obstetric Hemorrhage Carts, Kits and Trays
- ▶ Obstetric Hemorrhage Simulations and Drills
- ▶ Using the Electronic Health Record (EHR) to Improve the Management of Obstetric Hemorrhage
- ▶ Hemorrhage Preparedness Considerations for Small and Low-Resource Hospitals

Implementing and Sustaining Maternal Quality, Safety and Performance Improvement for Obstetric Hemorrhage

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Key Principles

1. Safety bundle and Toolkit implementation is not a ‘one size fits all’ endeavor and each birth facility will need to address unique challenges depending on local resources and organizational priorities. Implementation is a continuous and adaptive process that requires multidisciplinary teamwork and partnership with patients and their families.
2. It is critical to develop an equitable data monitoring and communication plan that clarifies what measures to track, trend and monitor, and where they need to be reported to align with regulatory and system goals.
3. The Joint Commission’s Standards for Maternal Safety include 7 Elements of Performance (EPs) for maternal hemorrhage that can function as a bundle checklist and guide for perinatal leaders to implement this Toolkit and help birth facilities meet accreditation requirements.

Background

An effective way to achieve continuous perinatal quality, safety and performance improvement is to fully implement safety bundles and integrate perinatal improvement metrics into existing hospital quality and safety strategic plans for ongoing monitoring. This integration will ensure that perinatal quality improvement (QI) is an organizational priority and guides ongoing decision-making and resource allocation. Patient safety bundles include lists of specific actions

that can be taken to improve care delivery, such as setting up a fully stocked, easily available hemorrhage cart. QI leaders can use bundles to organize a coordinated and standardized clinical care pathway that will improve the quality and safety of perinatal care for mothers and their newborns. When these interventions are followed consistently, they can be powerful agents of change for reducing preventable harm.

Alliance for Innovation on Maternal Health (AIM) program

A coordinated national effort focused on reducing maternal mortality and severe maternal morbidity (SMM), in partnership with state-based Perinatal Quality Collaboratives (PQC) and Maternal Child Health departments, has been underway for over a decade. In 2015, the U.S. Department of Health and Human Services (HHS) Health Resources and Services Administration’s Maternal and Child Health Bureau (HRSA-MCHB) awarded funding to the American College of Obstetricians and Gynecologists (ACOG) to develop the AIM Program, a national data-driven maternal safety and quality improvement initiative based on proven implementation approaches to improve maternal safety and eliminate preventable severe maternal morbidity and maternal mortality across the U.S. The AIM program works through state teams and health systems to align national-, state- and hospital-level quality improvement efforts to improve overall maternal health outcomes. AIM also coordinates the development and endorsement of maternal safety bundles and resources through ACOG’s Council on Patient Safety in Women’s Health Care.¹

It is important to consider the racial equity impacts of any QI project. It is well recognized that reducing health disparities leads to higher-value, lower-cost care, and that achieving racial equity in perinatal outcomes is essential to improving the overall quality of maternity care.²⁻⁴ Standard QI tools help to provide a safety infrastructure for all women, regardless of race, because they potentially adjust for implicit biases that are present in providers and systems as a whole. Importantly, after California birth facilities implemented the CMQCC hemorrhage safety bundle, severe maternal morbidity rates due to hemorrhage declined in all races and reduced the clinical outcome gap for Black and white patients by more than 50% as measured by severe maternal morbidity and transfusion rates.⁴

As perinatal unit leaders plan to implement a hemorrhage clinical bundle, one resource includes QI approaches such as the “SPEAK UP Against Racism” campaign, developed by the Institute for Perinatal Quality Improvement.³ This project acknowledges that a person’s exposure to systemic racism is a risk factor for poor perinatal outcomes, and provides training to health care professionals to speak up against racist behaviors or comments they witness.³ Centering patient voices in perinatal quality improvement work at birth facilities is a key best practice, and there are many ways to partner with patients in clinical QI initiatives. In particular, patients may act as subject matter experts to provide insights and resources for supporting families with information and emotional resources after a severe maternal event.^{5,6}



Implementation planning steps

Step 1: Gap analysis

It is critical to compare the birth facility’s current state to its ideal future state. Using a bundle checklist, conduct a full examination of the status of each critical element. Some elements may have never been addressed, while others may need updating.

When examining each element, ask: Is there a workflow/process/policy education already in place that meets this requirement?

If yes, are revisions or updates needed? How can data or audits assess compliance with current practice? All leaders should critically reflect on how this workflow/process/policy/education might reflect or maintain inequitable care or omit specific populations.

If no, what can be adopted from the Toolkit to inform facility efforts to meet the standard?

In addition to the facility-wide gap analysis, perinatal QI leaders may consider conducting a patient safety culture survey within the unit. This information can help leaders identify safety gaps in areas of teamwork, communication and hierarchy that, if left unaddressed, can undermine even the most solid workflow or process, and negatively affect patient safety and experience.

Examples of patient safety culture surveys

[AHRQ Survey on Patient Safety Culture \(SOPS\) Hospital Survey](#)

[UT Health Center for Healthcare Safety & Quality: Safety Attitudes Questionnaire](#)

Step 2: Identify resources and collaborators

- ▶ Invite and involve representatives from all departments to engage in process change plans to encourage successful implementation.
- ▶ Identify leadership support and assess level of engagement at the organization, department and unit levels.
- ▶ Identify the quality, safety and performance improvement experts in the facility that monitor and review TJC Perinatal Care (PC) data, organizational maternity care data and perinatal safety risk incidents. Ideal candidates will have passion for the project.
- ▶ Reach out to quality and safety experts at the hospital and regional maternal level III and IV centers to build relationships for mentoring, developing peer-to-peer connections and sharing resources.
- ▶ Identify who is assigned to, or is a subject matter expert for, perinatal documentation in the electronic health record (EHR).
- ▶ Connect with the facility-wide committee meeting and/or work group dedicated to perinatal safety and quality that reports its findings and systems learning to senior leadership. Assess for opportunities to integrate perinatal patient safety into existing organizational quality and safety work plans.

READINESS

- ▶ Identify data sources and share data on priority quality metrics and key clinical criteria related to hemorrhage. Consider disaggregation of data to identify specific drivers and opportunities (e.g., by race/ethnicity). (See Section: Using Outcomes Metrics for Hemorrhage-Related QI Projects on page 174.) Evaluate existing data reports from the EHR that could be used or modified to enhance data tracking and trending. (See Section: Using the Electronic Health Record to Improve the Management of Obstetric Hemorrhage on page 76.)
- ▶ Involve educators and simulation experts in safety work and team-based communication training. Include patient support and information scenarios as part of the drills and debriefs.
- ▶ Whenever possible, utilize the EHR to reinforce guidelines and develop interactive treatment pathways.
- ▶ Assemble a perinatal patient safety team.
 - ▶ Types of perinatal patient safety team members
 - ▶ Physician Leader(s): OB, NICU, Anesthesia
 - ▶ Nurse Leader(s): CNM, Director, Manager, Educator
 - ▶ Peer Leaders: Physician, Bedside Nurses
 - ▶ Quality Staff
 - ▶ Patient Safety-Risk Management Staff
 - ▶ Pharmacist
 - ▶ Blood Bank Representative
 - ▶ Data Analyst/Consultant
 - ▶ Health Information Management/Clinical Informatics Staff
 - ▶ Patient Representative(s)

Step 3: Implementation

Implementation is not a ‘one size fits all’ endeavor, and each facility will need to address unique challenges depending on local resources and organizational priorities. Bundle implementation—whether it occurs all at once or incrementally over time—is critical to achieve meaningful, sustainable and systems-level improvements that will improve hospital-based perinatal outcomes. We encourage a rapid-cycle Plan-Do-Study-Act (PDSA) approach to implementation. Learn about PDSA cycle here: [Institute of Healthcare Improvement \(IHI\)](#). It is important to remember that quality improvement work should never be dependent on a single person, but rather operate as an integrated unit-level process that can be easily replicated to ensure ongoing success!

The CMQCC Maternal Data Center Joint Commission Standards for Maternal Safety Tool

CMQCC Maternal Data Center (MDC) member hospitals can access and utilize an integrative tool that assists in tracking standards that have been met and provides resources for completing standards that have *not* been met. Actionable sustainability guidance is also included within the tool. The tool lists each EP using identical language provided within TJC Standards for Maternal Safety. CMQCC provides rationales for each EP to ensure clinicians better understand and promote its adoption. This Toolkit includes examples of how to achieve compliance with each EP, links to resource documents, and templates utilized by past CMQCC collaboratives. In addition, a PDF feature of the MDC allows obstetric and nursing leaders to easily share institutional progress on the EPs with the C-suite and staff.

The Joint Commission’s New Standards for Maternal Safety

Reporting and systems learning content highlighted in the Alliance for Innovation on Maternal Health (AIM) and the California Maternal Quality Care Collaborative (CMQCC) hemorrhage and maternal safety bundles informed The Joint Commission (TJC) in developing Standards for Maternal Safety (PC.06.01.01)⁷ to reduce the likelihood of harm related to obstetric hemorrhage. TJC Standards for Maternal Safety went into effect January 1, 2021, and go beyond metric benchmarks and require leaders of hospitals, health systems and birth facilities to examine the processes and procedures surrounding the care of women experiencing maternal hemorrhage and severe hypertension/preeclampsia with severe features. While the intention of these standards is to improve the quality and safety of perinatal care in TJC-accredited hospitals, standards such as these are useful for all birth facilities to review and adopt, regardless of the accreditation body, to ensure quality care for women and their newborns.

The Joint Commission Standards for Maternal Safety dedicated to obstetric hemorrhage are organized around 7 Elements of Performance (EP), which are closely aligned with the 4R Framework of this Toolkit.⁷ (See Introduction on page 13.) These seven EPs are recommended as a bundle to guide the implementation of this Toolkit. This approach will organize and focus implementation efforts and ensure that the birth facility is ready for the TJC accreditation process.

Box 1: Standards for Maternal Safety: Elements of Performance to reduce the likelihood of harm related to maternal hemorrhage (PC.06.01.01)

1. Complete an assessment using an evidence-based tool for determining maternal hemorrhage risk on admission to labor and delivery and on admission to postpartum.

Resource Documents from this Toolkit:

- ▶ Section: Obstetric Hemorrhage Risk Factor Assessment on page 30
- ▶ Appendix K: Obstetric Hemorrhage Risk Factor Assessment Screen on page 224
- ▶ Appendix Q: Sample Schematic: Preadmission Planning for Women Undergoing Scheduled Cesarean Section on page 233

2. Develop written evidenced-based procedures for managing pregnant and postpartum patients who experience maternal hemorrhage that includes the following:

- ▶ The use of an evidence-based tool that includes an algorithm for identification and treatment of hemorrhage
- ▶ The use of an evidence-based set of emergency response medications that are immediately available on the obstetric unit
- ▶ Required response team members and their roles in the event of severe hemorrhage
- ▶ How the response team and procedures are activated
- ▶ Blood bank plan and response for emergency release of blood products and how to initiate the hospital’s massive transfusion procedures
- ▶ Guidance on when to consult additional experts and consider transfer to a higher level of care
- ▶ Guidance on how to communicate with patients and families during and after the event
- ▶ Criteria for when a team debrief is required immediately after a case of severe hemorrhage

Continued on next page...

Note: The written procedures should be developed by a multidisciplinary team that includes representation from obstetrics, emergency department, anesthesiology, nursing, laboratory and pharmacy.

Resource Documents from Toolkit:

- ▶ Section: Definition, Early Recognition and Rapid Response to Obstetric Hemorrhage Using Triggers on page 93
- ▶ Section: Medications for Prevention and Treatment of Postpartum Hemorrhage on page 114
- ▶ Section: Blood Product Replacement: Obstetric Hemorrhage on page 124
- ▶ Section: Communicating with and Supporting Women, Birthing People and Families After an Obstetric Hemorrhage on page 146
- ▶ Section: Debrief and Multidisciplinary Case Review Guidelines on page 167
- ▶ Appendix B: Obstetric Hemorrhage Care Guidelines: Checklist Format on page 187
- ▶ Appendix C: Obstetric Hemorrhage Care Guidelines: Table Format on page 194
- ▶ Appendix D: Obstetric Hemorrhage Care Guidelines: Flowchart Format on page 195
- ▶ Appendix E: Checklist: Carts, Kits, and Trays on page 196
- ▶ Appendix R: Medications for Postpartum Hemorrhage on page 234
- ▶ Appendix S: Sample Massive Transfusion Policy – Torrance on page 235
- ▶ Appendix T: Sample Policies-Procedures Children’s and Women’s Hospital on page 238
- ▶ Appendix U: Sample Code Crimson Postpartum Hemorrhage Management on page 244
- ▶ Appendix W: Patient and Family Support Checklist for Postpartum Hemorrhage on page 259
- ▶ Appendix Z: Sample Patient Summary Form: Obstetric Hemorrhage Event on page 264
- ▶ Appendix AA: Sample Script: Provider - Patient Postpartum Hemorrhage Post-Event Discussion on page 265
- ▶ Appendix CC: Sample Hemorrhage Rapid Debrief Form on page 270
- ▶ Appendix DD: Sample Labor and Delivery Event Debrief Form on page 273
- ▶ Appendix FF: Obstetric Hemorrhage Sample Order Set Staged on page 278

Other: [AHRQ Rapid Response for Perinatal Safety](#)

3. Each obstetric unit has a standardized, secured and dedicated hemorrhage supply kit that must be stocked per the hospital's defined process and, at a minimum, contains the following:

- a. Emergency hemorrhage supplies as determined by the hospital
- b. The hospital's approved procedures for severe hemorrhage response

Resource Documents from Toolkit:

- ▶ Section: Obstetric Hemorrhage Carts, Kits and Trays on page 69
- ▶ Appendix E: Checklist: Carts, Kits and Trays on page 196

4. Provide role-specific education to all staff and providers who treat pregnant/postpartum patients about the hospital's hemorrhage procedure. At a minimum, education occurs at orientation, whenever changes to the procedure occur, or every two years.

Resource Documents from Toolkit:

- ▶ [Obstetric Hemorrhage Toolkit V3.0 Educational Slide Set](#)

Continued on next page...

5. Conduct drills at least annually to determine system issues as part of ongoing quality improvement efforts. Hemorrhage drills include a team debrief.

Resource Documents from Toolkit:

- ▶ Section: Obstetric Hemorrhage Simulations and Drills on page 71
- ▶ Section: Debrief and Multidisciplinary Case Review Guidelines Section on page 167
- ▶ Appendix F: Simulations and Drills: Guidelines for Simulation Scenario Development on page 199
- ▶ Appendix G: Simulations and Drills Sample Scenarios on page 203
- ▶ Appendix CC: Sample Hemorrhage Rapid Debrief Form on page 270
- ▶ Appendix DD: Sample Labor and Delivery Event Debrief Form on page 273

6. Review severe hemorrhage cases that meet criteria established by the hospital to evaluate the effectiveness of the care, treatment, and services provided to the patient during the event.

Resource Documents from Toolkit:

- ▶ Section: Debrief and Multidisciplinary Case Review Guidelines on page 167
- ▶ Appendix CC: Sample Hemorrhage Rapid Debrief Form on page 270
- ▶ Appendix DD: Sample Labor and Delivery Event Debrief Form on page 273

Other: [CMQCC Severe Maternal Morbidity \(SMM\) Case Review PDF Form](#)
[AIM Reduction of Peripartum Racial/Ethnic Disparities Bundle](#)

7. Provide printed education to patients (and their families including the designated support person whenever possible). At a minimum, education includes:

- ▶ Signs and symptoms of postpartum hemorrhage during hospitalization that alert the patient to seek immediate care
- ▶ Signs and symptoms of postpartum hemorrhage after discharge that alert the patient to seek immediate care

Resource Documents from Toolkit:

- ▶ Section: Communicating with and Supporting Women, Birthing People, and Families After an Obstetric Hemorrhage on page 146
- ▶ Section: Secondary Postpartum Hemorrhage and Readmission on page 163
- ▶ Appendix I: Discharge Planning for Women with Hemorrhage During the Birth Hospital Stay on page 220
- ▶ Appendix L: Hemorrhage ED Visit Stop Sign on page 225
- ▶ Appendix V: A Guide to Recognizing Acute Stress Disorder in Postpartum Women in the Hospital Setting on page 254
- ▶ Appendix W: Patient and Family Support Checklist for Postpartum Hemorrhage on page 259
- ▶ Appendix X: Life After Postpartum Hemorrhage on page 260
- ▶ Appendix Y: Resources for Postpartum Hemorrhage Survivors on page 262
- ▶ Appendix Z: Sample Patient Summary Form: Obstetric Hemorrhage Event on page 264
- ▶ Appendix AA: Sample Script: Provider - Patient Postpartum Hemorrhage Post-Event Discussion on page 265

Other: [AWHONN POSTBIRTH Flyer](#)

The Joint Commission (2019). Provision of Care, Treatment, and Services standards for maternal safety (24). R3 Report.

Quality measures and monitoring

Implementing the Toolkit and associated maternal safety bundles requires developing structure, process and outcomes measures. Monitoring data is an essential part of the quality improvement process and facilitates appropriate designation of time and resources to specific interventions. It is critical to develop an equitable data monitoring and communication plan that clarifies what measures to track, trend and monitor, and where they need to be reported to align with regulatory and system goals.

Sustainability of perinatal quality care is a data-driven process achieved through monitoring data metrics that track and trend cases and the interventions and treatment provided. The value-add to integrating reporting and systems-learning from severe maternal events into organizational workflows is that it ensures timely, meaningful and sustainable improvements that directly contribute to high quality outcomes. (See Section: Debrief and Multidisciplinary Case Review Guidelines on page 167.)

Structure measures

The goal of structure measures is to ensure that basic support features are in place within the facility. Structure measures may include policies, equipment and staff training.⁷ The AIM program and CMQCC collaborated to develop structure measures that align with the TJC Standards for Maternal Safety. (See Box 1 on page 24.)

Celebrate the success of incremental implementation of the bundle to motivate staff. Patient stories describing successful outcomes following bundle implementation are particularly powerful. Perinatal leaders can demonstrate to staff that their QI efforts are noticed and appreciated, which may reduce project burnout.

Process measures

Process measures focus on the elements of care that are linked to improved outcomes (e.g., risk assessment, quantification of blood loss, debriefs, staff education).¹ These measures may help evaluate the success of structure measure implementation.

Perinatal leaders who promote safe care and identify opportunities for improvement in obstetric hemorrhage need to collect data on the following process measures: risk assessment, quantified blood loss (QBL), debriefs and staff education. These measures have a goal rate of 100%. For risk assessment and QBL, the measure may be based on a sample of the total population in order to minimize data burden when appropriate (high volume sites or when in the sustainability phase of the bundle). At minimum, CMQCC recommends reviewing 5 births per month.

Risk assessment: *the rate of patients with a hemorrhage risk assessment completed on admission to labor and delivery and on admission to postpartum*

- Denominator population: all women who gave birth at your facility
- Numerator population: all women who had a hemorrhage risk assessment completed on admission to labor and delivery and on admission to postpartum
- Method of data collection: manual chart review or EHR report

Quantified blood loss: *the rate of patients who had blood loss quantified at delivery*

- Denominator population: all women who gave birth at your facility
- Numerator population: all women who had QBL done at delivery
- Method of data collection: manual chart review or EHR report

Debriefs: *the rate of debriefs completed after an obstetric hemorrhage*

- Denominator population: all women who had an obstetric hemorrhage
- Numerator population: all women who had an obstetric hemorrhage that was debriefed after the event
- Method of data collection: manual chart review or debrief documentation

Obstetric hemorrhage staff education: *the proportion of medical and nursing staff that have completed a training on obstetric hemorrhage*

- Denominator population: all applicable staff
- Numerator population: all staff that completed obstetric hemorrhage training
- Method of data collection: enrollment lists

Outcome measures may be challenging to review with an equity lens due to low numbers of patients within some racial/ethnic groups. Reviewing hemorrhage process measures by race/ethnicity to guide unit education and action is highly recommended.

Outcome measures

Morbidity from obstetric hemorrhage is uncommon, so observations of large numbers of patients may be needed to identify trends. For practical use, hospital-level measures are designed to be collected from administrative data sets. Consider using the Centers for Disease Control and Prevention (CDC)'s metric for severe maternal morbidity for both the overall birthing population and among those with obstetric hemorrhage. Learn more about these measures in the section titled "Using Outcome Metrics for Hemorrhage-Related QI Projects" on page 174.

Recommendations

1. Utilize a critical element bundle checklist along with completing education and resource gap analysis when implementing new quality improvement practices.
2. Recognize that bundle implementation is a continuous and adaptive process that requires multidisciplinary teamwork, consideration of stakeholder priorities and support of the hospital administration.

READINESS

3. Sustainability of quality improvement work requires refresher training utilizing methods such as annual skills day, drills, simulations and computer-based assessment. This education should be provided to new hires to meet the expectations of the team and maintain progress toward universal staff knowledge.
4. Create a data monitoring plan that outlines which measures to track, trend and monitor during both the implementation and sustainability phase.
5. Progress during implementation and status in the sustainability phase should be reported to align with regulatory requirements and communicated to system leaders and staff.

Educational tools and sample resources

[IHI Science of Improvement: Establishing Measures](#)

[CMQCC QI Academy](#)

[AIM \(ACOG\) Implementing Quality Improvement Projects Toolkit](#)

[IHI Maternal and Infant Health](#)

[AIM \(ACOG\) Data Documents](#)

EVIDENCE GRADING

LEVEL OF EVIDENCE: C

References

1. Alliance for Innovation on Maternal Health. AIM data resources. American College of Obstetricians and Gynecologists ACOG. <https://safehealthcareforeverywoman.org/aim/resources/aim-data-resources/>. Published 2021. Accessed 2/28/2021.
2. Ojo A, Shah P. Value-based health care must value Black lives. 2020.
3. Bingham D, Jones DK, Howell EA. Quality improvement approach to eliminate disparities in perinatal morbidity and mortality. *Obstet Gynecol Clin North Am*. 2019;46(2):227-238.
4. Main EK, Chang SC, Dhurjati R, Cape V, Profit J, Gould JB. Reduction in racial disparities in severe maternal morbidity from hemorrhage in a large-scale quality improvement collaborative. *American Journal of Obstetrics and Gynecology*. 2020;223(1):123 e121-123 e114.
5. Rouse TB, DeJoseph J, Ollendorff AT. Bringing depth and meaning to perinatal quality improvement by partnering with patients. *Clinical Obstetrics and Gynecology*. 2019;62(3):528-538.
6. Morton CH, Hall MF, Shaefer SJM, et al. National Partnership for Maternal Safety: Consensus bundle on support after a severe maternal event. *Journal of Obstetric, Gynecologic, and Neonatal Nursing: JOGNN*. 2021;50(1):88-101.
7. Joint Commission. Provision of care, treatment, and services standards for maternal safety. https://www.jointcommission.org/-/media/tjc/documents/standards/r3-reports/r3_24_maternal_safety_hap_9_6_19_final1.pdf2019.

Obstetric Hemorrhage Risk Factor Assessment

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Key Principles

1. All pregnant patients should have a prenatal evaluation for key risk factors associated with major obstetric hemorrhage, such as placenta accreta spectrum, placenta previa, coagulation disorders, anticoagulation medication(s) and anemia.
2. Because patients with antepartum anemia are at risk for postpartum transfusion (independent of blood loss magnitude at delivery), those with anemia should undergo workup and treatment before delivery.
3. Routine risk assessment can alert providers to those at risk for obstetric hemorrhage and allow resources and staff to be mobilized in advance of the birth or postpartum hemorrhage (PPH) event.
4. All patients should undergo intrapartum obstetric hemorrhage risk assessment on admission, at the start of the second stage of labor, at transfer to postpartum care, and **any time the patient's condition changes**. Identified risk factors must be clearly communicated during hand-offs to each new clinical team caring for the patient.
5. Patients who require an intrapartum cesarean section, especially those in the second stage of labor, need close surveillance for severe hemorrhage from refractory uterine atony and surgical causes (including an extension of hysterotomy incision).
6. Up to 40% of patients who experience obstetric hemorrhage have no identifiable risk factors.

Background

Obstetric hemorrhage is considered the most preventable cause of maternal death, with some estimates saying up to 70% of cases were preventable.¹ Using an obstetric risk assessment tool can raise awareness about hemorrhage prevention and treatment for clinicians and patients. In its guidelines for Standards for Maternal Safety, The Joint Commission mandates

that hemorrhage risk assessment be performed for every pregnant person on admission to labor and delivery, as well as on admission to postpartum.² Therefore, hemorrhage risk assessment is now a process measure for every person in labor. (See Section: Implementing and Sustaining Maternal Quality, Safety and Performance Improvement for Obstetric Hemorrhage on page 20.)

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Identifying those persons at risk for obstetric hemorrhage is important for planning and resource mobilization, starting as early as the prenatal period. Prenatal screening for obstetric hemorrhage risk is a way to assess risk for hemorrhage, especially for patients with placenta accreta spectrum, placenta previa, inherited or acquired coagulation disorders (e.g., hemophilia, von Willebrand disease), anticoagulation medication(s), and prenatal anemia. (See Sections: Placenta Accreta Spectrum: Incidence, Risks, Diagnosis, Counseling and Preparation for Birth on page 51, Inherited Bleeding Disorders in Pregnancy on page 59, and Management of Iron Deficiency Anemia on page 41.) Additionally, patients should be asked in the prenatal period about their beliefs about receiving a blood transfusion, as those who refuse blood products are at higher risk for complications from hemorrhage. (See Section: Planning for Patients Who May Decline Blood and Blood Products on page 64.)



Women who experience severe hemorrhage want information about what happened and why. Those who had no risk factors at the time of birth are often staggered by the unexpected nature of the complication. A Hispanic woman who experienced a placental abruption and ensuing hemorrhage requiring a primary cesarean described how unsettling the unexpected complications were:

I would never think that this would happen to me, and it did.... The whole time I was pregnant I felt like I was healthy and this would never happen to me ever, and it did, and worse.³

Studies of women and their partners show that lack of timely information and long periods of separation from their babies and families are central themes in their experience.⁴ The lack of communication affects women's understanding of their health needs postpartum, particularly around breastfeeding and mental wellness. A white woman who had been admitted to the ICU after an emergent hemorrhage/hysterectomy noted:

My biggest concern in ICU, I needed to get to my baby, I didn't know what they [nurses] were doing with her or what they were giving her and I needed to get to her...⁴

Women with known risk factors should be counseled and informed about the likelihood of obstetric hemorrhage, and how to prepare in advance for recovery support after they are discharged postpartum.

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If a patient is identified as high-risk for obstetric hemorrhage, experienced staff and key resources can be mobilized in advance of delivery.

Decisions about the timing, mode and location for delivery may be influenced by each patient's risk. For example, patients at high risk for severe hemorrhage, such as placenta accreta spectrum, may be advised to plan to give birth at a high level of care center that has in-house surgical and anesthesia staff, a well-stocked blood bank, and the necessary equipment and resources for managing severe obstetric hemorrhage. (Note that any reference to level of care throughout the Toolkit is in reference to ACOG's Levels of Maternal Care consensus statement.)⁵ The Toolkit recommendations are in alignment with ACOG Consensus Statement regarding placenta accreta spectrum.⁶ Similarly, those women who are at highest risk of hemorrhage (especially those with placenta accreta spectrum) may need to give birth in the facility's main operating room (OR), rather than the OR in labor and delivery if more staff and resources can be accommodated there.

Postpartum hemorrhage (PPH) is the predominant cause of obstetric hemorrhage. While atony is the leading cause of PPH, a significant number are due to other birth-related complications, such as retained placenta or vaginal, cervical, or uterine laceration(s). These complications may be considered causes of, as opposed to risk factors for, PPH.^{7,8} Data from observational studies indicate that, compared with spontaneous vaginal delivery, women undergoing an intrapartum cesarean or instrumental birth have increased risk for PPH.⁹⁻¹¹ In particular, patients who require an intrapartum cesarean section for a fetal or maternal indication in the second stage of labor (e.g., arrest of descent and/or a non-reassuring fetal heart rate), especially after prolonged pushing or a failed attempt to perform an instrumental delivery, should undergo close surveillance for PPH, including post-discharge.¹²⁻¹⁵

(See Section: Secondary Postpartum Hemorrhage and Readmission on page 163.)

For patients undergoing an intrapartum cesarean section, potential causes of PPH include refractory uterine atony in a very thin lower uterine segment (which does not respond to first or second-line uterotonic therapy); an extension of the hysterotomy incision into the broad ligament, cervix or vagina; major cervical and/or vaginal lacerations; and/or traumatic bleeding from adjacent organs or viscera. Care providers should be vigilant for more than one potential bleeding etiology in this clinical scenario (e.g., concealed hemorrhage) and have a low threshold to call for additional surgical assistance when managing severe PPH in this clinical situation. (See Section: Definition, Early Recognition and Rapid Response to Obstetric Hemorrhage Using Triggers on page 93.) Intra-abdominal or pelvic bleeding may warrant input from an experienced general, trauma and/or gynecologic-oncologic surgeon, depending on local staffing and availability. For patients undergoing instrumental delivery, hemorrhage causes may include direct trauma to the genital tract, cervix or adjacent tissues.

Risk assessment for hemorrhage preparedness

Performing risk assessments may allow the maternity team to better prepare for the majority of hemorrhages, although no risk assessment guide has been proven to capture every patient who experiences an obstetric hemorrhage. The risk assessment framework could benefit from revisions as more research becomes available. CMQCC's Risk Assessment V3.0 has been updated to reflect the latest research. (See Table 1 on page 34.)^{8,16-20} Two studies found that 40% of hemorrhages occurred in the low-risk group (i.e., among those without risk factors).^{8,17} As stated above, a significant number of hemorrhages are due to complications directly related to the

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birth itself such as retained placenta, vaginal, cervical or uterine lacerations, and complications of instrumental vaginal births or cesareans which are not covered by the risk factors for uterine atony.^{19,21-22} Several risk assessment tools have been promoted by maternal safety agencies, including CMQCC, the Association of Women's Health, Obstetrics and Neonatal Nurses (AWHONN) and the Safe Motherhood Initiative (SMI).^{23,24} Based on expert opinion, these tools classify patients as low-, medium- and high-risk for obstetric hemorrhage to guide resource preparedness at the facility level. Ultimately, performing risk assessments serve to increase surveillance and vigilance so that response and treatment can be timely. *While there will always be sudden, severe hemorrhages that require activation of a massive transfusion protocol, foreknowledge of high hemorrhage risk status can allow resources to be readily available, whether*

blood products, hemorrhage carts, staff, or an open OR. This represents a proactive, rather than reactive, approach to hemorrhage response.

The prevalence of obstetric hemorrhage is generally low within each risk group. Studies indicate hemorrhage rates of 0.4-4.4% in low-risk patients and 5.1-23% in high-risk patients.^{18,25} The goal is to be as prepared as possible to care for those who experience an obstetric hemorrhage. The risk assessment algorithm should provide a shared mental model for which risk factors prompt an increased level of surveillance and specific resource mobilization. The obstetric risk screen table (see Table 1 on page 34) has several additions (noted in the shaded rows) from the prior version. The additions include factors that had high relative risks for hemorrhage in recent studies.^{8,11,17-19,25-27}

Blood typing considerations

In the event of a rapidly evolving severe obstetric hemorrhage, un-crossmatched blood can be given and transfusion and treatment **should not be delayed**. However, transfusing un-crossmatched blood should be avoided if possible. Having a type and screen or type and cross information readily available can save time obtaining crossmatched blood when responding to an obstetric hemorrhage. While there is minimal risk in giving un-crossmatched O type negative blood,²⁸ type O blood is a finite resource, and over-reliance on its availability as a default may lead to less available blood for individuals with O type blood for unanticipated hemorrhages both in obstetrics and in the rest of the hospital. (See Section: Blood Product Replacement: Obstetric Hemorrhage on page 124.)



Table 1: Obstetric hemorrhage risk screen

(Risk factors added since Obstetric Hemorrhage Toolkit V2.0, 2015, are shaded)

Blood bank recommendations should be highly localized. Many institutions no longer hold a specimen in the blood bank, while others utilize automated technology to type and screen all obstetric patients. An example of a risk-based approach is included in the table below.

ADMISSION and LABOR RISK FACTORS ^{8,17-20,25,29}		
LOW RISK	MEDIUM RISK	HIGH RISK
MONITOR FOR HEMORRHAGE <i>Routine obstetric care</i>	NOTIFY CARE TEAM <i>Personnel that could be involved in response are made aware of patient status and risk factors</i>	NOTIFY CARE TEAM MOBILIZE RESOURCES <i>Consider anesthesia attendance at birth</i>
<i>Specimen on hold in blood bank</i>	<i>Type and screen</i>	<i>Type and cross, 2 units on hold</i>
No previous uterine incision	Prior cesarean(s) or uterine surgery	Placenta previa, low lying placenta
Singleton pregnancy	Multiple gestation	Suspected/known placenta accreta spectrum
≤ 4 vaginal births	> 4 vaginal births	Abruption or active bleeding (greater than show)
No known bleeding disorders	Chorioamnionitis	Known coagulopathy
No history of PPH	History of previous postpartum hemorrhage	History of > 1 prior postpartum hemorrhage
	Large uterine fibroids	HELLP Syndrome
	Platelets 50-100,000	Platelets < 50,000
	Hematocrit < 30% (Hgb < 10)	Hematocrit < 24% (Hgb < 8)
	Polyhydramnios	Fetal demise
	Gestational age < 37 weeks or > 41 weeks	2 or more medium risk factors
	Preeclampsia	
	Prolonged labor/Induction (> 24 hours)	

Continued on next page...

ADDITIONAL BIRTH and ONGOING POSTPARTUM RISK FACTORS*		
ROUTINE CARE	INCREASED SURVEILLANCE POSTPARTUM CARE TEAM ASSESSES RESPONSE READINESS	
	Cesarean during this admission – <i>especially if urgent/emergent/2nd stage</i>	Active bleeding soaking > 1 pad per hour or passing a ≥ 6 cm clot
	Operative vaginal birth	Retained placenta
	Genital tract trauma including 3 rd and 4 th degree lacerations	Non-lower transverse uterine incision for cesarean
	Quantitative cumulative blood loss 500-1000 mL with a vaginal birth	Quantitative cumulative blood loss ≥ 1000 mL or treated for hemorrhage
		Received general anesthesia
		Uterine rupture

*The Joint Commission requires that an assessment using an evidence-based tool for determining maternal hemorrhage risk be completed on admission to labor and delivery and on admission to postpartum. The birth and ongoing postpartum factors should be included in addition to admission factors in the risk assessment.

This table was adapted from the *Improving Health Care Response Obstetric Hemorrhage: A California Quality Improvement Toolkit*, funded by the California Department of Public Health, 2015; supported by Title V funds.

Racism and hemorrhage outcomes for Black women

A few studies have found higher rates of hemorrhage in one racial or ethnic group compared to another, but it is important to acknowledge that race/ethnicity are not biologic constructs and do not make the patient physiologically at higher risk for hemorrhage. However, several studies have noted higher rates of morbidity among Black and Native American women³⁰ and, most concerning, higher case fatality rates among Black women.³¹ These data strongly suggest that the medical system and providers are not providing the same level of care to all women with hemorrhage (e.g., not listening to patient’s concerns or not responding in as timely a manner). This difference is not explained by biological factors and is most likely due to inequitable quality of care. It is recommended that hospitals and educators carefully review quality gaps related to obstetric hemorrhage preventive and management practices. System-wide protocols, guidelines and care providers’

practices should be evaluated to determine if and to what extent care quality differs according to patients’ race or ethnicity. (See Section: Implementing and Sustaining Maternal Quality, Safety and Performance Improvement for Obstetric Hemorrhage on page 20.) This information will allow quality gaps to be identified and targeted interventions for reducing disparities in care to be deployed. Clinicians of all levels need to receive education about the embeddedness of structural racism in medicine and obstetrics and how implicit bias can be part of the clinical interaction.³²⁻³⁶ Reductions in racial disparities can occur and there is evidence that implementation of a standardized approach (e.g., Hemorrhage Safety bundle) can significantly reduce inequities in hemorrhage outcomes.³⁷ Lastly, all patients should receive the same quality of information about their hemorrhage risk and respectful care from providers before, during and after a hemorrhage event. (See Section: Communicating with and Supporting Women, Birthing People, and Families After an Obstetric Hemorrhage on page 146.)

Sample script for clinicians to address care concerns of Black women

Patient: “I have been hearing a lot that Black women are more likely to die giving birth. I’m scared. What are you going to do to prevent that from happening?”

Provider: “I hear that you are afraid. It is true that Black women experience higher rates of hemorrhage complications and rare but tragic events like maternal death when giving birth. We will provide you with safe and equitable care that treats you with dignity and respect. There is a law that was signed in California Senate Bill 464, [California Dignity in Pregnancy and Childbirth Act](#) that requires hospitals and providers who take care of Black birthing people to understand these risks and put in place policies and staff training to take the best care of you. We value your concerns and I appreciate you sharing them with me. Please continue to share your concerns with the care team. We want you to have a safe and empowering birth!”

Ongoing risk assessment: Communication and mobilization of resources

The risk assessment process should start early in the pregnancy with emerging risk factors closely monitored by the patient’s prenatal care provider. As the patient’s risk profile changes, other providers may need to be added to the care team throughout the pregnancy (e.g., MFM, OB Anesthesiology, etc.). Decisions regarding birth location should be made based upon the risk assessment and the facility should be made aware of the patient’s risk and needs prior to the birth, if possible, so that appropriate preparations can be made in advance. For example, multiple repeat cesarean sections are known to be more technically difficult with unanticipated complications, such as undiagnosed placenta accreta spectrum and multiple adhesions, which can lead to hemorrhage. Therefore, specific facility preparations are advised, including ready availability of expertise, additional surgeons, specialized surgical instruments and blood resources. (See Appendix Q: Preadmission Planning for Women Undergoing Scheduled Cesarean Section on page 233.)

Upon hospital admission, a risk assessment should be performed and documented. The

patient should be informed of their risk status, even if their risk is low. This communication allows the care provider to explain how risk assessment is utilized and that the risk of hemorrhage may change during the course of the stay. A best practice is to provide reassurance that necessary preparations are taking place and that the patient and her support team will be kept informed of changes, and what these changes mean for possible response. The communication can include a statement that not all hemorrhages are predictable, but that the team is well trained and will provide the best care possible. This gives the patient an opportunity to ask questions before the birth, at which time swift action may impede a complete explanation until after the hemorrhage occurs and is managed.

The care team responsible for hemorrhage response should communicate medium- and high-risk status and risk factors with the patient and their support team. While high-resource facilities *may* choose to reserve broad team communication for high-risk patients, small or low-resource facilities with obstetric and/or anesthesiology providers off-site or with responsibilities in other parts of the hospital should not use this approach, and keep all staff informed of patients’ hemorrhage risk status. (See Section: Hemorrhage Preparedness

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Considerations for Small and Low-Resource Hospitals on page 83.) Even though mobilization of resources may be a quick process at a level III or IV care center, early communication still facilitates appropriate planning, a shared mental model and transparency with the patient and support team. Communication and resource mobilization should be standardized so that every person on the care team knows what resources are expected for a medium- or high-risk case and are prepared to respond. While the care plan may vary by condition, the communication strategies and resources developed by the facility should be consistently applied to all patients in each category.

Obstetric decision-making for labor and delivery should be updated if the risk profile changes during the intrapartum period. For example, a patient may have been admitted with no risk factors, but may develop chorioamnionitis after a long induction process and prolonged second stage of labor. This patient is now considered high-risk, but the appropriate resources may not be activated if there is sole reliance on the

risk assessment at admission. Additionally, obstetric hemorrhage does not always occur in the immediate post-birth period, so postpartum clinicians should be trained in risk assessment and coordinated resource activation. To recap, risk assessment should be done on admission, at the start of the second stage, on transition to postpartum care, **or any time the patient's condition changes**. Communication of risk status among appropriate team members and the patient is a critical part of the anticipation and preparation for hemorrhage.

Note that the list of hemorrhage risk factors does not encompass all cases where the patients may need closer monitoring. Some patients are at higher risk for morbidity and mortality as a result of hemorrhage, such as those with preexisting anemia and patients who decline blood and blood products.^{38,39} These patients should be monitored closely, as the threshold for intervention may be lower. (See Sections: Planning for Patients Who May Decline Blood and Blood Products on page 64 and Management of Iron Deficiency Anemia on page 41.)

Risk assessment time out prior to birth

Some teams have implemented the practice of a pre-delivery huddle with the care team. This is an ideal opportunity to review pertinent patient history, risk factors, labor course, resource availability and anticipated complications. This practice allows for all team members to develop a shared mental model regarding expectations, review roles, and gather additional team members as needed.

While the care plan will depend on the cause of the elevated hemorrhage risk (i.e., planning interventions for placenta accreta spectrum is different than planning interventions for chorioamnionitis), it is important to develop a standardized approach for communicating hemorrhage risk within the care team. This may be done in the following ways:

- ▶ Add an alert to the EHR banner to identify high-risk patients
- ▶ Identify patients who decline blood or blood products and review their advance medical directive or refusal checklist. Patient preferences regarding transfusion should be communicated to the care team and actively incorporated into the care plan. (See Section: Planning for Women Who May Decline Blood and Blood Products on page 64.)

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- ▶ Clearly identify the patient's risk on the labor and delivery whiteboard
- ▶ Make the hemorrhage risk assessment a standard data element included in safety huddles and patient handoffs
- ▶ Before birth, the care team should ensure that all providers are aware of patient risk levels. For patients considered high-risk, individual staff should be assigned specific roles (i.e., QBL measurement, activating the MTP, administering uterotonic medications, preparing necessary supplies/equipment, opening the OR, scribing, patient reassurance, and communicating with the family). We advise apprising team members of the potential for obstetric hemorrhage and for planning appropriate mitigation strategies. (See Section: Definition, Early Recognition, and Rapid Response to Obstetric Hemorrhage Using Triggers on page 93.)

If a positive antibody screen (excluding low-level anti-D from RhoGam) is identified during prenatal care or on hospital admission this can lead to significant delays in obtaining emergent blood products. Therefore, these patients benefit from a type and crossmatch for 2 units of packed red blood cells.

Determine what resources need to be mobilized based on hemorrhage risk. This may include:

- ▶ Moving the hemorrhage cart in front of the room of a patient who is high-risk
- ▶ Considering hemorrhage risk in staffing ratios
- ▶ Ensuring QBL equipment is available and present at birth
- ▶ Preparing for the possibility of emergency (room close to the OR, area cleared of obstructions)
- ▶ Consider potential preparation for use of a rapid infuser or cell saver technology as applicable at the institution
- ▶ Increasing patient surveillance (e.g., more frequent rounding, vital sign and fundal checks, bleeding assessments, post-birth CBC the next day for high-risk patients)

Recommendations

1. Standardization of both risk assessment and hemorrhage preparation prenatally and within the facility can improve response time and teamwork when managing obstetric hemorrhage.
2. Perform risk assessment regularly during the prenatal period and fully document all potential risk factors for obstetric hemorrhage in patients' medical records. Patients, family and support team should be informed of these risk factors before birth.
3. Refer all patients with suspected placenta accreta spectrum to a higher level of care obstetric center that has an experienced team and a large blood bank inventory. Ensure that an experienced team and resources are in place for these high-risk patients.

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4. Perform careful review of documented risk factors in the prenatal record and the patient's prior history. Upon admission to labor and delivery, assign a risk category and proceed with the recommended preparation/communication associated with risk level.
5. Risk assessment for hemorrhage preparedness should be done on admission, at the beginning of the second stage, at the transition to postpartum care, or ***any time the patient's condition changes.***

EVIDENCE GRADING

LEVEL OF EVIDENCE: B

References

1. California Department of Public Health. The California Pregnancy-Associated Mortality Review. Report from 2002 - 2007 Maternal Death Reviews. 2019.
2. Joint Commission. Provision of care, treatment, and services standards for maternal safety. https://www.jointcommission.org/-/media/tjc/documents/standards/r3-reports/r3_24_maternal_safety_hap_9_6_19_final1.pdf2019.
3. New York City Department of Health and Mental Hygiene. Women's experiences with severe maternal morbidity in New York City: A qualitative report. New York, NY2020.
4. Elmir R, Schmied V, Wilkes L, Jackson D. Separation, failure and temporary relinquishment: women's experiences of early mothering in the context of emergency hysterectomy. *Journal of Clinical Nursing*. 2012;21(7-8):1119-1127.
5. ACOG. Levels of maternal care. Obstetric Care Consensus No. 2 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology*. 2015;125(2):502-515.
6. ACOG; SMFM; Cahill AG, Beigi R, Heine RP, Silver RM, Wax JR. Placenta accreta spectrum. American College of Obstetricians and Gynecologists, Society for Maternal Fetal Medicine. *American Journal of Obstetrics and Gynecology*. 2018;219(6):B2-B16.
7. Miller CM, Cohn S, Akdagli S, Carvalho B, Blumenfeld YJ, Butwick AJ. Postpartum hemorrhage following vaginal delivery: risk factors and maternal outcomes. *Journal of Perinatology*. 2017;37(3):243-248.
8. Ruppel H, Liu VX, Gupta NR, Soltesz L, Escobar GJ. Validation of postpartum hemorrhage admission risk factor stratification in a large obstetrics population. *American Journal of Perinatology*. 2020.
9. Bateman ST, Lacroix J, Boven K, et al. Anemia, blood loss, and blood transfusions in North American children in the intensive care unit. *American Journal of Respiratory Critical Care Medicine*. 2008;178(1):26-33.
10. Al-Zirqi I, Vangen S, Forsen L, Stray-Pedersen B. Prevalence and risk factors of severe obstetric haemorrhage. *British Journal of Obstetrics and Gynecology*. 2008;115(10):1265-1272.
11. Kramer MS, Berg C, Abenhaim H, et al. Incidence, risk factors, and temporal trends in severe postpartum hemorrhage. *American Journal of Obstetrics and Gynecology*. 2013;209(5):449 e441-447.
12. Bhide A, Guven M, Prefumo F, Vankalayapati P, Thilaganathan B. Maternal and neonatal outcome after failed ventouse delivery: comparison of forceps versus cesarean section. *Journal of Maternal-Fetal and Neonatal Medicine*. 2007;20(7):541-545.
13. Miller CM, Cohn S, Akdagli S, Carvalho B, Blumenfeld YJ, Butwick AJ. Postpartum hemorrhage following vaginal delivery: risk factors and maternal outcomes. *Journal of Perinatology*. 2017;37(3):243-248.
14. Grobman WA, Bailit J, Lai Y, et al. Association of the Duration of Active Pushing With Obstetric Outcomes. *Obstetrics and Gynecology*. 2016;127(4):667-673.
15. Laughon SK, Berghella V, Reddy UM, Sundaram R, Lu Z, Hoffman MK. Neonatal and maternal outcomes with prolonged second stage of labor. *Obstetrics and Gynecology*. 2014;124(1):57-67.
16. Wu SK, M.; Hibbard, J. U. Abnormal placentation: twenty-year analysis. *American Journal of Obstetrics and Gynecology*. 2005;192(5):1458-1461.
17. Dilla AJ, Waters JH, Yazer MH. Clinical validation of risk stratification criteria for peripartum hemorrhage. *Obstetrics and Gynecology*. 2013;122(1):120-126.

18. Kawakita T, Mokhtari N, Huang JC, Landy HJ. Evaluation of risk-assessment tools for severe postpartum hemorrhage in women undergoing cesarean delivery. *Obstetrics and Gynecology*. 2019;134(6):1308-1316.
19. Ende HB, Lozada MJ, Chestnut DH, et al. Risk factors for atonic postpartum hemorrhage: A systematic review and meta-analysis. *Obstetrics and Gynecology*. 2021;137(2):305-323.
20. Pressly MA, Parker RS, Waters JH, Beck SL, Jeyabalan A, Clermont G. Improvements and limitations in developing multivariate models of hemorrhage and transfusion risk for the obstetric population. *Transfusion*. 2021;61(2):423-434.
21. Helman S, Drukker L, Fruchtmann H, et al. Revisit of risk factors for major obstetric hemorrhage: insights from a large medical center. *Archives of Gynecology and Obstetrics*. 2015;292(4):819-828.
22. Bienstock JL, Eke AC, Hueppchen NA. Postpartum hemorrhage. *New England Journal of Medicine*. 2021;384(17):1635-1645.
23. ACOG District II. Safe Motherhood Initiative: Obstetric Hemorrhage. Published 2021. Accessed 2/18/2021.
24. Association of Women's Health Obstetric and Neonatal Nurses. Postpartum hemorrhage (PPH) risk assessment table 1.1. https://cdn-links.lww.com/permalink/aog/b/aog_134_6_2019_10_06_kawakita_19-1065_sdc2.pdf. Published 2017. Accessed 2/18/2021.
25. Wu E, Jolley JA, Hargrove BA, Caughey AB, Chung JH. Implementation of an obstetric hemorrhage risk assessment: validation and evaluation of its impact on pretransfusion testing and hemorrhage outcomes. *Journal of Maternal-Fetal and Neonatal Medicine*. 2015;28(1):71-76.
26. Butwick AJ, Ramachandran B, Hegde P, Riley ET, El-Sayed YY, Nelson LM. Risk Factors for Severe Postpartum Hemorrhage After Cesarean Delivery: Case-Control Studies. *Anesthesia and Analgesia*. 2017;125(2):523-532.
27. Nyflot LT, Sandven I, Stray-Pedersen B, et al. Risk factors for severe postpartum hemorrhage: a case-control study. *BMC pregnancy and childbirth*. 2017;17(1):17.
28. Mulay SB, Jaben EA, Johnson P, Badjie K, Stubbs JR. Risks and adverse outcomes associated with emergency-release red blood cell transfusion. *Transfusion*. 2013;53(7):1416-1420.
29. Butwick AJ, Liu C, Guo N, et al. Association of Gestational Age with Postpartum Hemorrhage. *Anesthesiology*. 2021.
30. Gyamfi-Bannerman C, Srinivas SK, Wright JD, et al. Postpartum hemorrhage outcomes and race. *American Journal of Obstetrics and Gynecology*. 2018;219(2):185 e181-185 e110.
31. Tucker ML, Berg CJ, Callaghan WM, Hsia J. The Black-white disparity in pregnancy-related mortality from 5 conditions: Differences in prevalence and case-fatality rates. *American Journal of Public Health*. 2007;97(2):247-251.
32. Bailey ZD, Krieger N, Agenor M, Graves J, Linos N, Bassett MT. Structural racism and health inequities in the USA: Evidence and interventions. *Lancet*. 2017;389(10077):1453-1463.
33. Chambers BD, Arabia SE, Arega HA, et al. Exposures to structural racism and racial discrimination among pregnant and early post-partum Black women living in Oakland, California. *Stress Health*. 2020;36(2):213-219.
34. Hardeman RR, Karbeah J, Kozhimannil KB. Applying a critical race lens to relationship-centered care in pregnancy and childbirth: An antidote to structural racism. *Birth*. 2020;47(1):3-7.
35. Hardeman RR, Medina EM, Kozhimannil KB. Structural Racism and Supporting Black Lives - The Role of Health Professionals. *New England Journal of Medicine*. 2016;375(22):2113-2115.
36. Scott KA, Britton L, McLemore MR. The Ethics of Perinatal Care for Black Women: Dismantling the Structural Racism in "Mother Blame" Narratives. *Journal of Perinatal and Neonatal Nursing*. 2019;33(2):108-115.
37. Main EK, Chang SC, Dhurjati R, Cape V, Profit J, Gould JB. Reduction in racial disparities in severe maternal morbidity from hemorrhage in a large-scale quality improvement collaborative. *American Journal of Obstetrics and Gynecology*. 2020;223(1):123 e121-123 e114.
38. Smith C, Teng F, Branch E, Chu S, Joseph KS. Maternal and Perinatal Morbidity and Mortality Associated With Anemia in Pregnancy. *Obstetrics and Gynecology*. 2019;134(6):1234-1244.
39. Van Wolfswinkel ME, Zwart JJ, Schutte JM, Duvekot JJ, Pel M, Van Roosmalen J. Maternal mortality and serious maternal morbidity in Jehovah's witnesses in The Netherlands. *British Journal of Obstetrics and Gynaecology*. 2009;116(8):1103-1108; discussion 1108-1110.

Management of Iron Deficiency Anemia

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Key Principles

1. Anemia is an important and potentially modifiable contributor to severe maternal morbidity.
2. Iron deficiency anemia (IDA) is prevalent in pregnant women and disproportionately affects Black and Hispanic women, which is likely due to the impact of socioeconomic marginalization with food deserts. The prevalence of IDA can be seen as the downstream effect of the ongoing policies and practices of systemic racism and exclusion.
3. Respectful care should focus on engaging the patient in the goals of reducing anemia at childbirth, decreasing risks of transfusion and potentially improving postpartum recovery. Providing detailed information about how to correctly take oral iron therapy is crucial.
4. Oral ferrous iron compounds are the first line treatment for IDA.
5. Treatment with any of the available intravenous (IV) iron products, typically with a total dose of one gram (gm), can be considered for women with IDA who are not successfully treated with adequate oral iron, or in whom rapid iron repletion is indicated, such as in the third trimester.
6. Repletion of iron stores after obstetric hemorrhage is an important component of the postpartum hemorrhage treatment plan.

Background

Although maternal anemia is recognized as a risk factor for adverse perinatal outcomes such as low birth weight, preterm birth and perinatal mortality, less attention has focused on maternal outcomes.¹ Recently, however, anemia in pregnancy was identified as an important and potentially modifiable contributor to severe maternal morbidity (SMM).² Additionally, there is increased recognition that postpartum anemia, either due to insufficient antepartum iron stores to meet maternal and fetal requirements or resulting from postpartum hemorrhage, is

associated with increased rates of postpartum depression, fatigue, breastfeeding difficulties and poor wound healing. Postpartum anemia has a reported prevalence of 50% in high resource countries.³

Antepartum anemia

There is an inverse and dose-response relationship between first trimester hemoglobin levels measured between 2-16 weeks gestation and the probability of SMM. The highest risk is for women with a hemoglobin < 9.0 gm/

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dL; however, the risk was elevated significantly across all first trimester hemoglobin levels of < 12.0 gm/dL even when adjusted for multiple important confounders and even when excluding women with hemoglobinopathies.²

The main cause of anemia worldwide, and in pregnancy specifically, is iron deficiency. Anemia in pregnancy is defined by the World Health Organization (WHO) as a hemoglobin concentration < 11.0 gm/dL. However, given the hemodilution that occurs in pregnancy, using hemoglobin alone to detect IDA and iron status in pregnant women is of uncertain sensitivity and specificity. Pregnancy requires a marked increased physiologic demand for iron. To meet both maternal and fetal needs, typically an additional 1 gm of elemental iron is needed during the pregnancy.⁵

Determination of iron status relies on measurement of serum ferritin, an iron storage protein, to reflect bone marrow iron stores. A cutoff of < 15 mcg/L is specific but not sensitive for the diagnosis of iron deficiency compared to a gold standard of absent bone marrow iron stores. Given the high iron demands of pregnancy and improved sensitivity for absent iron stores, using a cut-point of < 30 mcg/L should be considered.⁶ Because serum ferritin is an acute phase reactant, a normal ferritin concentration may mask an iron-deficient state if inflammation is present. Outside of pregnancy, an alternative marker is a decreased serum transferrin saturation of < 20%, which correlates with iron deficiency in the setting of either a normal or elevated ferritin due to inflammation although its use has been less well studied in pregnancy.⁷

Based on U.S. data from the National Health and Nutrition Examination Survey (NHANES), using cut-points of serum ferritin < 12.0 mcg/L and a

hemoglobin of < 11.0 gm/dL, rates of iron deficiency anemia during pregnancy were 2.2%, 5.7% and 18% in women who self-identified as white, Mexican American and Black respectively.⁸ The prevalence of iron deficiency in reproductive age women in another cross-sectional study, using a cut-point of serum ferritin < 15 mcg/L was 2.9%, 6.0% and 6.2% in white, Hispanic and Black women respectively.⁹ Note that both of these studies use the lower threshold for ferritin. Anemia as reported by ICD-9-CM diagnosis codes at time of admission for birth was found to substantially contribute to the Black-white disparity in SMM.¹⁰ Potential drivers for disparities in anemia rates by race/ethnicity may include social determinants of health, conditions associated with increased menstrual blood loss including earlier age of menarche, the prevalence of symptomatic fibroids and obesity, and systemic and institutionalized racism.¹¹⁻¹³ Race-based definitions for anemia cutoffs are no longer considered valid.¹⁴ The Task Force does not support separate cutoffs for identification and treatment of anemia by race/ethnicity.

There is clear evidence that treating IDA in pregnant patients significantly improves hematologic parameters.¹⁵ There is evidence from a large randomized controlled trial (RCT) that treatment of severe anemia (hemoglobin \leq 7.0 gm/dL) with intravenous iron decreased the need for transfusion up to 6 weeks postpartum, as compared to treatment with oral iron.¹⁶ However, there is a lack of data to evaluate the effects of treatment of IDA on important maternal and infant health outcomes other than maternal transfusion. Nevertheless, given that transfusion is an important driver of SMM and that anemia at birth admission is a predictor of transfusion, treating anemia during pregnancy is an important goal of quality prenatal care.¹⁷

Community health care providers play a critical role in providing pregnancy health care services including the information and access they need regarding IDA diagnosis and treatment. Expanded funding for, and access to, community-based providers could assist with fostering relationships that keep people healthy throughout their life and when they choose to become a parent.¹⁸

The first line treatment for IDA is typically oral iron supplementation. Ferrous iron compounds have the highest bioavailability compared to ferric iron and carbonyl iron. Oral iron must be taken with an empty stomach (such as at bedtime) and at least one hour before food is ingested, otherwise absorption is substantially reduced. Most multivitamin supplements such as prenatal vitamins contain too little iron to meaningfully impact iron deficiency and IDA, and typically contain minerals such as zinc and calcium that interfere with absorption. Food, coffee, tea, and gastric acid-reducing medications all significantly impair iron absorption. Controlled or slow-release preparations of iron are typically more expensive, have no clear therapeutic advantage, and are not recommended in part because of poor absorption. Most of the iron from these products is carried into the distal gut past the site of duodenal absorption.^{19,20}

A meta-analysis of subjects randomized to daily ferrous sulfate or IV iron treatment found that individuals taking oral iron were significantly more likely to report gastrointestinal side effects with an odds ratio of 3.05 (95% CI 2.07 - 4.48). However, the daily oral iron doses used were at least 195 mg or higher in the vast majority of subjects.²¹ There is evidence that doses lower than 100-200 mg daily are better tolerated.

Further, pregnant women have a high rate of gastrointestinal symptoms at baseline and it is not clear that oral iron at doses of up to 80 mg daily cause any additional symptoms. One study of 427 pregnant women found that the incidence of gastrointestinal symptoms at the baseline gestational age of 18 weeks prior to enrollment did not differ over time (at baseline, 32 weeks, or 39 weeks gestational age) among those given double blinded doses of either 20 mg, 40 mg, 60 mg, or 80 mg of ferrous iron taken daily at bedtime.²²

More evidence is needed to determine optimal recommendations for oral iron dosing in anemic pregnant women. A Cochrane review comparing daily oral iron supplementation to intermittent oral iron specifically in pregnancy found evidence of fewer maternal side effects in those taking intermittent iron; however, the quality of evidence from the available studies was judged to be low or very low. Most of the subjects in the intermittent study arms were taking iron only once a week, a high proportion were not anemic at baseline and most of the studies did not attempt allocation blinding of subjects or researchers.²³ Better information is needed to determine if alternate day regimens are better than daily regimens, for efficacy and tolerability. Absorption of iron is transiently decreased after a single oral dose for approximately 24 hours and therefore dosing more than once daily is not recommended.²⁴

Repletion of iron stores and normalization of serum ferritin may require 4-6 months of treatment, so early identification of anemia is important – and especially important for those that will not accept blood or blood products. (See Section: Planning for Patients Who May Decline Blood or Blood Products on page 64.) Daily dosing of 60 mg of ferrous iron, taken on an empty stomach after appropriate patient counseling and close follow-up for compliance is

likely sufficient to treat most pregnant women identified with IDA defined as a hemoglobin < 11.0 gm/dL in the first trimester. For more severe anemia in the first trimester (hemoglobin < 10.0 gm/dL), or anemia diagnosed in the late second or third trimester (hemoglobin < 11.0 gm/dL) with less treatment time available before birth, higher doses of iron such as 180 mg may be indicated and could be given on alternate days to improve absorption based on limited available data. Women with first trimester hemoglobin levels between 11.0 gm/dL and 12.0 gm/dL and low total iron stores (serum ferritin less than 30 mcg/L) could be given 60 mg of ferrous iron on alternate days, if prioritizing avoidance of anemia in the second trimester is desired.

Although antenatal iron deficiency anemia will require treatment with exogenous iron supplementation, nevertheless, clinicians should take the opportunity to sensitively ask anemic pregnant women about their nutrition and whether they may be experiencing food insecurity that might have adversely impacted their preconception iron stores. Referrals can be made to Women, Infants and Children (WIC) or other available nutrition support programs.

Intravenous iron

There are seven IV iron products available in the U.S. The preponderance of published data to guide use in pregnant or postpartum women is centered on 3 products: low molecular weight iron dextran (InFed), iron sucrose (Venofer) and ferric carboxymaltose (Injectafer).²⁵⁻²⁹ Sodium ferric gluconate complex (Ferlecit) is also in wide use. Historically, there has been a widespread belief that IV iron infusions have high potential for serious reactions including anaphylaxis, particularly with prior dextran-derived products.

The high molecular dextran products from the past were associated with these rare events, but they have been removed from the market. Current data with low molecular weight dextran (LMWID) demonstrates that the product has a very low serious event rate comparable to iron sucrose and ferric carboxymaltose. About 2 to 6% of patients may experience mild, transient and self-resolving reactions. (See Table 1 on page 46.)³⁰⁻³⁶ True anaphylaxis among these products is quite rare, reported generally as 1:200,000 administrations.^{28,29,34,37,38} Anaphylaxis signs and symptoms include persistent significant hypotension (drop of 30 mm Hg in systolic blood pressure (SBP) from baseline or SBP < 90 mm Hg); angioedema of the tongue/airway; or involvement of two or more organ systems including cardiovascular (e.g., chest pain), respiratory (e.g., stridor or bronchospasm), gastrointestinal (e.g., abdominal pain, vomiting), or skin (e.g., non-airway angioedema or generalized urticaria).³⁰ Steroids and fluids should be a part of treatment of severe reactions.³⁸

All products may cause two types of minor, transient, acute non-life-threatening reactions: 1) Fishbane reactions (myalgias including chest, back or flank pain or tightness, arthralgias, flushing and sometimes dyspnea); and 2) nonallergic complement activation-related pseudo-allergy reactions (pruritis, urticaria, rash, nausea, headache, wheezing, mild hypotension, mild hypertension). These reactions usually abate spontaneously after several minutes following infusion interruption. Infusions should be stopped for such reactions and the patient observed for the disappearance of signs and symptoms. After a symptom-free time period of 15 minutes, the infusion may be resumed at a lower rate while observing for any reoccurrence while providing reassurance to the patient. Slowly increase the rate after 15 minutes when it is clear that the patient is tolerating resumption of the medication. If symptoms

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reoccur, then the infusion should be halted.³⁰ If the isolated symptom does not spontaneously abate after initially stopping the infusion but is not worsening, treat the isolated symptom with appropriate medication (e.g., antihistamine for urticaria).

There are occasionally delayed reactions to these agents, such as ongoing fatigue, muscle weakness and bone pain. If these do not resolve spontaneously after a few days post-infusion, then serum phosphate could be checked. Hypophosphatemia is a rare adverse effect with IV iron administration.^{33,35} Most case reports of hypophosphatemia treated in the emergency department are associated with ferric carboxymaltose. This also appears to be more of an issue with the two-dose regimen (1500mg). Based on a systematic review, it is least associated with LMWID and most associated with ferric carboxymaltose.^{39,40} A recommendation for those who will receive ferric carboxymaltose could be to order a baseline phosphate prior to administration. For those with low baseline serum phosphate, the dose may be limited or a serum phosphate may be checked within two weeks or certainly with any symptoms of hypophosphatemia.⁴¹ Patients should be informed of the possibility that infusion reactions can occur, with a focus on the more likely scenario of mild and self-resolving reactions and how those might be treated. Theoretically, risk of any reaction could be enhanced in the setting of multiple allergies, asthma, eczema, immune or inflammatory conditions. A consideration can be made to administer a steroid as premedication for asthmatics and those with two or more

allergies.³¹ In most cases, pre-medication is not necessary. In fact, antihistamines such as diphenhydramine can cause vasoactive reactions and are not recommended as a pre-medication.^{25,30,31}

It is the perspective of this task force that there is no current optimal agent for all scenarios. Head-to-head trial data is lacking, though there is some data available.^{26,42} All products can raise hemoglobin by at least 1-2 gm/dL on average, with traditional doses near or at 1 gram. The choice of product is less important than implementation of an intravenous route when indicated. Online equations such as the Ganzoni equation to calculate an iron dose may be used, but the Task Force holds the position that most will simply need 1 gram of IV iron.

There are large cost differentials between iron products often based on local contracting, which may influence institutions to choose a particular agent. Costs and patient convenience (based on simplicity of dosing regimen) may ultimately dictate formulary choices. Acquisition costs to hospitals are lower for sodium ferric gluconate complex and low molecular weight iron dextran, and often highest with ferric carboxymaltose. Costs for administration are lower if the product is provided in an outpatient setting, such as an infusion center, over inpatient settings. All IV products are currently billable under Medi-Cal. Authorization may always be checked on the Medi-Cal website under eTAR, where the J-code can be entered to determine if a TAR (technical assistance request) is required (in other states please check with the Medicaid program).

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Both low molecular weight iron dextran (1 gm single vial dose) and ferric carboxymaltose (750 mg single vial dose) will require only a single patient visit where other forms of IV iron such as iron sucrose would require more than one visit to achieve the needed total dose. This may impact the cost of administration in the outpatient setting.

Refer further to Appendix J on page 221 for a sample IV iron order set that features the agents mentioned in the table.

Table 1: Intravenous iron products widely used in pregnant and postpartum patients

Drug Name	Suggested Regimen	Inpatient Acquisition Cost per 1 gm (Average Wholesale) *
LMW Iron Dextran (InFed®)**	1000 mg IV in 250 mL normal saline (NS) administered over 1-4 hours: give 25 mg test dose over 10-15 minutes followed by remaining balance if no reaction ³¹	\$275
Iron Sucrose (Venofer®)**	Option 1: 500 mg IV in 250 mL NS over 4 hours x 2 doses given up to 1 week apart Option 2: 200 mg IV in 100 mL NS over 30-90 minutes x 5 doses given every other day or within 1 week If daily doses are given, consider replacing IV to reduce the risk of phlebitis ⁴³	\$300
Ferric Carboxymaltose (Injectafer®)**	750 mg (if ≥ 50 kg) IV in 250 mL over 15-30 minutes x 2 doses one week apart	\$1100
Sodium ferric gluconate complex (Ferrlecit®)**	125 mg given over 1 hour in 8 separate sessions to achieve up to 1 gm	\$300

*Reflects hospital acquisition costs for drug, not actual charges. Outpatient acquisition costs can be up to 25-30% lower. Administration costs are not reflected and will be dependent on number of visits.

** Premedication is not recommended, but IV steroid for 2+ allergies or asthma can be considered.

Improving Health Care Response to Obstetric Hemorrhage, a CMQCC Quality Improvement Toolkit, 2022

Postpartum anemia

Treatment of antepartum anemia is an important way to prevent postpartum anemia, but even an iron-repleted patient is at risk for postpartum iron-deficiency anemia after a significant hemorrhage. Treatment of anemia due to acute blood loss from obstetric hemorrhage should be an important part of the treatment plan. Once the patient is hemodynamically stable, evaluation of anemia with a complete blood count is recommended to evaluate the degree of anemia. The definition of postpartum anemia is not standardized, with international organizations using a cut-off of hemoglobin ranging from 10.0-12.0 gm/dL.⁴⁴

Postpartum anemia has been shown to increase the risk of postpartum depression,⁴⁵ fatigue,⁴⁶ and difficulties breastfeeding,⁴⁷⁻⁴⁹ although it is difficult to separate the physiologic and psychologic effects of the hemorrhage from the effects of the resulting anemia. Iron supplementation in the postpartum period can alleviate many of these symptoms, and IV iron has been shown to have a quicker repletion of iron stores.^{50,51}

Guidelines on postpartum IV iron treatment recommendations are sparse and vary in their recommendations. For example, international guidelines recommend treatment with IV iron if hemoglobin levels are < 9.0 gm/dL or if compliance with oral iron is likely to be low due to side effects or malabsorption.⁵² However, many studies offered IV iron to postpartum women with less severe levels of anemia (Hgb < 12.0 gm/dL) and demonstrated improved hemoglobin stores at 6 weeks, less need for blood transfusion, and some improvements in symptoms such as depression and fatigue.⁵¹ Thus, women with postpartum IDA should be offered IV iron repletion as an option to more quickly return to an iron-replete state and counseled on the risks, benefits and formulations for IV and oral iron supplementation.

Following IV iron administration, some amount of iron will likely be present in breast milk^{33,35,53,54} Administration of maternal iron sucrose and ferric carboxymaltose appear to be safe for a nursing infant given a lack of adverse events noted in the available literature.⁵³ Treatment of postpartum anemia with LMWID has been documented, although experience with nursing infants has not been described.^{54,55} Sodium ferric gluconate complex contains the preservative benzyl alcohol, which is contraindicated in medications given to neonates (at a specific threshold), due to their immature metabolism. However, in the adult, benzoyl alcohol is rapidly metabolized and transfer to breast milk is extremely unlikely.⁵⁴ The benefits of breastfeeding, the risk of an untreated condition (fatigue), and the available literature need to be taken into consideration.

Because adequate repletion of iron stores in an otherwise healthy postpartum woman will rapidly trigger erythropoiesis, IV iron infusion may be sufficient to treat postpartum anemia while avoiding a blood transfusion.^{50,56} If after weighing the risks and benefits, it is decided that a stable postpartum patient requires a blood transfusion, transfusion should begin with one unit, with reassessment before administering a second one.^{57,58} Utilize the practices and tools provided to discuss the treatment plan with the patient for optimal communication between the patient and family. (See Sections: Communicating with and Supporting Women, Birthing People and Families After an Obstetric Hemorrhage on page 146 and Secondary Postpartum Hemorrhage and Readmission on page 163.)

Even if a transfusion is given, that does not provide enough iron to replete lost stores or to encourage new RBC formation. Oral iron supplementation should be offered every time a transfusion is given.^{59,60} In addition, it can take at least three months to replete iron stores even after the anemia of iron deficiency has resolved. Women with a history of IDA should be continued

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on iron supplementation 6-12 weeks postpartum even if they have a normal hemoglobin.⁷ Providers should stress the importance of the medication for the patient's lifelong health, and seek to understand potential barriers, such as the pill size or swallowing challenges, and identify alternatives that will best suit the woman's situation.

Recommendations

1. Identification and treatment of antenatal anemia should be a key component of high-quality prenatal care for all pregnant people, with the goal to achieve a hemoglobin of > 11.0 gm/dL at the time of birth. It is not advised to use the social construct of race to define hemoglobin levels in the diagnosis of anemia.¹⁴
2. Preferred oral iron treatment is with a ferrous iron product, such as ferrous sulfate, given with an empty stomach, once daily doses of 60 mg elemental iron, or every other day if doses of > 100 mg are given. Delayed or slow-release products should not be used.
3. Intravenous iron, usually a 1-gram total dose, should be given when barriers to oral iron therapy are apparent such that achieving the goal hemoglobin of > 11.0 gm/dL at childbirth appears unlikely, and rapid iron repletion is needed. Examples might include first trimester anemia which has worsened or failed to improve with oral iron therapy by the second trimester, a hemoglobin of < 10.0 gm/dL in the third trimester or in the context of anticipated preterm birth.
4. Intravenous iron should be considered in women with hemoglobin of < 9.0 gm/dL post- birth. Postpartum patients who require transfusion of red cells often still require repletion of total body iron stores. A postpartum plan for oral or intravenous iron should be addressed with consideration given to potential barriers affecting oral iron compliance and access to, or probability of, postpartum care follow-up.

Educational tools and sample resources

[Sample Order Set for Iron Deficiency Management \(Appendix J on page 221\)](#)

EVIDENCE GRADING

LEVEL OF EVIDENCE: C

References

1. Smith C, Teng F, Branch E, Chu S, Joseph KS. Maternal and perinatal morbidity and mortality associated with anemia in pregnancy. *Obstetrics and Gynecology*. 2019;134(6):1234-1244.
2. Ray JG, Davidson A, Berger H, Dayan N, Park AL. Haemoglobin levels in early pregnancy and severe maternal morbidity: Population-based cohort study. *British Journal of Obstetrics and Gynecology*. 2020;127(9):1154-1164.
3. Milman N. Postpartum anemia I: Definition, prevalence, causes, and consequences. *Annals of Hematology*. 2011;90(11):1247-1253.
4. Wang E, Glazer KB, Sofaer S, Balbierz A, Howell EA. Racial and ethnic disparities in severe maternal morbidity: A qualitative study of women's experiences of peripartum care. *Women's Health Issues*. 2021;31(1):75-81.
5. Georgieff MK. Iron deficiency in pregnancy. *American Journal of Obstetrics and Gynecology*. 2020;223(4):516-524.
6. Daru J, Colman K, Stanworth SJ, De La Salle B, Wood EM, Pasricha SR. Serum ferritin as an indicator of iron status: What do we need to know? *American Journal of Clinical Nutrition*. 2017;106(Suppl 6):1634S-1639S.
7. Pavord S, Daru J, Prasannan N, et al. UK guidelines on the management of iron deficiency in pregnancy. *British Journal of Haematology*. 2020;188(6):819-830.

8. Mei Z, Cogswell ME, Looker AC, et al. Assessment of iron status in US pregnant women from the National Health and Nutrition Examination Survey (NHANES), 1999-2006. *American Journal of Clinical Nutrition*. 2011;93(6):1312-1320.
9. Barton JC, Wiener HH, Acton RT, et al. Prevalence of iron deficiency in 62,685 women of seven race/ethnicity groups: The HEIRS Study. *PLoS One*. 2020;15(4):e0232125.
10. Leonard SA, Main EK, Scott KA, Profit J, Carmichael SL. Racial and ethnic disparities in severe maternal morbidity prevalence and trends. *Annals of Epidemiology*. 2019;33:30-36.
11. Salsberry PJ, Reagan PB, Pajer K. Growth differences by age of menarche in African American and White girls. *Nursing Research*. 2009;58(6):382-390.
12. Sekhar DL, Murray-Kolb LE, Kunselman AR, Weisman CS, Paul IM. Differences in risk factors for anemia between adolescent and adult women. *Journal of Women's Health*. 2016;25(5):505-513.
13. ACOG. Management of Symptomatic Uterine Leiomyomas: Practice Bulletin No. 228 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology*. 2021;137(6):e100-e115.
14. ACOG. Anemia in pregnancy. Practice Bulletin No. 95 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology*. 2008 reaffirmed 2017;112(1):201-207.
15. Siu AL. Screening for iron deficiency anemia and iron supplementation in pregnant women to improve maternal health and birth outcomes: U.S. Preventive Services Task Force Recommendation Statement. *Annals of Internal Medicine*. 2015;163(7):529-536.
16. Neogi SB, Devasenapathy N, Singh R, Bhushan, H, et al. Safety and effectiveness of intravenous iron sucrose versus standard oral iron therapy in pregnant women with moderate-to-severe anaemia in India: a multicentre, open-label, phase 3, randomised, controlled trial. *Lancet Global Health*. 2019;7(12):e1706-e1716.
17. Centers for Disease Control and Prevention. Severe Maternal Morbidity in the United States. Division of Reproductive Health, National Center for Chronic Disease Prevention and Health Promotion. <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/severematernalmorbidity.html>. Published 2021. Accessed 2/18/2021.
18. National Partnership for Women and Families. Black women's maternal health: A multifaceted approach to addressing persistent and dire health disparities. 2018.
19. Moe S, Grill AK, Allan GM. Newer iron supplements for anemia. *Canadian Family Physician*. 2019;65(8):556.
20. Chaplin S, Bhandari S. Oral iron: Properties and current place in the treatment of anaemia. *Prescriber*. 2012(23):12-18.
21. Tolkien Z, Stecher L, Mander AP, Pereira DI, Powell JJ. Ferrous sulfate supplementation causes significant gastrointestinal side-effects in adults: a systematic review and meta-analysis. *PLoS One*. 2015;10(2):e0117383.
22. Milman N, Byg KE, Bergholt T, Eriksen L. Side effects of oral iron prophylaxis in pregnancy--myth or reality? *Acta Haematologica*. 2006;115(1-2):53-57.
23. Pena-Rosas JP, De-Regil LM, Gomez Malave H, Flores-Urrutia MC, Dowswell T. Intermittent oral iron supplementation during pregnancy. *Cochrane Database of Systematic Reviews*. 2015(10):CD009997.
24. Means R. Iron deficiency and iron deficiency anemia: Implications and impact in pregnancy, fetal development, and early childhood parameters. *Nutrients*. 2020;12(1):447.
25. Froessler B, Gajic T, Dekker G, Hodyl NA. Treatment of iron deficiency and iron deficiency anemia with intravenous ferric carboxymaltose in pregnancy. *Archives of Gynecology and Obstetrics*. 2018;298(1):75-82.
26. Jose A, Mahey R, Sharma JB, et al. Comparison of ferric Carboxymaltose and iron sucrose complex for treatment of iron deficiency anemia in pregnancy- randomised controlled trial. *BMC Pregnancy and Childbirth*. 2019;19(1):54.
27. Radhika AG, Sharma AK, Perumal V, et al. Parenteral Versus Oral Iron for Treatment of Iron Deficiency Anaemia During Pregnancy and post-partum: A Systematic Review. *Journal of Obstetrics and Gynaecology Canada India*. 2019;69(1):13-24.
28. Lewkowitz AK, Gupta A, Simon L, et al. Intravenous compared with oral iron for the treatment of iron-deficiency anemia in pregnancy: A systematic review and meta-analysis. *Journal of Perinatology*. 2019;39(4):519-532.
29. Govindappagari S, Burwick RM. Treatment of Iron Deficiency Anemia in Pregnancy with Intravenous versus Oral Iron: Systematic Review and Meta-Analysis. *American Journal of Perinatology*. 2019;36(4):366-376.
30. Achebe M, DeLoughery TG. Clinical data for intravenous iron - debunking the hype around hypersensitivity. *Transfusion*. 2020;60(6):1154-1159.
31. Auerbach M, Pappadakis JA, Bahrain H, Auerbach SA, Ballard H, Dahl NV. Safety and efficacy of rapidly administered (one hour) one gram of low molecular weight iron dextran (INFeD) for the treatment of iron deficient anemia. *American Journal of Hematology*. 2011;86(10):860-862.
32. InFed®. Package insert. In. Madison, NJ NY: Allergan, Inc.; 2020.
33. Injectafer®. Package insert. In. Shirley, NU: American Regent, Inc.; 2020.
34. Lim W, Afif W, Knowles S, et al. Canadian expert consensus: management of hypersensitivity reactions to intravenous iron in adults. *Vox Sang*. 2019;114(4):363-373.
35. Venofer®. Package insert. In. Shirley, NY: American Regent, Inc.; 2020.

36. Wong L, Smith S, Gilstrop M, et al. Safety and efficacy of rapid (1,000 mg in 1 hr) intravenous iron dextran for treatment of maternal iron deficient anemia of pregnancy. *American Journal of Hematology*. 2016;91(6):590-593.
37. Driscoll M, Forster D, Dyer B, et al. Iron deficiency anemia: safety and cost-effectiveness of treatment with various intravenous iron preparations. *Blood*. 2008;112(11):4661.
38. Szebeni J, Fishbane S, Hedenus M, et al. Hypersensitivity to intravenous iron: classification, terminology, mechanisms and management. *British Journal of Pharmacology*. 2015;172(21):5025-5036.
39. Wolf M, Chertow GM, Macdougall IC, Kaper R, Krop J, Strauss W. Randomized trial of intravenous iron-induced hypophosphatemia. *JCI Insight*. 2018;3(23).
40. Glaspy JA, Lim-Watson MZ, Libre MA, et al. Hypophosphatemia associated with intravenous iron therapies for iron deficiency anemia: A systematic literature review. *Therapeutics and Clinical Risk Management*. 2020;16:245-259.
41. Huang LL, Lee D, Troster SM, et al. A controlled study of the effects of ferric carboxymaltose on bone and haematinic biomarkers in chronic kidney disease and pregnancy. *Nephrology Dialysis Transplantation*. 2018;33(9):1628-1635.
42. Christoph P, Schuller C, Studer H, Irion O, De Tejada BM, Surbek D. Intravenous iron treatment in pregnancy: Comparison of high-dose ferric carboxymaltose vs. iron sucrose. *Journal of Perinatal Medicine*. 2012;40(5):469-474.
43. Main EK, Chang SC, Cheng YW, Rosenstein MG, Lagrew DC. Hospital-level variation in the frequency of cesarean delivery among nulliparous women who undergo labor induction. *Obstetrics and Gynecology*. 2020;136(6):1179-1189.
44. Ruiz de Vinaspre-Hernandez R, Gea-Caballero V, Juarez-Vela R, Iruzubieta-Barragan FJ. The definition, screening, and treatment of postpartum anemia: A systematic review of guidelines. *Birth*. 2020.
45. Wassef A, Nguyen QD, St-Andre M. Anaemia and depletion of iron stores as risk factors for postpartum depression: A literature review. *Journal of Psychosomatic Obstetrics and Gynaecology*. 2019;40(1):19-28.
46. Corwin EJ, Arbour M. Postpartum fatigue and evidence-based interventions. *American Journal of Maternal Child Nursing: MCN*. 2007;32(4):215-220; quiz 221-212.
47. Henly SJ, Anderson CM, Avery MD, Hills-Bonczyk SG, Potter S, Duckett LJ. Anemia and insufficient milk in first-time mothers. *Birth*. 1995;22(2):86-92.
48. Chessman J, Patterson J, Nippita T, Drayton B, Ford J. Haemoglobin concentration following postpartum haemorrhage and the association between blood transfusion and breastfeeding: A retrospective cohort study. *BMC Research Notes*. 2018;11(1):686.
49. Drayton BA, Patterson JA, Nippita TA, Ford JB. Red blood cell transfusion after postpartum haemorrhage and breastmilk feeding at discharge: A population-based study. *Australian and New Zealand Journal of Obstetrics and Gynaecology Canada*. 2016;56(6):591-598.
50. Holm C, Thomsen LL, Langhoff-Roos J. Intravenous iron isomaltoside treatment of women suffering from severe fatigue after postpartum hemorrhage. *Journal of Maternal-Fetal and Neonatal Medicine*. 2019;32(17):2797-2804.
51. Sultan P, Bampoe S, Shah R, et al. Oral vs intravenous iron therapy for postpartum anemia: a systematic review and meta-analysis. *American Journal of Obstetrics and Gynecology*. 2019;221(1):19-29 e13.
52. Munoz M, Pena-Rosas JP, Robinson S, et al. Patient blood management in obstetrics: management of anaemia and haematinic deficiencies in pregnancy and in the post-partum period: NATA consensus statement. *Transfusion Medicine*. 2018;28(1):22-39.
53. Breyman C, Gliga F, Bejenariu C, Strizhova N. Comparative efficacy and safety of intravenous ferric carboxymaltose in the treatment of postpartum iron deficiency anemia. *International Journal of Gynaecology and Obstetrics*. 2008;101(1):67-73.
54. National Library of Medicine (US). <https://www.ncbi.nlm.nih.gov/books/NBK501922/>.
55. Daniilidis A, Giannoulis C, Pantelis A, Tantanasis T, Dinas K. Total infusion of low molecular weight iron-dextran for treating postpartum anemia. *Clinical and Experimental Obstetrics and Gynecology*. 2011;38(2):159-161.
56. Dodd J, Dare MR, Middleton P. Treatment for women with postpartum iron deficiency anaemia. *Cochrane Database of Systematic Reviews*. 2004(4):CD004222.
57. Hamm RF, Perelman S, Wang EY, Levine LD, Srinivas SK. Single-unit vs multiple-unit transfusion in hemodynamically stable postpartum anemia: A pragmatic randomized controlled trial. *American Journal of Obstetrics and Gynecology*. 2021;224(1):84 e81-84 e87.
58. ABIM Foundation. Five things physicians and patients should question. Choosing Wisely Web site. <https://www.choosingwisely.org/wp-content/uploads/2015/02/AABB-Choosing-Wisely-List.pdf>. Published 2014. Accessed 2/18/2021.
59. Saxena S, Shulman IA, Johnson C. Effect of blood transfusion on serum iron and transferrin saturation. *Archives of Pathology and Laboratory Medicine*. 1993;117(6):622-624.
60. Milman N. Postpartum anemia II: Prevention and treatment. *Annals of Hematology*. 2012;91(2):143-154.

Placenta Accreta Spectrum: Incidence, Risks, Diagnosis, Counseling and Preparation for Birth

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Key Principles

1. The risk of placenta accreta spectrum (PAS) is highest in women with a history of prior cesarean and current placenta previa; PAS risk increases with each subsequent cesarean.
2. Ultrasound is the preferred tool for diagnosis of PAS.
3. The best outcomes occur with advanced planning for birth in a level III or IV center experienced in the care of women with PAS with a team of surgeons skilled in complex pelvic surgery, a full array of surgical sub-specialty consultants, obstetric anesthesiologists, interventional radiologists and a high-capacity blood bank proficient with massive transfusions.
4. Delivery is advised prior to the onset of labor.
5. ACOG suggests that infants of women with placenta previa with suspected accreta spectrum be delivered between 34 0/7-35 6/7 weeks gestation.
6. Counseling should be offered for those patients with PAS to address emotional concerns and trauma associated with their birth experience to mitigate poor mental health outcomes and increase healing and recovery.

Background

Placenta accreta spectrum (PAS), formerly referred to as morbidly adherent placenta, encompasses the full extent of pathologic adherence of the placenta, including placenta accreta, placenta increta and placenta percreta.¹ Placenta accreta spectrum is classified pathologically by the degree of invasion into the uterine wall. There are three variants of this condition: 1) *accreta*, which denotes the invasion of the placenta into the endometrium; 2) *increta*, where the placenta extends into the myometrium; and 3) *percreta*, where the placenta extends through the myometrium and uterine serosa. The rising incidence of placenta accreta spectrum is due to the rapidly rising numbers of cesareans.¹ The U.S. total cesarean rate peaked in 2009 at 32.9% and has slightly fallen since. In 2019 it was 31.6%.² As 86.2% of all US women with a prior cesarean have had a repeat cesarean, the impact of elevated rates of primary

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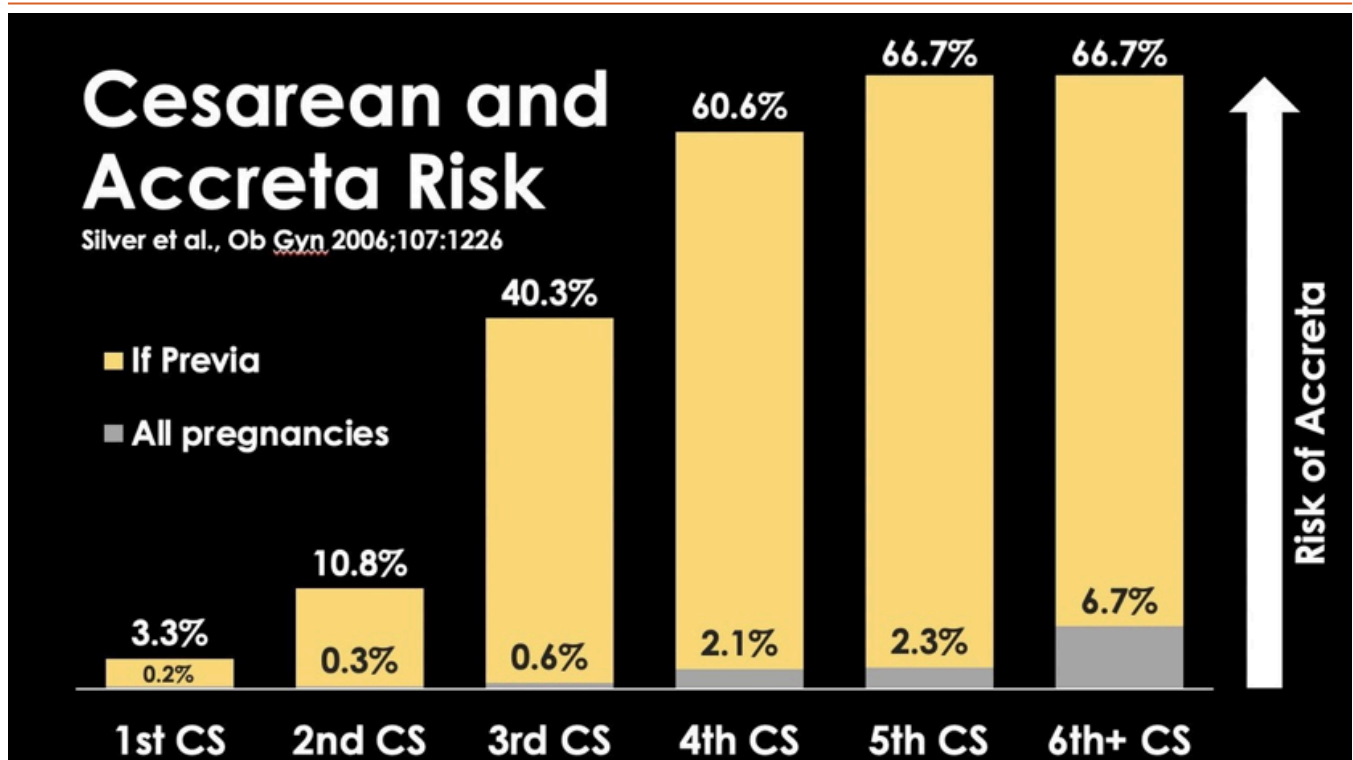
cesarean is enduring and affects subsequent pregnancy outcomes for millions of women.² The total cesarean rate in California had been similar to the US until the recent efforts to lower the first birth nulliparous, term, singleton, vertex (NTSV) cesarean rate in 2016-2019.

The reported rates of PAS have been increasing. In observational studies by the University of Chicago between 1982 and 2002, the overall incidence of placenta accreta was 1 in every 533 deliveries.³ In the most recent study, conducted by the National Inpatient Sample (2016), the investigators found the rate of placenta accreta in the United States was as high as 1 in 272.³ These figures represent “best” estimates that are hampered by varied case definitions, patient sampling and, until recently, a lack of a specific code in the ICD-9 coding system.

Risk

The risk of placenta accreta is highest in patients with both prior cesareans and placenta previa. Placenta previa risk also increases with prior cesareans.⁴ Silver, et al. reported proportionally increased risk of placenta accreta with higher numbers of prior cesareans in women with and without placenta previa. (See Figure 1.)⁵

Figure 1: Cesarean and accreta risk



(Used with Permission from Brett Einerson, MD)

Multiple cesareans and placenta previa are highly associated with PAS. Black women have higher risk of placenta accreta due to high rates and overuse of cesarean by obstetric providers, particularly among first time mothers. The total cesarean rate for Black women has been 5-6 percentage points higher than for women of other races/ethnicities.² Asian and Black women have also been noted to have higher rates of placenta previa than white women, odds ratio of 1.73 and 1.43 respectively.⁶ Lack of access to hospitals that support vaginal birth after cesarean (VBAC) as a birth option is a contributor to repeat cesareans. It is important for birth facilities to monitor rates and policies around cesarean and VBAC, especially for the benefit of Asian and Black women.

Diagnosis

Antenatal diagnosis is critical to successfully manage patients with PAS, as high-risk patients can be referred to level III or IV maternal care centers before the onset of labor or bleeding. This was further reinforced in a recent joint consensus statement by American College of Obstetrics and Gynecology (ACOG) and Society for Maternal Fetal Medicine (SMFM) (2018), recommending “whenever possible, to refer women with clinical risk factors for placenta accreta spectrum to centers with experience and expertise in imaging and diagnosis of the condition.”¹

Carefully performed obstetric ultrasound can detect the presence of accreta (with some series reporting sensitivity as high as 80-90%),

can predict the likely absence of accreta (95% specificity), and is largely regarded as the primary modality for diagnosis.⁷⁻¹⁰ Furthermore, ultrasound has been utilized to estimate the extent of placental invasion.¹¹ It is important to remember that some series suggest significantly lower ultrasound detection rates for PAS with the lowest sensitivity in cases with lesser degrees of myometrial involvement (placenta accreta) compared to higher degrees of myometrial invasion (placenta increta or percreta). Investigators at one center, for example, describe 55 placental pathology evaluations from patients who were referred antenatally to the placental disorders program with confirmed accreta, increta or percreta (of whom 89% required hysterectomy for definitive treatment). Of these cases, 74.5% overall were suspected to have PAS with antenatal ultrasound; however, of placenta accreta cases, only 47% were suspected, compared to 82% of increta cases and 100% of percreta cases.¹² Although ultrasound evaluation is important, the absence of ultrasound findings does not preclude a diagnosis of placenta accreta spectrum; thus, clinical risk factors remain equally important as predictors of placenta accreta spectrum and all institutions attending births need to be prepared for a case of unexpected placenta accreta spectrum. Multiple repeat cesarean sections are known to be more technically difficult with unanticipated complications such as undiagnosed placenta accreta spectrum and multiple adhesions which can lead to excess hemorrhage. Therefore, specific facility preparations are advised, including ready availability of expertise, additional surgeons, specialized surgical instruments, and blood resources.

Magnetic resonance imaging (MRI) has also been used in the antenatal evaluation of PAS. It should be noted that MRI is more expensive than ultrasound and requires specialized

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expertise and experience in interpretation for PAS which is not widely available; thus, the reported accuracy from small case series may not be generalizable. The accuracy of MRI for the prediction of placenta accreta^{13,14} spectrum has been reported to be reasonably good, with a systematic review reporting sensitivity of 75-100% and specificities of 65-100%.¹⁴ Another meta-analysis demonstrated somewhat lower sensitivities and specificities for MRI detection of placenta accreta.⁷ However, it is likely that awareness of clinical risk factors and selection bias in cases referred for MRI are significantly more likely to have PAS, which enhances the reported accuracy of MRI. One early study suggests that high-resolution sonography and MRI may be complimentary when one modality is inconclusive, however a more recent study of 78 patients found that MRI incorrectly changed the ultrasound diagnosis in 17% of cases and incorrectly confirmed an ultrasound diagnosis of PAS in 21% of cases.^{13,15} Further, MRI was not likely to change the diagnosis in cases of posterior or lateral placenta implantation, nor did its accuracy improve over time with increased experience and case volume.¹³ In summary, given the lack of robust data regarding its role, MRI cannot be recommended routinely as an adjunct to ultrasound for the diagnosis of PAS.

Counseling

Providers caring for patients with prenatally suspected or diagnosed PAS should counsel patients extensively about potential risks and complications as early as possible in pregnancy. Patients with accreta are at increased risk for hemorrhage, blood transfusion, bladder/ureteral damage, infection, intubation, prolonged hospitalization, ICU admission, reoperation, thromboembolic events and death.^{4,11,14,15} Discussions should involve relative likelihood for hysterectomy and subsequent infertility. It is also important for providers to be aware of

mental health support needs for their patients with PAS. (See Section: Communicating with and Supporting Women, Birthing People, and Families After an Obstetric Hemorrhage on page 146.)

Women with PAS may experience significant mental health issues that may or may not improve at the same rate as their physical recovery. A 2021 study about the impact of PAS on quality of life found that women who experienced complications from PAS had improved physical health 24-36 months after birth, yet low mental health scores persisted. Low mental health scores did not correlate with an antenatal diagnosis of PAS, clinical severity, or outcomes. Because those who have experienced PAS are a vulnerable population, it is important to provide ongoing mental health support.¹⁶

Birth timing and location

Timing of birth must balance maternal risks and benefits with risks to the neonate. In patients with high suspicion for PAS, it is strongly advised to perform the cesarean before labor begins or hemorrhaging occurs.¹¹ In the case of a stable placenta previa/accreta, a decision analysis demonstrated optimized outcomes with birth at 34 weeks gestation without amniocentesis for both mother and fetus.¹⁷ Amniocentesis to assess fetal lung maturity is not warranted as the result is unlikely to change clinical management at this gestational age.^{18,19} The ACOG and SMFM suggest that patients with placenta previa and suspected accreta be delivered between 34 0/7-35 6/7 weeks gestation, in the absence of

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“extenuating circumstances.”^{18,19} Several factors increase the risk for unscheduled delivery among patients with suspected PAS diagnosis, including vaginal bleeding, uterine contractions, or preterm premature rupture of membranes (PPROM), and may result in a recommendation for an earlier delivery. In the absence of a supervening clinical indication, consideration should be given to performing the cesarean electively and prematurely, ideally preceded by administration of antenatal corticosteroids. For women with even minor recurrent bleeding episodes, consideration for an earlier delivery may be indicated to optimize available resources and to avoid the risk of massive antenatal hemorrhage.

If the patient lives at a distance from a facility that can safely manage a PAS complication, she may need to temporarily relocate sometimes weeks or months prior to the birth. Consider involving a case management or social work team to coordinate this planning. Additionally, the patient may present to their local hospital with active bleeding and may not be able to access the ideal level of care location. The obstetrician managing care of patients who do not live close to a high-level hospital should coordinate with the nearest hospital to the patient to ensure the perinatal unit is aware of the high-risk patient in their community. Together, the care teams should develop an emergency response plan in the event that the patient arrives at the local hospital and is unable to be transferred. (See Section: Hemorrhage Preparedness Considerations for Small and Low-Resource Hospitals on page 83.)

Birth preparations

When the diagnosis of PAS is strongly suspected, the birth should occur in maternity centers with highly experienced, coordinated care teams and the ability to call on additional expertise and resources in cases of severe hemorrhage (level III or IV). PAS births conducted in higher level centers appear to improve outcomes.²¹ An essential first step is advance planning

with anesthesia, blood bank, nursing (OB/OR), intensivists and experienced pelvic surgeons, such as gynecologic oncologists or experienced pelvic surgeons familiar with the operative management of complex pelvic surgeries. Packed red blood cells (PRBCs), fresh frozen plasma (FFP), cryoprecipitate and platelets should be available.^{18,19} Cell saver technology is more frequently used in the planned intraoperative setting and should be incorporated into birth planning discussions with the patient. Blood salvage equipment should also be considered and planned for where available.²² Obstetric leaders should have a process in place coordinated with blood bank, anesthesia, and transfusion teams to ensure availability and use of cell savers and their appropriate use in the care of patients diagnosed with PAS. (See Section: Obstetric Hemorrhage Risk Factor Assessment on page 30 and Appendix B: Obstetric Hemorrhage Care Guidelines: Checklist Format on page 187.)

At the time of cesarean, it is strongly advised that the hysterotomy be made away from the location of the placenta—without disturbance of the placenta.^{11,18} Leaving the placenta in situ or delayed interval hysterectomy has been recently reviewed with many complications noted (e.g., infection, delayed hemorrhage, re-operation requiring hysterectomy, disseminated intravascular coagulation). This option should be considered only in the most select situations with extensive shared decision making with the patient and family and ideally in coordination with level III/IV maternal care centers.²³⁻²⁵

The use of adjunct interventional radiologic procedures, such as prophylactic intravascular balloon catheters or arterial embolization, for cesarean hysterectomy for PAS remains controversial.²³ A recent review of trials of distally located prophylactic balloon catheters (hypogastric artery) did not demonstrate consistent benefit when matched to appropriate

controls. In addition, there have been documented cases of harm.²⁶ Placement in more proximal locations (i.e., common iliacs or aorta) have yielded some positive finding internationally but have not been validated in the U.S. Pelvic arterial embolization has also been used prior to hysterectomy, yet its effectiveness and safety is still subject to debate.^{23,27,28} (See Section: Uterine Artery Occlusion and Embolization on page 143.)

Recommendations

Screen

1. Screen all women with prior cesareans for PAS.⁴
2. Screen all women with placenta previa for any history of uterine surgery (cesarean, myomectomies, uterine perforations, etc.).
3. Ultrasound is the preferred modality for screening for the initial evaluation of possible PAS. The role of MRI for the evaluation of PAS remains uncertain.
4. If results of imaging suggest PAS or are inconclusive, consider evaluation in a level III/IV center.²⁴

Counsel

1. Counsel all patients with PAS about cesarean risks, complications and future infertility if hysterectomy is performed.⁴
2. Counsel patients and their families with placenta previa and prior cesarean section without suspected PAS that a residual risk still remains for hysterectomy due to undiagnosed PAS or recalcitrant lower uterine segment atony.⁴

Prepare

1. Prepare a multi-disciplinary approach for the birth, including a plan for emergent surgery prior to scheduled cesarean.
 - a. Planning should include a team of surgeons skilled in complex pelvic surgery, labor and delivery nurses, OR personnel, neonatologists, interventional radiologists, and a high-capacity blood bank proficient with massive transfusions.
 - b. If experienced surgical personnel or ancillary services are not available, consider transfer to a level III/IV center.
 - c. Blood salvage equipment should also be considered and planned for where available. Obstetric leaders should have a process in place coordinated with blood bank, anesthesia, and transfusion teams to ensure the availability and use of cell savers and their appropriate use in the care of patients diagnosed with PAS.
 - d. Educate and consent the patient for possible hysterectomy.
2. Consider early birth (34-35 6/7 weeks) before the onset of labor and after corticosteroids for fetal benefit have been given unless clinical circumstances warrant earlier delivery.

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3. Consider communication with all involved or potentially involved services (e.g., NICU, trauma surgery, urology, vascular surgery, ICU) prior to cesarean.
4. Notify blood bank of the potential for hemorrhage and verify immediate availability of PRBCs, FFP/plasma, and platelets per hospital massive transfusion protocol (MTP).
5. Perform the cesarean in an operating room (OR) with ready access to all of the resources and staff necessary for the unique needs of patients with PAS. The OR should be large enough to accommodate all the staff and supplies needed. In some hospitals, this may mean the cesarean will need to take place in a main OR rather than one on the labor ward.
6. Mobilize surgeon(s) with advanced skills for controlling heavy pelvic bleeding and repairing bladder or ureteral injury.
7. The Task Force was divided on the desirability for pre-placement of internal iliac artery balloon catheters with a recent large case control study showing no benefit.²⁶ More research is needed in this area.
8. Any attempts to remove the placenta should be avoided when PAS is diagnosed antenatally or is clearly evident at the time of cesarean. Removing the placenta can result in massive blood loss prior to initiation of the hysterectomy.

EVIDENCE GRADING

LEVEL OF EVIDENCE: B

References

1. ACOG; SMFM; Cahill AG, Beigi R, Heine RP, Silver RM, Wax JR. Placenta accreta spectrum. American College of Obstetricians and Gynecologists, Society for Maternal Fetal Medicine. American Journal of Obstetrics and Gynecology. 2018;219(6):B2-B16.
2. Martin JA, Hamilton BE, Osterman MJK, Driscoll AK. Births: Final Data for 2018. National Vital Statistics Reports. 2019;68(13):1-47.
3. Higgins MF, Monteith C, Foley M, O'Herlihy C. Real increasing incidence of hysterectomy for placenta accreta following previous caesarean section. European Journal of Obstetrics and Gynecology and Reproductive Biology. 2013;171(1):54-56.
4. Wu S, Kocherginsky M, Hibbard JU. Abnormal placentation: Twenty-year analysis. American Journal of Obstetrics and Gynecology. 2005;192(5):1458-1461.
5. Silver RM, Landon MB, Rouse, DJ, Leveno KJ, et al. NICHD. Maternal morbidity associated with multiple repeat cesarean deliveries. Obstetrics and Gynecology. 2006;107(6):1226-1232.
6. Kim LH, Caughey AB, Laguardia JC, Escobar GJ. Racial and ethnic differences in the prevalence of placenta previa. Journal of Perinatology. 2012;32(4):260-264.
7. Chalubinski KM, Pils S, Klein K, Seemann, R et al. Prenatal sonography can predict degree of placental invasion. Ultrasound Obstetrics and Gynecology. 2013;42(5):518-524.
8. Chou MM, Ho ES, Lee, YH. Prenatal diagnosis of placenta previa accreta by transabdominal color Doppler ultrasound. Ultrasound Obstetrics and Gynecology. 2000;15(1):28-35.
9. Comstock CH, Love JJ Jr, Bronsteen RA, Lee W, et al. Sonographic detection of placenta accreta in the second and third trimesters of pregnancy. American Journal of Obstetrics and Gynecology. 2004;190(4):1135-1140.
10. Dwyer BK, Belogolovkin V, Tran L, Rao A, et al. Prenatal diagnosis of placenta accreta: sonography or magnetic resonance imaging? Journal of Ultrasound in Medicine. 2008;27(9):1275-1281.
11. Meng X, Xie L, Song W. Comparing the diagnostic value of ultrasound and magnetic resonance imaging for placenta

- accreta: a systematic review and meta-analysis. *Ultrasound Medical Biology*. 2013;39(11):1958-1965.
12. Panigrahi AK, Yeaton-Massey A, Bakhtary S, et al. A Standardized Approach for Transfusion Medicine Support in Patients With Morbidly Adherent Placenta. *Anesthesia and Analgesia*. 2017;125(2):603-608.
 13. Einerson BD, Rodriguez CE, Kennedy AM, Woodward PJ, Donnelly MA, Silver RM. Magnetic resonance imaging is often misleading when used as an adjunct to ultrasound in the management of placenta accreta spectrum disorders. *American Journal of Obstetrics and Gynecology*. 2018;218(6):618 e611-618 e617.
 14. Oyelese Y, Smulian JC. Placenta previa, placenta accreta, and vasa previa. *Obstetrics and Gynecology*. 2006;107(4):927-941.
 15. Warshak CR, Eskander R, Hull AD, Scioscia AL, et al. Accuracy of ultrasonography and magnetic resonance imaging in the diagnosis of placenta accreta. *Obstetrics and Gynecology*. 2006;108(3 Pt 1):573-581.
 16. Bartels HC, Terlizzi K, Cooney N, et al. Quality of life and sexual function after a pregnancy complicated by placenta accreta spectrum. *Australian and New Zealand Journal of Obstetrics and Gynaecology*. 2021.
 17. Bowman ZS, Manuck TA, Eller AG, Simons M, Silver RM. Risk factors for unscheduled delivery in patients with placenta accreta. *American Journal of Obstetrics and Gynecology*. 2014;210(3):241 e241-246.
 18. ACOG. Standardization of practice to improve outcomes. Committee Opinion No. 526 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology*. 2012;119(5):1081-1082.
 19. Shainker SA, Coleman B, Timor-Tritsch IE, et al. Special Report of the Society for Maternal-Fetal Medicine Placenta Accreta Spectrum Ultrasound Marker Task Force: Consensus on definition of markers and approach to the ultrasound examination in pregnancies at risk for placenta accreta spectrum. *American Journal of Obstetrics and Gynecology*. 2021;224(1):B2-B14.
 20. O'Brien JM, Barton JR, Donaldson ES. The management of placenta percreta: Conservative and operative strategies. *American Journal of Obstetrics and Gynecology*. 1996;175(6):1632-1638.
 21. ACOG. Levels of maternal care. *Obstetric Care Consensus No. 2 of the American College of Obstetricians and Gynecologists*. *Obstetrics and Gynecology*. 2015;125(2):502-515.
 22. Fitzpatrick, KES, S.; Spark, P.; Kurinczuk, J. J.; Brocklehurst, P.; Knight, M. The management and outcomes of placenta accreta, increta, and percreta in the UK: A population-based descriptive study. *BJOG: British Journal of Obstetrics and Gynecology*. 2014;121(1):62-70; discussion 70-61
 23. Timmermans S, van Hof AC, Duvekot JJ. Conservative management of abnormally invasive placentation. *Obstetrical & Gynecological Survey*. 2007;62(8):529-539.
 24. ACOG; SMFM; Menard MK, Kilpatrick S, Saade G, Hollier LM, et al. Levels of maternal care. American College of Obstetricians and Gynecologists, Society for Maternal Fetal Medicine. *American Journal of Obstetrics and Gynecology*. 2015;212(3):259-271.
 25. Sentilhes L, Kayem G, Silver RM. Conservative management of placenta accreta spectrum. *Clinical Obstetrics and Gynecology*. 2018;61(4):783-794.
 26. Dilauro MD, Dilauro S, Athreya, S. Prophylactic balloon occlusion of internal iliac arteries in women with placenta accreta: Literature review and analysis. *Clinical Radiology*. 2012;67(6):515-520.
 27. Poujade O, Ceccaldi PF, Davitian C, Amate P, et al. Uterine necrosis following pelvic arterial embolization for post-partum hemorrhage: Review of the literature. *Eur Journal of Obstetrics and Gynecology Reprod Biol*. 2013;170(2):309-314.
 28. Shrivastava V, Nageotte M, Major C, Haydon M, Wing, D. Case-control comparison of cesarean hysterectomy with and without prophylactic placement of intravascular balloon catheters for placenta accreta. *American Journal of Obstetrics and Gynecology*. 2007;197(4):402.e401-405.

Inherited Bleeding Disorders in Pregnancy

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Key Principles

1. Inherited bleeding disorders place women at risk for obstetric hemorrhage.
2. It is crucial to identify women with inherited coagulation disorders early in care and to plan in advance for supporting their safety at birth.
3. Maternal-fetal medicine, hematology and anesthesia consultation should be obtained well in advance of delivery to coordinate antepartum, intrapartum and postpartum care for women with inherited coagulation disorders.

Background

The coagulation process is a complex biochemical chain reaction involving several pathways and proteins. Genetic abnormalities in any of these proteins can lead to serious coagulation problems. Although relatively rare in pregnant women, such abnormalities can lead to maternal hemorrhage events during antepartum, birth or postpartum and can have deleterious effects on the health of both the mother and baby. Defects may often be identified through repeated bleeding episodes or family history.¹⁻¹⁰ Identifying patients with inherited coagulation disorders and carefully planning their care is crucial for optimal outcomes. Although postpartum hemorrhage can occur in these patients, routine screening will not identify a large number of these rare cases.¹¹⁻¹⁵

The most commonly identified coagulation disorders are von Willebrand disease (factor VIII platelet adhesion and coagulant deficiency), hemophilia A (factor VIII coagulant deficiency), hemophilia B (factor IX deficiency), and hemophilia C (factor XI deficiency). Basic knowledge of these disorders will help to better understand the management recommendations

below. In addition, less common disorders such as factor XIII deficiency, congenital fibrinogen deficiency, and dysfibrinogenemia can be diagnosed and successfully managed in pregnancy.^{16,17}

Von Willebrand disease (vWD) is the most common hereditary coagulation abnormality described in humans with a prevalence of 1% in the general population.^{1,18,19} It occurs less frequently as an acquired disorder (acquired von Willebrand Syndrome) manifested by the presence of auto-antibodies. Von Willebrand disease is caused by a deficiency of the plasma protein that controls platelet adhesion (VIII:vWF) and decreased activity of the protein that stabilizes blood coagulation (VIII:C). The disorder can cause mucous membrane and skin bleeding symptoms, bleeding with vaginal birth and surgical events or other hemostatic challenges. Women of childbearing age may be disproportionately symptomatic compared with other age groups.

Several types of vWD have been described.²⁰ Individuals with Type 1 make up 60-80% of

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all vWD cases and have a quantitative defect (heterozygous for the defective gene) but may not have clearly impaired clotting function.²¹ Decreased levels of vWF are detected in these patients, (10-45% of normal, i.e. ,10-45 IU). Most patients lead nearly normal lives without significant bleeding episodes. Patients may experience bleeding following surgery (including dental procedures), noticeable easy bruising, or menorrhagia (heavy menstrual bleeding).

Individuals with Type 2 vWD make up < 20-30% of all vWD cases and have a qualitative defect. The tendency to bleed varies between individuals. Individuals with Types 1 and 2 are usually mildly affected by vWD and pass the trait in an autosomal dominant fashion.

Type 3 vWD (1-5%) is the most severe form; it is autosomal recessive and severely affected individuals are homozygous for the defective gene. Individuals with Type 3 have severe mucosal bleeding, no detectable vWF antigen, and may have sufficiently low factor VIII. They can have occasional hemarthroses (joint bleeding), as in cases of mild hemophilia. Most vWD is diagnosed in women with a positive family history or menorrhagia. Blood testing for vWF activity provides confirmation of diagnosis and help aid management, taking into account there is a normal increase in vWF levels during pregnancy.²²

Hemophilia A (factor VIII coagulant deficiency) is a blood clotting disorder caused by a mutation of the factor VIII gene, which leads to factor VIII deficiency. Inheritance is X-linked recessive; hence, males are affected while females are carriers or very rarely display a mild phenotype. It is the most common hemophilia, occurring in 1 in 5000 males. Women can, on rare occasion, exhibit a homozygous state if both parents carry the disorder. More frequently, carriers show atypical performance of “Lyonization” of the X chromosome, meaning they exhibit random

inactivation of the X chromosome. Women usually have 50% activity but if inactivation of the “normal” gene occurs in greater frequency, lower levels can be seen.²³ Of note, factor VIII activity usually increases during pregnancy.²⁴

Hemophilia B (factor IX deficiency) is a blood clotting disorder caused by a mutation of the Factor IX gene, also carried on the X-chromosome. It is a less commonly seen form of hemophilia (sometimes called “Christmas Disease,” after the first afflicted patient), occurring in about 1 in 30,000 males and very rarely in females. Diagnosis can be made by measuring levels of IX activity in the blood, which does not usually change during pregnancy.

Hemophilia C (factor XI deficiency) is a rare condition in the general population (occurring in less than 1 in 100,000 individuals) but more common in the Ashkenazi Jewish population. It can occur in both males and females.^{7,25} Up to 8% of these individuals are carriers (autosomal recessive) of the gene, which is located on Chromosome 4. Treatment is not usually necessary because patients have approximately 20-60% factor XI activity; however, they should be followed closely since the postpartum hemorrhage rate is 20%. Factor XI doesn’t show any significant change during pregnancy.²⁶

Congenital factor XIII deficiency is a rare autosomal recessive disorder which when identified can be successfully followed and treated in pregnancy with replacement factor.¹⁷ Patients with congenital fibrinogen deficiency will require monitoring of fibrinogen levels and replacement of fibrinogen with targets of > 50-100 mg/dL in the antepartum, intrapartum and postpartum periods.²⁷ Those with inherited dysfibrinogenemia require similar replacement of fibrinogen to maintain levels > 100 mg/dL and should be given anticoagulation to balance the risk between bleeding and clotting.¹⁶

Diagnosis in pregnancy of any of these coagulation disorders may be difficult due to the variability of clotting factor activity caused by hormonal changes of pregnancy.²⁸ When a patient with an inherited coagulation disorder delivers, extra-uterine bleeding and hematomas and the effect of the disorder on the fetus are significant concerns. Cesarean birth is rarely recommended.^{5,9,29} Autoimmune acquisition of these disorders has been described and therefore may occur despite the lack of familial history.

Recommendations

1. Review family, surgical and pregnancy history for possible clinical symptoms of excessive bleeding following surgery (including dental procedures), noticeable easy bruising, joint hemorrhage, or menorrhagia (heavy menstrual bleeding).
2. Request the following laboratory screening tests^{20,23} for patients with suspected disorders:
 - ▶ vWD: measurement of ristocetin co-factor activity and von Willebrand antigen (VIII:Ag) activity
 - ▶ Hemophilia A: measurement of factor VIII activity (factor VIII:C assay)
 - ▶ Hemophilia B: measurement of factor IX activity (If factor VIII:C is normal)
 - ▶ Hemophilia C: measurement of factor XI activity

Additional laboratory tests to consider are complete blood count (especially platelet counts), activated partial thromboplastin time (APTT), prothrombin time, thrombin time and fibrinogen level. Note that patients with vWD typically display normal prothrombin time and variable prolongation of partial thromboplastin.

3. Affected patients or carriers, or patients with suspected history should consult with a hematologist who has specific interest and knowledge of coagulation disorders.^{5,9}
4. Obtain perinatal and anesthesia consultation for planning and coordination of antepartum and intrapartum management of patients with bleeding disorders.^{5,9,30} In general, regional anesthesia must be given with caution given the risks of spinal hematoma. Individualized decisions should be made in a multidisciplinary fashion. Current guidelines do not suggest the use of ROTational ThromboElastoMetry (ROTEM) or ThromboElastoGraphy (TEG) in decision-making for the use of regional anesthesia.³¹
5. Route of delivery for most patients with carrier status, which may cause neonatal coagulation disorders (e.g., factor VIII deficiency), should still be based on obstetric indications since studies have not shown a protective effect of cesarean for the neonate.^{2,3}
6. Refer patients for genetic counseling regarding possible testing and evaluation of the fetus and newborn if genetic etiology is suspected.^{5,9,29}
7. Develop intrapartum and postpartum management plans well in advance of the anticipated date of birth so specific medications and blood components are available at the time of delivery and given in consultation with a hematologist.^{5,9} (See Section: Obstetric Hemorrhage Risk Factor Assessment on page 30.)
 - ▶ vWD: Mild forms are often treated with desmopressin acetate (DDAVP) and more severe forms require vWF and VIII factor replacement.³ To identify whether patients will respond to DDAVP, perform a DDAVP challenge test.

READINESS

- ▶ Hemophilia A/B: Concentrates of clotting factor VIII (for hemophilia A) or clotting factor IX (for hemophilia B) are slowly infused or injected into a vein. Consider DDAVP adjunctive therapy.
- ▶ Hemophilia C: Fresh frozen plasma (FFP) is the first product used to treat patients with hemophilia C. The main advantage of FFP/plasma is its availability. Disadvantages of its use include the large volumes required, the potential for transmission of infective agents and the possibility of allergic reactions.
- ▶ Factor XI activity: Factor XI concentrates provide the best source for factor XI replacement.

EVIDENCE GRADING

LEVEL OF EVIDENCE: C

References

1. Demers C, Derzko C, David M, Douglas, J. Gynaecological and obstetric management of women with inherited bleeding disorders. Society of Obstetricians and Gynaecologists of Canada. 2006;95(1):75-87.
2. Gojnic M, Fazlagic A, Likie I, Stefanovic A, et al. New approach of the treatment of von Willebrand's disease during pregnancy. Archives of Gynecology and Obstetrics. 2005;273(1):35-38.
3. Michiels JJ, van Vliet HH, Berneman Z, Gadisseur A, et al. Intravenous DDAVP and factor VII-von Willebrand factor concentrate for the treatment and prophylaxis of bleeding in patients with von Willebrand disease type 1, 2 and 3. Clinical and Applied Thrombosis and Hemostasis. 2007;13(1):14-34.
4. Dhar P, Abramovitz S, DiMichele D, Gibb CB, Gadalla F. Management of pregnancy in a patient with severe haemophilia. Anaesthesia. 2003;91(3):432-435.
5. Lee CA, Chi C, Pavord SR, Bolton-Maggs PH, Pollard D, et al. U. K. Haemophilia Centre Doctors' Organization. The obstetric and gynaecological management of women with inherited bleeding disorders—review with guidelines produced by a taskforce of UK Haemophilia Centre Doctors' Organization. Haemophilia. 2006;12(4):301-336.
6. Nichols WL, Hultin MB, James AH, Manco-Johnson MJ, et al. von Willebrand disease (VWD): Evidence-based diagnosis and management guidelines, the National Heart, Lung, and Blood Institute (NHLBI) Expert Panel report (USA). Haemophilia. 2008;14(2):171-232.
7. Siegel JE. Factor XI Deficiency treatment and management. Medscape. 2019.
8. National Heart Lung and Blood Institute. Bleeding disorders. <https://www.nhlbi.nih.gov/health-topics/bleeding-disorders>. Published 2019. Accessed 3/12/2021.
9. Dunkley SM, Russell SJ, Rowell JA, et al. A consensus statement on the management of pregnancy and delivery in women who are carriers of or have bleeding disorders. The Medical journal of Australia. 2009;191(8):460-463.
10. Chi C, Kadir RA. Inherited bleeding disorders in pregnancy. Best Practice and Research: Clinical Obstetrics and Gynaecology. 2012;26(1):103-117.
11. Clark P, Greer, I. Practical Obstetric Hematology. Taylor and Francis Abington, Oxon. 2006.
12. Kadir RA, Kingman CE, Chi C, Lee CA, Economides, DL. Is primary postpartum haemorrhage a good predictor of inherited bleeding disorders? Haemophilia. 2007;13(2):178-181.
13. James AH, Konkle BA, Kouides P, et al. Postpartum von Willebrand factor levels in women with and without von Willebrand disease and implications for prophylaxis. Haemophilia. 2015;21(1):81-87.
14. Leebeek FWG, Atiq F. How I manage severe von Willebrand disease. British Journal of Haematology. 2019;187(4):418-430.
15. Castaman G, James PD. Pregnancy and delivery in women with von Willebrand disease. European Journal of Haematology. 2019;103(2):73-79.
16. Munoz J, Schering J, Lambing A, Neal S, et al. The dilemma of inherited dysfibrinogenemia during pregnancy. Blood Coagulation Fibrinolysis. 2012;23(8):775-777.
17. Schroeder V, Kohler HP. New developments in the area of factor XIII. Journal of Thrombosis and Haemostasis. 2013;11(2):234-244.

18. James AH. Von Willebrand disease. *Obstetrical & Gynecological Survey*. 2006;61(2):136-145.
19. Kouides P. Current understanding of Von Willebrand's disease in women - some answers, more questions. *Haemophilia*. 2006;12(Supplement 3):143-151.
20. Sadler JE. A revised classification of von Willebrand disease. For the Subcommittee on von Willebrand Factor of the Scientific and Standardization Committee of the International Society on Thrombosis and Haemostasis. *Thrombosis and Haemostasis*. 1994;71(4):520-525.
21. Goodeve A, James P. 2009 Jun 4 [Updated 2017 Oct 5]. In: Adam MP AH, Pagon RA, et al., editors. GeneReviews® [Internet]. Seattle (WA): University of Washington, Seattle; 1993-2021. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK7014/>. von Willebrand Disease. In: Adam M, Ardinger H, Pagon R, et al., eds. GeneReviews® Seattle, WA: University of Washington, Seattle; 2017.
22. ACOG. von Willebrand disease in women. Committee Opinion No. 580 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology*. 2013;122(6):1368-1373.
23. Verbruggen B, Meijer P, Novakova I, Van Heerde, W. Diagnosis of factor VIII deficiency. *Haemophilia*. 2008;14 Suppl 3:76-82.
24. Chi C, Lee CA, Shiltagh N, Khan A, Pollard D, Kadir RA. Pregnancy in carriers of haemophilia. *Haemophilia*. 2008;14(1):56-64.
25. Kadir RA, Kingman CE, Chi C, O'Connell N, et al. Screening for factor XI deficiency amongst pregnant women of Ashkenazi Jewish origin. *Haemophilia*. 2006;12(6):625-628.
26. Gerber GF, Klute KA, Chapin J, Bussel J, DeSancho MT. Peri- and postpartum management of patients with Factor XI deficiency. *Clinical and Applied Thrombosis and Hemostasis*. 2019;25:1076029619880262.
27. Peyvandi F. Epidemiology and treatment of congenital fibrinogen deficiency. *Thrombosis Research*. 2012;130 Suppl 2:S7-11.
28. Franchini M. Haemostasis and pregnancy. *Thrombosis and Haemostasis*. 2006;95(3):401-413.
29. Tarantino MD, Gupta SL, Brusky RM. The incidence and outcome of intracranial haemorrhage in newborns with haemophilia: Analysis of the Nationwide Inpatient Sample database. *Haemophilia*. 2007;13(4):380-382.
30. Katz D, Beilin Y. Disorders of coagulation in pregnancy. *British Journal of Anaesthesia*. 2015;115 Suppl 2:ii75-88.
31. Bauer ME, Arendt K, Beilin Y, et al. The Society for Obstetric Anesthesia and Perinatology Interdisciplinary Consensus Statement on Neuraxial Procedures in Obstetric Patients With Thrombocytopenia. *Anesthesia and Analgesia*. 2021.

Planning for Patients Who May Decline Blood and Blood Products

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Key Principles

1. It is important to assess the patient's attitudes toward blood products well in advance of labor or planned surgery. This discussion should be incorporated into all standard anticipatory guidance and birth planning, ideally at the initiation of prenatal care to facilitate care coordination and prepare for alternative interventions if blood products are not desired.
2. Prenatal optimization of hemoglobin and developing a detailed management plan for birth and postpartum are critical steps for patients who may decline transfusion of some or all blood products. (See Section: Management of Iron Deficiency Anemia on page 41.)

Background

While transfusion of blood products is an important tool in the management of obstetric hemorrhages, providers may also encounter patients that decline blood products. A patient that chooses to forego blood transfusions may do so for religious reasons, as may be the case for those of the Jehovah's Witness faith, or because of other personal beliefs or preferences. In order to effectively prepare and plan for patients who decline the use of blood products, discussions regarding alternatives should occur in advance of emergencies. There are options for those who do not want whole blood, such as cryoprecipitate, albumin, and/or erythropoetin.¹ In addition to considering these non-whole blood products, efforts should be focused on prenatal hemoglobin optimization, inpatient hemorrhage prevention, and aggressive medical/surgical treatment of hemorrhage instead of relying mainly on blood substitutes.

In order to optimize hemoglobin and coordinate care in advance of birth, patients need to be asked about their attitude towards blood transfusions in the prenatal care setting. The Task Force recommends an optimal hemoglobin level of > 12.0 gm/dL for a patient who refuses blood or blood products in order to buffer blood loss at birth. As noted in the Toolkit section on Management of Iron Deficiency Anemia, it may take 4-6 months to replete iron stores and normalize serum ferritin. Therefore, early identification of prenatal anemia is important, and those who refuse blood products may need iron supplementation even if their hemoglobin is within normal limits. As such, transfusion preferences should be ascertained early enough (e.g., in the second trimester) to provide time to

READINESS

optimize hemoglobin ahead of birth. Additionally, if the patient will accept some blood products, advance notice can allow for coordination with blood bank to ensure availability if the patient has a scheduled cesarean, induction or any other procedure.

Acknowledging and honoring patient preferences is an important part of providing respectful care and respecting patient autonomy. Reasons for declining transfusions can vary, and may include religious beliefs (e.g., Jehovah's Witnesses), safety concerns, previous transfusions reactions, or simply preferences. In some instances, patients may want to avoid transfusion, if possible, but may be open to the possibility under specific circumstances. It is important to take the time to thoroughly discuss preferences, answer questions and develop a plan based on shared decision-making in which patient preferences are respected, and their choices are made based on informed consent. Facilitating an open dialogue about the options they are comfortable with will lead to improved outcomes and better provider-patient relationships.

Providers obtaining consent from patients should be clear about the risks involved in refusing a transfusion, including death or permanent injury, and that some interventions, like a hysterectomy, may be needed if bleeding cannot be controlled even with alternative interventions. However, these conversations need to be approached with compassion and understanding in the spirit of shared decision-making and patient-centered care, and preferences should be respected without judgment.

The goals of interactions with patients who are declining transfusion are the following:

- ▶ To identify whether there are bloodless alternatives the patient will accept as early as possible
- ▶ To build trust with the patient and their family/support system and establish a shared decision-making model that does not include judgment and/or the assumption the patient does not want her life saved
- ▶ To develop a carefully considered birth plan that minimizes blood loss and supports prompt decisive actions
- ▶ Transfer of patient to a center with the capacity and resources to better manage the desires of the patient, if needed

In response to patient hesitancy about or refusal of blood products, there is a broad movement within hospitals in the United States to develop skills and promote the concepts of “bloodless surgery.” Studies show similar outcomes between surgeries with transfusions vs. bloodless approaches, though many studies focus on cardiac surgeries.²

Strategy for bloodless medicine management^{2,3}

- Medical optimization before anticipated events (e.g., anemia)
(See Section: Management of Iron Deficiency Anemia on page 41.)
- Strategic intraoperative and postoperative management and hemostasis (e.g., fibrin sealants, Tranexamic Acid (TXA) (See Section: Medications for Prevention and Treatment of Postpartum Hemorrhage on page 114.)
- Minimization of other iatrogenic blood loss (e.g., laboratory testing)

Not all blood products are “off the table”

There can be a range of blood interventions that patients will accept, and many may not be aware of alternatives to the traditional packed red blood cell (PRBC) transfusion. Therefore, it is imperative to begin discussions prenatally to educate and review all possible options that are available at the time of birth. (See Appendix H: Checklist for Patients Who May Decline the Use of Blood Products on page 218.)

Autologous blood transfusion

Some patients who initially decline allogenic transfusions may be open to an autologous blood transfusion, which means a transfusion of their own blood back to them. This can be done in two different ways:

- ▶ Preoperative autologous blood donation
- ▶ Intraoperative/perioperative cell salvage (cell saver)

Autologous blood donation may be a good solution for those who refuse allogenic blood transfusions out of concern for safety and infectivity. However, there are some limitations to this approach. A facility may not have a workflow in place to facilitate autologous blood donations. Some patients, such as devout Jehovah’s Witnesses, may not consider the removal and storage of blood to be acceptable within their belief system.⁴ Prenatal blood donation may

also increase the risk of pre-operative anemia that followed the initial donation.⁵ The CMQCC task force on obstetric hemorrhage encourages the optimization of anemia correction over the prioritization of autologous blood donation.

Cell saver technology is more frequently used in the planned intraoperative setting rather than during vaginal delivery or emergency cesareans. Use of a cell saver for intraoperative blood salvage may be considered acceptable by those that would otherwise refuse blood or blood products and should be incorporated into birth planning discussions with the patient. Obstetric leaders should have a process in place coordinated with blood bank, anesthesia, and transfusion teams to ensure availability and use of cell savers for situations where transfusion is not an available option.

Some patients may change their mind about receiving blood and blood products if the situation becomes life-threatening. However, birth planning and care should still prioritize alternatives that are deemed acceptable to the patient. The birthing person should be updated on their status in order to allow them to make informed decisions regarding their care and possible treatment options.

Recommendations

Prenatal Care

1. Engage in a comprehensive discussion using a checklist specifying acceptable interventions, along with clear documentation of patients' wishes. Review the patient's Advance Medical Directive or utilize the Checklist for Patients Who May Decline the use of Blood Products (Appendix H on page 218) for suggested decision points. This can be accomplished via an advance directive, or a building a blood refusal alert into the electronic medical record.
2. Aggressively screen for anemia and optimize hemoglobin prior to birth. Consider aggressively correcting any hemoglobin below 12.0 gm/dL rather than using the general obstetric threshold of 11.0 gm/dL. (See Section: Management of Iron Deficiency Anemia on page 41.)
3. Coordinate with consultants (consider Maternal Fetal Medicine, Hematology, Anesthesiology as referenced in Section: Inherited Bleeding Disorders of Pregnancy on page 59) in advance of expected admission.

Labor and Delivery

1. Notify care team upon admission and review coordinated plan of care. Including (but not limited to): Obstetrics, Anesthesiology, Maternal-Fetal Medicine, Neonatology, ICU, Main OR, Blood Bank, Hematology, etc.
2. Use the risk assessment to plan interventions and availability of resources accordingly. (See Section: Obstetric Hemorrhage Risk Factor Assessment on page 30.) Declining blood transfusion alone *does not* make patients at higher risk of hemorrhage but may increase their risk of morbidity and mortality and influences what treatment options are available.⁶
3. Review previous discussions of options and patient wishes, or have a discussion based on shared decision-making if not done prior to admission. Review their advanced medical directive or blood refusal form with any acceptable alternatives identified.
4. Limit blood draws/laboratory testing when possible (e.g., use low-volume pediatric microtainers).
5. Instead of using a specific hemoglobin level as a prompt for transfusion, identify a hemoglobin level that will prompt medical management or other alternative interventions.⁷
6. Consider earlier utilization of uterotonics or other interventions (e.g., TXA, intraoperative fibrin glues).
7. When surgical intervention is necessary, select minimally invasive procedures when possible. Consider bloodless management strategies like use of cell saver if given the opportunity, though this may not be available in an urgent/emergent cesarean setting.⁶

Postpartum

1. Maintain volume with crystalloids.
2. Aggressively treat anemia. (See Section: Management of Iron Deficiency Anemia on page 41.)
3. Limit blood draws/laboratory testing when possible.
4. Continue close monitoring of postpartum bleeding and vital signs to assess for other intervention needs.
5. Communicate transfusion preferences in each patient hand-off, as well as need for increased surveillance of potential hemorrhage or anemia.
6. Ensure the patient's primary care provider or obstetrician is aware of the patient's preferences and clinical course in order to closely monitor for anemia when indicated. If possible, consider a warm handoff between providers in person where the patient and family can be included in the conversation.
7. Educate the patient on warning signs that should prompt concern and medical re-evaluation. (See Appendix I: Discharge Planning for Women with Hemorrhage During the Birth Hospital Stay on page 220.)

Educational tools and sample resources

[Checklist for Management of Pregnant Patients Who Decline Transfusions \(Appendix H on page 218\)](#)

[ACOG Guidance Document: Patients Who Decline Blood Products](#)

[Jehovah's Witnesses: Medical Information for Clinicians](#)

EVIDENCE GRADING

LEVEL OF EVIDENCE: C

References

1. Jahr JS, Guinn NR, Lowery DR, Shore-Lesserson L, Shander A. Blood substitutes and oxygen therapeutics: A review. *Anesthesia and Analgesia*. 2021;132(1):119-129.
2. Resar LM, Wick EC, Almasri TN, Dackiw EA, Ness PM, Frank SM. Bloodless medicine: Current strategies and emerging treatment paradigms. *Transfusion*. 2016;56(10):2637-2647.
3. Scharman CD, Burger D, Shatzel, JJ, Kim E, DeLoughery TG. Treatment of individuals who cannot receive blood products for religious or other reasons. *American Journal of Hematology*. 2017;92(12):1370-1381.
4. Bodnaruk ZM, Wong CJ, Thomas MJ. Meeting the clinical challenge of care for Jehovah's Witnesses. *Transfusion Medicine Review*. 2004;18(2):105-116.
5. Perez A, Bakhtary S, Nedelcu E, Manuel S. Overtransfusion of autologous blood identifies opportunities for improving patient blood management. *Cureus*. 2019;11(3):e4202.
6. Van Wolfswinkel ME, Zwart JJ, Schutte JM, Duvekot JJ, Pel M, Van Roosmalen J. Maternal mortality and serious maternal morbidity in Jehovah's witnesses in The Netherlands. *British Journal of Obstetrics and Gynaecology*. 2009;116(8):1103-1108; discussion 1108-1110.
7. Zeybek B, Childress AM, Kilic GS, Phelps JY, et al. Management of the Jehovah's Witness in obstetrics and gynecology: A comprehensive medical, ethical, and legal approach. *Obstetrical & Gynecological Survey*. 2016;71(8):488-500.

Obstetric Hemorrhage Carts, Kits and Trays

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Key Principles

1. Hemorrhage supply carts centralize supplies needed for the treatment of postpartum hemorrhage (PPH) and can easily be brought to the site of the obstetric emergency.
2. Standardized medication kits save time and can reduce medication errors.
3. Standardized instrument trays streamline emergency surgical procedure preparation.

Background

Obstetric hemorrhage is a common obstetric emergency on labor and delivery units.¹⁻³ A hemorrhage cart centralizes all of the supplies commonly used in the treatment of obstetric hemorrhage, significantly reducing the time needed for supportive staff to locate supplies. Staff are able to stay at the bedside where they are most needed and care of the patient is streamlined.¹

A checklist has been created to outline suggested supplies, instruments and medications to include on a hemorrhage cart or kit. The perinatal quality team should meet to review the recommended checklist and discuss if additional items would be beneficial for inclusion. Consider adding a binder with page protectors for cart content lists, quick reference documents, consent forms, blood bank forms, advanced gynecology surgeons on-call schedule, etc. (See Appendix E: Checklist for Carts, Kits and Trays on page 196.)

Although medical management is often successful in treating PPH, surgery may be needed. For ideal response to the emergency, the team should have rapid access to medications, devices, and surgical instruments designed to treat PPH. Equipment and instruments contained in obstetric hemorrhage carts and trays are designed to perform uterine tamponade, complete uterine/ovarian artery ligation, and repair of vaginal/cervical lacerations. For more in-depth details about the hemorrhage cart, the reader is referred to articles by TF Baskett.^{4,5}

Recommendations

1. Obstetric units should maintain hemorrhage carts containing common treatment supplies for obstetric hemorrhage that are stored in a readily accessible location(s) for rapid access. Each obstetric care unit should have a designated cart (i.e., postpartum and labor and delivery in separate geographical locations).⁶ If there are care areas that are remote from the obstetric units, consider additional carts or trays in those areas or have a process in place for transporting a cart from a central location.

READINESS

2. Develop procedures for restocking carts after use. The cart should be appropriately stocked as to ensure supplies are present and unexpired when needed, but not overstocked hindering its use.
3. Ensure a medication kit containing uterotonic medications and tranexamic acid is available on applicable units such as in a locked refrigerator on the cart or separately in automated dispensing cabinets with refrigeration capability.^{7,8} (See Section: Medications for Prevention and Treatment of Postpartum Hemorrhage on page 114.) High volume sites should evaluate an appropriate par level for hemorrhage medication kits available on the unit.
4. Assemble a sterile tray with instruments used to surgically treat obstetric hemorrhage. These trays should be readily available on labor and delivery units.
5. Make trays for hysterectomy and deep pelvic surgery readily available on labor and delivery units and in the main OR.

EVIDENCE GRADING

LEVEL OF EVIDENCE: C

References

1. Kogutt BK, Will S, Ferrell J, Sheffield JS. 1180: Development of an obstetric hemorrhage response intervention: The postpartum hemorrhage cart. *American Journal of Obstetrics and Gynecology*. 2020;222(1):S725-S726.
2. Main EK, Chang SC, Dhurjati R, Cape V, Profit J, Gould JB. Reduction in racial disparities in severe maternal morbidity from hemorrhage in a large-scale quality improvement collaborative. *American Journal of Obstetrics and Gynecology*. 2020;223(1):123 e121-123 e114.
3. World Health Organization. WHO recommendations for the prevention and treatment of postpartum haemorrhage. Geneva, Switzerland: World Health Organization;2012.
4. Baskett TF. Equipment tray for postpartum hemorrhage. In: *A Textbook of PostPartum Hemorrhage*, C. B-Lynch, et al., eds. Sapiens Publishing 2006.
5. Baskett TF. Surgical management of severe obstetric hemorrhage: Experience with an obstetric hemorrhage equipment tray. *Journal of Obstetrics and Gynaecology Canada*. 2004;26(9):805-808.
6. Main EK, Goffman D, Scavone BM, et al. National Partnership for Maternal Safety Consensus Bundle on Obstetric Hemorrhage. *Journal of Midwifery and Women's Health*. 2015;60(4):458-464.
7. de Guzman R, Polykratis IA, Sondeen JL, Darlington DN, Cap AP, Dubick MA. Stability of tranexamic acid after 12-week storage at temperatures from -20 degrees C to 50 degrees C. *Prehospital Emergency Care: Official Journal of the National Association of EMS Physicians and the National Association of State EMS Directors*. 2013;17(3):394-400.
8. Loner C, Estephan M, Davis H, Cushman JT, Acquisto NM. Effect of fluctuating extreme temperatures on tranexamic acid. *Prehospital Disaster Medicine*. 2019;34(3):340-342.

Obstetric Hemorrhage Simulations and Drills

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Key Principles

1. Multidisciplinary drills improve communication and coordination among team members in emergency situations.
2. Drills assess system weaknesses, identify opportunities for improvement and test new or modified policies and procedures.
3. Access to a simulation center is not required for the development of an effective simulation program. In situ team drills for hemorrhage are particularly useful and allow more participants to engage in drills more frequently.

Background

The use of simulation for team training is a practical approach that gives health care providers an opportunity to develop and maintain the necessary skills to effectively manage patient care in an emergency. Simulation has the potential to decrease maternal and neonatal morbidity and mortality by providing an opportunity to assess system weaknesses, identify opportunities for improvement and test new or modified policies and procedures. Simulation involves the entire team practicing in a realistic environment wherein the focus is not on a live patient but on the team, learners and methods.¹

The Joint Commission has recently developed standards for maternal safety related to

hemorrhage and severe hypertension in pregnancy.² The standards require facilities to conduct drills at least annually to determine system issues as part of ongoing quality improvement efforts. Drills include representation from each discipline identified in the hospital’s hemorrhage response procedure and include a team debrief after the drill. In addition to identifying areas of success and opportunities for improvement of care, these recommendations are applicable to the hospital accreditation process and thus important to facilities that provide obstetric care. (See Section: Implementing and Sustaining Maternal Quality, Safety and Performance Improvement for Obstetric Hemorrhage on page 20.)

TeamSTEPPS® is an evidence-based framework to enhance team performance across the health care system^{3,4}

Key principles

Team structure: Identification of the components of system where multiple disciplines must work together effectively to ensure patient safety

Communication: Structured process by which information is clearly and accurately exchanged among team members

Leadership: Ability to maximize the activities of team members by ensuring that collective actions are understood, changes in information are shared and the necessary resources are available

Situation monitoring: Process of actively scanning and assessing situational elements to gain information or understanding, or to maintain awareness to support team functioning

Mutual support: Ability to anticipate and support team members’ needs through accurate knowledge about their responsibilities and workload

TeamSTEPPS® provides higher quality, safer patient care by⁴:

- ▶ Producing highly effective medical teams that optimize the use of information, people and resources to achieve the best clinical outcomes for patients
- ▶ Increasing team awareness and clarifying team roles and responsibilities
- ▶ Resolving conflicts and improving information sharing
- ▶ Eliminating barriers to quality and safety
- ▶ Practicing worst case scenarios
- ▶ Establishing back up plans and behavior
- ▶ Monitoring performance and providing feedback³

Prior to conducting simulations or drills, consider conducting a gap analysis to identify specific education needs. This can be done by evaluating previous simulations, reviewing prior debriefs

of hemorrhage events, or by polling staff to determine their knowledge gaps.⁵ In some cases, it may be beneficial to practice individual, technical skills (e.g., uterine tamponade placement) prior to combining them into a full drill scenario to increase the value of the drill scenario.

Scenarios for simulation should be designed to meet the needs of the learners (nurses, physicians, residents, respiratory therapists, etc.) and tailored to available resources. Simulation can be low-tech and use live models, high-tech and use complex computerized simulators, or a combination of both. The objective of simulation is to create situations that are as similar to “real life” as possible.



Perinatal healthcare providers should participate in an implicit bias training designed to curtail the impact of bias on maternal health. While bias training alone will not lead to immediate improvements in disparities for birthing people of color, it can improve patient provider/communication, highlight behaviors that can be corrected, and begin the work of providing more equitable care for pregnancy-capable people and their families.

Staff Education Resources

[Office of Minority Health \(US HHS\)](#)

[Diversity Sciences](#)

[March of Dimes](#)

Additional resources can be found in the [Birth Equity](#) section of the CMQCC website.

In situ drills are simulations that occur in the patient care area and can be a cost-effective way to maximize time and resources while improving the quality and safety of patient care.⁶ Simulation in-situ may improve ability to address systems issues and provides practice in one’s own hospital setting with familiar resources and enables more team members to participate in simulation more frequently.

Because hemorrhage is an infrequent event, simulation can provide an opportunity for teams to maintain proficiency and identify systems issues that impact care. Participants have the opportunity to practice skills and team communication, improve readiness and collaborate, and identify issues, concerns and barriers to care, all while in their actual working environment.⁷ Simulations also offer participants a safe space to practice how to communicate with a patient and family during an emergency, and the debrief addresses any gaps in team performance. (See Section: Communicating with and Supporting Women, Birthing People, and Families After an Obstetric Hemorrhage on page 146.)

Before beginning simulation, it is important for educators to define the learning objectives and ensure a safe and welcoming environment for participants. Leaders should remind participants at the beginning of the drill of the overall goals of simulation: to identify systems issues and practice together, focusing on key workflows and communication amongst the clinical team, patient and family. While participants may feel silly or make “mistakes,” this is all part of the process. It is important participants stay in character in order to maintain the integrity of the simulation and for the entire team to debrief after the simulation has completed. Debriefing is appropriate and encouraged both for simulation drills and for live events. Video taken during simulation serves as a tool to explore during debrief what went well and what needs improvement after a scenario is performed.⁹ To facilitate debriefing, leaders should provide a safe private area for discussion, acknowledge value of all input and the importance of reflection and clarify that debriefing is confidential.¹⁰

Patient experience

Participants in drills need to practice sensitive yet effective communication. As clinical information is called out, and management of the scenario is underway, it is important to consider how the communication (or lack thereof) impacts the patient and her family. One survivor reported that her partner had been in the hallway on the phone organizing childcare when she began to hemorrhage. He heard her screaming and later heard hospital staff, “yelling ‘blood transfusion—we need the blood bank!’” She described debriefing with her partner while recovering and telling him, “I saw myself die. I saw the white light. I was screaming.” ... He said, “Yeah, I heard you screaming. Nobody told me anything. They kept walking past me. They kept walking past me, and nobody told me anything.”⁸

Evaluation tools such as checklists for expectations of each participant in their role and for team and individual performances can provide an objective approach to debriefing. Similarly, follow-up evaluation ensures that specific goals and objectives for each level of participant are met. The Ottawa Crisis Resource Management Global Rating Scale and Mayo High Performance Teamwork Scale are examples.^{11,12} Lessons learned from simulation and ideas for systems improvements should be communicated back to staff, providers and hospital quality improvement committees or hospital administration, when appropriate. Simulations can also help identify areas for future learning, whether that be done in a future drill, in-service, or one-on-one orientation. Doing so reinforces the value of simulation and responsiveness of leaders to correct identified problems prior to impacting patient care.

Women appreciate the life-saving care they receive, and very much remember the kindnesses shown to them. Simulation lets team members practice how to communicate with one another and also their patients. Providing reassurance to a patient during an obstetric emergency is highly important and goes a long way to ensuring the patient’s emotional safety. A Hispanic woman who experienced placental abruption reported how a nurse responded in the moment of the emergency:

*She was running back and forth, but every time she comes close to me, she sees me crying and she tells me, “You’re going to be okay. Everything’s going to be okay.” She goes running back and forth doing whatever she has to do, and then she comes right back to me and she tells me the same thing. She told me that three times. She was the only person that made me feel comfortable, because she was the only one that told me that everything’s going to be okay.*¹³

Recommendations

1. Birthing facilities should adopt a schedule for regularly performing simulations and drills.
2. When planning for simulation, include key personnel who would be involved in obstetric hemorrhage management. Including the defined obstetric rapid response team, anesthesiologists, nurses, midwives, resident and attending physicians, community physicians, and hospitalists is recommended. Clear expectations of what each discipline’s role should be in the hemorrhage

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response should be communicated. Consider acknowledgment of services outside of labor and delivery and identification of systems failures outside the unit. For example, if you are including notification of the blood bank in the simulation, does the blood bank have a system in place to respond in the manner you expect in the drill? (See Section: Definition, Early Recognition and Rapid Response to Obstetric Hemorrhage Using Triggers on page 93.)

3. An important part of simulations and drills is to model communications with the patient and family.
4. In situ drills are a key adjunct to evidence-based protocols and established educational programs. Well-planned and carefully conducted drills can further reinforce important educational concepts concerning high-risk events such as obstetric hemorrhage. These drills allow the team to develop team skills to improve performance and uncover systems barriers that may affect care provision.

Educational tools and sample resources

[Guidelines for Simulation Scenario Development \(Appendix F on page 199\)](#)

[Simulations and Drills Sample Scenarios \(Appendix G on page 203\)](#)

[A Blueprint for Medium-Fidelity Postpartum Hemorrhage Simulations Obstetric In-Situ Drill Program Manual⁵](#)
[AIM Practicing for Patients Clinical Simulation Scenario](#)

EVIDENCE GRADING

LEVEL OF EVIDENCE: B

References

1. Andreatta PB, Bullough AS, Marzano D. Simulation and team training. *Clinical Obstetrics and Gynecology*. 2010;53(3):532-544.
2. The Joint Commission. Provision of Care, Treatment, and Services standards for maternal safety. 2019.
3. Agency for Healthcare Research and Quality. TeamSTEPPS®: National implementation 2020.
4. Agency for Healthcare Research and Quality. Pocket Guide: TeamSTEPPS. <https://www.ahrq.gov/teamstepps/instructor/essentials/pocketguide.html>. Published 2020. Accessed 2/15/2021.
5. Jackson A, Haynes L. A Blueprint for medium-fidelity postpartum hemorrhage simulations. *Nursing for Women's Health*. 2020;24(5):351-369.
6. Lutgendorf MA, Spalding C, Drake E, Spence D, Heaton JO, Morocco KV. Multidisciplinary In situ simulation-based training as a postpartum hemorrhage quality improvement project. *Military Medicine*. 2017;182(3):e1762-e1766.
7. ACOG. Obstetric postpartum hemorrhage drill program manual Obstetric Drill Program Manual Postpartum Hemorrhage. Published 2019. Accessed 2/18/2021.
8. Wang E, Glazer KB, Sofaer S, Balbierz A, Howell EA. Racial and ethnic disparities in severe maternal morbidity: A qualitative study of women's experiences of peripartum care. *Women's Health Issues*. 2021;31(1):75-81.
9. Rudolph JW, Simon R, Raemer DB, Eppich WJ. Debriefing as formative assessment: Closing performance gaps in medical education. *Academic Emergency Medicine*. 2008;15(11):1010-1016.
10. Gardner R. Introduction to debriefing. *Seminars in Perinatology*. 2013;37(3):166-174.
11. Kim J, Nellipovitz D, Cardinal P, Chiu M, Clinch, J. A pilot study using high-fidelity simulation to formally evaluate performance in the resuscitation of critically ill patients: The University Ottawa Critical Care Medicine, High-Fidelity Simulation and Crisis Resource Management I Study. *Critical Care Medicine*. 2006;34:2167-2174.
12. Malec JF, Torsher LC, Dunn WF, et al. The MAYO high performance teamwork scale: Reliability and validity for evaluating key crew resource management skills. *Simulations in Healthcare*. 2007;2(1):4-10.
13. New York City Department of Health and Mental Hygiene. Women's experiences with severe maternal morbidity in New York City: A qualitative report. New York, NY. 2020.

Using the Electronic Health Record (EHR) to Improve the Management of Obstetric Hemorrhage

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Key Principles

1. Modern electronic health records (EHR) can provide a safety infrastructure for common conditions by utilizing multiple tools including documentation templates with embedded critical data, best practice advisories/alerts (BPAs), standardized order sets utilizing management algorithms, communication tools, reports communicating current status/evolving trends and other resources.

2. The EHR system can allow for quicker recognition, rapid response and a more standardized/coordinated team approach by sharing the most up to date information on the patient’s status. The EHR can automate vital sign assessment monitoring (early warning systems). The Task Force recommends using a warning system tailored for the obstetric population.

3. A standardized approach to care provision is an integral part of hemorrhage management. Care pathways and artificial intelligence associated with EHR have the potential to maximize and improve quality infrastructure in obstetric care, including hemorrhage.

Background

Computers and software are designed to perform tasks repetitively without mistake and in rapid fashion. The application of computerized tools in healthcare is an effort to reduce human error by automating repetitive, tedious tasks and providing clinicians current information to guide care.¹ Electronic health records (EHR) are a system that contains patient-centric information and a longitudinal record of a patient’s medical history. This can include an individual’s health status, demographic data, or clinical information (e.g., laboratory reports, radiology, or pharmacy data) all of which have the capacity to be shared even among different health systems and settings.^{1,2} Implementation and utilization of the EHR to assist and improve quality of health care provision has increased greatly over the last few years and virtually all major EHR vendors have embedded tools to assist in these efforts.³ Utilization of the EHR may assist with decision support, improve efficiency of care, and make quality and safety metrics and up-to-date clinical guidelines for common conditions easily obtainable.⁴ In addition to improving outcomes, proper management techniques can mitigate risk.⁵

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As it relates to inpatient care, expanded use of the EHR through the implementation of BPAs, standardized order sets, semi-automated treatment algorithms, alerts and reminders have been shown to improve patient safety indicators, patient outcomes and decrease length of stay.^{5,6} A large body of evidence indicates EHR systems improve quality care by providing access to longitudinal medical records, as well as data and reporting metrics for hospital systems to evaluate the care they provide.⁷

Brokel, et al. described implementation of an EHR as continuous quality improvement with five redesign of care principles: 1) identify and address safety problems, 2) promote evidence-based practices, 3) reduce practice variations and standardize terminologies and care processes, 4) improve communication and relationships among clinician roles and 5) augment multiple uses of data in supported care processes.⁸ Admission-to-discharge workflows addressed gaps in quality, safety and efficiency and helped ensure that the EHR and decision support tools reflected crucial interactions among clinicians and with the patient. Goffman et al. concluded that EHR systems are becoming increasingly available and can provide detailed assessment of PPH incidence, management and outcomes to facilitate surveillance and quality improvement.⁹

Another growing area of utilization of the EHR is within the clinical care pathway and semi-automated treatment algorithms (SATA).¹⁰ Clinical care pathways that incorporate clinical data surveillance and standardized treatment algorithms have been used in various areas of medical practice for over 20 years.¹¹ They have the potential to decrease delays and errors in communication.¹² Until recently, these pathways have not been implemented or studied in the obstetric population. Implementation of EHR care pathways can eliminate many of the barriers identified by objectively monitoring vital signs and provide actionable nursing orders based on

strict treatment guidelines, without bias, even in clinical settings with limited staffing.¹⁰ There can also be improved efficiency in patient care with care pathway utilization.¹³ Semi-automated treatment algorithms can utilize the EHR and nursing driven pathways to prompt the care team to take important actions in emergencies and use evidence-based treatment recommendations.¹⁴

A good example of SATA involves the embedding of the Modified Early Warning Score (MEWS). The MEWS aims to predict early clinical deterioration by using auto calculation from the data entered into the EHR to trigger electronic alerts and notify providers by posting results on track boards and patient lists.¹⁵ The application of these functions to obstetric hemorrhage management is obvious, in that a standardized approach, rapid transmission of critical patient data and timely alerting can be augmented by the EHR.

The application of MEWS demonstrates the importance of close collaboration between obstetric providers and clinical informatics specialists who are charged with revising, refining and optimizing the EHR and workflows to improve usability and functionality. Because MEWS was developed for the adult non-pregnant population, it is not sensitive to critical changes in maternal physiology. The result can be detrimental in the obstetric setting where it may cause alert fatigue and/or miss critical patients. The implementation of obstetric-specific systems such as modified early obstetric warning system (MEOWS)¹⁶ or the Maternal Early Warning Trigger (MEWT) requires that a multidisciplinary team redesign the current MEWS triggers in the EHR, utilizing the more appropriate triggers for obstetric patients.¹⁶⁻¹⁸

Even with optimization of early warning systems for pregnant patients, increasing or decreasing the sensitivity of alarms or BPA triggers have ramifications. Increasing the sensitivity of preset triggers contributes to alarm fatigue and loss of concern in the alert itself, whereas decreasing the

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sensitivity increases the risk of missing sentinel changes that the EHR system hopes to catch. More data defining the optimal sensitivity setting would be beneficial as more EHR infrastructure and strategy is incorporated into obstetric practice.¹⁶

Because most toolkits give multiple choices of management techniques and tools, clinical and informatics experts can assist in choosing the proper selection of specific tools and guide implementation into the EHR. Health systems have created novel patient safety bundles and incorporated risk scoring systems to evaluate hemorrhage risk along the patient care continuum, hemorrhage reports and standing orders for nurses. Real world experience, however, has also taught that unforeseen problems can occur. For example, when alerts rely on blood pressure data which must be validated before triggers can occur, timely notification is prevented.

As EHR tools are developed and implemented, it is important to continually evaluate its effectiveness and safety. It is also recommended that quality improvement teams and leaders track metrics before and after implementation of EHR tools to ensure the purpose of the tools are realized and that there are no unintended consequences that affect the system or patients. Finally, providers and health care teams should be reminded that these systems and tools are intended as safety infrastructure and should not take the place of thorough history taking, in-person examinations, and clinical judgment. Not every patient will be a candidate for EHR-guided care or fit into the care pathway recommendations.¹⁹ A review of the Alliance for Innovation on Maternal Health (AIM) Hemorrhage Bundle¹⁹ may

help to determine where these informatics tools aid in care management. The bundle is organized using the “4 Rs” method which may help in delineating where computerization can be applied. (See Box 1 on page 79.)

EHR implementation utilizing the 4R approach

Readiness

Hemorrhage readiness involves assuring that every obstetric unit has the tools and personnel in place to rapidly respond. Risk scoring assessments can be completed at transitions of care as required by The Joint Commission and embedded into track boards and handoff reports. Institutions should evaluate the current risk scoring method in its EHR to allow for multiple evaluations, typically stored in flowsheet rows. Immediate access to medications can be enhanced by embedding first line agents in admission order sets consistent with recommended protocols such as oxytocin administration. Stage 1 medications can be included as conditional orders based on the parameters outlined in the institutional algorithm. These standards will speed response since the teams will automatically get the standard dosing and frequency of critical medications. Similarly, the establishment of a massive transfusion and emergency release protocols should be developed to allow clinicians to quickly activate and notify the blood bank and lab to the presence of a hemorrhage event. The use of these tools should be part of the unit education and drills with the proper evaluation during unit debriefs. (See Section: Obstetric Hemorrhage Simulation and Drills on page 71 and Debrief and Multidisciplinary Case Review Guidelines on page 167.)

Box 1: EHR tools for improving outcome in obstetric hemorrhage

Readiness

- ▶ Admission orders sets with standardized medications
- ▶ Emergency release/massive transfusion order sets
- ▶ Structured documentation tools for drills/simulations, handoffs and huddles
- ▶ Risk scoring embedded into track boards and handoff reports

Recognition

- ▶ Automated risk assessment calculation, alerts and denotation on patient board
- ▶ Calculation of quantitative blood loss (QBL) and cumulative blood loss (CBL) reports
- ▶ Blood bank systems to track blood status and utilization
- ▶ Active third stage management with specific guidelines for oxytocin administration in order sets
- ▶ Reports/charts with vital signs, CBL, transfusion types/totals and laboratory results

Response

- ▶ Order sets with staged base response including best practice alerts (BPAs) to guide providers
- ▶ Documentation tools for clinicians
- ▶ Rapid access to the hemorrhage algorithm/protocol
- ▶ Family education on what to expect post hemorrhage and support resources

Reporting/System Learning

- ▶ Specialized report and debriefing tools to aid in review
- ▶ Data metrics
 - Hemorrhage risk assessment compliance
 - Alert management: firing/response analysis
 - Quantitative blood loss (QBL) and cumulative blood loss (CBL)
 - Transfusion

Improving Health Care Response to Obstetric Hemorrhage, a CMQCC Quality Improvement Toolkit, 2022

Recognition

Institutions should agree upon a hemorrhage risk screening tool and consider building it into the EHR. Modern records are able to auto calculate and assign a risk score based on patient history, admission assessment and laboratory values. The score can be prominently displayed in the patient record, unit electronic “chalkboards” and other communication sites for clinicians. Electronic alerts can assess the scores and make standard recommendations to caregivers for lab orders or blood preparation. Risk scores can be recalculated at standard times during labor and postpartum

according to guidelines.²⁰ Electronic alerts notify the care team of standard recommendations for lab orders or blood preparation based on score assessment.

An important role of the EHR is to continually update and display the cumulative blood loss (CBL), the most common trigger for management algorithms. The EHR can also assist in gravimetric quantified blood loss (QBL) by converting the weights of sponges and other items and thereby relieving busy caregivers of this tedious activity

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and improving accuracy. Data from artificial intelligence-driven colorimetric systems can be added by direct manual entry into or interfaced directly with the EHR. Lastly, if calculated manually the quantified blood loss (QBL) can be entered, and rule checking algorithms can be developed to prevent duplicate entry. The CBL can also be displayed in reports that allow clinicians to track the total amount and timing of blood loss correlated with clinical data such as vital signs, urinary output, transfusion data and laboratory findings. (See Section: Best Practice Techniques to Assess Quantitative, Cumulative Blood Loss on page 104.)

To ensure every patient receives the appropriate active management of the third stage, order sets should contain careful instructions on the proper timing and dosing of prophylactic oxytocin.

Response

Just as admission and transfusion order sets follow algorithms, the specialized order sets for post anesthesia care units and intensive care settings should include vital signs, medications and laboratory test results utilized for obstetric hemorrhage.

Documentation tools such as a specialized flowsheet, integrated vital sign readings and templated notes outlining care, can assist clinicians in assuring critical items such as blood loss measurements and checklists for diagnostic and therapeutic steps can be constructed and used. The lack of easy access to documentation from previous clinical encounters can make subsequent care more difficult in cases of massive hemorrhage. Pulling in critical information can also make sure “dueling” results/calculations are not recorded to allow a single source of truth.

Informational tools and event summaries for patients and families can also be embedded into the EHR and made readily available to assist with supporting patients after a traumatic event. These

can be made available prior to discharge and in the after-visit summaries and automatically routed to obstetric and primary care providers ensuring improved utilization by caregivers. Women who experience a significant hemorrhage should be given discharge paperwork that reflects their diagnoses, blood transfusion information, resources for counseling, support groups, follow up plans and appointments, referral information and consideration for an early postpartum visit in accordance with ACOG recommendations. The EHR can optimize these documents by having standardized information ‘pull in’ from smart phrases or saved text that can be easily inserted into discharge instruction fields. This can ensure that patients who experience hemorrhage and its sequelae receive standard instructions and information that may be imperative for their follow up care and recovery. Furthermore, having standardized discharge summaries and documentation of the clinical course during hospitalization is important for primary care providers, and may guide multi-disciplinary care in the postpartum period. (See Section: Communicating with and Supporting Women, Birthing People, and Families After an Obstetric Hemorrhage on page 146.)

Reporting/Systems Learning

Ensuring that every unit is able to report on its performance of managing obstetric hemorrhage events to learn from these experiences is critical to improving outcomes. To support post-event debriefs, a timeline log of critical events can help the team identify important variances from the hemorrhage algorithm and uncover system errors which could be improved.

Data metrics can be helpful in assessing aggregated performance of an institution. This requires carefully choosing data definitions for important metrics such as CBL, QBL and transfusion metrics (units vs. volume) to align with national definitions of severe maternal

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morbidity and other administrative coding standards. (See Section: Using Outcome Metrics for Hemorrhage-Related QI Projects on page 174.) Performance metrics are also critical, such as percentage of patients being screened, transfused or followed with active management of third stage, etc. All of these should be available by direct extraction from the EHR.

As part of systems learning, it is important to assess alert management and design by analyzing the volume of alerts and responses by clinicians. Regular assessment of tools such as MEWT or MEOs, to evaluate how often they fire and how many alerts are correctly addressed can help refine the alerts and reduce alarm fatigue. Reviewing the “data quality” of important measurements can lead to refinement of data entry techniques and improve outcome assessment.

Recommendations

1. All birthing facilities should investigate opportunities to have obstetric specific content built into its EHR to improve management of obstetric hemorrhage.
2. Multidisciplinary teams that manage obstetric hemorrhage should partner with clinical informaticists who are charged with revising, refining and updating the EHR and workflows to improve usability and functionality. Utilizing various computerized tools within the EHR is a novel way to improve postpartum hemorrhage safety and mitigate legal risk.
3. Invest in further research into the utilization of tools such as decision support via care pathways for hemorrhage risk assessment, identification and treatment. Integrating EHR into clinical practice may be limited by funding for clinical informatics teams and quality improvement priorities at different institutions.
4. Aim to continually upgrade and refine EHR systems to improve response and ultimately outcomes in managing obstetric hemorrhage. With improved user interfaces and the application of artificial intelligence, the EHR will be capable of doing more to assist in the care of obstetric patients.

EVIDENCE GRADING LEVEL OF EVIDENCE: A

References

1. Agency for Healthcare Research and Quality. Optimizing Electronic Health Records (EHRs) for Quality Improvement (QI). <https://www.ahrq.gov/evidencenow/tools/facilitation/qi-ehrs.htm>. Published 2018. Accessed 2/15/2021.
2. Joint Commission. Safely implementing health information and converging technologies. Sentinel Event Alert Issue No. 42 http://www.jointcommission.org/assets/1/18/SEA_42.PDF. Published 2008. Accessed 2/15/2021.
3. Institute of Medicine. Health IT and patient safety: Building safer systems for better care. Washington, D.C.: The National Academies Press;2012.
4. ACOG. Patient safety and health information technology. Committee Opinion No. 621 of the American College of Obstetricians and Gynecologists. 2015.
5. Atallah F, Goffman D. Improving healthcare responses to obstetric hemorrhage: Strategies to mitigate risk. Risk Management and Healthcare Policy. 2020;13:35-42.
6. Smith A, Banville D, Gruver EJ, Lenox J, Melvin P, Waltzman M. A Clinical Pathway for the Care of Critically Ill Patients With Asthma in the Community Hospital Setting. Hospital Pediatrics. 2019;9(3):179-185.

7. Aeyels D, Bruyneel L, Sinnaeve PR, et al. Care pathway effect on in-hospital care for ST-elevation myocardial infarction. *Cardiology*. 2018;140(3):163-174.
8. Brokel J, Harrison M. Redesigning care processes using an electronic health record: A system's experience. *Joint Commission Journal on Quality and Patient Safety*. 2009;35:82-92.
9. Goffman D, Friedman AM, Sheen JJ, et al. A framework for improving characterization of obstetric hemorrhage using informatics data. *Obstetrics and Gynecology*. 2019;134(6):1317-1325.
10. Martin C, Pappas J, Johns K, Figueroa H, Balli K, Yao R. Semiautonomous treatment algorithm for the management of severe hypertension in pregnancy. *Obstetrics and Gynecology*. 2021;137(2):211-217.
11. Pearson SD, Goulart-Fisher D, Lee TH. Critical pathways as a strategy for improving care: problems and potential. *Annals of Internal Medicine*. 1995;123(12):941-948.
12. Kho A, Rotz D, Alrahi K, et al. Utility of commonly captured data from an EHR to identify hospitalized patients at risk for clinical deterioration. *AMIA Annual Symposium Proceedings*. 2007:404-408.
13. Zemek R, Plint A, Osmond MH, et al. Triage nurse initiation of corticosteroids in pediatric asthma is associated with improved emergency department efficiency. *Pediatrics*. 2012;129(4):671-680.
14. Wakamiya S, Yamauchi K. What are the standard functions of electronic clinical pathways? *International Journal of Medical Informatics*. 2009;78(8):543-550.
15. Sanders S, Marsal S, Riley C, Boardman S, Bayley B, Freer S. An electronic modified early warning system can reduce mortality. *Harvard Business Review*. 2013. <https://hbr.org/2013/09/an-electronic-modified-early-w>. Accessed 2/15/2021.
16. Blumenthal EA, Hooshvar N, Tancioco V, Newman R, Senderoff D, McNulty J. Implementation and evaluation of an electronic maternal early warning trigger tool to reduce maternal morbidity. *American Journal of Perinatology*. 2020.
17. Shields LE, Wiesner S, Klein C, Pelletreau B, Hedriana HL. Use of Maternal Early Warning Trigger tool reduces maternal morbidity. *American Journal of Obstetrics and Gynecology*. 2016;214(4):527 e521-526.
18. Friedman AM, Campbell ML, Kline CR, Wiesner S, D'Alton ME, Shields LE. Implementing Obstetric Early Warning Systems. *AJP Reports*. 2018;8(2):e79-e84.
19. ACOG. Obstetric hemorrhage patient safety bundle. <https://safehealthcareforeverywoman.org/aim/patient-safety-bundles/maternal-safety-bundles/obstetric-hemorrhage-patient-safety-bundle-2/>. Published 2015. Accessed.
20. Troiano NH, Witcher PM, Baird SM. AWHONN High Risk Critical Care Obstetrics. 4th ed: Association of Women's Health Obstetric and Neonatal Nursing; 2018.

Hemorrhage Preparedness Considerations for Small and Low-Resource Hospitals

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Key Principles

1. Consideration for birth at a hospital with a higher maternal level of care should be discussed for women with prenatal conditions that put them at high risk for hemorrhage.
2. Communication and collaboration between departments and disciplines is essential to providing optimal hemorrhage care.
3. All staff need a clear picture of response times, and teams should be mobilized early for high-risk situations.
4. Blood product availability and time to obtain blood products should be clearly communicated to all members of the care team.

Background

While data are conflicting on whether low-volume rural hospitals have higher incidences of obstetric hemorrhage and associated morbidities, it is clear that these facilities face special challenges and require additional planning to ensure high-quality care.^{1,2}

Multidisciplinary and multi-departmental collaboration is critical to facilitating the care for patients during an obstetric hemorrhage. Availability of resources such as personnel, equipment and blood products may pose unique challenges for small hospitals.² These hospitals should proactively identify potential challenges and modify processes to optimize outcomes for their patients. A massive hemorrhage should be considered an emergency similar to a respiratory or cardiac arrest and elicit the same level of hospital emergency response and resources.

Women with high-risk conditions such as placenta accreta spectrum, placenta previa with a prior cesarean, multiple prior cesareans, or a history of PPH should be counseled to give birth at a hospital with a higher level of maternal care and where appropriate resources may be more readily available. If the patient and care team agree that a higher-level facility is the best care plan, the smaller hospital should identify transfer resources and options including a possible transfer agreement with a higher-level facility. In California, consider utilizing a Regional Perinatal Programs of California (RPPC) coordinator to help facilitate these relationships.

Pre-planning for women at high risk for an obstetric hemorrhage to give birth at level III or IV hospitals will not prevent all hemorrhages from occurring at small hospitals, however, clinicians at the latter may be able to safely treat

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women with high-risk conditions if they have the appropriate resources and staffing availability (e.g., surgeons available with expertise in managing placenta accreta spectrum). Patients with active bleeding will typically present to the closest hospital and up to 40% of women with no identified risk factors will develop a postpartum hemorrhage.^{3,4} Emergency scenarios should be practiced, simulated, discussed, and a plan developed to facilitate an optimal response to these situations. If a high-risk birth cannot occur at a level III or IV hospital, ensure the scheduled cesarean or induction is performed during times most optimal for multidisciplinary care, and when key emergency personnel are most available.

Maternity care providers need to understand that Indigenous women and Black women incur higher rates of severe morbidity compared to women of other races/ethnicities due to historical exclusions and genocide, as well as ongoing barriers to accessing timely and quality health care due to racist policies and institutions in the United States.⁵ Severe maternal morbidity and mortality is higher for women living in rural areas.⁶ Efforts to improve maternal health should focus on populations at greatest risk, including Indigenous, Black and rural populations.

Communication

Early and frequent communication throughout the birth process is essential to facilitate care during an obstetric hemorrhage. Risk factors should be identified early in the pregnancy and hospital admission. (See Section: Obstetric Hemorrhage Risk Factor Assessment on page

30.) Risk assessments should be performed on admission, at the beginning of the second stage, on transfer/admission to postpartum, and any time the patient's status changes. Additionally, the risk assessment must be communicated to the entire birth team even if they are not physically present in the hospital. Offsite providers should be notified of evolving high-risk situations in order to actively participate in the development of a plan of care. Additionally, have clear guidelines in place to communicate the severity and immediacy of a situation so that all involved parties (including the patient and her support system) have clear expectations regarding expected response.

The entire care team should have a shared mental model of the emergency resources available within the hospital. Dialogue regarding time frames needed for mobilization of equipment and personnel should occur prior to an emergency situation. All hospital personnel should be aware of obstetric-specific codes paged overhead, and which resources need to be mobilized in response. (See Section: Definition, Early Recognition and Rapid Response to Obstetric Hemorrhage Using Triggers on page 93.)

Personnel

There may be limited nursing resources available in the labor and delivery unit, emergency department (ED) and general hospital operating room(s) (OR). OR personnel may not be in-house at all times especially during nights, weekends, and holidays. There should be an expectation that OR personnel and staff home on call will be requested early in the event of a hemorrhage and for high-risk situations, not just when an emergency is already in progress.

Consider all hospital staff when mobilizing resources during an obstetric hemorrhage. A nursing supervisor or administrator may be able to assist with mobilizing personnel from other

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areas of the hospital or from home, and may find space in the OR, post anesthesia care unit, or a bed in the intensive care unit (ICU) to care for the patient. Nurses from the ED and ICU have critical care skills that are helpful during a hemorrhage. Medical-surgical nurses may be able to care for postpartum patients during an emergency or be a scribe during a hemorrhage. Trauma/general surgeons may be available as a surgical assist during a laparotomy and can also assist with obtaining vascular access in emergencies. Regardless of the size of the facility or personnel included, it is imperative that you have a designated rapid response team (RRT) in place to respond to obstetric emergencies. (See Section: Definition, Early Recognition, and Rapid Response to Obstetric Hemorrhage Using Triggers on page 93.) This team does not need to be entirely made up of obstetric-specific clinicians, but those expected to respond need to be prepared to address the specific needs of this patient population.

Anesthesia providers that also cover the main OR or are not required to be in-house may not be able to attend to the labor and birth without a time delay. Specialists such as gynecologic oncologists or vascular surgeons that may provide benefit to complicated emergent surgical cases may be limited or not available. A clear and simple process to contact providers should be developed and practiced during hemorrhage drills. An organization chart with contact information that is correct and kept up-to-date is crucial. It may be helpful to keep notification policies and call schedules readily accessible (i.e., on the hemorrhage cart).

Emergency readiness and training

All obstetric care providers should go through routine training to be prepared for obstetric emergencies. (See Section: Obstetric Hemorrhage Simulations and Drills on page 71.) High-fidelity simulators may not be

available at small or low-resource facilities; however, they are not necessary. Conducting in situ hemorrhage drills and simulations is beneficial and valuable. Clearly defining roles and role-specific tasks during simulation may help save time and facilitate productive communication during an obstetric emergency.

If non-OB providers and support staff are expected to respond to obstetric emergencies, ensure that they are included in obstetric simulations and drills, and can easily access and understand care management algorithms that are available and understandable to a provider outside of the obstetric specialty. For example, quantified blood loss may not be the standard in the main operating room, but is being done routinely on labor and delivery. Ensure that the care plan is followed even as the care team grows. Similarly, establish contingency plans in the event that personnel are not available. For example, consider training personnel on the use of intraosseous access in the event that IV access cannot be established and there are limited personnel available to place central access.

If a woman presents with obstetric hemorrhage in the emergency department, early identification of obstetric status is important and personnel should provide aggressive resuscitation as they would for any patient presenting with active bleeding. (See Section: Definition, Early Recognition and Rapid Response to Obstetric Hemorrhage Using Triggers on page 93.)

Equipment and supplies

A significant hemorrhage is rare. Developing and maintaining hemorrhage supplies in a portable container expedites care during hemorrhage emergencies. Since a hemorrhage may occur in multiple locations throughout the hospital, it is optimal to have a designated hemorrhage cart or box that can be easily transported to the patient. (See Appendix E: Checklist: Carts, Kits and Trays on page 196.)

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Emergency equipment may need to be brought from other areas of the hospital (e.g., OR, ED, etc.). A plan should be in place to mobilize emergency equipment that is not located in labor and delivery. Personnel with the responsibility to mobilize emergency equipment should be identified prior to an emergency hemorrhage. Additionally, consider availability of those personnel during all shifts. For example, OR techs may not be available on nights or weekends. Mobilization of equipment should be practiced during obstetric hemorrhage drills to identify barriers within the process.

Blood products

All types of blood products may not be stored at a facility; for example, platelets may need to be brought in from a central regional location outside of the hospital. Blood bank personnel should consult with the blood bank to identify the availability of each type of blood product and the processing time frames for each and communicate this information to the care team. Information about blood products should be posted in an easily accessible location on the unit and is critical education for all obstetric and anesthesia providers. This information may be especially important to communicate to providers that are unfamiliar with the hospital's specific processes, as it may impact their clinical

decision-making process. (See Section: Blood Product Replacement: Obstetric Hemorrhage on page 124.)

Blood bank personnel should be kept informed of the care plan for women at high risk of hemorrhage. Plans and criteria should be developed to guide pre-transfusion preparation for high-risk patients and for obtaining blood products in massive transfusion situations. It may be necessary for the blood bank to be notified sooner in order for blood products to be available when needed, so consider incorporating this timing into care algorithms. Any changes to the availability of blood products should be immediately communicated to key participants of the care team.

It may also be important to consider blood bank processing times and product availability when deciding whether to either put a specimen on hold or do a type and screen for a low-risk patient. (See Section: Obstetric Hemorrhage Risk Factor Assessment on page 30.) If there is any concern for an additional delay to get crossmatched blood at the facility, consider running a type and screen on admission rather than holding a specimen in the blood bank in order to prevent any additional delays in care.

Recommendations

1. Convene a multidisciplinary, multi-departmental team to evaluate readiness for managing obstetric hemorrhage.
2. Small or low-resource hospitals should identify high-risk antenatal conditions that would be appropriate for a planned birth at a higher-level facility with appropriate resources and staff availability. Review this list of conditions periodically.
3. Consider all potential personnel resources within the facility and include departments such as the OR in planning response strategies.
4. Conducting routine inter-departmental obstetric hemorrhage drills may assist the team in developing a shared mental model of response times, identifying opportunities for system improvement, and ensuring there is adequate cross training in cases of emergency or unexpected hemorrhage.

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5. Small or low-resource hospitals should carefully map the response process for obstetric hemorrhage to identify availability of equipment, personnel and blood products.
6. Pre-transfusion testing based on risk assessment (specimen on hold vs. type and screen vs. type and crossmatch) strategies should be modified to account for potentially longer time to conduct tests and obtain blood products.

EVIDENCE GRADING

LEVEL OF EVIDENCE: C

References

1. Merriam AA, Wright JD, Siddiq, Z, D'Alton, ME, Friedman AM, Ananth CV, Bateman BT. Risk for postpartum hemorrhage, transfusion, and hemorrhage-related morbidity at low, moderate, and high volume hospitals. *Journal of Maternal-Fetal and Neonatal Medicine*. 2018;31(8):1025-1034.
2. Mhyre JM, Shilkrut A, Kuklina EV, et al. Massive blood transfusion during hospitalization for delivery in New York State, 1998-2007. *Obstetrics and Gynecology*. 2013;122(6):1288-1294.
3. Dilla AJ, Waters JH, Yazer MH. Clinical validation of risk stratification criteria for peripartum hemorrhage. *Obstetrics and Gynecology*. 2013;122(1):120-126.
4. Ruppel H, Liu VX, Gupta NR, Soltesz L, Escobar GJ. Validation of postpartum hemorrhage admission risk factor stratification in a large obstetrics population. *American Journal of Perinatology*. 2020.
5. Kozhimannil KB, Interrante JD, Tofte AN, Admon LK. Severe maternal morbidity and mortality among indigenous women in the United States. *Obstetrics and Gynecology*. 2020;135(2):294-300.
6. Kozhimannil KB, Interrante JD, Henning-Smith C, Admon LK. Rural-urban differences in severe maternal morbidity and mortality in the US, 2007-15. *Health Affairs*. 2019;38(12):2077-2085.



Recognition

This domain includes resources to ensure obstetric hemorrhage can be recognized and addressed at the first signs of abnormal bleeding. Response triggers are presented and terminology regarding measurement of blood loss is further defined. The importance of an obstetric rapid response team is highlighted.

In this section you will find the following:

- ▶ Active Management of Third Stage Labor
- ▶ Definition, Early Recognition and Rapid Response to Obstetric Hemorrhage Using Triggers
- ▶ Best Practice Techniques to Assess Quantitative Cumulative Blood Loss

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Active Management of Third Stage Labor

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Key Principles

1. Evidence-based analysis has established that active management of the third stage of labor (AMTSL) can reduce obstetric hemorrhage. However, studies evaluating the individual components of AMTSL have confirmed only oxytocin administration as effective.
2. Delayed cord clamping does not increase the risk for hemorrhage, and any components of AMTSL that may be used should not interfere with the practice of delayed cord clamping and skin to skin for newborn benefit.
3. Unit standardization of prophylactic oxytocin regimen is recommended. (See Section: Medications for Prevention and Treatment of Postpartum Hemorrhage on page 114.)

Background

Active management of third stage of labor (AMTSL) as a prophylactic intervention is composed of a package of three components or steps: 1) administration of a uterotonic, preferably oxytocin, immediately after birth of the baby; 2) controlled cord traction (CCT) to deliver the placenta; and 3) massage of the uterine fundus after the placenta is delivered.^{1,2} The Cochrane review of AMTSL was designed to consider the benefits versus potential harms of the components of AMTSL, and specifically to tease out differences in effect based on low- versus high-resource settings.³ The review included 8,247 women enrolled in seven studies conducted in six high-income countries and one low-income country. Four of the studies compared active management with expectant management of the third stage of labor. Three studies compared active management with a “mixture of managements.” The primary outcomes for the review were postpartum

hemorrhage at ≥ 1000 mL, postpartum hemorrhage at > 2500 mL, and maternal death.²

The authors concluded that AMTSL reduced the risk of bleeding, but that the reduction in risk may be due to oxytocin alone. Notably, active management also resulted in increased risk of hypertension, higher likelihood of hospital readmission for bleeding, and a possible decrease in average newborn blood volume in the active management group. There was no difference in the rate of severe bleeding (defined as ≥ 1000 mL blood loss) between groups in low-risk women. The authors noted that the sample sizes for all included studies were below those needed for optimal statistical power, and the Grading of Recommendations, Assessment, Development and Evaluations (GRADE) scores for primary outcomes were low.

In a 2019 Cochrane review of third stage of labor, the authors looked at eight studies representing

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a total of 8,892 patients and concluded that severe hemorrhage (> 1000 mL) could be reduced by active management of labor but was supported by weak evidence. For patients at low risk for hemorrhage, the benefits of implementing AMTSL were unclear aside from oxytocin administration. The review concluded by recommending a shared decision-making approach for women at low-risk.

Sheldon, et al. conducted a secondary analysis of data from two clinical trials that were conducted in Egypt, Ecuador, Turkey, Vietnam and Burkina Faso.⁴ This analysis included 39,202 women and evaluated the probability of blood loss > 700 mL under various combinations of the component interventions used in AMTSL. They found that when oxytocin prophylaxis was administered intramuscularly, controlled cord traction significantly reduced the risk of bleeding; however, cord traction was not beneficial in the setting of intravenous (IV) oxytocin prophylaxis. Uterine massage increased the risk of bleeding, and the combination of controlled cord traction and uterine massage doubled the predicted probability of blood loss over 700 mL in the setting of IV oxytocin prophylaxis. The authors concluded there is no benefit to uterine massage, and other decisions about AMTSL protocols need to take into account the availability and route of oxytocin administration. In hospital settings using IV oxytocin prophylaxis, controlled cord traction may not be necessary.

Other studies support the focus on oxytocin as the main ingredient contributing the effect of AMTSL.⁵ A more recent 2019 Cochrane meta-analysis from 24 trials demonstrated that prophylactic oxytocin usage reduces hemorrhage by approximately 50% compared to no medication.⁶

Deneux-Tharoux, et al. conducted a randomized controlled trial in five high-resource maternity units in France comparing the incidence of

hemorrhage with controlled cord traction prior to placental separation versus standard placenta expulsion.⁷ Standard expulsion was described as spontaneous separation and expulsion through maternal efforts, assisted if needed by fundal pressure and “soft tension” on the cord. Length of the third stage was shorter and manual removal of the placenta was less frequent in the controlled traction arm. However, there was no difference in mean blood loss between groups at either > 500 mL or > 1000 mL in the immediate period of birth and initial recovery, nor in mean peripartum change in hematocrit. The authors conclude that controlled cord traction had no effect on postpartum blood loss in the high-resource context. They note that it is difficult to evaluate the impact on manual removal of the placenta because the policy in France is to intervene to remove the placenta if it is not expelled within 30 minutes, and that controlled cord traction is incompatible with delayed cord clamping.

In a Cochrane collaboration systematic review of delayed cord clamping that included 15 trials and 3,911 women, there was no difference in hemorrhage risk between the early and delayed cord clamping groups.⁸ Another consideration is the addition of routine bimanual examination for clots following surgery complicated by hemorrhage reduced the need for further surgical intervention. The small retrospective trial suggests the need for a randomized trial to further study the utility of routine bimanual exam in vaginal birth.⁹

Evidence-based analysis has established a clear benefit of oxytocin prophylaxis in the third stage of labor for reducing maternal hemorrhage, but studies evaluating the individual components have not clearly demonstrated benefit of non-oxytocin components of AMTSL including uterine massage, immediate cord clamping and cord traction in low-risk women. The benefit of

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this technique appears to be the combination of oxytocin, careful attention to possible hemorrhage and prompt intervention.

Based on the current evidence, management protocols should continue to support variations of AMTSL in all women but not allow the individual components to interfere with the labor processes with the exception of the use of oxytocin. The World Health Organization recommends prophylactic oxytocin for all women, advises against sustained uterine massage for hemorrhage *prevention* when prophylactic oxytocin has been used, and recommends

delayed cord clamping for all births unless there is an immediate need for neonatal resuscitation.¹ Further research, with larger numbers of patients in various subgroups and more rigorous methods of determining blood loss, would be helpful to clarify which patients might benefit from other measures. Finally, it is important to make distinctions between management for *prevention* of hemorrhage (AMTSL components) versus *treatment* of hemorrhage which will initially entail similar measures. (See Section: Medications for Prevention and Treatment of Postpartum Hemorrhage on page 114.)

Recommendations

1. Administer prophylactic oxytocin to all women to prevent risk of hemorrhage.
2. Other components of AMTSL are less well supported in the literature and some may increase risk of bleeding. Proceed with AMTSL as desired, but do not let any of these components interfere with labor processes.
3. The benefits of delayed cord clamping for the newborn are believed to outweigh any benefit that might be obtained from other components of AMTSL.

EVIDENCE GRADING LEVEL OF EVIDENCE: A

References

1. World Health Organization. WHO recommendations for the prevention and treatment of postpartum haemorrhage. Updated from 2012. Geneva, 2018.
2. Begley CM, Gyte GM, Devane D, McGuire W, Weeks A, Biesty LM. Active versus expectant management for women in the third stage of labour. Cochrane Database of Systematic Reviews. 2019;2:CD007412.
3. Begley CM, Gyte GM, Devane D, McGuire W, Weeks A. Active versus expectant management for women in the third stage of labour. Cochrane Database of Systematic Reviews. 2011;11.
4. Sheldon WR, Durocher J, Winikoff B, Blum J, Trussel J. How effective are the components of active management of the third stage of labor? BMC Pregnancy and Childbirth 2013;13:46.
5. Gulmezoglu AML, Pisake; Landoulsi, Sihem; Widmer, Mariana; Abdel-Aleem, Hany; Festin, Mario; Carroli, Guillermo; Qureshi, Zahida; Souza, Joao Paulo; Bergel, Eduardo; Piaggio, Gilda; Goudar, Shivaprasad S., Yeh JA, Deborah; Singata, Mandisa; Pelaez-Crisologo, Cristina; Althabe, Fernando; Sekweyama, Peter; Hofmeyr, Justus; Stanton, Mary-Ellen; Derman, Richard; Elbourne, Diana. Active management of the third stage of labour with and without controlled cord traction: a randomised, controlled, non-inferiority trial. Lancet. 2012;379(9827):1721-1727.
6. Salati JA, Leathersich SJ, Williams MJ, Cuthbert A, Tolosa JE. Prophylactic oxytocin for the third stage of labour to prevent postpartum haemorrhage. Cochrane Database of Systematic Reviews. 2019;4:CD001808.

7. Deneux-Tharoux C, Sentilhes L, Maillard F, et al. Effect of routine controlled cord traction as part of the active management of the third stage of labour on postpartum haemorrhage: multicentre randomised controlled trial (TRACOR). *British Medical Journal*. 2013;346:f1541.
8. McDonald SJ, Middleton P, Dowswell T, Morris PS. Effect of timing of umbilical cord clamping of term infants on maternal and neonatal outcomes. *Cochrane Database of Systematic Reviews*. 2013(7):CD004074.
9. Koh PR, Di Filippo D, Bisits A, Welsh AW. Bimanual examination for clot evacuation: A retrospective cohort study of women with postpartum haemorrhage after vaginal delivery. *BMC pregnancy and childbirth*. 2020;20(1):245.

Definition, Early Recognition and Rapid Response to Obstetric Hemorrhage Using Triggers

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Key Principles

1. Identification of risk factors for hemorrhage beginning in the prenatal period and continued re-evaluation of risk is recommended. (See Section: Obstetric Hemorrhage Risk Factor Assessment on page 30.)
2. Early recognition of hemorrhage is critical for timely intervention and prevention of progression to severe hemorrhage. Adoption of a standard obstetric rapid response team and activation criteria for obstetric emergencies such as hemorrhage is recommended.
3. While the majority of obstetric hemorrhage is due to uterine atony, a systematic evaluation should be performed for other causes including retained placental fragments, vaginal sidewall, cervical and posterior uterine lacerations and concealed intra-abdominal bleeding.
4. Initial signs and symptoms of blood loss can be difficult to detect due to the relative health of obstetric patients, compensatory responses and physiologic changes in pregnancy. Laboratory values such as hemoglobin and hematocrit are not accurate in the real-time determination of severity of blood loss.
5. Quantitative cumulative blood loss of 500 mL *and continued bleeding* in a vaginal birth should alert the clinician to the need for increased surveillance. Rapid intervention is indicated *if bleeding continues* or changes in clinical triggers are detected.

The American College of Obstetrics and Gynecology (ACOG) definition of obstetric hemorrhage is cumulative blood loss > 1,000 mL for either vaginal or cesarean birth. ACOG denotes > 500 mL in a vaginal birth is *abnormal*.¹

The Task Force recommends enhanced surveillance and early interventions, as needed, in a vaginal birth with > 500 mL of blood loss *with continued bleeding*.

Background

A comprehensive obstetric hemorrhage protocol should include mechanisms for risk identification, early recognition, rapid response and treatment. Risk identification and early recognition may be difficult due in part to the broad range of clinical risk factors for obstetric hemorrhage, lack of standardized methods for determining the cause of hemorrhage, and challenges in quantifying blood loss. This document focuses on providing a consensus definition of significant blood loss in pregnant and postpartum women and outlining the clinical signs of hypovolemia to quickly identify and respond to heavy or concealed bleeding. Identification of risk factors and stratification is found elsewhere in this Toolkit. (See Section: Obstetric Hemorrhage Risk Factor Assessment on page 30.)

The risk of obstetric hemorrhage is present in every pregnancy. Early identification of abnormal blood loss creates the potential to intervene and prevent major blood loss and subsequent complications of hemorrhage. Early intervention requires:

1. Recognition of risk factors leading to heightened surveillance (including a re-evaluation of risk factors at the beginning of the second stage of labor to include intrapartum events).
2. Appropriate preparations.
3. A standardized proactive approach to accurately determine quantitative cumulative blood loss. (See Section: Best Practice Techniques to Assess Quantitative Cumulative Blood Loss on page 104.)
4. A systematic approach to identify the cause of the hemorrhage.
5. Continuous surveillance for clinical findings suggestive of or indicating hypovolemia.

A systematic approach to identify the cause of the hemorrhage is important and a checklist to support this process is recommended. Performing a thorough examination of the vagina, uterus and abdomen and potentially assessing coagulation status are critical steps in identifying the cause of the hemorrhage. Although the majority of obstetric hemorrhage is related to uterine atony, other causes like vaginal and cervical lacerations, hematomas, uterine rupture, abnormally adherent placenta, uterine inversion and coagulopathies are included in the differential diagnosis.² More than one issue can simultaneously contribute to hemorrhage. To have the best chance of preventing the progression of heavy bleeding to massive hemorrhage, which carries the risk of more devastating sequelae, all of these possible etiologies should be considered.

Box 1: Standardized checklist for evaluation of the cause of obstetric hemorrhage

Perform each examination carefully and thoroughly the first time (so it does not need to be repeated!)

- Vaginal examination
 - Appropriate lighting and instruments, assistants are critical
 - Evaluate for cervical laceration(s)
 - Evaluate for vaginal laceration(s)
 - Evaluate for vaginal hematoma(s)
- Placental examination
 - Evaluate for a potential succenturiate lobe or other evidence of retained placental fragments
- Uterine examination
 - Bimanual examination
 - Assessment for atony, perform massage and manual focal exploration of the uterus
 - Ultrasound evaluation
 - Evaluate for retained placenta, accessory placental lobes, retained membranes, consider possibility of occult or partial accreta
- Abdominal examination
 - Evaluate for symptoms of intra-abdominal bleeding (shoulder pain, peritoneal signs, abdominal distention)
 - Consider uterine rupture (regardless of prior cesarean or not)
 - Consider post-operative complication (bleeding vessel, tubal ligation site)
 - Consider the possibility of concealed hemorrhage
 - Evaluate for post-operative/post-delivery, intra-abdominal or retroperitoneal bleeding/hematoma with ultrasound or CT scan, if clinically stable
- Evaluation for coagulopathy
 - Ascertain patient or family history of bleeding disorders
 - Laboratory evaluation with CBC, PT/PTT/INR, fibrinogen level

Improving Health Care Response to Obstetric Hemorrhage, a CMQCC Quality Improvement Toolkit, 2022

Trigger significant blood loss

Obstetric hemorrhage, as defined by ACOG, is a cumulative blood loss of greater than or equal to 1,000 mL or blood loss accompanied by signs or symptoms of hypovolemia within 24 hours after the birth process regardless of route of birth.¹

In healthy women, blood loss is generally tolerated without vital sign changes until cumulative blood loss exceeds 1,000 mL.³ Traditional definitions of hemorrhage have been based on estimated blood

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loss, changes in laboratory values and clinical signs. Problems exist with all of these quantifiers. Visual estimation of blood loss has been shown to be inaccurate particularly when blood loss is excessive.^{2,4,5} Changes in laboratory blood values such as hemoglobin level or hematocrit are often delayed following hemorrhage and therefore are not helpful with early recognition and treatment.⁶ Generally, it takes approximately four hours after acute blood loss for changes in laboratory values to be seen, with the peak change occurring as late as 48-72 hours after birth.⁶⁻⁸

Commonly used alarm triggers of ≥ 500 mL **and continued bleeding** for a vaginal birth and $> 1,000$ mL for cesareans should be considered for beginning the steps of active management of hemorrhage. The ≥ 500 mL **and continued bleeding** trigger can be supported for vaginal birth because unlike cesareans in an OR where anesthesia providers are present, medications are immediately available, and staff and resources are increased; most vaginal births are not performed in a similar setting and thus a lower threshold to begin active management of hemorrhage is prudent. ACOG agrees that blood loss ≥ 500 mL in a vaginal birth should be considered **abnormal** and should spur the provider to investigate and address the cause.^{1,9,10}

Secondary (late) postpartum hemorrhage

Secondary PPH can occur 24 hours to 12 weeks postpartum. Common causes are retained products of conception, infection, and subinvolution of the placental bed. The patient should first be stabilized, then evaluated clinically and potentially with imaging to determine a cause, followed by management with medical or surgical interventions.²

Secondary postpartum hemorrhage occurs in 1% of pregnancies.¹ Ultrasound evaluation can help identify retained placental tissue. Endometritis should be suspected in the presence of uterine tenderness and low-grade fever. Secondary PPH may be the first indication of a bleeding disorder such as von Willebrand disease.² (See Section: Inherited Bleeding Disorders in Pregnancy on page 59.) Uterine arteriovenous malformation (AVM) is a rare condition with potentially life-threatening consequences and should be considered in patients with continued bleeding unresponsive to medical and surgical interventions.

Patients with delayed PPH often present in the emergency department (ED) after discharge home from their birth admission.¹¹ When women present to the ED, it is **important to identify whether they have been pregnant in the last 6 weeks**. If yes, assess immediately. Emergency department personnel should be familiar with the risk factors and signs and symptoms of PPH, including evaluation of postpartum bleeding and assessment of clots.¹²

Place a striking graphic to inform women or their families to alert the triage nurse if they are recently postpartum. A graphic may help to ensure timely diagnosis and treatment. Appendix L: HEM ED Visit Stop Sign on page 225 contains an example of a stop sign graphic.

Since each hospital has different resources and workflows, an interdepartmental team of ED and obstetric clinicians should discuss assessment, consultation and transfer practices that would work best for their hospital. Ideally, the interdepartmental team should use mutually developed workflows to implement a policy that is agreed upon by all affected departments. (See Section: Secondary Postpartum Hemorrhage and Readmission on page 163.)



Trigger: Clinical signs of hypovolemia

In response to blood loss, several compensatory mechanisms work to move venous blood into central circulation, redirect blood to essential organs, and cause the heart to pump blood more forcefully.¹² In a state of health, the body can successfully compensate for as much as a 20-25% blood loss before clinical signs of hypovolemia develop. Changes in vital signs can be subtle in the initial stages of hemorrhage based on a young healthy person's ability to compensate for loss of volume. This is particularly true during pregnancy when increased circulating blood volume may further conceal loss.^{7,10}

Clinical signs of excessive blood loss or hypovolemia include elevated heart rate and respiratory rate, decrease in blood pressure, drop in urine output, dizziness, altered level of consciousness, pallor and a sense of "impending doom."¹³ Many studies have questioned a single focus on vital signs measurements in acute hemorrhage using the cut offs defined by advanced trauma life support (ATLS) guidelines. A systematic review on the association of

blood loss with clinical signs and symptoms in trauma patients reported a significant variability between blood loss and clinical signs.¹⁴ Normal physiologic changes in pregnant women cause increases in maternal blood volume and cardiac output, and these important changes may alter the vital sign responses to hemorrhage. The updated classification from ATLS 10th edition, published in 2018, recognizes the shortcomings of previous versions and includes a category for pulse pressure and base deficit -- both have been shown to better correlate with the degree of hypovolemia due to hemorrhage. Importantly, *trends*, not absolute values of vital signs, are emphasized to assist in the assessment of hemorrhage.¹⁴

Aggressive treatment of women at clinical trigger points has the potential to limit overall blood loss and prevent hemorrhage complications such as dilutional coagulopathy or disseminated intravascular coagulation (DIC).

Table 1 on page 98 correlates clinical signs with the amount of blood loss as defined by the ATLS-10 classification.¹⁴ Note that many clinical signs do not occur until the blood loss reaches very large volumes.

Table 1: Clinical signs of hypovolemia

Amount of blood loss	Clinical signs ¹⁴
1000 mL	Slight change in blood pressure, heart rate may be normal, palpitations, respiratory rate normal, dizziness, normal urine output. Normal pulse pressure, normal base deficit.**
1500 mL	Narrowed pulse pressure* , tachycardia, increasingly diaphoretic and weak, base deficit -2 to -6 mEq/L**
2000 mL	Developing hypotension, narrowed pulse pressure, marked tachycardia (> 110), tachypnea (RR > 24), pale, extremities cool, restlessness with mental status changes, decreased urine output, base deficit -6 to -10 mEq/L**
≥ 2500 mL Severe hemorrhagic shock	Profound hypotension, worsening tachycardia and tachypnea, negligible urine output or anuria, altered level of consciousness, base deficit > -10 mEq/L**

*Pulse pressure is the difference between the systolic and diastolic blood pressure. With hemorrhage, a rise in the diastolic pressure reflects vasoconstriction and narrows the pulse pressure. This can be one of the key findings in early stages of hemorrhage.^{7,15}

**The base deficit is a measurement of acidemia as a result of poor peripheral tissue oxygenation from hypovolemia.¹⁴

This table was adapted from the Improving Health Care Response Obstetric Hemorrhage: A California Quality Improvement Toolkit, funded by the California Department of Public Health, 2015; supported by Title V funds.

When should you be concerned?

While absolute numbers are important for Maternal Early Warning Systems, the following scenarios warrant elevated levels of concern from nursing and provider staff even if the cut off “parameters” are not yet met.

- Vital signs are trending towards abnormal compared to the patient’s baseline
- A febrile patient with tachycardia, especially post-cesarean, should be considered for concealed hemorrhage *coexistent* with chorioamnionitis or endometritis
- Vital sign abnormalities that are not responsive to usual resuscitative measures
- Patient confusion, lethargy, or change from baseline mental status
- Pain unrelieved by standard postpartum medications

Bedside evaluation and validation of vitals is crucial. The team must ensure that vital sign abnormalities are not discounted as “normal” due to “anxiety” or pain. Patient or family concerns regarding blood loss, clots and discomfort must be thoroughly evaluated and addressed. Ensuring early recognition and intervention of hemorrhage is key.

A promising option for clinical evaluation of volume status in hemorrhage is the shock index (SI).¹⁶ The SI can be an accurate predictor of cardiovascular changes secondary to blood loss even in patients with normal blood pressure. The SI represents a more reliable indicator of compensatory adjustments in hemorrhage based on available data.¹⁷ An elevated SI ≥ 0.9 has been shown to be

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associated with massive transfusion and is a strong predictor of ICU admission and morbidity in women with postpartum hemorrhage.¹⁸ Although more prospective data is needed in an obstetric-specific population, the SI is a simple calculation, and may be an early indication of significant hypovolemia and risk of progression to complications.¹⁶

Shock index calculation

Shock Index = Heart Rate/Systolic BP

An SI > 0.9 indicates increased risk for hemorrhage related morbidity due to hypovolemia.

Maternal early warning systems

To identify clinical signs of deterioration or concerning patient vitals, many institutions have implemented various versions of maternal abnormal vitals triggers, best practice advisories, or other safety checkpoints to be alerted to changes in patient status. While these scores or risk factors can be calculated by nursing staff on paper, the widespread adoption of electronic health records (EHR) provides an automated way of calculating scores and implementing early warning notifications. (See Section: Using the Electronic Health Record (EHR) to Improve the Management of Obstetric Hemorrhage on page 76.) The MEWS can enable early detection of vital sign abnormalities in obstetric patients with the goal of reducing maternal morbidity and mortality. Implementation and successful use of such a system requires dedicated resources such as administrative support, coordination of healthcare staff and providers, and information technology resources. Although MEWS may identify significant vital sign abnormalities in many obstetric emergencies, they have not been shown to aid in early identification of hemorrhage specifically, the majority of which are readily apparent in real time as they occur. A small proportion of obstetric hemorrhages are concealed, and therefore initial studies may have been underpowered to detect an impact of MEWS on this important subtype of hemorrhage. Further, in healthy

women, blood loss is generally tolerated without vital sign changes until the cumulative blood loss exceeds 1,000 mL or more.^{3,19}

When risk factors for hemorrhage are present or hemorrhage is suspected, careful and accurate assessment of the clinical parameters and attention to patient concerns are essential to detect signs of decompensation. When medical conditions exist such as anemia or preeclampsia, signs of decompensation can occur with smaller amounts of blood loss. Signs of hypovolemia may only be clearly apparent when the body is no longer able to successfully compensate, therefore response needs to be rapid, particularly during pregnancy. Utilization of the combination of clinical signs of hypovolemia, the SI and MEWS could aid in earlier identification of hemorrhage, a critical first step toward preventing morbidity and mortality.

Improving racial disparities in recognition and treatment of hemorrhage

Research shows that racism, not race, impacts health care, health and health outcomes. Systemic and institutional racism affect health care provision and social determinants of health. This is such an important issue that training for all providers and staff regarding implicit bias and how it relates to and affects maternal and infant morbidity and mortality is a California

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state law ([California Dignity in Pregnancy and Childbirth Act](#)) with completion in 2021. See the section titled Obstetric Hemorrhage Simulations and Drills on page 71 for training examples. Research shows that non-Hispanic Black women receive lower quality pregnancy care and have the highest rates of severe maternal morbidity indicators used by the Center for Disease Control.²⁰ Among women with a diagnosis of hemorrhage, non-Hispanic Black and Hispanic women are 4.7 and 3.7 times more likely to die than white women.²¹ These elevated risks are not explained by medical risk factors alone, but are likely due to disparities in antenatal, intrapartum and postpartum care.

In addition to clinical techniques for recognizing hemorrhage, it is critically important for clinicians to practice active listening regarding patient experiences as experts of their own bodies. One woman shared that she felt like nurses did not believe her report of hemorrhage and insisted her family take a photo in the bathroom where the bleeding occurred.

They wanted to see how heavy I was bleeding, because I feel like my words weren't enough. I don't know if they thought I was lying about the golf ball-sized blood clot, but they wanted to see it physically. I showed them the picture, and they still didn't know what was wrong with me.²²

It is critical to have a uniform and objective metric when assessing risk factors for hemorrhage and clinical signs of hypovolemia and deterioration. These standard tools will help provide an

infrastructure that ensures safety for all birthing people, regardless of race, because they potentially adjust for implicit biases that are present in providers and systems as a whole. As noted above, EHR systems that objectively assess vitals, patient history, lab results and clinical information may be an important tool to counter implicit biases and provide uniformity in evaluation and scoring of hemorrhage risk and need for intervention. (See Section: Using the Electronic Health Record (EHR) to Improve the Management of Obstetric Hemorrhage on page 76.)

Importantly, the experience in California has shown that implementation of the CMQCC hemorrhage safety bundle significantly improved outcomes. Data analysis revealed reduced rates of severe maternal morbidity due to hemorrhage in all races, and a narrowing of the performance gap between Black and white women by more than 50% as measured by severe maternal morbidity and transfusion rates. Incorporating safety bundles and quality improvement projects has the capacity to reduce morbidity and mortality due to obstetric hemorrhage in all patients, and they can narrow racial/ethnic disparities that may be present.^{8,23}

Rapid response and emergency activations

Many hospitals have rapid response teams (RRT) and code teams comprised of a set group of interdisciplinary care providers that respond to conditions like respiratory distress, sepsis and other concerning conditions or signs of deterioration. These teams may include nurses, respiratory therapists, intensivists, phlebotomists and pharmacists. Hospital-wide RRTs should have dedicated staff without competing clinical responsibilities who are able to work collaboratively with bedside nurses. Any clinical team member should be able to activate the RRT without fear of reprisal.²⁴ Furthermore,

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empowering nursing to activate the RRT to quickly provide resources in instances of obstetric emergencies is an integral part of safety culture.

Rapid response teams are typically not designed to respond to specific obstetric conditions, given the uniqueness of the field and special training required to manage obstetric emergencies, in particular obstetric hemorrhage. Evidence suggests that an obstetric-specific rapid response team (OB-RRT) can have a positive impact on patient safety.²⁵ An OB-RRT team, with a standardized mechanism for activation, ensures a standardized response of appropriate personnel to obstetric-specific emergencies, and provides situational awareness to the rest of the unit that a critical event is occurring. Hospitals that utilize a hospital-wide RRT to respond to obstetric emergencies should include these teams in simulation and training so that there is no role confusion among team members. (See Appendix U: Sample Code Crimson on page 244.)

Key principles for obstetric rapid response activation:

- Obstetric hemorrhage requires rapid mobilization of trained team members with obstetric-specific training
- Each hospital should have predetermined minimum criteria describing when to activate the OB-RRT
- Any clinical team member involved in the care of a patient should be empowered to activate the OB-RRT
- Activation of an OB-RRT requires a predetermined process for notification of all team members simultaneously whenever possible. Examples include an overhead page or an emergency pager, however each hospital will have different choices available to them.
- Members of OB-RRT should have an understanding of their specific roles during an OB hemorrhage
- Activation of the OB-RRT should be included in drills and simulations

Recommendations

1. Use the following as **alert and action triggers** for obstetric hemorrhage:
 - a. Alert triggers: Quantitative cumulative blood loss ≥ 500 mL for vaginal birth and ≥ 1000 mL for cesarean warrants heightened surveillance **for continued bleeding**.
 - b. Action triggers: In the presence of **ongoing bleeding** or any evidence of hypovolemia, additional steps (Stage 1) should be considered. (See Appendix C: Obstetric Hemorrhage Care Guidelines: Table Format on page 194.)
2. Use a standard clinical definition of obstetric hemorrhage for **safety/quality monitoring**. An example is obstetric hemorrhage defined as quantitative cumulative blood loss of ≥ 1000 mL **OR** blood loss accompanied by signs/symptoms of hypovolemia within 24 hours following birth processes including intrapartum blood loss.^{6,26} (See Section: Debrief and Multidisciplinary Case Review Guidelines on page 167.)

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3. Perform risk assessment for hemorrhage at birth admission, at the start of the 2nd stage of labor, at transfer to postpartum care, and as the patient's status changes. (See Section: Obstetric Hemorrhage Risk Factor Assessment on page 30.)
4. Implement quantification of cumulative blood loss at all births leading to stage-based management of hemorrhage. (See Section: Best Practice Techniques to Assess Quantitative Cumulative Blood Loss on page 104.)
 - a. Identify and treat all women with quantitative cumulative blood loss ≥ 500 mL after vaginal birth or ≥ 1000 mL after cesarean birth *and continued bleeding*. (See Appendix B: Obstetric Hemorrhage Care Guidelines: Checklist Format on page 187.)
 - b. Clinical triggers that warrant surveillance and intervention:
 - i. Vital sign trends; increasing heart rate and respiratory rate
 - ii. Narrowed pulse pressure
 - iii. Base deficit Increasing > -2
 - iv. Maternal anxiety and sense of doom^{13,27}
 - v. Shock index > 0.9 (SI = HR/Systolic BP)¹⁹
 - c. Clear and consistent guidelines for when to activate an OB-RRT including a simple standardized notification process that can be activated by any clinical team member.
5. Implement standardized protocols and safety bundles for OB hemorrhage to improve outcomes and reduce racial disparities.
6. Provide staff training regarding clinical triggers and implement a maternal early warning system to increase timely recognition and appropriate response to hemorrhage, thus improving maternal safety, the ultimate goal.²⁷

EVIDENCE GRADING

LEVEL OF EVIDENCE: B

References

1. ACOG. Postpartum hemorrhage. Practice Bulletin No. 183 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology*. 2017;130(4):e168-e186.
2. Belfort MA. Secondary (late) postpartum hemorrhage. UpToDate. Published 2020. Accessed 3/1/2021, 2021.
3. Blumenthal EA, Hooshvar N, Tancioco V, Newman R, Senderoff D, McNulty J. Implementation and evaluation of an electronic maternal early warning trigger tool to reduce maternal morbidity. *American Journal of Perinatology*. 2020.
4. ACOG. Postpartum Hemorrhage. Practice Bulletin of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology*. 2006;108(4).
5. Schorn MN. Measurement of blood loss: Review of the literature. *Journal of Midwifery and Women's Health*. 2010;55(1):20-27.
6. Rath WH. Postpartum hemorrhage--update on problems of definitions and diagnosis. *Acta Obstetrica et Gynecologica Scandinavica*. 2011;90(5):421-428.

7. Francois K, Foley M. Antepartum and postpartum hemorrhage. In: Gabbe SG, et al., eds. *Obstetrics: Normal and Problem Pregnancies*. 6th ed. Philadelphia, PA: Elsevier Saunders; 2012.
8. Main EK, Cape V, Abreo A, et al. Reduction of severe maternal morbidity from hemorrhage using a state perinatal quality collaborative. *American Journal of Obstetrics and Gynecology*. 2017.
9. Pritchard Jea. Blood volume changes in pregnancy and the puerperium. *American Journal of Obstetrics and Gynecology*. 1962;84:1271-1272.
10. Cunningham F, Leveno K, Bloom S, Hauth J, Gilstrap L, Wenstrom K. *Williams Textbook of Obstetrics*. 22nd Edition. 2005.
11. Rampersad F, Narine S, Rampersad D, Diljohn J, Ali R. Uterine arteriovenous malformation mimicking retained products Of conception - treated with embolization. *Radiology Case Reports*. 2020;15(11):2076-2079.
12. Franklin C, Darovic G. Monitoring the patient in shock. In: *Hemodynamic monitoring: Invasive and noninvasive clinical application*. 3rd ed. Philadelphia: Saunders; 2002.
13. Gilchrist PT, Ditto B. Sense of impending doom: Inhibitory activity in waiting blood donors who subsequently experience vasovagal symptoms. *Biological Psychology*. 2015;104:28-34.
14. ATLS. *Advanced Trauma Life Support Student Course Manual*. Chicago, IL: American College of Surgeons; 2018.
15. Harvey CD, G. Obstetric hemorrhage. In: Trojano NH, C. ; Chez, B., eds. *High risk and critical care obstetrics*, 3rd ed. Philadelphia: Wolters Kluwer Lippincott Williams & Wilkins; 2013.
16. Lee SY, Kim HY, Cho GJ, Hong SC, Oh MJ, Kim HJ. Use of the shock index to predict maternal outcomes in women referred for postpartum hemorrhage. *International Journal of Gynaecology and Obstetrics*. 2019;144(2):221-224.
17. Pacagnella RC, Souza JP, Durocher J, et al. A systematic review of the relationship between blood loss and clinical signs. *PLoS One*. 2013;8(3):e57594.
18. El Ayadi AM, Nathan HL, Seed PT, et al. Vital sign prediction of adverse maternal outcomes in women with hypovolemic shock: The role of Shock Index. *PLoS One*. 2016;11(2):e0148729.
19. Friedman AM, Campbell ML, Kline CR, Wiesner S, D'Alton ME, Shields LE. Implementing Obstetric Early Warning Systems. *AJP Reports*. 2018;8(2):e79-e84.
20. Howell EA. Reducing disparities in severe maternal morbidity and mortality. *Clinical Obstetrics and Gynecology*. 2018.
21. Rosenberg D, Geller SE, Studer L, Cox SM. Disparities in mortality among high risk pregnant women in Illinois: A population based study. *Annals of Epidemiology*. 2006;16(1):26-32.
22. New York City Department of Health and Mental Hygiene. *Women's experiences with severe maternal morbidity in New York City: A qualitative report*. New York, NY2020.
23. Main EK, Chang SC, Dhurjati R, Cape V, Profit J, Gould JB. Reduction in racial disparities in severe maternal morbidity from hemorrhage in a large-scale quality improvement collaborative. *American Journal of Obstetrics and Gynecology*. 2020;223(1):123 e121-123 e114.
24. Dukes K, Bunch JL, Chan PS, et al. Assessment of rapid response teams at top-performing hospitals for in-hospital cardiac arrest. *JAMA: Journal of the American Medical Association* 2019.
25. Al Kadri HM. Obstetric medical emergency teams are a step forward in maternal safety! *J Emerg Trauma Shock*. 2010;3(4):337-341.
26. Menard MKM, Elliott K.; Currigan, Sean M. Executive summary of the reVITALize initiative: Standardizing obstetric data definitions. *Obstetrics and Gynecology*. 2014;124(1):150-153.
27. Mhyre JM, D'Oria R, Hameed AB, et al. The maternal early warning criteria: A proposal from the National Partnership for Maternal Safety. *Journal of Obstetric, Gynecologic, and Neonatal Nursing: JOGNN*. 2014;43(6):771-779.

Best Practice Techniques to Assess Quantitative Cumulative Blood Loss

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Key Principles

1. Quantification of blood loss is the best clinical method of calculating cumulative blood loss.
2. Quantitative cumulative blood loss is the determination of blood loss over a period of time which should be used as the trigger for clinical intervention. This ongoing total throughout the admission should include all losses before, during and after birth. Totals should be regularly communicated with all members of the care team.
3. Early identification of obstetric hemorrhage with accurate blood loss quantification may alert care teams to the patient's bedside for further clinical assessment and treatment.
4. Visual estimation significantly underestimates large volumes of blood by 33-50%.
5. Evidence indicates that the gravimetric, volumetric and colorimetric methods for measuring blood loss are more accurate than visual estimates.
6. Cumulative blood loss should **NOT** be used in isolation to confirm or rule out obstetric hemorrhage.

Background

Accurate measurement of blood loss is an important process measure for detecting obstetric hemorrhage. A high rate and/or magnitude of blood loss after birth should be used as a trigger to alert the care team to perform immediate assessment and management.

Defining common terms

With the introduction of multiple methods for measuring blood loss, there are now more terms

to define blood loss. This has created an issue of confusing terms describing various methods. Estimated blood loss (EBL) is a traditional term used in documentation and communication between providers. With the move toward the refinement of volume estimation, the term quantitative blood loss (QBL) has been introduced in an attempt to delineate that a presumably more accurate assessment has occurred. Additionally, the term cumulative blood loss (CBL) is utilized as a clinical trigger measurement.

RECOGNITION

Because these are new and evolving terms there is significant confusion with communication and documentation using these terms, particularly in electronic format. These terms should be embedded into all written and electronic documentation regarding blood loss assessment to improve communication between providers and staff. (See Appendix O: Terms and Techniques for Describing Blood Loss on page 230.)

To clarify, the following definitions are proposed:

Estimated blood loss (EBL): Traditional estimate of blood loss by providers considering their visual impression of the amount of blood visually on drapes, pads, sponges, etc., combined with knowledge of the total fluid in suction cannisters and other collection devices. Training is experience-based, and measurement involves giving a total estimate following completion of a procedure or bleeding episode. Commonly, different estimates have been given by multiple providers for the same birth causing confusion in management.

Quantitative blood loss (QBL): Estimate of blood loss by various methods which may involve formal training with visual estimation, gravimetric techniques involving weighing items, and/or colorimetric (photometric) methods using specialized equipment which estimates blood volumes on sponges and in canisters. These techniques are meant to provide a more accurate measure of the quantity of blood lost but are still approximations. Workflows using these methods often involve multiple measurements during lengthy procedures or bleeding events in order to give the latest status to providers.

Cumulative blood loss (CBL): The process of accruing multiple observations of EBL or QBL during an episode of care. The cumulative blood loss is used in management algorithms to guide interventions for hemorrhage control including medications, hemorrhage balloons and surgical procedures. This ongoing total throughout the hospitalization should include all losses before, during and after birth.

To improve communication between providers and staff, these terms with accompanying definitions should be imbedded into all written and electronic documentation regarding blood loss assessment.



Maternal health advocacy group, *MoMMA's Voices*, is working to translate all Alliance for Innovation in Maternity Services (AIM) clinical bundles into everyday language so women and their support persons will be familiar with standardized practices in treatment of severe events. The patient representative on the Obstetric Hemorrhage Toolkit 2.0 had read about CMQCC's work and then understood that an opportunity was missed in her care when her blood loss was not measured:

I must have used the portable toilet four times in that emergency room. The nurse never weighed that blood. And that's a common thing: people don't realize you're hemorrhaging because they don't even keep track.¹

What modalities can be used for quantifying blood loss?

Several modalities have been described for measuring blood loss after birth. Visual estimation, historically, has been the most common modality,²⁻⁴ and measurements of EBL rely heavily on this method. This can be problematic, as visual estimation has consistently been shown to significantly underestimate large volume blood loss by 33-50% when compared to direct measurement.²⁻⁶ Visual estimation of blood loss may also be complicated by the presence of a large volume of urine, amniotic, or irrigation fluid. Studies demonstrate that while visual estimation of blood loss is inaccurate, especially for larger volumes, it can be improved with training.^{2-4,6} However, visual estimation training has been shown to deteriorate over time.^{7,8}

Quantitative blood loss standardizes the process of measuring blood loss, making it more consistent between operating room (OR) teams, providers and nurses. This method correlates moderately well with decreases in hemoglobin and has been shown to have good reproducibility and feasibility. While evidence of clear improvement in clinical outcomes is lacking, the Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN) and the Council

on Patient Safety in Women's Health Care recommend routine QBL measurement at all births.⁹⁻¹²

Gravimetry: This modality involves the weighing of blood-soaked materials, notably laps and sponges. To calculate the blood weight, the dry weight needs to be subtracted from the weight of blood-soaked materials and then converted into milliliters (mL) blood volume. Use of simple applications, such as a calculator embedded within an EHR or a spreadsheet which includes standard dry weights for any items used during cesarean or vaginal birth, can facilitate easier determination of QBL. A paper worksheet with dry weights listed can also be used. (See Appendix P: Sample Paper Calculators for Quantifying Blood Loss on page 231.)

The weight of irrigation fluids or amniotic fluid may lead to inaccuracies in the calculation of blood weight. To account for the weight of the wet laps, many institutions determine the "wet weight" of moist laparotomy sponges or subtract the amount of irrigation fluid used to moisten the sponges. Since this extra volume is usually low, however, AWHONN endorses ignoring this fluid and using only dry weights for simplicity.⁹ Limited data exist comparing blood loss estimation using a gravimetric approach to a gold standard



hemoglobin extraction.¹⁰ In one study, blood loss measured gravimetrically overestimated actual blood loss.¹³ Also, this approach typically does not account for blood on surgical drapes, providers' clothing, or the floor.

Volumetry: For vaginal birth, conical volumetric drapes can be used. Previous research has shown that the use of calibrated V-drapes is associated with improved blood loss measurement accuracy in a simulated postpartum hemorrhage (PPH) scenario compared with uncalibrated drapes. Measurement of blood loss by calibrated drape at vaginal birth was highly correlated with photo spectrometry values.^{14,15} To improve accuracy, after birth of the baby the volume of amniotic fluid in the drape should be noted, recorded and then subtracted from the total final volume to assess blood volume lost. For cesareans, suction container volumes should be quantitated by subtracting the amount of irrigation fluid and amniotic fluid suctioned from the total cannister volumes. The amniotic fluid volume should be noted prior to suctioning blood after expulsion of the placenta.

Combined volumetry and gravimetry: This involves combining the gravimetric totals from sponges, chuxs, etc. with the volumetric measurement in V-drapes and cannisters. The use of a combined approach may have clinical utility; however, limited research has been conducted to assess this. In a retrospective 'before vs. after'

study comparing visual estimation to a combined approach, the PPH detection rate with a combined approach tripled (from 2.8% to 10.8%), but with no significant difference in transfusion rates. This increased detection rate can lead to earlier and more aggressive implementation of a stage-based hemorrhage protocol, as recommended by The Joint Commission.^{16,17} (See Section: Implementing and Sustaining Maternal Quality, Safety and Performance Improvement for Obstetric Hemorrhage on page 20.)

Colorimetrics with artificial intelligence: A system using colorimetric analysis for quantifying hemoglobin content is commercially available. This system uses a feature extraction technology coupled with a color density-based algorithm to calculate hemoglobin mass. In addition, the system accounts for non-blood contamination on blood-soaked materials in its algorithm. Studies validating the accuracy of this technology in vivo and in vitro have been performed.^{18,19} Based on data from several retrospective studies, this system may enable early recognition of PPH and have greater accuracy than other measurement modalities.²⁰⁻²² However, such a system cannot account for larger materials that collect blood, including surgical drapes and bedsheets. Also, it is unclear whether these devices lead to earlier or better treatment and thereby, improve maternal outcomes. In summary, large prospective studies are needed to assess the performance and cost-effectiveness of this method.

RECOGNITION

While there is limited data on clear clinical improvement with the implementation of QBL, replacing visual estimation with more precise quantification of blood loss at birth has been proposed as one of seven safety objectives of the National Maternal Health Initiative and is recommended at all births for the following reasons.²³

Rationale for routine quantification of blood loss at all births, during labor, and postpartum:

1. A delay in diagnosis of hemorrhage remains the most significant factor in patients being at higher risk of severe morbidity from hypoperfusion and severe anemia, leading to major organ damage, failure, and potentially death. Underestimation of the rate and magnitude of blood loss may result in a delayed diagnosis because the care team may not fully appreciate the true extent and severity of the blood loss after birth.^{24,25}

2. Standardization of procedures is an important aspect of improving safety and quality. If QBL is performed only in severe cases, staff may be unfamiliar with the procedures and less likely to obtain valid data. With practice and routine adoption, quantification of blood loss generally requires only minutes to perform in the majority of births.²⁶ When the staff is well-trained and comfortable with the modalities used to quantify blood loss, care processes will go much smoother during an actual hemorrhage.

3. Setting the expectation that QBL will be performed at each birth removes any opportunity for disagreement about when the processes to quantify blood loss should be initiated.

4. While QBL measurement is a nurse-led process, it must be supported by the obstetric and anesthesia teams for success of implementation and accuracy. Incorporating QBL into every birth emphasizes the importance of interdisciplinary communication in all aspects of patient care.²⁷

5. When hemorrhage happens outside of the delivery room (during antepartum, intrapartum, or in the delayed postpartum period), underestimation of blood loss is particularly common. Routine QBL assessment in these situations can help improve safety for patients, as nurses can provide more accurate information on blood loss to obstetric providers.

Challenges and responses to measuring QBL

Challenge: QBL is not exact; it is too difficult to measure accurately with all this amniotic fluid and irrigation.

Response: *QBL is not meant to be exact, but it is **still more accurate** than EBL. Even if measurements are off by 100-200 mL, QBL can still help identify hemorrhage. Once the uterus is closed and the bleeding is controlled, QBL measurements can be completed by calculating suction container volumes, without the need to account for further irrigation and fluids.*

Challenge: QBL takes too long to do in real time and delays the closing of the case.

Response: *With practice, performing QBL measurements will become quicker. Measurements are most effective if called out in real time so that continued bleeding can be assessed, and appropriate treatments initiated.*

Challenge: During a real hemorrhage, we have too much to do to worry about QBL.

Response: *Hemorrhage is an obstetric emergency, requiring recruitment of additional staff (e.g. obstetric rapid response team) to assist with all of the steps in the algorithm. Quantitative cumulative blood loss should be considered primarily as a trigger for urgent assessment and management. Once a care team has initiated assessment and treatment, teams should transition to resuscitation and medical and surgical management. If staff members are in short supply, those who are managing the obstetric emergency should be focused on resuscitative measures. Still, continued quantitative cumulative blood loss assessment helps to gather the complete picture of the hemorrhage and ensure adequate repletion of blood products.*

Challenge: QBL has not been shown to improve clinical outcomes in any randomized controlled trials.

Response: *QBL is generally implemented as part of a bundle, as it emphasizes the importance of early recognition of hemorrhage, close teamwork between nurses, OB providers, anesthesiologists, and a shared mental model on what interventions should be initiated. It is one part of the strategy to facilitate effective response to hemorrhage, which is clearly underestimated using visual estimation of blood loss. As an analogy, just because we can generally tell when someone has a fever does not mean that the thermometer is not a useful tool.*

Challenge: If the quantitative cumulative blood loss is normal, does this mean that the patient does not have an obstetric hemorrhage?

Response: *No. Quantitative cumulative blood loss should NOT be used in isolation to confirm or rule out obstetric hemorrhage. Patients may have concealed hemorrhage (from placental abruption or a retroperitoneal hematoma) but have normal or scant blood loss. During a cesarean, blood loss from the uterus that is lost per vagina under the surgical drapes will not be quantified or fully appreciated in real time because of the visual obstruction of the surgical drapes. In addition, internal bleeding into the peritoneal cavity is unlikely to present with external bleeding; however, the patient may present with clinical signs of shock, worsening anemia and developing coagulopathy.*

For these reasons, providers should not be falsely reassured in a patient with hemodynamic instability and a 'normal' QBL after birth. Repeated quantitative cumulative blood loss should be taken into account with other physiological indices (including heart rate, blood pressure, urine output) and laboratory indices (hemoglobin, platelet count, coagulation indices, lactate, acid-base balance) when

RECOGNITION

there is clinical suspicion of major obstetric hemorrhage. In addition, paying attention to patient complaints of feeling cold, nauseated, lightheaded or just “not feeling right” should also be a cue to evaluate for possible postpartum hemorrhage. (See Section: Definition, Early Recognition and Rapid Response to Obstetric Hemorrhage Using Triggers on page 93.)

QBL tools

1. Make scales readily available in labor and delivery:
 - a. Blood-soaked materials should be placed in a precautionary container system, such as red-bagging, but kept accessible to facilitate resolution of any discrepancies in blood volume loss assessment if needed.
 - b. Subtract the materials dry weight from the total weight. Strategies for doing this include:
 - i. Zeroing the scale with dry material.
 - ii. Weighing blood-soaked material and subtracting known dry weight from the total weight.
 - Facilities should keep an updated list of standard dry weights for materials that is easily accessible.
2. Use under-buttocks calibrated V-drapes with measurement marks on collection pouches.
3. Sample Paper Calculators for Quantifying Blood Loss. (Appendix P on page 231)
4. Sample QBL Worksheet. (Appendix M on page 226)

Recommendations

1. All facilities should provide resources and standardized education on the calculation and documentation of quantitative cumulative blood loss.²⁸
2. Quantitative cumulative blood loss is a key component of stage-based assessment of obstetric hemorrhage and should be implemented as a routine practice on all units caring for obstetric patients.²⁸
3. Measuring quantitative cumulative blood loss should be a collaborative effort that includes nurses, anesthesiologists and obstetric providers.
4. For vaginal birth:
 - a. Use under-buttocks calibrated V-drapes with graduated markers to collect blood for vaginal births.
 - b. Immediately after the birth of the baby, pause to assess the amount of fluid in the under-buttocks calibrated drape. This value is the ‘baseline’ and all subsequent fluid represents blood loss.
 - c. At the start of the recovery period, weigh all blood clots and blood-soaked materials to determine cumulative volume. Alternatively, a colorimetric method could be used.

RECOGNITION

5. For cesarean birth:
 - a. After the birth of the baby, suction all amniotic fluid and stop to assess the amount of collected fluid before delivery of the placenta. This value is the 'baseline' and all subsequent fluid represents blood loss. Once the uterus is closed and the bleeding has stopped, the suction canister should be reevaluated and that amount should be recorded. In this manner, irrigation (if used) does not need to be accounted for.
 - b. In addition to counting lap sponges, the circulating nurse should assess volume of blood loss by weight or saturation assessment techniques. Alternatively, a colorimetric method could be used.
6. Because estimations of average amount of amniotic fluid vary greatly it is preferable to start QBL after amniotic fluid amount has been noted.²⁹
7. CBL should not be used in isolation to confirm or rule out obstetric hemorrhage. It is one parameter that should be given equal emphasis as key changes in vital signs over time (including increasing heart rate, decreasing blood pressure, decreasing urine output) and alterations in key hematological and biochemical indices. Patient concerns of feeling unwell should also be part of the criteria to seek out concealed hemorrhage. During the early phases of the roll out of QBL practices, calculations may occasionally lead to nonsensical values (such as negative numbers). In these instances, clinical judgment should supersede the calculation. (See Section: Definition, Early Recognition and Rapid Response to Obstetric Hemorrhage Using Triggers on page 93.)
8. For all cases of ongoing hemorrhage quantitative intake and output measurement should be documented regularly during the period of active bleeding and in the first 4-6 hours after arrest of active blood loss. These values should be reported to the team at frequent intervals.^{30,31}

EVIDENCE GRADING

LEVEL OF EVIDENCE: B

References

1. Morton CH, Nack A, Banker J. The social invisibility of maternal morbidities in US motherhood narratives: Giving voice to lived experience. Motherhood Conference; March 6-8, 2014, 2014; New York City.
2. Bose P, Regan F, Paterson-Brown S. Improving the accuracy of estimated blood loss at obstetric haemorrhage using clinical reconstructions. *British Journal of Obstetrics and Gynecology*. 2006;113:919-924.
3. Dildy G, Paine A, George N, Velasco C. Estimating blood loss: Can teaching significantly improve visual estimation? *Obstetrics and Gynecology* 2004;104(3):601-606.
4. Patel A, Goudar SS, Geller SE, et al. Drape estimation vs. visual assessment for estimating postpartum hemorrhage. *International Journal of Gynaecology and Obstetrics*. 2006;93(3):220-224.
5. Al Kadri HM, Al Anazi BK, Tamim HM. Visual estimation versus gravimetric measurement of postpartum blood loss: A prospective cohort study. *Archives of Gynecology and Obstetrics*. 2011;283(6):1207-1213.
6. Toledo P, McCarthy R, Hewlett B, Fitzgerald P, Wong C. The accuracy of blood loss estimation after simulated vaginal delivery. *Anesthesia and Analgesia*. 2007;105:1736-1740.
7. Toledo P, Eosakul ST, Goetz K, Wong CA, Grobman WA. Decay in blood loss estimation skills after web-based didactic training. *Simulations in Healthcare*. 2012;7(1):18-21.

8. Toledo, PE, Stanley T.; Goetz, Kristopher; Wong, Cynthia A.; Grobman, William A. Decay in blood loss estimation skills after web-based didactic training. *Simulation in Healthcare*. 2012;7(1):18-21.
9. AWHONN. Quantification of Blood Loss: AWHONN Practice Brief Number 1. *Journal of Obstetric, Gynecologic, and Neonatal Nursing*. 2015;44:158-160.
10. Fedoruk K, Seligman KM, Carvalho B, Butwick AJ. Assessing the association between blood loss and postoperative hemoglobin after cesarean delivery: A prospective study of 4 blood loss measurement modalities. *Anesthesia and Analgesia*. 2019;128(5):926-932.
11. Ladouceur MK, Goldbort J. A proactive approach to quantification of blood loss in the perinatal setting. *Nursing for Women's Health*. 2019;23(6):471-477.
12. Powell E, James D, Collis R, Collins PW, Pallmann P, Bell S. Introduction of standardized, cumulative quantitative measurement of blood loss into routine maternity care. *Journal of Maternal-Fetal and Neonatal Medicine*. 2020:1-7.
13. Doctorvaladan SV, Jelks AT, Hsieh EW, Thurer RL, Zakowski MI, Lagrew DC. Accuracy of blood loss measurement during cesarean delivery. *AJP Reports*. 2017;7(2):e93-e100.
14. Patel A, et al. Blood loss: Accuracy of visual estimation. In: B-Lynch C, ed. *A Textbook of PostPartum Hemorrhage*. Sapiens Publishing; 2006.
15. Prasertcharoensuk W, Swadpanich U, Lumbiganon P. Accuracy of the blood loss estimation in the third stage of labor. *International Journal of Gynaecology and Obstetrics*. 2000;71(1):69-70.
16. Joint Commission. Provision of care, treatment, and services standards for maternal safety. https://www.jointcommission.org/-/media/tjc/documents/standards/r3-reports/r3_24_maternal_safety_hap_9_6_19_final1.pdf2019.
17. Coviello E, Iqbal S, Kawakita T, et al. Effect of implementing quantitative blood loss assessment at the time of delivery. *American Journal of Perinatology*. 2019;36(13):1332-1336.
18. Konig G, Holmes AA, Garcia R, et al. In vitro evaluation of a novel system for monitoring surgical hemoglobin loss. *Anesthesia and Analgesia*. 2014;119(3):595-600.
19. Holmes AA, Konig G, Ting V, et al. Clinical evaluation of a novel system for monitoring surgical hemoglobin loss. *Anesthesia and Analgesia*. 2014;119(3):588-594.
20. Rubenstein AF, Zamudio S, Douglas C, Sledge S, Thurer RL. Automated quantification of blood loss versus visual estimation in 274 vaginal deliveries. *American Journal of Perinatology*. 2020.
21. Lumbreras-Marquez MI, Reale SC, Carusi DA, et al. Introduction of a novel system for quantitating blood loss after vaginal delivery: A retrospective interrupted time series analysis with concurrent control group. *Anesthesia and Analgesia*. 2020;130(4):857-868.
22. Katz D, Wang R, O'Neil L, et al. The association between the introduction of quantitative assessment of postpartum blood loss and institutional changes in clinical practice: an observational study. *International Journal of Obstetric Anesthesia*. 2020;42:4-10.
23. Conry JA. Every woman, every time. *Obstetrics and Gynecology*. 2013;122(1):3-6.
24. Goswami D, Rathore AM, Batra S, Dubey C, Tyagi S, Wadhwa L. Facility-based review of 296 maternal deaths at a tertiary centre in India: Could they be prevented? *Journal of Obstetrics and Gynaecology Research*. 2013;39(12):1569-1579.
25. Della Torre M, Kilpatrick SJ, Hibbard JU, et al. Assessing preventability for obstetric hemorrhage. *American Journal of Perinatology*. 2011;28(10):753-760.
26. ACOG. Standardization of practice to improve outcomes. Committee Opinion No. 526 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology*. 2012;119(5):1081-1082.
27. Steinberg MC. Using scorecard feedback to improve quantitative blood loss measurement at birth. *Nursing for Women's Health*. 2019;23(5):390-403.
28. Katz D, Farber MK. Can measuring blood loss at delivery reduce hemorrhage-related morbidity? *International Journal of Obstetric Anesthesia*. 2021.
29. Ounpraseuth ST, Magan EF, Spencer HJ, Rabie NZ, Sandlin AT. Normal amniotic fluid volume across gestation: Comparison of statistical approaches in 1190 normal amniotic fluid volumes. *Journal of Obstetrics and Gynaecology Research*. 2017;43(7):1122-1131.
30. Harrison P, et al. Early warning scoring in obstetrics. *International Journal of Obstetric Anesthesia*. 2008;15(Supplement):S1-S43.
31. Swanton RDJ, Al-Rawi S, Wee, MYK. A national survey of obstetric early warning systems in the United Kingdom. *International Journal of Obstetric Anesthesia*. 2009;18(3):253-257.



Response

This domain covers best practices and protocols for responding to obstetric hemorrhage. Medications, blood product replacement, and surgical techniques that will assist clinicians in caring for patients, including patient education for support after a severe maternal event, are presented.

In this section you will find the following:

- ▶ Medications for Prevention and Treatment of Postpartum Hemorrhage
- ▶ Blood Product Replacement: Obstetric Hemorrhage
- ▶ Uterine Tamponade for Postpartum Hemorrhage: Internal Balloons and External Compression Stitches
- ▶ Uterine Artery Occlusion and Embolization
- ▶ Communicating with and Supporting Women, Birthing People, and Families After an Obstetric Hemorrhage
- ▶ Secondary Postpartum Hemorrhage and Readmission

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Medications for Prevention and Treatment of Postpartum Hemorrhage

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Key Principles

1. Oxytocin (Pitocin) is the medication of choice for ***both prophylaxis and treatment*** of postpartum hemorrhage.
2. Second-line uterotonics for **treatment** of refractory uterine atony include methylergonovine maleate (Methergine) or carboprost/15 methyl PGF2 alpha (Hemabate). The choice of treatment should be made based on availability and contraindications. Administering misoprostol (Cytotec) with oxytocin does not improve bleeding outcomes or morbidity and is associated with significant maternal side-effects such as fever and vomiting. Misoprostol is not a preferred second-line uterotonic agent.
3. Tranexamic acid (TXA) has been shown to reduce mortality due to postpartum hemorrhage if given within three hours after recognition. Use is adjunctive and can be considered for all episodes of postpartum hemorrhage (PPH).
4. Medication protocols for both ***prophylaxis*** and ***treatment*** should be standardized within each institution to provide ease of access and timely administration of medication according to processes that are well understood by all intrapartum and postpartum staff.
5. When there is an inadequate or lack of response to uterotonics, clinicians should move promptly to next steps such as surgical methods of treatment.

Background

The number one cause of obstetric hemorrhage is uterine atony. Uterotonic medications should be used aggressively in an effort to minimize blood loss and prevent the need to progress through the hemorrhage algorithm. Non-uterotonic

agents such as TXA, surgical interventions and transfusions could potentially be avoided by employing swift and appropriate uterotonic administration.

Uterotonic medications

Oxytocin (Pitocin): Oxytocin is a synthetic version of the natural nonapeptide produced in the posterior pituitary and is recommended as the drug of choice for prophylaxis and treatment of uterine atony.¹⁻⁴ Oxytocin comes in solution at a concentration of 10 units per milliliter (mL). For prophylaxis against uterine atony after birth, oxytocin can be administered as an intravenous (IV) infusion, a low bolus dose followed by an IV infusion, or as a single intramuscular (IM) injection. The World Health Organization (WHO) recommendations state that oxytocin IV infusion and bolus are acceptable. Quickly infusing highly concentrated infusion bags of oxytocin should be done with caution because of concern for dose-related maternal tachycardia and hypotension, especially in the setting of refractory uterine atony. If IV access is not available, intramuscular (IM) oxytocin (10 units) can be given.¹

There are not clear recommendations for oxytocin dosing regimens. To investigate dosing standardization for prophylaxis, a retrospective cohort study published in 2019 evaluated a protocol that delivered a total of 60 units of oxytocin using a 30u/500 mL dilution, administered using three sequential and decreasing doses over the course of 5.25 hours postpartum.⁵ The study included over 16,000 women. Postpartum hemorrhage treatment rates (signified by a composite of need for additional uterotonics, transfusion, intrauterine balloon, uterine artery embolization and hysterectomy) were lower after introduction of the protocol for all subjects as well as in a subset of women at low risk for PPH (adjusted odds ratio 0.63 for all women and 0.33 for low-risk women). The study investigators highlighted the importance of standardizing institution practices to improve safety and reduce variability in care.

Table 1: Recommendations for oxytocin dosing regimens for atony prophylaxis and treatment

Prophylaxis	Treatment
<p><i>Oxytocin infusion:</i></p> <ul style="list-style-type: none"> ▶ Oxytocin 10-30 units in 500 mL or 20-60 units in 1000 mL controlled infusion with a standardized rate <p>An example for a typical oxytocin regimen for atony prophylaxis is as follows: In 500 mL NS containing 30 units oxytocin – start with 334 mL/hour (10 u oxytocin given over 30 min). After 30 min, change to a maintenance rate 125 mL/hour, (7.5 u oxytocin over 60 min)</p> <p style="text-align: center;">OR</p> <p><i>Oxytocin bolus:</i></p> <ul style="list-style-type: none"> ▶ Oxytocin IV bolus of 1-3 units to initiate adequate uterine tone followed by an infusion to maintain adequate tone (30 units in 500 mL; running at 125 mL/hour (7.5 u/hour) <p style="text-align: center;">OR</p> <p><i>Oxytocin IM:</i></p> <ul style="list-style-type: none"> ▶ Oxytocin 10 units IM when no IV access 	<p><i>Administer first-line agent:</i></p> <ul style="list-style-type: none"> ▶ Oxytocin 10-30 units in 500 mL or 20-60 units in 1000 mL, time-limited bolus infusion over 10-15 minutes, followed by maintenance infusion at a lower rate <ul style="list-style-type: none"> • Avoid high doses of oxytocin infusion greater than 30-40 units/hour • Closely monitor maternal heart rate (using pulse oximeter) and blood pressure when delivering higher-rate oxytocin infusions or boluses for active hemorrhage ▶ Call anesthesiology backup early and consider activating OB Rapid Response if you need assistance with monitoring maternal vital signs in women post-vaginal birth with evolving hemorrhage due to severe refractory uterine atony

Continued on next page...

	<p><u>Choose a standard second-line agent:</u></p> <ul style="list-style-type: none"> ▶ Methylergonovine 0.2 mg IM <li style="text-align: center;"><i>or</i> ▶ Carboprost 250 mcg IM <p style="text-align: center;"><u>Consider misoprostol only for patients with asthma and hypertension (misoprostol is no longer recommended otherwise due to high rates of side effects and inconsistent efficacy)</u></p> <ul style="list-style-type: none"> ▶ Misoprostol 600 mcg orally or 800 mcg sublingually (<i>Rectal administration is no longer recommended due to the late onset of action</i>)
	<p><u>Unresponsive to uterotonics:</u></p> <ul style="list-style-type: none"> ▶ Move quickly to non-pharmacologic methods of treatment based on etiology: e.g., uterine balloon tamponade; b-lynch suture; interventional radiology; trauma repair; dilation and curettage ▶ Consider tranexamic acid (TXA) 1 gm IV within 3 hours of recognition of PPH, may give a second dose of 1 gm if bleeding continues after 30 minutes or if bleeding stops and then restarts within 24 hours of completing the first dose

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Alternative approaches to prophylactic dosing

Alternative approaches to prophylaxis dosing of oxytocin at cesareans are actively being investigated. Three discussions of oxytocin dosing at elective (pre-labor) cesareans suggest that a slow, small IV bolus of 1-3 units of oxytocin over 15-30 seconds are sufficient to initiate adequate uterine tone followed by an ongoing infusion of 4–10 units per hour.⁶⁻⁸ The use of low dose oxytocin boluses reduces the risk of maternal side effects (e.g., nausea, flushing and hypotension) associated with high-rate infusions of highly concentrated bags of oxytocin or high IV bolus doses. Significant hemodynamic changes may be observed after IV boluses, including tachycardia, increased cardiac output and cardiac work, and myocardial ischemia.⁷ These potential adverse effects are of increasing concern in patients with severe cardiovascular disease or preeclampsia.⁹

Large doses of oxytocin (delivered either as boluses and/or infusions) should not be used in women with fixed cardiac output states (e.g., severe mitral or aortic stenosis or hypertrophic cardiomyopathy). In a case series of women with cardiac disease, small doses of 0.5-2 units of oxytocin delivered as an infusion over 5-15 minutes have been shown to initiate adequate uterine tone without altering maternal cardiovascular parameters in case series of women with cardiac disease. A full discussion about appropriate oxytocin dosing in advance of birth is required, with the obstetric anesthesia and cardiology team present, to ensure that

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oxytocin overdosing does not contribute towards hemodynamic collapse after birth in these high-risk patients.^{10,11}

Addition of oxytocin to an IV bag of crystalloid solution already in use, or to a standardized premade bag of oxytocin is *never* recommended. For example, a common request may be to add 20-40 units of oxytocin to 500-700 mL crystalloid and ‘run it wide open’. If there is a poor initial response to oxytocin, providers should have a low threshold for transitioning to a second-line uterotonic agent. In this case, avoid administering high-dose oxytocin because it may induce more severe hemodynamic instability in a patient with hypovolemia secondary to severe and evolving atonic hemorrhage. A 10 IU bolus of oxytocin was the precipitating cause of death in two women; one had a high spinal block and was also hypovolemic, and the other had pulmonary hypertension.¹² An oxytocin bolus was thought to have contributed to five maternal deaths according to the South African Confidential Enquiries into Maternal Deaths between 2005 and 2010.¹³

- ▶ **Adverse effects:** High doses of oxytocin (either as a bolus or infusion) should not be given as they are associated with hypotension, tachycardia and other adverse hemodynamic changes. Side effects associated with low doses of oxytocin are rare in the absence of prolonged use. Nausea and vomiting have been reported. The most serious additional side effect from prolonged use of IV oxytocin is water intoxication with subsequent dilutional hyponatremia. Oxytocin bags should not be diluted in dextrose 5% (D5W). In addition, oxytocin and magnesium sulfate bags should not be premade in the same volume. The Institute for Safe Medication Practices for decades has described cases of patient harm from magnesium toxicity when oxytocin and magnesium sulfate bags are confused.¹⁴ If an institution uses

a 500 mL bag of oxytocin for example, it is advisable for pharmacy departments to supply pre-mixed bags of magnesium sulfate in an alternative bag size such as 250 mL.

- ▶ **Contraindications:** The only postpartum contraindication to the use of oxytocin is hypersensitivity to the drug.
- ▶ **Healthcare workers:** Special handling of oxytocin is required by USP800 (Hazardous Drug-Potential Reproductive Risk). Provide appropriate ancillary labeling for all infusion bags. The use of single gloves is recommended when handling infusion bags of oxytocin. Having standardized bag concentrations that can be used for both prophylaxis and treatment of hemorrhage in which no additional oxytocin is added to a bag during a hemorrhage event is beneficial.

If there is a poor initial response to oxytocin, providers should have a low threshold for transitioning to a second-line uterotonic agent.

Methylergonovine maleate (Methergine):

Methylergonovine is a semi-synthetic ergot alkaloid that is approved by the U.S. Food and Drug Administration (FDA) for routine management of the third stage of labor and postpartum atony. It is considered a second-line uterotonic in PPH. Methylergonovine is supplied in ampules containing 0.2 mg of active drug in a volume of 1 mL or as a single tablet of 0.2 mg of active drug. The drug is given either as an intramuscular injection or orally. When given as an intramuscular injection, the onset of action is 2-5 minutes and the bioavailability is 78% (about 25% greater than when given orally). When given as an oral agent, the onset of action is within 5-10 minutes with a bioavailability of 60%. The plasma half-life is about 3.4 hours. The agent should not be given by intravascular injection. The frequency

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of administration is 2-4 hours for intramuscular administration and 6-8 hours when given orally. In an acute hemorrhage situation, a single dose of IM methylergonovine is all that is indicated. The IM preparation of the drug must be refrigerated when stored beyond 14 days; refer to the facility's local pharmacy department storage guidelines.

- ▶ **Adverse effects:** Side effects are rare in the absence of prolonged use. Most common side effects are nausea, vomiting and diarrhea. Chest pain, arterial spasm, myocardial infarction, and hallucination have been reported in cases of toxicity.
- ▶ **Contraindications:** Methylergonovine should be used with extreme caution in women with hypertension, known coronary artery disease, preeclampsia, or hypersensitivity to the drug. Care should be exercised when there has been recent administration of other vasoconstrictive agents (e.g., ephedrine). In these settings, there may be a rise in blood pressure with the use of this agent. Care should also be taken after recent administration of CYP 3A4- inhibiting agents, such as macrolide antibiotics, protease inhibitors, or azole antifungals.
- ▶ **Healthcare workers:** Methylergonovine is considered special handling for the healthcare worker (Hazardous Drug-Potential Reproductive Risk). Provide institution-specific PPE and appropriate

ancillary labeling on the product.

Carboprost / 15-methyl PGF2 alpha (Hemabate):

Carboprost is FDA-approved for the treatment of postpartum hemorrhage secondary to uterine atony that is not responsive to conventional treatment of uterine massage and oxytocin. The drug is available as a single-dose 250 mcg/1 mL ampule and is given intramuscularly. The peak plasma level of the drug is reached about 30 minutes after injection. A successful clinical response is expected after a single injection in about 75% of cases. In refractory cases, additional dosing at 15-90-minute intervals may be beneficial. Because additional benefit beyond the administration of two or three doses of carboprost is unlikely in most patients, moving on to other treatment modalities after a maximum of three doses is recommended.¹⁵ The clinical response may be enhanced with concomitant use of oxytocin. The drug must be refrigerated when stored.

- ▶ **Adverse effects:** Recognized side effects include nausea, vomiting, diarrhea, fever (up to 1 degree Celsius), bronchospasm, and hypertension.¹
- ▶ **Contraindications:** It is recommended that the drug be given with caution to patients with active hepatic or cardiovascular disease, asthma (due to potential for severe bronchospasm), or hypersensitivity to the drug.

There is little data to evaluate which second-line therapy is preferable. There are no prospective studies comparing the efficacy of methylergonovine versus carboprost. However, in an observational study of 1,335 women who underwent cesareans, women with uterine atony who received carboprost had a 1.7-fold increased risk of hemorrhage-related morbidity compared to those receiving methylergonovine.¹⁶ In the absence of contraindications, these data suggest that methylergonovine may be the preferred second-line uterotonic. A previous study also reported that methylergonovine is the most commonly used second-line uterotonic compared with carboprost (1.0%) and misoprostol (median usage rates: 5.2%, 1.0% and 1.2%, respectively).¹⁷

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Misoprostol (Cytotec): This agent is a synthetic prostaglandin E1 analog. It is available in either 100 or 200 mcg tablets and may be stored on labor and delivery units at room temperature. The drug is water-soluble and is quickly absorbed after sublingual, oral and vaginal use, with rectal use having a much longer time to onset of action.¹⁸ The time to peak plasma concentration is shortest for sublingual administration (onset within 11 minutes and peak at 30 minutes). Sublingual administration also produces a higher peak concentration than oral administration since the drug avoids the first-pass metabolism via the liver which occurs with the oral route. The drug undergoes a series of chemical reactions after ingestion that convert the agent to a prostaglandin F analog, making the drug very similar to carboprost (15 methyl PGF2 alpha). Therefore, it is unlikely that misoprostol would be effective if carboprost has failed. Unlike carboprost, misoprostol does not appear to exacerbate bronchoconstriction in patients with asthma.

Recent data has called into question the role of misoprostol as a uterotonic in management of PPH. For the treatment of postpartum hemorrhage from uterine atony, two large randomized controlled trials (RCTs)^{19,20} demonstrated oxytocin had the best efficacy, for both prophylaxis and first-line treatment of postpartum hemorrhage caused by uterine atony.⁴ In the first study by Blum, et al., women allocated to misoprostol following prophylactic oxytocin were significantly more likely to have serious ongoing hemorrhage (> 1000 mL) compared to those who received additional oxytocin. In the second study by Widmer et al., the addition of sublingual misoprostol to oxytocin did not improve outcomes over oxytocin alone and led to high rates (22-58%) of shivering and fever.⁴ Based on the results of these RCTs, Gibbons et al. concluded that misoprostol should be infrequently used in the developed

world. A recent Cochrane Review in 2020, which included the aforementioned studies, concluded that giving misoprostol together with oxytocin probably does not improve effectiveness and merely increases the likelihood of significant fever, diarrhea and vomiting.²¹

Based on this data, the use of misoprostol as a second line uterotonic **can no longer be routinely recommended**. It may be reserved for those patients with contraindications to methylergonovine or carboprost, such as those with asthma or hypertension, or in a birth setting where other uterotonics are difficult to maintain or stock. When misoprostol is administered rectally, compared to oral or sublingual routes, it takes a longer time to reach maximum serum concentration. This results in lower maximum serum concentrations and is associated with lower measured uterine activity and longer time to onset. Therefore, this route is not recommended in the setting of postpartum hemorrhage should misoprostol be utilized.^{18,22-24}

- ▶ **Adverse effects:** The most common side effects are diarrhea, shivering, pyrexia and headaches.¹
- ▶ **Contraindications:** Hypersensitivity to the drug.

Non-uterotonic medications

Tranexamic Acid/TXA (Cyklokapron):

Tranexamic acid (TXA) is a lysine analog and antifibrinolytic agent and may reduce bleeding in the setting of coagulation abnormalities. The hemostatic process is reliant on a combination of coagulation factors and a tight net of fibrin covering the damaged areas. Tranexamic acid has been used in many settings such as in elective surgical cases and trauma. The WOMAN international RCT showed a 31% reduction in death from hemorrhage when one gram of TXA was administered intravenously within three hours after the diagnosis of PPH in

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vaginal or cesarean births.²⁵ The trial included over 20,000 women with PPH from 21 low and high-resource countries. A 2018 Cochrane Review, for which most of the data came from the WOMAN trial, concluded that TXA reduces mortality from bleeding in women with primary PPH, regardless of mode of birth and without increasing thromboembolic events.²⁶

In an addendum to the CMQCC Obstetric Hemorrhage Toolkit 2.0, TXA was considered to be an adjunctive treatment and **not a primary treatment for PPH**. The recommendations suggested use of TXA if bleeding continued after methylergonovine and a higher dose of oxytocin had been administered or additional interventions (e.g., carboprost or compression balloons) were being considered. The WOMAN trial demonstrated that TXA is most effective when given within three hours of hemorrhage diagnosis, warranting consideration relatively early in the hemorrhage protocol. (See Appendix B: Obstetric Hemorrhage Care Guidelines: Checklist Format on page 187.)

The WHO guidelines on updated TXA recommendations suggest consideration of use in all cases of PPH.¹ Tranexamic acid should be considered for inclusion in the obstetric hemorrhage medication kit for rapid accessibility. Exclusively storing TXA in a hemorrhage medication kit may reduce the risk of a look-alike drug error. (Specifically, do not put TXA in the same place as local anesthetics, as inadvertent intrathecal administration has led to death or major neurological injuries).²⁷ While the manufacturer endorses room temperature storage, military data is supportive of refrigeration, which is helpful in the creation of kits.^{28,29}

Based on data from a large RCT involving women with vaginal deliveries, the use of TXA prophylactically did not result in a significantly lower risk of PPH compared to a placebo.³⁰ Currently prophylactic use of TXA for cesareans

is controversial. A recent randomized control trial found a statistical reduction in the blood loss calculated using changes in hemoglobin but not in measured blood loss, the need for additional uterotonics, transfusion rate, or additional surgical interventions.³¹

Tranexamic acid is available as a 1 gm/10 mL vial as well as a 1000 mg/100 mL IV piggyback medication. The 1 gm/10 mL vial is typically infused over 10 minutes as undiluted drug, with a second dose of 1 gm/10 mL given if bleeding continues after 30 minutes or if bleeding stops and then restarts within 24 hours of completing the first dose. Although there is no compatibility data on TXA and oxytocin in published literature, communications with authors of a large study of TXA report that the two agents are routinely infused together via Y-site together without sequelae.³⁰ Do not mix TXA with blood products or heparin.

In the WOMAN trial, rates of arterial and venous thrombotic events, seizures and other complications were not significantly different between women who received TXA versus placebo.²⁵ However, the WOMAN trial was not powered to assess safety and the majority of the study sites were in the developing world. Complications have been a concern in earlier studies with higher TXA doses, which were generally not powered to truly examine adverse drug events.

- ▶ **Adverse effects:** The most common effects reported with TXA administration include nausea, vomiting and diarrhea. Hypotension is possible if TXA is given more rapidly than recommended above. Adhere to dosing of one gram, as TXA has a known safety profile regarding the potential risk of thromboembolism. The drug has 95% renal clearance, so a prolonged elimination half-life is expected in those with impaired renal function.

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- ▶ **Contraindications:** WHO guidelines recommend TXA not be used in women with a known contraindication, including a known thromboembolic event in pregnancy, history of coagulopathy, active intravascular clotting or known hypersensitivity to TXA.¹

Recombinant factor VIIa or rfVIIa (Novoseven RT): Recombinant factor VIIa or rfVIIa is a vitamin K-dependent glycoprotein serine protease with a pivotal role in coagulation and the promotion of hemostasis. The agent is approved for use in patients with hemophilia A and B with inhibitors, acquired hemophilia and congenital factor VII deficiency.

The off-label role of rfVIIa in primary postpartum hemorrhage is controversial and the drug's use in obstetric patients continues to be very rare.^{1,30,32-35} In reports with small patient numbers, use of rfVIIa has anecdotally improved hemostasis in hemorrhaging obstetric patients and possibly helped to avoid hysterectomy in others. However, use of rfVIIa may also result in life-threatening thrombosis.³⁴

The latest WHO guidelines do not mention a role for rfVIIa. Continued concern over the

medication causing venous thrombosis prevents recommending usage outside of a narrow range of patients.^{36,37} It is also extraordinarily expensive. If rfVIIa is to be used, treatment should be provided in consultation with a local and/or regional expert in the area of massive hemorrhage, such as a hematologist, transfusion medicine specialist, or trauma surgeon.^{1,38} In general, the Task Force would advise consideration of rfVIIa only in the setting of life-threatening hemorrhage when all medical and surgical interventions have been exhausted. Although there is no consensus on dosing recommendations and timing of use in obstetric hemorrhage patients, a dose range of 35-90 mcg/kilogram (kg) may be considered. This range is based on case reports, in which the mean dosage is 70 mcg/.^{32,34,35}

- ▶ **Adverse effects:** Events in reports were thrombotic, including deep vein thrombosis, pulmonary embolism, cerebral thrombosis and myocardial infarction.
- ▶ **Contraindications:** Patients with known hypersensitivity.

Recommendations

1. All labor and delivery and postpartum units should have standardized medications regimens and protocols for uterine atony prophylaxis and treatment.
2. Oxytocin is the first-line agent for **both prophylaxis and treatment of hemorrhage**. Intramuscular administration of oxytocin (e.g., 10 units) is recommended when IV access is not available.
3. Methylergonovine and carboprost are the preferred second-line uterotonics.
4. Institutions should select a standard medication for second-line treatment. Options include methylergonovine or carboprost / 15 methyl PGF2 alpha.
5. Choose misoprostol only for those patients with asthma and hypertension. When there is an inadequate or lack of response to uterotonics, clinicians should move promptly to consider surgical treatment options.

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6. All relevant uterotonic medications and the antifibrinolytic medications (e.g., TXA) should be readily available on all labor and delivery units. Placement of these medications in central medication kits should be considered. (See Section: Obstetric Hemorrhage Carts, Kits and Trays on page 69.)
7. There is currently insufficient data for use of TXA for hemorrhage **prophylaxis**. TXA has been shown to reduce mortality due to PPH if given within three hours after recognition. Use is adjunctive to other treatments.
8. The use of rFVIIa is controversial, as it may cause possible life-threatening thromboembolic events. Optimal dosing and timing of use are in question. Published reports of use are uncontrolled with small patient numbers.

EVIDENCE GRADING

LEVEL OF EVIDENCE: B

References

1. World Health Organization. WHO recommendations for the prevention and treatment of postpartum haemorrhage. Updated from 2012. Geneva. 2018.
2. Westhoff GC, Amanda M., Tolosa JE. Prophylactic oxytocin for the third stage of labour to prevent postpartum haemorrhage. *Cochrane Database of Systematic Reviews*. 2013;10.
3. Tita AT, Szychowski JM, Rouse DJ, et al. Higher-dose oxytocin and hemorrhage after vaginal delivery: a randomized controlled trial. *Obstetrics and Gynecology*. 2012;119(2 Pt 1):293-300.
4. Gibbins KJ, Albright CM, Rouse DJ. Postpartum hemorrhage in the developed world: whither misoprostol? *American Journal of Obstetrics and Gynecology*. 2013;208(3):181-183.
5. Doyle JL, Kenny TH, Gothard MD, Seagraves E, McCarroll M, Silber A. A standardized oxytocin administration protocol after delivery to reduce the treatment of postpartum hemorrhage. *Joint Commission Journal of Quality and Patient Safety*. 2019;45(2):131-143.
6. Dyer RA, Butwick AJ, Carvalho B. Oxytocin for labour and caesarean delivery: Implications for the anaesthesiologist. *Current Opinion in Anaesthesiology*. 2011;24(3):255-261.
7. Stephens LC, Bruessel T. Systematic review of oxytocin dosing at caesarean section. *Anaesthesia and Intensive Care*. 2012;40(2):247-252.
8. Tsen LC, Balki M. Oxytocin protocols during cesarean delivery: Time to acknowledge the risk/benefit ratio? *International Journal of Obstetric Anesthesia*. 2010;19(3):243-245.
9. Creanga AA, Berg CJ, Ko JY, et al. Maternal mortality and morbidity in the United States: Where are we now? *Journal of Women's Health* 2014;23(1):3-9.
10. Cauldwell M, Steer PJ, Swan L, Uebing A, Gatzoulis MA, Johnson MR. The management of the third stage of labour in women with heart disease. *Heart*. 2017;103(12):945-951.
11. Langesaeter E, Dragsund M, Rosseland LA. Regional anaesthesia for a Caesarean section in women with cardiac disease: A prospective study. *Acta Anaesthesiologica Scandinavica*. 2010;54(1):46-54.
12. Lewis G. Why Mothers Die 1997–1999. The Confidential Enquiries into Maternal Deaths in the United Kingdom. London 2001.
13. Farina Z, Fawcus S. Oxytocin—ensuring appropriate use and balancing efficacy with safety. *South African Medical Journal*. 2015;105(4):271-274.
14. Institute for Safe Medication Practices. Preventing magnesium toxicity in obstetrics. <https://www.ismp.org/resources/preventing-magnesium-toxicity-obstetrics>. Published 2005. Accessed 3/2/2021.
15. Hayashi RH, Castillo MS, Noah ML. Management of severe postpartum hemorrhage with a prostaglandin F2 alpha analogue. *Obstetrics and Gynecology*. 1984;63(6):806-808.

16. Butwick AJ, Carvalho B, Blumenfeld YJ, El-Sayed YY, Nelson LM, Bateman BT. Second-line uterotonics and the risk of hemorrhage-related morbidity. *American Journal of Obstetrics and Gynecology*. 2015;212(5):642 e641-647.
17. Bateman BT, Tsen LC, Liu J, Butwick AJ, Huybrechts KF. Patterns of second-line uterotonic use in a large sample of hospitalizations for childbirth in the United States: 2007-2011. *Anesthesia and Analgesia*. 2014;119(6):1344-1349.
18. Tang OS, Gemzell-Danielsson K, Ho PC. Misoprostol: Pharmacokinetic profiles, effects on the uterus and side-effects. *International Journal of Gynaecology and Obstetrics*. 2007;99 Suppl 2:S160-167.
19. Blum J, Winikoff B, Raghavan S, et al. Treatment of post-partum haemorrhage with sublingual misoprostol versus oxytocin in women receiving prophylactic oxytocin: a double-blind, randomised, non-inferiority trial. *Lancet*. 2010;375(9710):217-223.
20. Widmer M, Blum J, Hofmeyr GJ, et al. Misoprostol as an adjunct to standard uterotonics for treatment of post-partum haemorrhage: A multicentre, double-blind randomised trial. *Lancet*. 2010;375(9728):1808-1813.
21. Parry Smith WR, Papadopoulou A, Thomas E, et al. Uterotonic agents for first-line treatment of postpartum haemorrhage: a network meta-analysis. *Cochrane Database of Systematic Reviews*. 2020;11:CD012754.
22. Chong YS, Chua S, Shen L, Arulkumaran S. Does the route of administration of misoprostol make a difference? The uterotonic effect and side effects of misoprostol given by different routes after vaginal delivery. *European Journal of Obstetrics and Gynecology and Reproductive Biology*. 2004;113(2):191-198.
23. Khan RU, El-Refaey H. Pharmacokinetics and adverse-effect profile of rectally administered misoprostol in the third stage of labor. *Obstetrics and Gynecology*. 2003;101(5 Pt 1):968-974.
24. Meckstroth KR, Whitaker AK, Bertisch S, Goldberg AB, Darney PD. Misoprostol administered by epithelial routes: Drug absorption and uterine response. *Obstetrics and Gynecology*. 2006;108(3 Pt 1):582-590.
25. WOMAN Trial Collaborators. Effect of early tranexamic acid administration on mortality, hysterectomy, and other morbidities in women with post-partum haemorrhage (WOMAN): An international, randomised, double-blind, placebo-controlled trial. *Lancet*. 2017;389(10084):2105-2116.
26. Shakur H, Beaumont D, Pavord S, Gayet-Ageron A, Ker K, Mousa HA. Antifibrinolytic drugs for treating primary postpartum haemorrhage. *Cochrane Database of Systematic Reviews*. 2018;2:CD012964.
27. Patel S, Robertson B, McConachie I. Catastrophic drug errors involving tranexamic acid administered during spinal anaesthesia. *Anaesthesia*. 2019;74(7):904-914.
28. de Guzman R, Polykratis IA, Sondeen JL, Darlington DN, Cap AP, Dubick MA. Stability of tranexamic acid after 12-week storage at temperatures from -20 degrees C to 50 degrees X. *Prehospital Emergency Care: Official Journal of the National Association of EMS Physicians and the National Association of State EMS Directors*. 2013;17(3):394-400.
29. Loner C, Estephan M, Davis H, Cushman JT, Acquisto NM. Effect of fluctuating extreme temperatures on tranexamic acid. *Prehospital Disaster Medicine*. 2019;34(3):340-342.
30. Sentilhes L, Winer N, Azria E, et al. Tranexamic acid for the prevention of blood loss after vaginal delivery. *New England Journal of Medicine*. 2018;379(8):731-742.
31. Sentilhes L, Senat MV, Le Lous M, et al. Tranexamic acid for the prevention of blood loss after cesarean delivery. *New England Journal of Medicine*. 2021;384(17):1623-1634.
32. Bhuskute N, Kritzinger S, Dakin M. Recombinant factor VIIa in massive obstetric haemorrhage. *European Journal of Anaesthesiology*. 2008;25(3):250-251.
33. Avorn J, Kesselheim A. A hemorrhage of off-label use. *Annals of Internal Medicine*. 2011;154(8):566-567.
34. Alfirevic Z, Elbourne D, Pavord S, et al. Use of recombinant activated factor VII in primary postpartum hemorrhage: The Northern European registry 2000-2004. *Obstetrics and Gynecology*. 2007;110(6):1270-1278.
35. Ahonen J, Jokela R, Korttila K. An open non-randomized study of recombinant activated factor VII in major postpartum haemorrhage. *Acta Anaesthesiologica Scandinavica*. 2007;51(7):929-936.
36. Phillips LE, McLintock C, Pollock W, et al. Recombinant activated factor VII in obstetric hemorrhage: experiences from the Australian and New Zealand Haemostasis Registry. *Anesthesia and Analgesia*. 2009;109(6):1908-1915.
37. Huber AW, Raio L, Alberio L, Ghezzi F, Surbek DV. Recombinant human factor VIIa prevents hysterectomy in severe postpartum hemorrhage: Single center study. *Journal of Perinatal Medicine*. 2011;40(1):43-49.
38. Yank V, Tuohy CV, Logan AC, et al. Systematic review: Benefits and harms of in-hospital use of recombinant factor VIIa for off-label indications. *Annals of Internal Medicine*. 2011;154(8):529-540.

Blood Product Replacement: Obstetric Hemorrhage

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Key Principles

1. Outcomes for major obstetric hemorrhage are improved with early and aggressive intervention.
2. Both emergency blood release and massive transfusion protocols should be in place.
3. Indicators for transfusion in an actively bleeding patient include: evidence of hemodynamic compromise (increasing heart rate, decreasing blood pressure), a high rate and/or magnitude of blood loss, the etiology of bleeding, response to medical/surgical measures to control bleeding, the type and degree of cardiovascular support, and laboratory or point-of-care data (if available). **Do not wait for laboratory results to begin transfusion.**
4. Calcium replacement will often be necessary with massive transfusion because citrate chelates with circulating ionized calcium, rendering calcium inactive.
5. During massive transfusion resuscitation, the patient's arterial blood gas, electrolytes, hematological and coagulation indices, and core temperature should be monitored repeatedly and regularly to guide clinical management.
6. All transfused fluids should be warmed; and direct warming of the patient should be initiated with an upper body warming device as needed to maintain euthermia and to avoid added coagulopathy.

Background

The need for transfusion during a birth hospitalization is not rare. Data from well-resourced countries, including the United States, Canada and Australia indicate that the obstetric transfusion rate is between 0.5-1.4%.¹⁻³ Additionally, rates of transfusion have increased over time in these locations. The incidence of massive transfusion in obstetric patients is uncommon and has been reported to be between 2.3 and 9.1 per 10,000 deliveries.⁴⁻⁷ Different definitions of massive transfusion (4-10+ units), transfusion policies and management approaches may explain this wide variation.⁸⁻¹⁰

This section reviews blood component replacement therapy in the context of significant obstetric hemorrhage. If transfusion therapy is delayed or if inadequate blood product support is given to patients with a major or life-threatening hemorrhage, then there is a significant risk of major morbidity from severe hypoperfusion, severe anemia, and coagulopathy.¹¹

At the time of the first release of this Toolkit (2010), nine massive hemorrhage protocols tailored specifically to obstetrics were

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evaluated.^{8,10,12-17} No formal clinical trials were available and all of the protocols were developed in consultation with experts in obstetrics, anesthesiology, and hematology/transfusion.^{13,15} The use of obstetric hemorrhage packs, which included all needed blood components (i.e., packed red blood cells (PRBCs), plasma, cryoprecipitate, platelets) was recommended by the task force to address the lack of a standard obstetric massive transfusion policy (MTP). Formal clinical trials are still lacking to determine the appropriate combinations of blood products in the treatment of massive obstetric hemorrhage, in particular, the role of early use of fresh frozen plasma (FFP). The American College of Obstetrics and Gynecology has no specific recommendation for the use of blood components for treating postpartum hemorrhage.¹⁸

Since the publication of the initial recommendations in the Obstetric Hemorrhage Toolkit and subsequent revisions (2010, 2015), two implementation studies have been published. Shields, et al. reported their results from a hemorrhage collaborative using many of the guidelines from the Toolkit.¹¹ CMQCC performed a multi-center trial with 99 hospitals that showed a 20% reduction in severe maternal morbidity from hemorrhage compared with 44 hospitals in the control group that showed a 1% reduction.¹⁹ The findings and conclusions from both of the reports confirm that early intervention improved patient outcomes. These reports, guidance in the original Toolkit, and recommendations from the American Society of Anesthesiologists Task Force on Perioperative Blood Loss are consistent with the protocols and recommendations reviewed and outlined below.

Blood product mobilization

It is important to develop system-wide processes that allow access to sufficient volumes and

types of blood products in the event of a rapidly evolving hemorrhage. This will depend on the facility's protocols and blood bank inventory, and thus a plan should be developed in concert with the blood bank team.

There are often two pathways for blood product mobilization: (1) emergency release of PRBCs and (2) massive transfusion protocol (MTP). In an emergency release protocol, at least two units of PRBCs are immediately released from the blood bank and brought to bedside. If the patient has already been typed and crossmatched, use crossmatched blood when possible. (See Section: Obstetric Hemorrhage Risk Factor Assessment on page 30.) If the patient has not been typed and crossmatched, **do not delay transfusion** to wait for crossmatched blood. In this scenario, the use of un-crossmatched O type blood is recommended.²⁰⁻²² If there is continued bleeding, consider activating the massive transfusion protocol (MTP). A standard MTP commonly includes 4-6 units PRBCS, four units FFP/plasma and one unit of platelets. (See Appendices S and T: Sample Massive Transfusion Policy, Torrance on page 235 and Sample Policies-Procedures MWCH on page 238.) Standardization of blood product mobilization reduces turnaround time between the ordering and receipt of blood products on the labor and delivery unit.²³ Additionally, The Joint Commission now requires hospitals providing obstetric care to have a massive transfusion protocol in place.²⁴ Having an MTP is critically important when the rate and magnitude of blood loss outpace the time required to prepare and transport crossmatched blood products to the labor and delivery unit. An MTP provides sufficient volumes and types of products to the primary care team in coolers.^{6,23,25} Once bleeding has been controlled, the care team can deactivate the MTP and transition to crossmatched compatible PRBCs as needed.

RhD type and its impact on transfusion for obstetric hemorrhage

The demand for O negative type blood is significantly higher than the available supply. Because of this, the allocation of O negative packed red blood cells (PRBCs) requires thoughtful management. The optimal massive transfusion pack contains O negative PRBCs for pregnancy-capable individuals of childbearing age who are RhD negative or their RhD status is unknown. However, when making a decision between a lifesaving treatment and the risks of alloimmunization in the future, transfusing RhD negative obstetric patients with RhD positive PRBCs may be a viable option in the setting of obstetric hemorrhage requiring transfusion. Hemolytic disease of the fetus and newborn (HDFN) is often a completely treatable condition. Accurate assessment of fetal anemia, the procedure of intrauterine transfusion (IUT), and early detection of severe fetal anemia before hydrops fetalis develops has improved through the use of modern technology lowering the rate of erythroblastosis fetalis in developed countries (0.3%). While the very low risk of a future treatable condition is a consideration of treatment, it is not the primary factor. The Pragmatic Randomized Optimal Platelet and Plasma Ratios (PROPPR) trial found a 5% increase in mortality for every minute that blood products were not provided to a trauma patient after the massive transfusion protocol (MTP) had been activated.²⁶ RhD negative patients (or those with an unknown RhD type) who are massively hemorrhaging should not have treatments withheld for fear of affecting the health of a future pregnancy.²²

Blood product replacement Packed red blood cells

The majority of protocols recommend 4-6 units of PRBCs be available and the patient's hematocrit be maintained at a minimum of 21-24% (hemoglobin 7-8 gm/dL).^{8,12,16,17} Ideally, the use of a single unit of PRBCs should increase the hematocrit by approximately 3-4% (1gm/dL increase in hemoglobin) in a 70 kg patient.²⁷ However, this concept applies only in non-bleeding, non-obstetric patients.

As noted elsewhere in this Toolkit, in a patient with continued bleeding after initial measures have failed, there should be a low threshold for activating an emergency release protocol or MTP. For women with a negative antibody screen, virtually all type compatible units will also be crossmatch compatible.

The timing and volume of RBC transfusion is dependent on clinical judgment. Indicators for transfusion in an actively bleeding patient include: evidence of hemodynamic compromise (increasing heart rate, decreasing blood pressure), a high rate and/or magnitude of blood loss, the etiology of bleeding and the response to medical/surgical measures to control bleeding, the type and degree of cardiovascular support, and laboratory or point-of-care data (if available). Good communication with the laboratory regarding the urgency of the situation and need for rapid turnaround of laboratory results is essential; however, receipt of laboratory results should not delay transfusion. (See Section: Hemorrhage Preparedness Considerations for Small and Low-Resource Hospitals on page 83.)

Traditionally providers have used the term ‘disseminated intravascular coagulopathy’ (DIC) to describe the coagulopathy which occurs with postpartum hemorrhage. While certain cases can have this specific diagnosis, there are in fact many causes of coagulopathy, most notably dilutional coagulopathy, occurring in most clinical scenarios rather than DIC. Therefore, the Task Force has made an effort to replace the term DIC with coagulopathy in the Toolkit. Coagulopathy is generally described as a derangement of hemostasis, which results in abnormal bleeding. The term disseminated intravascular coagulation is used to indicate widespread systemic activation of the coagulation system from severe hyperfibrinolysis and resulting coagulopathy. DIC may occur in specific obstetric conditions such as amniotic fluid embolus, severe placental abruption, or sepsis. However, it is likely that most women who experience postpartum hemorrhage develop coagulopathy due to dilution or consumption of coagulation factors associated with loss of significant blood volumes.

Plasma

The type of plasma that is available can vary from institution to institution. Fresh frozen plasma (FFP) is plasma that has been frozen within eight hours after collection and contains nearly all coagulation factors. Concomitant use of plasma and PRBCs is recommended during massive hemorrhage. Other acceptable choices

of plasma for MTP include PF24, which is plasma that has been frozen within 24 hours of collection (instead of 8 hours as in FFP), and liquid (never frozen) plasma. The use of PF24 is virtually identical to FFP and PF24 can also be stored up to five days if labeled “thawed.” Liquid plasma must be collected in a closed system and may contain cellular elements increasing the risk for cytomegalovirus; therefore, liquid plasma is less of a desirable choice in this setting.²⁸

Similar recommendations have been established at centers with existing massive transfusion protocols with the goal of maintaining the international normalized ratio (INR) at < 1.5-1.7.^{8,16,17,29,30} If diffuse bleeding is noted, or there is laboratory evidence of coagulopathy and the patient’s blood type is unknown, AB plasma is recommended. However, AB plasma is often in short supply as only 4% of the general population has AB blood type. Therefore, group A plasma is commonly utilized in this situation as it will be compatible for approximately 85% of the general population. Further, it has been shown that several units of ABO incompatible plasma is well tolerated by adults, pending completion of the individual’s blood typing.³¹ FFP usually requires 20-30 minutes to thaw and may not be available immediately. Large trauma centers and facilities that routinely handle complex obstetric cases may have a small amount of thawed plasma available. Similarly, blood banks that service a patient population at higher risk for obstetric emergencies may consider keeping a unit or two of AB or A plasma thawed at all times for emergencies.

It is unclear whether early FFP/plasma transfusion leads to improved maternal outcomes.³² In an observational study of 1,216 women who ultimately received either 4 or more units of PRBCs or a multicomponent transfusion in the context of a persistent PPH (defined as ≥ 1000 mL blood loss refractory to first-line intervention),

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plasma transfused within 60 minutes of persistent PPH onset was not associated with reduced severe hemorrhage-related morbidity (defined as a composite of death, hysterectomy, or arterial embolization) compared with no or later plasma transfusion.³³ For that analysis, 114 women from the larger cohort who received plasma (median of 2 units) within 60 minutes of the diagnosis of persistent PPH (early group) were propensity score matched for characteristics at baseline thought predictive of hemorrhage severity, to 114 women who received either later (58 patients) or no plasma (47 patients). In a different observational study, in which FFP/plasma was withheld in 605 women with a moderate to severe PPH (blood loss exceeding 1000 mL but that was rapidly controlled thereafter) and a FIBTEM A5 greater than 15 mm (using ROTEM, a rapid assessment test) there were no cases of ongoing bleeding secondary to hemostatic failure.³⁴ Furthermore, the majority of women with severe PPH typically have normal coagulation profiles and platelet counts when blood products are administered.³⁵⁻³⁸ The median fibrinogen concentration of FFP/plasma is 2 mg/mL; range 0.8-3 mg/mL, whereas a pregnant individual's third trimester serum fibrinogen concentrations are reported to range from 3.73-6.19 mg/mL (i.e., 373-619 mg/dL).³⁹ Therefore, paradoxically, administration of FFP/plasma may lower plasma fibrinogen levels in women who have moderate PPH and normal coagulation indices.⁴⁰ Other potential complications associated with high-volume FFP/plasma use include hypervolemia, transfusion-associated circulatory overload and transfusion-related acute lung injury (the most common cause of transfusion-related death in the United States).⁴¹ Nevertheless, despite current uncertainty on the precise patient characteristics that should prompt consideration of plasma infusion absent available laboratory data, the use of plasma along with RBCs should remain part of a clear-cut

institutional MTP for those needing the initial resuscitation of life-threatening massive PPH.³²

Cryoprecipitate and fibrinogen

In the face of hypofibrinogenemia (fibrinogen levels < 200 mg/dL) and ongoing bleeding, fibrinogen supplementation is necessary. Historically, transfusion recommendations were based on maintaining a fibrinogen concentration above 100 mg/dL. More recent evidence indicates that a fibrinogen level < 200 mg/dL is a noted risk factor for progression to severe hemorrhage and increased blood product requirement.^{35,37,42,43}

Cryoprecipitate released from the blood bank is often in pools of 4-10 units. Each unit provides \geq 150 mg of fibrinogen for a total of at least 1500 mg in a pool of 10 units in a total volume of approximately 80-100 mL. A pooled "10-unit" pack would be expected to increase the fibrinogen level of a 70 kg patient by approximately 75 mg/dL.²⁷ It is worth noting that a 10-unit pool represents 10 separate donor exposures. Improved manufacturing techniques are making smaller pools with equivalent fibrinogen dose common, thereby reducing the patient's exposure risk to multiple donor's blood. If continued bleeding and hypofibrinogenemia are present, additional units of cryoprecipitate should be used. In the presence of severe abruptio or amniotic fluid embolism, the initial request for blood products should include cryoprecipitate as both of these conditions are associated with significant fibrinogen depletion.

Fibrinogen concentrate, which is commercially available in the United States, has attracted considerable interest as a therapy for treating hypofibrinogenemia in bleeding patients. Reviews have provided detailed descriptions of fibrinogen concentrate, including its formulation, licensing, pharmacokinetics and studies of effectiveness in the non-obstetric setting.^{41,44,45} In summary, fibrinogen concentrate is derived from human

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plasma, undergoes viral inactivation, is available in the form of pasteurized, lyophilized product and does not require crossmatching. It is reconstituted in sterile water to a concentration of 20 mg/mL. Each vial contains approximately one gram of fibrinogen, with a range of 900-1300 mg (according to the package insert). It is normally injected intravenously (at a rate of 5 mL/min); however, it is possible to infuse more quickly when severe bleeding occurs.

Preemptive early fibrinogen infusion before available laboratory results using fibrinogen concentrate has been studied in randomized blinded trials in the setting of postpartum hemorrhage, however, it has not been shown to significantly reduce the overall rate of transfusion or other important secondary outcomes.^{34,46,47}

The largest of these studies randomized 437 patients experiencing hemorrhage after vaginal birth to placebo or fibrinogen concentrate preemptively, prior to knowledge of laboratory information. In fact, at baseline, fewer than 2% had a fibrinogen level < 2gm/dL. The composite outcome of the loss of hemoglobin of at least 4 g/dL and/or the need for transfusion of at least 2 units of RBCs did not differ between groups in this adequately powered trial.⁴⁷

Platelets

The incidence of thrombocytopenia in women with PPH is low. A retrospective study of 347 women with moderate-to-severe PPH reported a prevalence of 3.4%, with a platelet count < 75,000/uL in only 2% women.⁴⁸ A platelet transfusion was more likely in women diagnosed with thrombocytopenia before PPH onset or those who experienced consumptive coagulopathies from amniotic fluid embolism or placental abruption. Platelet pheresis units are the standard equivalent of 5-6 units of whole blood-derived pooled platelets and may increase the platelet count in a 70 kg patient by approximately 40-50,000/uL.²⁷

In the face of massive obstetric hemorrhage, platelet transfusions should be administered in order to maintain a platelet count of 50,000/uL. However, platelet counts should be used only as a guide and should be interpreted in conjunction with the patient's clinical condition. These recommendations are consistent with those of the American Society of Anesthesiologists Task Force on Perioperative Blood Loss.^{49,50} Some protocols have suggested higher platelet counts for initiating transfusion and maintaining appropriate platelet levels. These suggestions are based on the assumption that unless bleeding and coagulopathy have been controlled, the patient will experience ongoing platelet loss.^{10,17} Platelets do not require crossmatching and are not always type specific. Rh negative platelets (at least those from whole blood) are preferentially given to patients with Rh negative blood type because of the small risk of sensitization to the D-antigen. If Rh negative platelets are unavailable, a dose of Rh immune globulin may be given to and is protective for patients with Rh negative blood type. As a general rule, apheresis platelets rarely are significantly contaminated with red blood cells; therefore, the observed seroconversion rate following RhD positive units in RhD negative patients is vanishingly low if only receiving apheresis platelets.^{51,52}

Calcium

Calcium is necessary for adequate clotting and myocardial contraction. Hypocalcemia is one of the most clinically significant electrolyte disturbances noted in massive transfusion. Both PRBCs and FFP/plasma contain the anticoagulant citrate, which binds calcium. Citrate ionized calcium should be frequently monitored by measuring arterial blood gas or taking venous blood samples. Calcium should be replaced to keep levels within a normal physiologic range. In a reported series of 123 patients undergoing cesarean hysterectomy for placenta accreta spectrum, the authors found receipt of ≥ 4

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units of PRBCs, and an estimated blood loss exceeding 1500 mL, to be significantly associated with severe hypocalcemia. In this series, 46.2% of women who received ≥ 4 units of PRBC developed severe hypocalcemia and the use of empiric calcium was recommended at a dose of one gram calcium chloride recommended for every four units PRBC transfused.⁵³ In trauma patients, receipt of any combination of four units of PRBC and FFP/plasma was independently associated with severe hypocalcemia based on ionized calcium levels with a dose response relationship documented.⁵⁴ Checking the ionized calcium level after every three units of PRBCs transfused is recommended. Proceed with aggressive calcium replacement as needed.

Coagulopathy, acidosis, and temperature

The coagulopathy frequently associated with massive hemorrhage may be further exacerbated by hypothermia and acidosis. Worsening acidosis results from hypoperfusion of multiple organs and an increase in lactate levels. Activity of clotting factors is significantly reduced ($> 50\%$ reduction) at a pH of 7.0, compared to a pH of 7.4 and electrolytes are frequently abnormal.⁵⁵

Hypothermia associated with the infusion of cold fluids (including blood products) is the main cause of heat loss during massive transfusion. In trauma patients, each 1°C drop in temperature is associated with a 10% drop-in clotting factor activity, and a core temperature below 33°C is associated with a $> 50\%$ reduction in normal clotting factor activity.⁵⁵

Acidosis and hypothermia are associated with increased morbidity and mortality in trauma patients. During massive transfusion resuscitation, clinical management should be guided by monitoring the patient's arterial blood gas, hematological and coagulation indices, electrolytes, and core temperature. Monitor early and repeatedly, every 20-30

minutes during the active phase of bleeding. All transfused fluids should be warmed, and direct warming of the patient should be initiated with an upper body warming device as needed to maintain euthermia.

Pro-hemostatic agents: tranexamic acid and recombinant factor VIIa

Information related to the use of tranexamic acid and recombinant factor VIIa in hemorrhage management are provided in the Medication Section of the Toolkit. (See Section: Medications for Prevention and Treatment of Postpartum Hemorrhage on page 114.)

Recommendations

During severe obstetric hemorrhage, the primary goals are to: 1) provide adequate and early blood product replacement and 2) with ongoing obstetric hemorrhage, regularly and repeatedly assess laboratory and/or point-of-care indices to screen for anemia, coagulopathy, thrombocytopenia, hypofibrinogenemia and electrolyte imbalances (especially hypocalcemia). Timely availability of these data is critical for providers using a goal-directed approach to transfusion.

For transfusion in the setting of massive obstetric hemorrhage, early access to sufficient types and volumes of blood products is critical. In this context, a massive transfusion protocol can be life-saving. For life-threatening obstetric hemorrhage, early use of plasma and platelets may be beneficial. One approach is the use of a ratio of PRBCs to FFP/plasma to platelets that is 4-6 units PRBC: 4 units FFP/plasma: 1 unit apheresis platelets. However, for non-life-threatening hemorrhage, a fixed ratio approach for transfusion may not be needed. Hospitals need a mechanism for emergency release of Group O or type-specific uncrossed blood initially until crossmatch units are released.⁵⁶

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STAT Labs

If bleeding exceeds expected volume and there is no response to initial therapy, request STAT laboratory analysis for the following labs. Repeat these labs every 30-60 minutes until patient is stable.

1. Complete blood count (CBC) with platelets.
2. Prothrombin time (PT)(INR) / partial thromboplastin time (PTT).
3. Fibrinogen and ionized calcium.

FFP/Plasma

1. Initial response: give early FFP/Plasma in patients with major or life-threatening hemorrhage.
2. Once stable enough for lab testing, infuse FFP/plasma to maintain INR < 1.5-1.7. Ensure early FFP/plasma or cryoprecipitate for women with severe PPH from significant placental abruption or suspected amniotic fluid embolism.

Platelets

1. Prefer single donor apheresis platelets.
2. Infuse to maintain platelet count > 50,000/uL in the face of ongoing hemorrhage.

Cryoprecipitate

1. Initial request: 6-10 units cryoprecipitate or 1-2 gm fibrinogen concentrate if fibrinogen is less than 200 mg/dL. Higher doses may be needed for lower plasma fibrinogen levels.
2. Initial request: 10 units cryoprecipitate if severe abruption or amniotic fluid embolism is suspected (in some institutions one adult dose may contain fewer units with equivalent amount of fibrinogen).
3. Additional units to maintain fibrinogen concentration \geq 200 mg/dL.⁵⁷

EVIDENCE GRADING

LEVEL OF EVIDENCE: C

References

1. Patterson JA, Roberts CL, Isbister JP, et al. What factors contribute to hospital variation in obstetric transfusion rates? *Vox Sang*. 2015;108(1):37-45.
2. Callaghan WM, Creanga AA, Kuklina EV. Severe maternal morbidity among delivery and postpartum hospitalizations in the United States. *Obstetrics and Gynecology*. 2012;120(5):1029-1036.
3. Joseph KS, Rouleau J, Kramer MS, et al. Investigation of an increase in postpartum haemorrhage in Canada. *British Journal of Obstetrics and Gynecology*. 2007;114(6):751-759.
4. Thurn L, Wikman A, Westgren M, Lindqvist PG. Massive blood transfusion in relation to delivery: Incidence, trends and risk factors: A population-based cohort study. *British Journal of Obstetrics and Gynecology*. 2019;126(13):1577-1586.
5. Mhyre JM, Shilkrut A, Kuklina EV, et al. Massive blood transfusion during hospitalization for delivery in New York State, 1998-2007. *Obstetrics and Gynecology*. 2013;122(6):1288-1294.

6. Green L, Knight M, Seeney F, et al. The haematological features and transfusion management of women who required massive transfusion for major obstetric haemorrhage in the UK: A population based study. *British Journal of Haematology*. 2016;172(4):616-624.
7. Ramler PI, van den Akker T, Henriquez D, Zwart JJ, van Roosmalen J. Incidence, management and outcome of women requiring massive transfusion after childbirth in the Netherlands: Secondary analysis of a nationwide cohort study between 2004 and 2006. *BMC Pregnancy and Childbirth*. 2017;17(1):197.
8. Bonnar J. Massive obstetric haemorrhage. *Baillieres Best Practices and Research in Clinical Obstetrics and Gynaecology*. 2000;14(1):1-18.
9. Cotton BA, Au BK, Nunez TC, Gunter OL, Robertson AM, Young PP. Predefined massive transfusion protocols are associated with a reduction in organ failure and postinjury complications. *Journal of Trauma*. 2009;66(1):41-48; discussion 48-49.
10. Santoso JT, Saunders BA, Grosshart, K. Massive blood loss and transfusion in obstetrics and gynecology. *Obstetrical and Gynecological Survey*. 2005;60:827-837.
11. Shields LE, Wiesner S, Fulton J, Pelletreau B. Comprehensive maternal hemorrhage protocols reduce the use of blood products and improve patient safety. *American Journal of Obstetrics and Gynecology*. 2015;212(3):272-280.
12. Barbeiri R. Lessons from Iraq reach the US Labor and Delivery Suite. *OBG Management*. 2007;19(7):8-11.
13. Burtelow M, Riley E, Druzin M, Fontaine M, Viele M, Goodnough LT. How we treat life-threatening primary postpartum hemorrhage with a standardized massive transfusion protocol. *Transfusion*. 2007;47:1564-1574.
14. California Pacific Medical Center. Obstetrical Hemorrhage Protocol. Not Published.
15. Lurie S, Feinstein M, Mamet Y. Disseminated intravascular coagulopathy in pregnancy: Thorough comprehension of etiology and management reduces obstetricians' stress. *Archives of Gynecology and Obstetrics*. 2000;263(3):126-130.
16. University of Southern California. Emergency Obstetrical Hemorrhage Protocol. Approved and in use in Department of Obstetrics, Women's and Children's Hospital.
17. University of Washington. Obstetric Emergency Hemorrhage Protocol. Not Published.
18. ACOG. Postpartum hemorrhage. Practice Bulletin No. 183 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology*. 2017;130(4):e168-e186.
19. Main EK, Cape V, Abreo A, et al. Reduction of severe maternal morbidity from hemorrhage using a state perinatal quality collaborative. *American Journal of Obstetrics and Gynecology*. 2017.
20. Apelseh TO, Strandenes G, Kristoffersen EK, Hagen KG, Braathen H, Hervig T. How do I implement a whole blood-based blood preparedness program in a small rural hospital? *Transfusion*. 2020;60(12):2793-2800.
21. AABB. Recommendations on the Use of Group O Red Blood Cells. *AABB Association Bulletin #19-02*. 2019.
22. Yazer MH, Delaney M, Doughty H, et al. It is time to reconsider the risks of transfusing RhD negative females of childbearing potential with RhD positive red blood cells in bleeding emergencies. *Transfusion*. 2019;59(12):3794-3799.
23. Goodnough LT, Daniels K, Wong AE, Viele M, Fontaine MF, Butwick AJ. How we treat: Transfusion medicine support of obstetric services. *Transfusion*. 2011;51(12):2540-2548.
24. Joint Commission. Provision of Care, Treatment, and Services standards for maternal safety. 2019.
25. Butwick A, Lyell D, Goodnough L. How do I manage severe postpartum hemorrhage? *Transfusion*. 2020;60(5):897-907.
26. Meyer DE, Vincent LE, Fox EE, et al. Every minute counts: Time to delivery of initial massive transfusion cooler and its impact on mortality. *Journal of Trauma and Acute Care Surgery*. 2017;83(1):19-24.
27. Versiti. Red blood cells. 3/12/2021 2020.
28. Silvergleid AJ. Clinical use of plasma components. UpToDate. 2021. https://www.uptodate.com/laneproxy.stanford.edu/contents/clinical-use-of-plasma-components?search=ffp§ionRank=1&usage_type=default&anchor=H9714875&source=machineLearning&selectedTitle=1~150&display_rank=1. Accessed 3/12/2021.
29. Riskin D, et al. Reduced mortality after implementation of a massive transfusion protocol: A single trauma center experience. *American College of Surgeons*. 2008(October):13-16.
30. Stinger HK, Spinella PC, Perkins JG, Grathwohl KW, Salinas J, et al. The ratio of fibrinogen to red cells transfused affects survival in casualties receiving massive transfusions at an army combat support hospital. *Journal of Trauma*. 2008;64(2):S79-S85.
31. Zielinski MD, Johnson PM, Jenkins D, Goussous N, Stubbs JR. Emergency use of prethawed Group A plasma in trauma patients. *Journal of Trauma and Acute Care Surgery*. 2013;74(1):69-74; discussion 74-65.
32. Munoz M, Stensballe J, Ducloy-Bouthors AS, et al. Patient blood management in obstetrics: Prevention and treatment of postpartum haemorrhage. A NATA consensus statement. *Blood Transfusion*. 2019;17(2):112-136.
33. Henriquez DC, Caram-Deelder C, le Cessie S, Zwart JJ, et al. Association of timing of plasma transfusion with adverse maternal outcomes in women with persistent postpartum hemorrhage. *JAMA: Journal of the American Medical Association Network Open*. 2019;2(11):e1915628.

34. Collins PW, Cannings-John R, Bruynseels D, et al. Viscoelastometry guided fresh frozen plasma infusion for postpartum haemorrhage: OBS2, an observational study. *British Journal of Anaesthesia*. 2017;119(3):422-434.
35. Collins PW, Lilley G, Bruynseels D, et al. Fibrin-based clot formation as an early and rapid biomarker for progression of postpartum hemorrhage: a prospective study. *Blood*. 2014;124(11):1727-1736.
36. Gillissen A, van den Akker T, Caram-Deelder C, et al. Coagulation parameters during the course of severe postpartum hemorrhage: A nationwide retrospective cohort study. *Blood Advances*. 2018;2(19):2433-2442.
37. Charbit B, Mandelbrot L, Samain E, et al. The decrease of fibrinogen is an early predictor of the severity of postpartum hemorrhage. *Journal of Thrombosis and Haemostasis*. 2007;5(2):266-273.
38. de Lloyd L, Bovington R, Kaye A, et al. Standard haemostatic tests following major obstetric haemorrhage. *International Journal of Obstetric Anesthesia*. 2011;20(2):135-141.
39. Abbassi-Ghanavati M, Greer LG, Cunningham FG. Pregnancy and laboratory studies: A reference table for clinicians. *Obstetrics and Gynecology*. 2009;114(6):1326-1331.
40. Collins PW, Solomon C, Sutor K, et al. Theoretical modelling of fibrinogen supplementation with therapeutic plasma, cryoprecipitate, or fibrinogen concentrate. *British Journal of Anaesthesia*. 2014;113(4):585-595.
41. Levy JH, Welsby I, Goodnough LT. Fibrinogen as a therapeutic target for bleeding: A review of critical levels and replacement therapy. *Transfusion*. 2014;54(5):1389-1405; quiz 1388.
42. Cortet M, Deneux-Tharoux C, Dupont C, Colin C, Rudigoz R-C, Bouvier-Colle M-H, Huissoud C. Association between fibrinogen level and severity of postpartum haemorrhage: Secondary analysis of a prospective trial. *BJA: British Journal of Anaesthesia*. 2012;108(6):984–989.
43. Gayat E, Resche-Rigon M, Morel O, et al. Predictive factors of advanced interventional procedures in a multicentre severe postpartum haemorrhage study. *Intensive Care Medicine*. 2011;37(11):1816-1825.
44. Fenger-Eriksen C, Ingerslev J, Sorensen B. Fibrinogen concentrate—a potential universal hemostatic agent. *Expert Opinion in Biological Therapy*. 2009;9(10):1325-1333.
45. Levy JH, Goodnough LT. How I use fibrinogen replacement therapy in acquired bleeding. *Blood*. 2015;125(9):1387-1393.
46. Wikkelso AJ, Edwards HM, Afshari A, et al. Pre-emptive treatment with fibrinogen concentrate for postpartum haemorrhage: Randomized controlled trial. *British Journal of Anaesthesia*. 2015;114(4):623-633.
47. Ducloy-Bouthors AS, Mercier FJ, Grouin JM, et al. Early and systematic administration of fibrinogen concentrate in postpartum haemorrhage following vaginal delivery: The FIDEL randomised controlled trial. *British Journal of Obstetrics and Gynaecology*. 2021.
48. Jones RM, de Lloyd L, Kealaher EJ, et al. Platelet count and transfusion requirements during moderate or severe postpartum haemorrhage. *Anaesthesia*. 2016;71(6):648-656.
49. American Society of Anesthesiologists Task Force on Perioperative Blood TA, Therapies. Practice guidelines for perioperative blood transfusion and adjuvant therapies: An updated report by the American Society of Anesthesiologists Task Force on Perioperative Blood Transfusion and Adjuvant Therapies. *Anesthesiology*. 2006;105(1):198-208.
50. Matot I, Einav S, Goodman S, Zeldin A, Weissman C, Elchalal U. A survey of physicians' attitudes toward blood transfusion in patients undergoing cesarean section. *American Journal of Obstetrics and Gynecology*. 2004;190(2):462-467.
51. Bartley AN, Carpenter JB, Berg MP. D+ platelet transfusions in D- patients: Cause for concern? *Immunohematology*. 2009;25(1):5-8.
52. O'Brien KL, Haspel RL, Uhl L. Anti-D alloimmunization after D-incompatible platelet transfusions: A 14-year single-institution retrospective review. *Transfusion*. 2014;54(3):650-654.
53. Erfani H, Shamshirsaz AA, Fox KA, et al. Severe hypocalcemia during surgery for placenta accreta spectrum: The case for empiric replacement. *Acta Obstetrica et Gynecologica Scandinavica*. 2019;98(10):1326-1331.
54. Byerly S, Inaba K, Biswas S, et al. Transfusion-related hypocalcemia after trauma. *World Journal of Surgery*. 2020;44(11):3743-3750.
55. Elmer J, Wilcox SR, Raja AS. Massive transfusion in traumatic shock. *Journal of Emergency Medicine*. 2013;44(4):829-838.
56. Avenoso D. The lab's role in mass transfusion. <https://www.jointcommission.org/resources/news-and-multimedia/blogs/leading-hospital-improvement/2019/11/the-labs-role-in-mass-transfusion/>. Published 2019. Accessed 4/23/2021.
57. Shakur H, Elbourne D, Gulmezoglu M, et al. The WOMAN Trial (World Maternal Antifibrinolytic Trial): Tranexamic acid for the treatment of postpartum haemorrhage: An international randomised, double blind placebo controlled trial. *Trials*. 2010;11:40.

Uterine Tamponade for Postpartum Hemorrhage: Internal Balloons and External Compression Stitches

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Key Principles

1. Uterine balloon tamponade is recommended for treatment of uterine atony-related hemorrhage in situations where uterotonics are contraindicated, ineffective, or unavailable, and should be stocked on all obstetric units.
2. Uterine balloon insertion and compression suture procedures should be practiced by the clinical team as a part of hemorrhage drills and training to ensure understanding of the sequence of steps and availability of necessary supplies and equipment.
3. The potential for concealed intra-abdominal bleeding, or concealed intrauterine bleeding after balloon placement, must be kept in mind. It is essential to carefully inspect for unrepaired lacerations prior to balloon placement and to monitor vital signs, urinary output and laboratory values closely after placement, even when visible bleeding is reduced or eliminated. Consider ultrasound confirmation and monitoring during placement and while in place.
4. If balloon placement is needed, plans should simultaneously be made for next steps, should balloon placement be unsuccessful at controlling the bleeding. This includes mobilizing additional personnel, activating a massive transfusion protocol (MTP) and making operating room (OR) preparations for possible hysterectomy.

Background

Direct pressure or tamponade on a bleeding site is a long-established approach for many types of hemorrhage. In obstetric hemorrhage, the large majority of cases involve bleeding from the placental implantation site in the setting of uterine atony. A secondary source to always keep in mind is bleeding from trauma (laceration) to the vaginal sidewall, cervix, or the uterus

itself. These lacerations generally require direct repair. In addition, rarer causes of hemorrhage are uterine inversion or undiagnosed placenta accreta spectrum. In the setting of atony, the most common cause of hemorrhage, uterine tamponade directly compresses the vascular bed to control bleeding temporarily until the uterine atony resolves. Tamponade has been

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demonstrated to be effective in controlling hemorrhage in 87% of atony related cases.¹ There are three well-studied approaches to uterine tamponade: intrauterine packing, intrauterine balloons, and uterine (myometrial) compression sutures. There is novel technology for treating postpartum hemorrhage from atony using an intrauterine vacuum device; however, there is very limited data thus far.

Uterine packing

Uterine packing with systematically placed gauze, retrieved from the vagina 24 hours later, has some disadvantages compared to the use of a balloon; however, it might remain a low-cost option in resource poor areas or in experienced hands. Reported disadvantages include the need to pack the uterine cavity tightly and methodically (which requires operator experience), significant volume of packing material, and adequate anesthesia. Further, there remains concern regarding a delay in recognizing ongoing hemorrhage until the blood loss has saturated many yards of packing material. Due to the risk of retained vaginal packing, a typical practice is to tie the lengths of gauze together so they are one contiguous strand. Consideration of a process for identification of patients who have internal packing in place is important, as well as the quantity of gauze pads used to ensure complete retrieval. Although recent case reports suggest that uterine packing might still play a role, in its updated 2012 guidelines for the treatment of postpartum hemorrhage, the World Health Organization (WHO) recommended against its use.^{2,3} If packing is placed into the vagina as well, consider Foley catheter placement while the packing is in place, to prevent urethral compression and urinary obstruction.

Uterine balloon tamponade

Uterine balloon tamponade has emerged as a simple and effective option that can be easily mastered. There are many reported retrospective series of uterine balloon tamponade showing efficacy. The use of uterine tamponade with balloon devices is associated with significant reduction in postpartum hemorrhage (PPH)-related invasive procedures such as uterine artery ligation, compression sutures, hysterectomy, and arterial embolization.¹ The postpartum uterine cavity requires a balloon of sizable volume to adequately apply pressure against its walls. All available balloon tamponade devices have a double lumen shaft, which allows ongoing drainage from the uterine cavity to be quantified externally. The filled balloons are easily visualized with bedside trans-abdominal ultrasound, which may be useful to assess development of intrauterine bleeding and clots or balloon extrusion through a dilated cervix into the vagina.

Successful use of a balloon catheter is defined in most case series as diminished bleeding such that no additional non-pharmacologic interventions are needed. The reported success rates range from 68%-88%, derived from recent case series ranging from 15-50 patients in a total of 204 women.⁴⁻¹⁰ Some authors have noted a higher rate of success in women who had vaginal births compared to those with cesareans.^{4,8,9} Because an intrauterine balloon can be fairly rapidly placed (typically less than 5-8 minutes), even if the balloon is ultimately not successful in completely controlling the hemorrhage, its placement may diminish bleeding while other therapeutic resources are mobilized, such as transferring the patient to the operating room or to an interventional radiology suite.

Uterine balloon tamponade placement tips

A critical first step is a thorough and well-lit examination for lacerations. Often this is best done in the OR with surgical stirrups, long retractors, assistants, superior lighting and anesthesia capabilities. This is also the opportunity to rule out retained placental fragments. If it is to be done in a birth room, one should assemble similar resources. (See Section: Definition, Early Recognition and Rapid Response Using Triggers (Box 1) on page 93.)

- The maximal uterine balloon fill volumes are varied depending on the device being used, but it is important to keep in mind that the volume required will change depending on the patient situation as well.
- Care should be taken not to inadvertently “kink” the short length of tubing connecting the fill device (syringe or IV bag) and stopcock to the main balloon catheter.
- Have one person hold the catheter in place while assessing the uterine filling and tone while an assistant draws up the saline syringes, turns the stopcocks and pushes the fluid.
- Immediately prior to placement, perform bimanual massage and evacuate clots in the uterine cavity. Clots ahead of the balloon catheter tip may cause occlusion. Document the amount of fluid used to fill the balloon, the number of vaginal packs (if used), and the blood loss out. The catheter should be attached to a drainage bag and not plugged or clamped (i.e., urometer from traditional Foley catheter set up).
- Tight vaginal packing may be needed to adequately retain the balloon within the uterine cavity and prevent hour-glassing through the partially dilated cervix. We do not recommend sewing to the cervix or around the cervix to secure the balloon in place. **Note: such packing should be tied to the balloon catheter so that it is removed at the same time, preventing retained vaginal packing.**
- Placement of tamponade balloons at the time of cesareans is possible and a viable option to manage hemorrhage due to uterine atony. If the hysterotomy is closed, the procedure is similar to placement after vaginal birth, but done by an assistant gloved and underneath the surgical drapes. Placement can be done with an open hysterotomy by threading the balloon catheter down into the vagina through the cervix.

Documentation of uterine tamponade and vaginal packing placement complete with counts is essential to prevent unintentional retained foreign items and to determine appropriate time for discontinuation. This can be achieved through the addition of a “Lines, Drains, Airway” (LDA) item in the EHR such as those used for a Foley catheter or IV placement which include date and time of placement and subsequent removal.



Facilities have adopted special arm bands as a safety “double check” and visual cue to alert staff that vaginal packing is in place, either one band for each vaginal packing placed or the number of sponges written on the band. As each individual vaginal packing is removed, an armband is removed or if using a single band, it is removed when all sponges have been removed. The patient should be informed that vaginal packing has been placed and when it is expected to be removed so she can actively engage in ensuring removal.¹¹

Post-procedure monitoring includes continuing with the hemorrhage protocol including the measurement of blood via the drainage bag. The next 20-30 minutes should be devoted to creating a plan for next steps should the bleeding not be controlled and consideration for ultrasound evaluation post placement to ensure blood is not collecting behind the balloon tip. Also, consistent with standard practice, assessing and marking fundal heights. Fortunately, in 60-80% of cases, the balloon will be the last major intervention needed. Although there is no specific evidence supporting the practice, most manufacturers and authors have suggested the empiric use of a

prophylactic antibiotic while the balloon remains in the uterus and some have suggested soaking any vaginal packing used in povidone iodine or antibiotic solution. Whether these measures are necessary is unknown.¹²

Complications of balloon placement are rare but include uterine perforation or cervical trauma during balloon placement, failure of tamponade, uterine rupture due to excessive inflation, and infection.¹ **Placement with ultrasound guidance and in the operating room with proper lighting and increased resources may reduce complications and should be considered.**

While some studies have indicated that balloon placement can cause infection, the infection rates have never been described, and little is known about the benefit of prophylactic antibiotic protocols.¹³ Considering placement of the balloon will be concordant with manual exploration of the uterus, antibiotic administration beyond the prophylaxis recommendations for manual exploration is likely unnecessary. Although there is not specific data to support a maximum indwelling time for the uterine tamponade, it is generally 24 hours or less to reduce concern for infection and tissue necrosis. The rate of deflation during discontinuation can either be all at once or incrementally over several hours. Because prolonged balloon use may involve continued prophylactic antibiotic administration and indwelling Foley catheter use, consideration for removal of the balloon at 6-12 hours is

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encouraged.¹⁴ By the 6-12-hour mark, uterotonics should have had time to work effectively, allowing enough time for patient stabilization, and removal of the balloon limits unnecessary exposure to antibiotics, patient discomfort, and prolonged Foley catheter use. One study found that after six hours, if the balloon tamponade is deemed successful, it is rare that further intervention is required. In addition, tamponade beyond 12 hours, gradual or incremental deflation of the balloon, and antibiotic coverage beyond the duration of tamponade are unlikely to yield any further safety benefit.¹⁵

Key insights

1. Lack of vaginal bleeding does not necessarily mean that the bleeding is controlled—hemorrhage may continue above the balloon OR intra-abdominally through an unrecognized laceration and be obscured by the balloon. Close attention to vital signs is critical and consideration for marking the fundal height, irrigating the drainage channel, and repeated bedside ultrasound evaluation by an experienced provider is recommended.
2. Uterine atony and lower segment bleeding from a poorly contracted placental implantation site are the most recognized indications for an intrauterine balloon. Experience with placenta accreta spectrum has been mixed: some claim great success, while others have noted failure with significant concealed blood loss.
3. Plans should simultaneously be made for next steps should balloon placement be unsuccessful at controlling the bleeding, including mobilizing additional personnel, activating a massive transfusion protocol, and making OR preparations for possibly hysterectomy.

Intrauterine vacuum device

A novel device, the intrauterine vacuum device, became available in the United States in October 2020. There is only one study to date that evaluates the effectiveness and safety of this device for treating postpartum hemorrhage (PEARLE study).¹⁶ The device applies low-level suction via an intrauterine vacuum device that facilitates uterine contractions and constriction of blood vessels. Initial data suggests that it might be a rapid and effective treatment option for uterine atony, working on average within 3 minutes. After placement and attachment to low wall suction of 70-90 mm Hg, if the bleeding is controlled and the uterus firm and contracted, the device is left in place with suction activated for a minimum of 60 min treatment, followed by 30 minutes of observation once suction is discontinued. In the PEARLE study, 106 patients with postpartum hemorrhage were treated with the vacuum device. 94% were considered treatment successes but thirty-three percent still received blood transfusions and five required additional procedural interventions including two with hysterectomies. Given the lack of comparative efficacy and safety data for this device and the small size of the study, more research needs to be conducted prior to incorporation into the management of uterine atony and hemorrhage.

Compression sutures

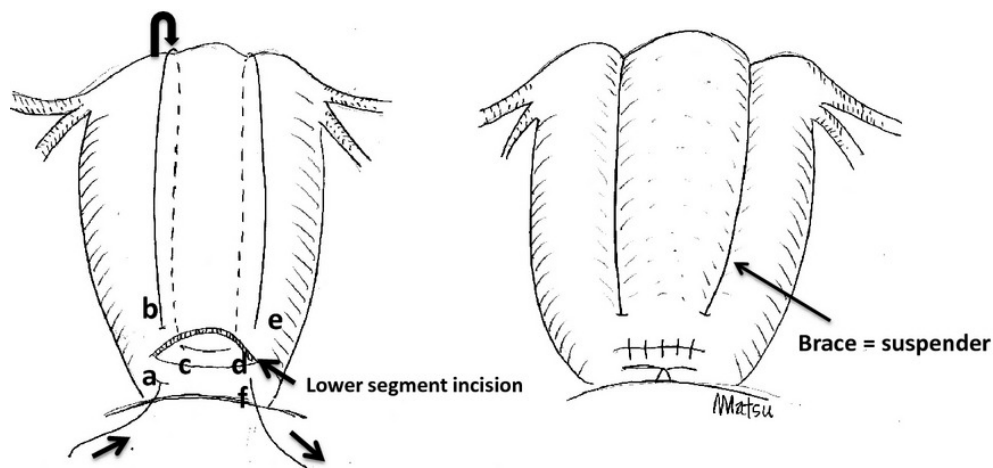
Another approach for refractory uterine atony that should be available for implementation in every institution is the use of uterine compression sutures. There are numerous described compression suture techniques. The most commonly used and studied is the B-Lynch suture, followed by Cho square compression sutures and the Hayman suture. The available evidence has not demonstrated whether a certain approach to compression sutures achieves better or safer results for postpartum hemorrhage than other methods, or if a certain suture material is better or safer than another.¹⁷

B-Lynch compression suture

B-Lynch “suspender-style” suturing with heavy gauge absorbable suture such as 1-Chromic or 1 Monocryl is the most commonly utilized method, but there are several other techniques described that are more locally focused on smaller areas (typically for focal accreta). The B-Lynch suture is typically done at cesarean when uterine atony persists despite uterotonics. It is both easy (takes under 90 seconds to apply and is easily taught) and can be quite effective when initiated early in the treatment of atony. The suture is typically placed 3 cm below and then above the hysterotomy (Figure 1). There are multiple variations of the B-Lynch suture but the principle is to forcefully compress the atonic

uterus in both a cephalocaudal and anterior posterior approach. The key step is to manually squeeze the uterus from top to bottom while cinching the stitch rather than use the stitch itself to try and compress the uterus while being tied down (pulling extensively on the stitch during tie down is likely to tear the myometrium or break the suture). At the very least, this simple step can buy time to prepare for other interventions. The placement of an intra-uterine balloon after a B-Lynch suture has been reported in a small number of cases. Typically, this is done by inserting the balloon inside the uterus and keeping it deflated until after the B-Lynch suture has been placed and tied. Then the balloon is inflated to the desired volume.

Figure 1: B-Lynch compression suture



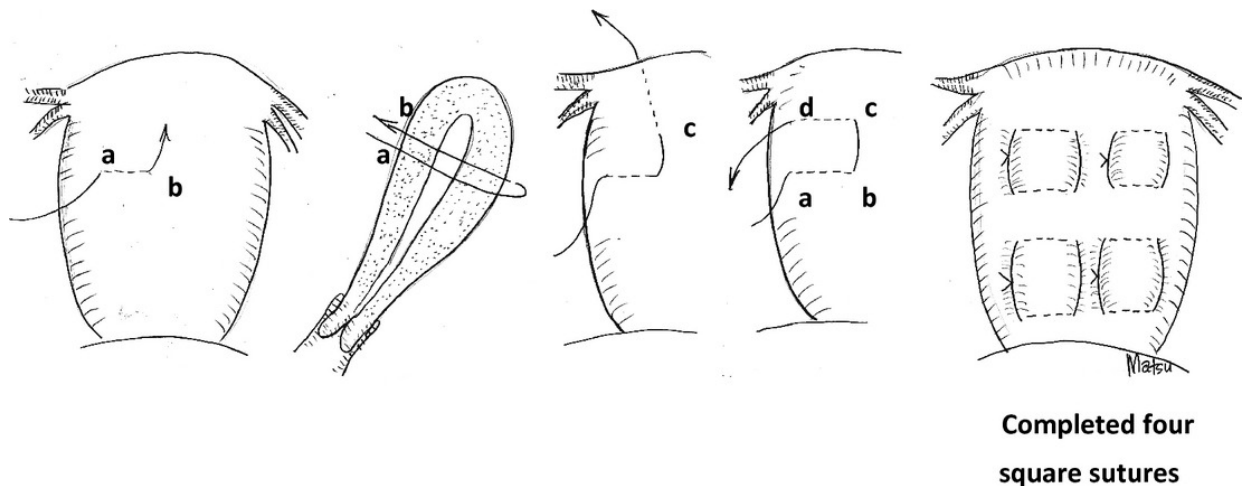
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Cho square compression sutures

Compression sutures or squared sutures can also be utilized with success. Suture placement is done as an anterior posterior compression stitch (Figure 2). Cho et al., published the first study using multiple uterine square sutures for PPH and found an efficiency of 100% in approximately 23 cases.¹⁸

Multiple square sutures can be effective and safe for the control of severe postpartum hemorrhage and for uterine conservation in most cases. Multiple square sutures are a relatively easy technique to learn. To perform the compression sutures, it is necessary to have a long needle with short-lasting resorbable sutures to transfix the entire uterine wall.¹⁹ A Keith needle or a straightened larger curved needle can suffice and be threaded with 1-Chromic suture. Given these suture placements collapse the endometrial canal, it is not generally used with an intrauterine balloon tamponade device. Limited data do not recommend long lasting sutures due to the concern for development of intrauterine adhesions.^{19,20} There are numerous small cohort studies concerning uterine compression sutures, and these authors have noted the efficiency of square sutures to treat severe PPH.¹⁷ In these studies, anywhere from 2-6 compression sutures were needed to be effective. Some authors suggest hysteroscopic evaluation after the postpartum recovery period due to increased risks of intrauterine adhesions.

Figure 2: Cho square compression suture



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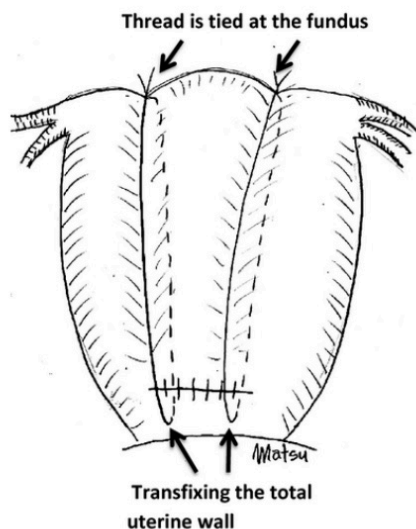
Hayman suture

The Hayman suture is a variation of the B-Lynch suture with similar principle of superior to inferior compression of the uterus. The benefits of the Hayman suture are that it can be applied faster and easier, avoiding the performance of a lower segment hysterotomy when PPH follows a vaginal birth.²¹ The difference in the approach and technique of the Hayman suture is that the suture is placed either anterior to posterior or vice versa through the lower uterine segment (underneath the hysterotomy if present). Next, the same process is repeated on the other side of the uterus. Then, the assistant should squeeze and compress the uterus as the surgeon ties the sutures down at the fundus (Figure 3). The

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process is then repeated for the other suture. This technique is less difficult to tie given the knots are placed on the fundus instead of one suture and one knot below the hysterotomy in the B-Lynch. The choice of suture is the same as the other compression suture techniques.

Figure 3: Hayman suture



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Recommendations

1. An intrauterine balloon tamponade device should be available on all obstetric units and utilized when there is persistent atony. It can be used with or without vaginal packing to treat hemorrhage from uterine atony. There is not enough evidence to recommend routine adoption of newer technologies like the intrauterine vacuum.
2. All birth providers at the institution should be familiar with the technique and instruments for placement of both the intrauterine balloon and the different suture techniques like B-lynch, Cho square and Hayman, including physically practicing the steps.
3. Appropriate protocols for the timing and method of placement of balloons and sutures should be added to institutional policies and procedures. (Diagrams with the techniques and indications for use may be helpful if clearly posted in the labor and delivery units as well as available in large, laminated size in an obstetric hemorrhage cart). Viewing a manufacturer's commercial animation may also be useful.²²
4. When intrauterine balloon placement is being considered, the Task Force recommends considering mobilization of additional personnel via activation of an obstetric rapid response team (OB-RRT), activation of the massive transfusion protocol, transfer to an OR and preparation for possible hysterectomy. (See Section: Definition, Early Recognition and Rapid Response to Obstetric Hemorrhage Using Triggers on page 93.)

EVIDENCE GRADING
LEVEL OF EVIDENCE: B

References

1. Suarez S, Conde-Agudelo A, Borovac-Pinheiro A, et al. Uterine balloon tamponade for the treatment of postpartum hemorrhage: A systematic review and meta-analysis. *American Journal of Obstetrics and Gynecology*. 2020;222(4):293 e291-293 e252.
2. Ge J, Liao H, Duan L, Wei Q, Zeng W. Uterine packing during cesarean section in the management of intractable hemorrhage in central placenta previa. *Archives of Gynecology and Obstetrics*. 2012;285(2):285-289.
3. Tuncalp O, Souza JP, Gulmezoglu M, World Health Organization. New WHO recommendations on prevention and treatment of postpartum hemorrhage. *International Journal of Gynaecology and Obstetrics*. 2013;123(3):254-256.
4. Aibar L, Aguilar MT, Puertas A, Valverde M. Bakri balloon for the management of postpartum hemorrhage. *Acta Obstetrica et Gynecologica Scandinavica*. 2013;92(4):465-467.
5. Gronvall M, Tikkanen M, Tallberg E, Paavonen J, Stefanovic V. Use of Bakri balloon tamponade in the treatment of postpartum hemorrhage: A series of 50 cases from a tertiary teaching hospital. *Acta Obstetrica et Gynecologica Scandinavica*. 2013;92(4):433-438.
6. Kong MC, To WW. Balloon tamponade for postpartum haemorrhage: Case series and literature review. *Hong Kong Medical Journal*. 2013;19(6):484-490.
7. Laas E, Bui C, Popowski T, Mbaku OM, Rozenberg P. Trends in the rate of invasive procedures after the addition of the intrauterine tamponade test to a protocol for management of severe postpartum hemorrhage. *American Journal of Obstetrics and Gynecology*. 2012;207(4):281 e281-287.
8. Olsen R, Reisner DP, Benedetti TJ, Dunsmoor-Su RF. Bakri balloon effectiveness for postpartum hemorrhage: A "real world experience." *Journal of Maternal-Fetal and Neonatal Medicine*. 2013;26(17):1720-1723.
9. Vitthala S, Tsoumpou I, Anjum ZK, Aziz NA. Use of Bakri balloon in post-partum haemorrhage: A series of 15 cases. *Australian and New Zealand Journal of Obstetrics and Gynaecology Canada*. 2009;49(2):191-194.
10. Vrachnis N, Salakos N, Iavazzo C, et al. Bakri balloon tamponade for the management of postpartum hemorrhage. *International Journal of Gynaecology and Obstetrics*. 2013;122(3):265-266.
11. Revert M, Rozenberg P, Cottenet J, Quantin C. Intrauterine Balloon Tamponade for Severe Postpartum Hemorrhage. *Obstetrics and Gynecology*. 2018;131(1):143-149.
12. Nagase Y, Matsuzaki S, Kawanishi Y, et al. Efficacy of Prophylactic Antibiotics in Bakri Intrauterine Balloon Placement: A Single-Center Retrospective Analysis and Literature Review. *AJP Reports*. 2020;10(1):e106-e112.
13. Georgiou C. Balloon tamponade in the management of postpartum haemorrhage: A review. *British Journal of Obstetrics and Gynecology*. 2009;116(6):748-757.
14. Mezei GC. Bakri balloon placement. *Medscape*. <https://emedicine.medscape.com/article/2047283-overview>. Published 2016. Accessed 3/10/2021.
15. Dorkham MC, Epee-Bekima MJ, Sylvester HC, White SW. Experience of Bakri balloon tamponade at a single tertiary centre: A retrospective case series. *Journal of Obstetrics and Gynaecology Canada*. 2020:1-6.
16. D'Alton ME, Rood KM, Smid MC, et al. Intrauterine vacuum-induced hemorrhage-control device for rapid treatment of postpartum hemorrhage. *Obstetrics and Gynecology*. 2020;136(5):882-891.
17. Matsubara S, Yano H, Ohkuchi A, Kuwata T, Usui R, Suzuki M. Uterine compression sutures for postpartum hemorrhage: An overview. *Acta Obstetrica et Gynecologica Scandinavica*. 2013;92(4):378-385.
18. Cho JH, Jun HS, Lee CN. Hemostatic suturing technique for uterine bleeding during cesarean delivery. *Obstetrics and Gynecology*. 2000;96(1):129-131.
19. Alouini S, Coly S, Megier P, Lemaire B, Mesnard L, Desroches A. Multiple square sutures for postpartum hemorrhage: results and hysteroscopic assessment. *American Journal of Obstetrics and Gynecology*. 2011;205(4):335 e331-336.
20. Fotopoulou C, Dudenhausen JW. Uterine compression sutures for preserving fertility in severe postpartum haemorrhage: An overview 13 years after the first description. *Journal of Obstetrics and Gynaecology Canada*. 2010;30(4):339-349.
21. Ghezzi F, Cromi A, Uccella S, Raio L, Bolis P, Surbek D. The Hayman technique: A simple method to treat postpartum haemorrhage. *British Journal of Obstetrics and Gynecology*. 2007;114(3):362-365.
22. Cook Medical. Bakri balloon postpartum with rapid installation components. In: YouTube; 2019:https://www.youtube.com/watch?v=n1McwrlZ2_I.

Uterine Artery Occlusion and Embolization

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Key Principles

1. Vaso-occlusive balloon insertion and uterine artery embolization (UAE) may be options for intervention to control hemorrhage in centers with interventional radiologists experienced in these procedures.
2. Literature on the efficacy and safety of these procedures has been mixed.
3. Severe complications, including uterine necrosis, are possible.
4. Vaso-occlusive and embolization techniques should only be performed by experienced interventional radiologists, in patients stable enough for transport to the interventional radiology (IR) suite, and after full review of risks and benefits.

Background

Uterine artery occlusion and embolization are alternatives to other conservative measures or hysterectomy for controlling postpartum hemorrhage (PPH).¹⁻³ Temporary arterial occlusion can be used as a prophylactic measure when conditions such as placenta accreta spectrum are diagnosed in the antenatal period.^{4,5} (See Section: Placenta Accreta Spectrum: Incidence, Risks, Diagnosis, Counseling and Preparation for Birth on page 51.) The occlusive balloons are placed preoperatively while the patient is stable. Uterine artery embolization (UAE) can be used to control persistent postpartum postoperative bleeding. A patient may receive UAE if hemodynamically stable enough to tolerate transport to the IR suite and the obstetric team is *immediately* available. Vaso-occlusive and embolization procedures should be performed *only* by experienced interventional radiologists, given the critical state of the postpartum hemorrhage patient requiring these procedures and the potential for

complications. The obstetric team should include a nurse skilled in assessment and treatment of obstetric hemorrhage to accompany the patient should her status suddenly decline. An in-house physician who is able to *immediately* call for and move to laporatomy in the case of failed embolization should be present. Anesthesiology services must also be immediately available. The need for radiologic interventions has been reduced by 92.1% with the introduction of intrauterine tamponade balloons.⁶

The literature describing the efficacy and safety of these techniques is limited to several case reports and small series. A review article of 46 studies found that uterine artery occlusion and embolization were effective but fell behind balloon catheters and hemostatic uterine sutures in efficacy. The success rates for controlling obstetric hemorrhage were as follows: 90.7% (95% confidence interval [CI], 85.7%-94.0%) for arterial embolization, 84.0% (95% CI, 77.5%-

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88.8%) for balloon tamponade, 91.7% (95% CI, 84.9%-95.5%) for uterine compression sutures and 84.6% (81.2%-87.5%) for iliac artery ligation or uterine devascularization.⁷ Kim et al. published a review involving 117 cases and found that while UAE was highly effective, about 10% of patients experienced long term complications, including a patient with uterine necrosis and two hysterectomies.⁸ The major limitation in these studies was the difficulty in assessing operator experience across various studies, and, unfortunately, the results have not always demonstrated clear-cut efficacy.⁹

There is the possibility of severe complications from arterial balloon occlusion and embolization.

One complication is uterine necrosis.¹⁰ In one case-control study, the authors found that 3 out of 19 subjects (15.8%) had complications from catheter placement and two required stent placement and/or arterial bypass.¹¹ Other serious complications have occurred, including thromboembolic events, fistulae¹² and in one study, fetal bradycardia requiring immediate delivery (15.4%) occurred.¹³ Given the severity of these reports, and until large studies can determine more precise risks, one should use these techniques only when sufficient expertise is available and after full review of the risks and benefits with the patient or surrogate decision maker.¹⁴

Recommendations

1. Vaso-occlusive balloons and embolization techniques can be considered for a specific subset of patients receiving treatment in centers with adequate interventional radiology expertise.
2. The indications, potential complications and effectiveness of these techniques are not well established and therefore must be approached with caution.
3. If UAE is utilized, the patient must be in stable condition for transport to the interventional radiology suite and should be accompanied by a nurse skilled in the assessment and treatment of obstetric hemorrhage should the patient's status suddenly decline. A physician who is able to *immediately* call for and move to laparotomy should be in-house in the case of failed embolization. Anesthesiology services must also be immediately available.
4. Obstetric staff should keep abreast of further research developments as to the most effective technique and indications for these procedures.

EVIDENCE GRADING

LEVEL OF EVIDENCE: B

References

1. Dubois J, Garel L, Grignon A, Lemay M, Leduc L. Placenta percreta: Balloon occlusion and embolization of the internal iliac arteries to reduce intraoperative blood losses. *American Journal of Obstetrics and Gynecology*. 1997;176(3):723-726.
2. Hansch E, Chitkara U, McAlpine J, El-Sayed Y, Dake MD, Razavi MK. Pelvic arterial embolization for control of obstetric hemorrhage: a five-year experience. *American Journal of Obstetrics and Gynecology*. 1999;180(6 Pt 1):1454-1460.
3. Vedantham S, Goodwin SC, McLucas B, Mohr G. Uterine artery embolization: an underused method of controlling pelvic hemorrhage. *American Journal of Obstetrics and Gynecology*. 1997;176(4):938-948.

4. Lambrecht S, Van De Velde M. Interventional radiology for the obstetric patient. *Current Opinion in Anaesthesiology*. 2020;33(4):566-570.
5. Hawthorn BR, Ratnam LA. Role of interventional radiology in placenta accreta spectrum (PAS) disorders. *Best Practices in Research and Clinical Obstetrics and Gynaecology*. 2021;72:25-37.
6. Gauchotte E, De La Torre M, Perdrille-Galet E, Lamy C, Gauchotte G, Morel O. Impact of uterine balloon tamponade on the use of invasive procedures in severe postpartum hemorrhage. *Acta Obstetrica et and Gynecologica Scandinavica*. 2017;96(7):877-882.
7. Doumouchtsis SK, Papageorghiou AT, Arulkumaran S. Systematic review of conservative management of postpartum hemorrhage: What to do when medical treatment fails. *Obstetrical & gynecological survey*. 2007;62(8):540-547.
8. Kim MJ, Kim IJ, Kim S, Park IY. Postpartum hemorrhage with uterine artery embolization: The risk of complications of uterine artery embolization. *Minimally Invasive Therapy and Allied Technologies*. 2020:1-8.
9. Bodner LJ, Nosher JL, Gribbin C, Siegel RL, Beale S, Scorza W. Balloon-assisted occlusion of the internal iliac arteries in patients with placenta accreta/percreta. *Cardiovascular and Interventional Radiology*. 2006;29(3):354-361.
10. Coulange L, Butori N, Loffroy R, et al. Uterine necrosis following selective embolization for postpartum hemorrhage using absorbable material. *Acta Obstetrica et and Gynecologica Scandinavica*. 2009;88(2):238-240.
11. Shrivastava V, Nageotte M, Major C, Haydon M, Wing D. Case-control comparison of cesarean hysterectomy with and without prophylactic placement of intravascular balloon catheters for placenta accreta. *American Journal of Obstetrics and Gynecology*. 2007;197(4):402.e401-405.
12. Maassen MS, Lambers MD, Tutein Nolthenius RP, van der Valk PH, Elgersma OE. Complications and failure of uterine artery embolisation for intractable postpartum haemorrhage. *British Journal of Obstetrics and Gynecology*. 2009;116(1):55-61.
13. Sadashivaiah J, Wilson R, Thein A, McLure H, Hammond CJ, Lyons G. Role of prophylactic uterine artery balloon catheters in the management of women with suspected placenta accreta. *International Journal of Obstetrics and Anesthesia*. 2011;20(4):282-287.
14. Dilauro MD, Dason S, Athreya S. Prophylactic balloon occlusion of internal iliac arteries in women with placenta accreta: Literature review and analysis. *Clinics in Radiology*. 2012;67(6):515-520.

Communicating with and Supporting Women, Birthing People, and Families After an Obstetric Hemorrhage

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Key Principles

1. Persons with known hemorrhage risk factors should be counseled and informed about the likelihood of obstetric hemorrhage and measures that may be taken to mitigate risk and treat the emergency.
2. Women need to know what happened to them and why. Formal and informal discussions about their experience and prognosis should occur throughout the hospitalization using emotionally and culturally sensitive communication.
3. After a severe hemorrhage, clinicians should be alert for, and able to identify, acute stress disorder, behavior, or emotional states that are outside the normal range of postpartum responses. Such reactions may include detachment, dissociation, and intrusive thoughts.
4. The experience of traumatic birth involving hemorrhage is individual; not all people respond the same way and their reactions may not correspond with clinicians' perception of the level of the severity, or resolution of the complication.
5. Tailored and specific discharge planning for women and their families who have experienced hemorrhage should include assessment of their physical and emotional recovery, and referrals for counseling and support in the community. Providers are encouraged to offer and should anticipate patient contact. The care team should take an *'open door to support'* approach to assist women in the longer-term processing and understanding of events that occurred, as this need may continue beyond physical recovery.
6. Disclosure of adverse events to the patient and their family is encouraged by professional societies including ACOG and American Society for Healthcare Risk Management (ASHRM). If not currently in place, policies and guidelines addressing disclosure should be developed by a hospital's clinicians and administration in accordance with state laws.

Background

Research on women's experience of hemorrhage suggests that those who give birth, their partners, and families have specific needs that promote their recovery and healing after a critical event. International research and published first-person narratives provide insights into women's experience of severe maternal morbidity (SMM). These insights suggest maternity clinicians can better meet the needs of women and families regarding what information is shared and what emotional support is offered during and after a severe maternal hemorrhage.¹⁻⁹

Maternity clinicians should provide support that is grounded in sensitive, trauma-informed and anti-racist principles, given that evidence indicates Black, Indigenous and other women of color experience lower quality of maternity care.¹⁰ Additionally, Black women experience hemorrhage at significantly higher rates than non-Black women,^{11,12} and their needs for quality care with cultural humility and respect should be front and center during their childbirth experiences.

After a traumatic birth event, women seek to understand what happened to them, make sense of the reasons behind their experience, and think about implications for their long-term health and future childbearing. Research on women's experience of obstetric hemorrhage from studies conducted in Australia, the United Kingdom, and other countries shows that a significant proportion of women report not receiving adequate information about their condition and recovery.^{2,3,13} While women report feeling grateful to health professionals for the life-saving care provided to them and their babies, they often report feelings of anger and frustration about not receiving sufficient information and/or at the quality of the emotional care they received.^{4,6}

Such experiences may intensify the need for a formal discussion, including review of events

and prognosis, with a health care provider who was present during the event. In the case of language barriers, provision should be made for professional (non-family) translators, preferably with experience in obstetrics. Even when women feel they received competent clinical care, the lack of communication afterward leaves them feeling alone, as this woman reported in a focus group study:

I feel like I got good care, I think I just had a bad experience. I don't know what happened to me. In terms of communication, my doctor still hasn't told me what happened. I don't know if she doesn't want me to know what happened.¹⁴

Women of color report high rates of feeling disrespected and unheard.¹⁵⁻¹⁷ A 2017 population-based survey conducted with over 2,500 California mothers in English and Spanish asked if they "perceived unfair treatment due to race or ethnicity." A total of 11.5% of Black mothers answered in the affirmative, and 8.5% of Asian/Pacific Islander (PI) mothers and 5.5% of Latina mothers also reported unfair treatment as a result of race or ethnicity. White mothers almost never (1%) reported being treated unfairly on the basis of race or ethnicity.¹⁸ Asked, "During your recent hospital stay, did you experience harsh or threatening language?" affirmative responses were highest among Asian/PI and Black women, each with 9%. For the question whether they "perceived unfair treatment due to language," affirmative responses varied: Asian language speakers, 12%; Spanish speakers, 10%; and other non-English speakers, 9%.

In two recent studies asking Black and Hispanic women who had severe hemorrhage or other severe events about their experiences, lack of continuity of care and poor caregiver interaction were predominant themes.^{14,19} A Black woman,

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whose story was included in a hospital safety and equity video, shared her experiences:

After I gave birth, I remember telling the nurse something wasn't right and I did not feel well. The nurse said "Oh, you are alright." I said, "No I am not could you take the baby?" She said, "Don't you want to bond with your baby?" Moments later I lost consciousness. I had lost a lot of blood and needed an emergency blood transfusion. It was scary. It was traumatizing. I could have died. All because my nurse did not listen to me when I said something was wrong."²⁰

These and other findings suggest that women are attuned to delays in recognition of and response to hemorrhage and may be further traumatized by perceptions of sub-optimal care.

After a severe hemorrhage, clinicians should be alert for behavior or emotional states that are outside the normal range of postpartum responses. Such reactions may include detachment, dissociation, and intrusive thoughts.²¹ There is a significant and clinically relevant increased risk for women to develop post-traumatic stress disorder (PTSD) after experiencing severe postpartum hemorrhage, so providers should refer women and families to counseling and mental health services.^{2,14,22} Clinicians may not know how women have perceived their experience, and thus assessment and discharge planning for follow-up care are essential for all women who have experienced severe hemorrhage or other potentially traumatic birth experiences.²¹ In these discussions, the focus should be on listening to the patient's experience and answering their questions, and then providing information in this context. While it is important to tell women what happened to them and why, the patient's own questions and readiness level should guide this discussion, rather than those of the providers. In some cases, patients may NOT be ready

to hear medical details until after discharge from hospital, in which case it should be done at an outpatient visit. For patients who have experienced severe/life-threatening events, it is advisable to consider an additional postpartum visit or check in by the primary obstetrician at 1-2 weeks postpartum. A labor and delivery nurse who had a severe hemorrhage reflected:

We [speaking as an obstetric nurse] have a lot of moms who do have traumatic births, and we don't have anything. When they come up, we don't really address the trauma. We do address, "I know you had heavy bleeding. Watch your bleeding if your bleeding's heavy." We don't address their emotional well-being around the trauma. (Black woman with VBAC and postpartum hemorrhage)¹⁹

Women who were treated by several providers through the course of their care felt frustrated at having to retell their medical history several times: a potentially re-traumatizing situation. While it is not uncommon for clinicians to want to personally hear from the patient regarding specific details about their experience, the patient's chart should be reviewed prior to speaking with them. It is helpful for the provider to summarize what they know and ask the patient to fill in details that may have been missed that they feel are important to their care. A Hispanic study participant who had a postpartum hemorrhage following a primary cesarean noted how distressing it was to repeat their story:

I didn't care if I saw one or the other, because that's the worst thing. You have to tell them your story.... It's a gynecologist today, and a resident tomorrow. The resident has never seen you, so you have to repeat the story... That's terrible."¹⁹

Finally, it is important to note that there are no specific organizations that support the unique needs of women who have experienced

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a severe obstetric hemorrhage. There are, however, organizations such as the Amniotic Fluid Embolism Foundation, the National Accreta Foundation, and the Preeclampsia Foundation that have resources that address medical crises and the impact of trauma in childbirth. (See Appendix Y: Resources for Postpartum Hemorrhage Survivors on page 262.)

Informational, emotional and physical health needs

A clinician's guide to key informational, emotional and physical health needs of women and families particular to specific time periods is included as in Table 1 on page 157.

Before the critical event

Current obstetric best practice incorporates and includes patients in decision making. This includes reproductive decision making, genetic testing, management of labor and route of birth. With an ongoing, trusting relationship between the clinician and the patient, it is possible to sensitively and accurately explain how adverse events can occur during the antepartum, intrapartum or the postpartum period.²³ Patients should be encouraged to ask questions and invited to share all concerns.²³

All women who have been identified antenatally as high risk for obstetric hemorrhage should be counseled early on in their prenatal course about the potential need for blood transfusions, or in the case of placenta accreta spectrum, a possible hysterectomy. The discussion, patient preferences and plan regarding treatment should be documented and communicated to the facility where the woman will give birth. In complex cases, the primary maternity provider should ensure that all relevant disciplines (e.g., anesthesia, nursing, and sub-specialty services as appropriate to the woman's condition) are included in care planning.²² Patients who become high-risk throughout the labor course should be

informed of their changed status and about likely measures that will be taken to mitigate risk and treat hemorrhage. Maternity providers should listen respectfully to women who communicate or present to care with a concern about their symptoms, and providers should give full, complete information in response.

During the critical event

Families and other close support persons are an integral part of the birth process, often providing strength and encouragement for women in managing unexpected health crises and they may wish to stay with their loved ones throughout the course of care. During childbirth, health crises are especially feared, and when one occurs, family members need information and support.

Although some health care providers may be uncomfortable with family presence during procedures and resuscitation due to fears of distraction, interference in care provision, psychological distress for family members and liability concerns,²⁴⁻²⁶ there is no evidence to support those perceptions or concerns.²⁴⁻²⁹ Furthermore, studies suggest family members, patients and clinicians benefit from family presence, even during resuscitation.^{27,29-33} Survey data revealed patients and families overwhelmingly wanted the option of family presence at resuscitations and a recent clinical trial suggested psychological benefit for family members present during cardiopulmonary resuscitation.²⁷⁻²⁹

Support for family presence during invasive procedures and resuscitations is formally endorsed by the Society for Critical Care Medicine, American Academy of Pediatrics, American College of Emergency Physicians, American Association of Critical Care Nurses, and the Emergency Nurses Association.^{27,33-35} Patient and family expectations and desires for presence during urgent medical care and resuscitation should be ascertained and supported.^{23,24,27,28,31,36}

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With this in mind, many resuscitations for patients experiencing obstetric hemorrhage will occur in the operating room, as hemorrhages often require surgical intervention. As such, the family may not be able to be present based on local hospital policies and available support personnel for family.³⁷ Hospitals should have a clear, formal policy regarding family presence during emergencies and resuscitation in obstetric units. In the event that a policy prohibits family presence at obstetric emergencies, a family liaison should be appointed in order to keep the family updated and informed on the patient's condition.^{33,35} Depending on staffing availability, this may be a social worker, house nursing supervisor, chaplain, or other designated staff. Plan on providing a family liaison in the event the patient needs to go to the OR unexpectedly. Family members who do not receive information experience stress, as does the birthing person, as this Hispanic woman who had a postpartum hemorrhage after a repeat cesarean shared:

They rushed me to the surgery room, and I didn't know nothing until the next day. I think when I went into the surgery room, I think [my sister] was already outside.... She [my sister] told me that, as she was waiting there, there was a lot of doctors going in, but no one told her what's going on.¹⁹

Recovery after the critical event (in hospital)

I needed my providers to maintain a caring and professional focus on me, which means not allowing one's own "stuff" to get in the way of sensitive and respectful communication. Experiencing medical trauma can be dehumanizing; treating patients as competent, resilient people restores their humanity.⁴

It is critical that health care providers be especially careful in the manner and language

used to communicate with women after a critical event, especially when there has been an unexpected or unwanted outcome, such as a hysterectomy. This woman shared her experience:

I can remember waking up and feeling...I was just mad. I was angry that it [a hysterectomy] had happened. I don't remember how I knew that everything had happened. I was told that a nurse had told me. She didn't know that I didn't know, that I wasn't going to be able to have any more kids. I had no clue what she was talking about and no one wanted to tell me at that point because I still wasn't stable and I guess this nurse kind of messed up and told me. And apparently, I screamed and I was angry and I made her cry.³⁸

An unexpected physical trauma may affect women's preferences regarding self and newborn care. As with all support, it is important to follow the mother's lead. For example, some women are grateful for breastfeeding assistance, such as pumping, in the ICU. Others report difficulty in obtaining appropriate support. Still others may be worried about how lactation may affect their own healing or may find that the physical challenges of healing supersede their prior preferences regarding breastfeeding. It is important not to make assumptions about what women need, can, or "should" do during this time. Shared decision-making using evidence-based information should be used to support the mother in her decisions and actions regarding feeding and other newborn care.

Clinicians should assess women's emotional state and pay attention to signs of trauma and negative emotional states, such as depression or dissociation. If available at the facility, on-site referrals to mental health professionals may be useful. Clinical counselor Michelle Flaum Hall developed a sample tool for clinicians to assess women's acute stress levels after a severe morbidity.³⁹ (See Appendix V: A Guide to Recognizing Acute Stress Disorder in Postpartum

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Women in the Hospital Setting on page Appendix V: A Guide to Recognizing Acute Stress Disorder in Postpartum Women in the Hospital Setting on page 254.) There is a significant and clinically relevant increased risk for women to develop post-traumatic stress disorder (PTSD) after experiencing severe postpartum hemorrhage.^{21,40} Obstetric and midwifery providers are advised to screen for PTSD in addition to anxiety and depression at postpartum follow-up visits to prevent long-term negative mental health effects.

Breastfeeding/chestfeeding considerations

It is important to consider the challenges birthing people may face if they choose to breastfeed/chestfeed their child. A difficult birth and maternal exhaustion may lead to delayed stage II lactogenesis (secretory activation). A nurse, lactation educator or healthcare worker should collaborate with the new mother to develop a plan to ensure they are supported in their desired infant feeding plan. How a mother experiences breastfeeding during the early days can have a lasting effect on the duration, and ultimately her success, of breastfeeding.

It is important to develop an infant feeding plan early on that will support the new mother's desires and efforts. For some who experience an adverse event, breastfeeding can help them reclaim "normalcy" or autonomy over their experience of motherhood. For others, the pressure to breastfeed may cause undue stress and can negatively impact their postpartum experience, as this Hispanic woman who had a postpartum hemorrhage and severe hypertension noted:

I was being seen by so many people. One woman came in at 11:00 p.m., and I was in such pain, and that woman was practically forcing me to pump... They should be more considerate. They're invading your space, and in the moment, it's not necessary.¹⁹

In the hospital setting, these patients should be provided lactation support if they so choose, even in non-obstetric units such as the emergency department or the intensive care unit. Obstetric units should be aware of postpartum patients throughout the hospital that may benefit from lactation support; units should facilitate mother-infant contact or provide pumping resources in addition to a storage plan for pumped breast milk if a lactating mother is separated from their baby. This can be done by placing a lactation consult order in the electronic health record (EHR), or providing education to each unit of the hospital stating that labor and delivery should be called if a patient is lactating. One white woman experienced significant challenges after her severe hemorrhage:

After delivery, I spent multiple days in ICU followed by a week in a gynecological oncology unit, all while my baby was in the NICU. It was a constant challenge to have assistance to pump and store breast milk while in the care of units that were not prepared to support lactating mothers. My family was often burdened with filling these gaps and were told that policy did not allow the storage of human milk in patient refrigerators on the unit. Between supporting my and my infant's recoveries as well as caretaking for my older son, my family was not always able to transport my milk to the NICU in a timely fashion. My family kept this knowledge from me at the time in order to keep my spirits up. To my dismay, I found later that much of the milk I was trying so hard to pump was poured down the drain because of this policy.⁴¹

New mothers who experience an obstetric hemorrhage have a need for education and support during their hospitalization and once they are discharged home. If possible, referrals to lactation support resources should be made

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prior to discharge, such as peer counselors or lactation educators. Peer counselors may also be able to provide some much-needed emotional support. Appendix Y: Resources for Postpartum Hemorrhage Survivors on page 262 provides an example of a resource document for women and their families that can be tailored to the local area.

A risk management view of disclosure and discussion after obstetric hemorrhage

Patients and their families often leave the hospital after an adverse event with misconceptions of what occurred and a lack of understanding that the medical team provided life-saving care in response to their clinical situation. In obstetrics, cases of severe maternal morbidity (SMM) and mortality related to hemorrhage occur, and the patient and their family may not comprehend the predisposing factors, the cause of the event and the response of the medical team.

Providing timely, transparent bedside communication with the patient and their family is crucial to promote trust, diffuse anger and improve patient safety. Women and their families who are not given the opportunity to discuss an SMM event with the clinicians often leave without facts and with misconceptions. This may lead to questions about whether the care rendered was appropriate and potentially seeking legal advice based on a lack of understanding. Clinicians are sometimes reluctant to discuss events based on fear of litigation and hospital administrative processes. However, the paradigm shift from a culture of blame to a culture of transparency and accountability promotes trust and reduces lawsuits. Conversations following SMM events also restore the integrity of the clinician-patient relationship. Several hospital systems and states who adopted disclosure and apology programs have decreased legal costs.⁴²

The bedside discussion with the patient after an adverse event is an extension of the ongoing clinician-patient relationship. Disclosure honors the patient's right to autonomy to make decisions about their care. The discussion should be tailored to the patient's preferences and questions and should include an objective review of the events that occurred. The provider of record is typically best positioned to have the discussion and the nurse manager should be present. The provider needs to be prepared and have an opportunity to formulate the discussion in their mind. The art of disclosure is an acquired skill that takes time to develop and can be modeled by senior physicians and enhanced by including post-event patient communication in simulation. It is imperative that the trainees not be left alone to complete this discussion.²³

The debrief with the patient should occur as soon as they are stable and in a private place, and the conversation should be unhurried and led by patient's questions and readiness for the discussion. Content of the initial discussion should include what happened to the woman or her newborn, the expected effect on the patient's condition and immediate plan of care and potential short- or long-term prognosis. The patient and family should have the opportunity to share their experience of the event, vent their frustrations, ask questions and have their concerns addressed. The conversation occurrence and contents should be documented in the EHR. An expression of sympathy and apology by the clinical team does not admit liability but shows empathy and concern. Apologies at the time of bedside debrief are appropriate and often appreciated by the patient.⁴³

Expressions of apology, sympathy and understanding are different than admissions of wrongdoing or liability for the event. States vary with respect to legislation prohibiting provider apologies when integrated with disclosure of an

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adverse event being admissible in legal actions. Many state laws protect providers who empathize with the patient's situation yet do not admit error. California Evidence 1160 clearly states that "benevolent gestures expressing sympathy shall be inadmissible as evidence of admission of liability."⁴⁴⁻⁴⁶ An admission of fault shall be considered admissible and should not be shared with the patient or their family.

The American College of Obstetricians and Gynecologists Committee Opinion #681, Disclosure and Discussion of Adverse Events states, "The disclosure and discussion of adverse events are critical to create and maintain high quality healthcare and to preserve the integrity of the patient-physician relationship."⁴⁷ The American Society for Healthcare Risk Management's (ASHRM) three article monograph on disclosure initially released in 2001 and re-released in 2013 supports disclosure being a component of safer and trusted healthcare in accordance with state laws.²³ The society also recognizes the disclosure process as an important part of the physician-patient relationship. Fear of litigation should not be an obstacle to disclosure. States such as Michigan, who was an early adopter of disclosure statutes, recognizes that the process is not only beneficial to the patient and does not increase liability but can decrease liability and lawsuits.

Disclosure of adverse events to the patient and their family is encouraged by professional societies including ACOG and American Society for Healthcare Risk Management (ASHRM).⁴⁷ If not currently in place, policies and guidelines addressing disclosure should be developed by a hospital's clinicians and administration in accordance with state laws. Education for clinicians is essential to promote appropriate disclosure practices.

Discharge information

It is important that discharge materials include post-birth warning signs,⁴⁸ as well as a patient-friendly narrative to explain the course of their care. This document should be reviewed with the patient and support person(s), creating an opportunity for the patient and support person(s) to ask questions and receive clarification from clinicians. It may take weeks, months, or years after physical recovery for a patient to process what happened during their birth experience. Having written details about their care can help them in their understanding and recovery. Patients have reported that once medical follow-up care has ended, it is beneficial for a provider, ideally one who was present during the critical event, to offer the patient a follow up meeting as an opportunity to review what happened and answer any lingering questions. Such a meeting and invitation can be very valuable in assisting the patient towards achieving closure. In Appendix I: Discharge Planning for Women with Hemorrhage During Birth Hospital Stay on page 220, there is a template of a patient-facing discharge document that includes resources for follow-up and details of the patient's admission. One of the most important sections of this discharge document is highlighting a patient resource person. The patient resource person is someone designated to be a point of contact for the patient after discharge. This individual may provide resources, answer questions and help the patient in navigating and processing their experience. The person who fills this role may vary based on the patient's experience and the resources at the facility, e.g., social worker, designated nurse, clergy.



Recovery after the critical event (at home)

It is important to assess women's needs for, and access to, in-home support and care. Women who have experienced a significant morbidity as a result of childbirth should receive thorough discharge planning reflecting their needs for physical and emotional recovery in addition to the routine discharge planning and teaching regarding self and newborn care. In particular, women with co-morbidities, including substance use disorder or mental health diagnoses, will need specific resources for recovery.⁴⁹ Several appendices are listed at the end of this section that may be particularly helpful for women and families to understand what to expect postpartum. This Toolkit includes a list of support resources, and a sample discharge planning tool.

Even with the highest quality of care, women may be at risk of developing traumatic stress reactions and post-traumatic stress disorder (PTSD) after a severe hemorrhage. These stress reactions can occur when people experience events in which there was an actual or perceived threat of death or severe injury. While not all women who experience an obstetric emergency experience will develop PTSD, women who do develop PTSD may be greatly debilitated and experience impaired functioning in many life domains.^{2,14,22,40} Women and their families should be informed of the signs and

symptoms of PTSD (for both the woman and her partner) and provided with referrals for counseling before they leave the hospital. Many participants in a research study recommended that women seek out therapy to explore their strong emotions after a life-threatening event, as this Black Hispanic woman noted:

...cherish life because that's scary. You experience that near-death experience.... Go to therapy if needed. [Interviewer: Mm-hmm. Is that something you've done?] I can go. I just haven't gone, for some odd reason. I don't know why. I do believe that I should go to therapy.¹⁹

Sensitive, trauma-informed and culturally competent care may support resiliency and reduce the development of severe emotional distress. Medical staff should understand that the experience of traumatic birth is individual. A woman's reactions following an obstetric emergency may be due to a sense of threat, loss of control, loss of trust in caregivers, or other factors. The patient's perception of the experience of hemorrhage may not align with a provider's perception of the clinical severity or clinical resolution of the event. This is why it is essential to assess for signs of traumatic stress reactions before discharge, and to provide referrals and resource lists for all women who experience severe morbidity.^{22,39} (See Appendix Y: Resources for Postpartum Hemorrhage Survivors on page 262.)

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Women with significant blood loss are likely to be physically weak and require additional help at home. Family members may not live nearby, and those who came from a distance for the birth may be unable to extend their stay. Partners may have to work and may not have sufficient time off to stay with women after they are discharged home. Those who have experienced a life-threatening event experience an existential crisis as well as a medical one.^{2,3,13,22,40} They need to process the event yet often find that family members and friends wish to put the ordeal behind them. One woman expresses how conflicting emotions arise in her life:

There are times...when people say, “Oh, you should just be thankful you’re alive.” Well, I totally agree with that, but there are times you still...you know, it’s hard. I guess every once and awhile you need a pity party and just to feel bad because I would’ve had more children. I feel like I was cheated in that way.³⁸

Family members and friends are often emotionally overwhelmed and can be unable or uncertain how best to provide support once the woman has been discharged home. Lack of support from family members can create lasting rifts, as this woman discovered after wanting to talk with family about her severe complications and hospital experience:

And my father-in-law said, “What happened to you was obviously supposed to, Beth, you need to move on.” And I was thinking, “Oh my god, if I was talking about this three years later, maybe someone should say that. But this has been three weeks. I’ve had two major abdominal surgeries in eight days of each other. I almost died and that’s your response?”³⁸

Women who have experienced severe complications during childbirth have significant recovery issues once discharged from the hospital. It is advised that policy makers consider including postpartum home visiting or other support services for women and their families following a severe event.²²

Spotlight: MoMMA’s Voices

MoMMA’s Voices (Maternal Mortality and Morbidity Advocates) is a national coalition of patient organizations and individuals with “lived experiences” – or those that represent them – using their voice to reduce maternal complications in pregnancy and the postpartum period.



**MoMMA’s
Voices**

As advocates to eliminate maternal mortality and severe morbidity, MoMMA’s Voices’ overarching goal is to provide a home and platform for the patient voice to actively engage in efforts to make childbirth safer in the United States. The coalition provides training and tools to prepare “champions for change.” It also looks at cross-cutting issues such as quality and consistency of healthcare provision, patient-provider communications, racial disparities, inadequate research funding, and other leading contributors to adverse outcomes in pregnancy and the postpartum period.

(Logo used with permission of MoMMA’s Voices)

Recommendations

1. Prioritize having the partner/support person in the room, even during emergent situations.
2. Provide patients and families with information about their medical condition as it changes.
3. Focus on understanding patients' experiences of the event; their questions should guide post-event conversations with patients and family.
4. Approach patients and families with sensitivity and concern; observe for signs and symptoms of acute stress disorder and provide resources for psychological counseling resources while in hospital and/or post discharge.
5. Assist patients and their families to process and understand events that occurred, and their short- and long-term prognosis, understanding that need may continue for some time afterward.
6. Ensure each patient who experiences obstetric hemorrhage receives a detailed discharge summary in writing. This document should be reviewed by the provider with the patient and support person(s). The patient and support person(s) should be encouraged to ask questions and clinicians should provide clarification.
7. Ensure that prior to discharge, each patient who experiences obstetric hemorrhage receives the contact information of a patient resource person who can answer questions about her care and ongoing concerns.
8. If not currently in place, policies and guidelines addressing disclosure should be developed by a hospital's clinicians and administration in accordance with state laws. Education for clinicians is essential to promote appropriate disclosure practices.
9. Policy makers should consider providing ongoing benefits for women and their families following a severe event, such as postpartum home visiting or other support services.¹³

Table 1: Guide for clinicians regarding informational, emotional and physical health needs among women, birthing people, and families who experience obstetric hemorrhage

A	PRENATAL/ before critical event	INTRAPARTUM/ during critical event	POSTPARTUM/ in hospital recovery	DISCHARGE	POSTPARTUM/ at HOME
Information needs of Women, Birthing People	<ul style="list-style-type: none"> ▶ What is normal bleeding postpartum ▶ When to seek medical care and where to go ▶ Professional translation, when applicable 	<ul style="list-style-type: none"> ▶ What is happening ▶ What is being done ▶ Explanation that hemorrhage is an emergent event ▶ Professional translator, when applicable, throughout hospital stay 	<ul style="list-style-type: none"> ▶ Review the chart and know the facts before speaking to patient ▶ Information about what has happened and her current condition that is sensitively and empathetically provided ▶ Keep focused on patient needs; avoid personal or social conversations with colleagues while with patient 	<ul style="list-style-type: none"> ▶ Formal discussion of ▶ chain of events; what caused hemorrhage ▶ Balance women’s need to know with hospital policy around disclosure ▶ Recognize possible conflict of interest ▶ Provide referrals to psychological counselor or social worker 	<ul style="list-style-type: none"> ▶ Risks in future pregnancy (if applicable) ▶ Formal discussion about what happened and prognosis at follow up postpartum visit
Information needs of Partner, Family, Support team	Same as above	Same as above, and <ul style="list-style-type: none"> ▶ Assign support to Partner ▶ Keep updated frequently ▶ Keep in the room, even during emergency care if the person wishes to stay 	Same as above, and <ul style="list-style-type: none"> ▶ Assign support to Partner ▶ Keep updated frequently 	Same as above	Same as above

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B	PRENATAL/ before critical event	INTRAPARTUM/ during critical event	POSTPARTUM/ in hospital recovery	DISCHARGE	POSTPARTUM/ at HOME
Emotional Support Needs of Women, Birthing People		Reassurance About baby: <ul style="list-style-type: none"> ▶ Where and how the baby is doing ▶ Provide pictures of the baby if separated for medical reasons About woman: <ul style="list-style-type: none"> ▶ “We are doing everything to take care of you” 	<ul style="list-style-type: none"> ▶ Minimize loud noises, bright lights if possible. Take the patient’s lead regarding TV, visitors, etc. ▶ Pay attention to signs of trauma, depression. Seek consultation with a mental health professional if necessary ▶ Present information of trauma behaviors, ways to support herself in a caring, nurturing manner 	<ul style="list-style-type: none"> ▶ Normalize postpartum experiences without discounting severe event 	<ul style="list-style-type: none"> ▶ Pay attention to signs of trauma, depression ▶ Seek consultation with a mental health professional if necessary
Emotional Support Needs of Partner, Family, Support team		Same as above	<ul style="list-style-type: none"> ▶ Ask how partner/family members are doing ▶ Remember the partner is also processing the experience ▶ Present information of trauma behaviors, ways to support mother and family in a caring, nurturing manner 	<ul style="list-style-type: none"> ▶ Referral to postpartum care needs ▶ Counseling and PTSD warning signs for self and woman 	<ul style="list-style-type: none"> ▶ Referral to postpartum care needs ▶ Counseling and PTSD warning signs for self and woman

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C	PRENATAL/ before critical event	INTRAPARTUM/ during critical event	POSTPARTUM/ in hospital recovery	DISCHARGE	POSTPARTUM/ at HOME
Physical and Health Needs of Women, Birthing People		<ul style="list-style-type: none"> ▶ Keep mother and baby together if possible 	<ul style="list-style-type: none"> ▶ Support breastfeeding if desired and provide breast pump and certified lactation consultant ▶ Check to see (don't assume) if medications contraindicate breastfeeding ▶ Assess strength and ability to perform activities of daily living 	<ul style="list-style-type: none"> ▶ Refer to outpatient lactation support ▶ Referral to physical therapy, specifically pelvic floor or urogynecologic, as indicated 	<ul style="list-style-type: none"> ▶ Postpartum follow up within 7-10 days; formal discussion about what happened and prognosis
Physical and Health Needs of Partner, Family, Support team		<ul style="list-style-type: none"> ▶ Comfortable place to sleep ▶ Private place to make calls for additional support and updates 	<ul style="list-style-type: none"> ▶ Comfortable place to sleep ▶ Private place to make calls for additional support and updates 	<ul style="list-style-type: none"> ▶ Counsel about need for extra physical support for woman at home 	<ul style="list-style-type: none"> ▶ Counsel about need for extra physical support for woman at home

This table was adapted from the Improving Health Care Response Obstetric Hemorrhage: A California Quality Improvement Toolkit, funded by the California Department of Public Health, 2015; supported by Title V funds.

Educational tools and sample resources

[A Guide to Recognizing Acute Stress Disorder in Postpartum Women in The Hospital Setting \(Appendix V on page 254\)](#)

[Patient and Family Support Checklist for Postpartum Hemorrhage \(Appendix W on page 259\)](#)

[Life After Postpartum Hemorrhage \(Appendix X on page 260\)](#)

[Resources for Postpartum Hemorrhage Survivors \(Appendix Y on page 262\)](#)

[Sample Patient Summary Form: Obstetric Hemorrhage Event \(Appendix Z on page 264\)](#)

[Sample Script: Provider – Patient Postpartum Hemorrhage Post-Event Discussion \(Appendix AA on page 265\)](#)

[FAQ What Do Patients Need to Know? \(Appendix BB on page 267\)](#)

[CDC Hear Her Campaign](#)

[MoMMA's Voices \(Maternal Mortality and Morbidity Advocates\)](#)

EVIDENCE GRADING

LEVEL OF EVIDENCE: C

References

- Callister LC, Holt ST, Kuhre MW. Giving birth: The voices of Australian women. *Journal of Perinatal and Neonatal Nursing*. 2010;24(2):128-136.
- Elmir R, Schmied V, Jackson D, Wilkes L. Between life and death: Women's experiences of coming close to death, and surviving a severe postpartum haemorrhage and emergency hysterectomy. *Midwifery*. 2012;28(2):228-235.
- Furuta M, Sandall J, Bick D. Women's perceptions and experiences of severe maternal morbidity: A synthesis of qualitative studies using a meta-ethnographic approach. *Midwifery*. 2013.
- Hall MF. The psychological impact of medical trauma: One woman's childbirth story. *Nursing for Womens Health*. 2013;17(4):271-274.
- Jonkers M, Richters A, Zwart J, Ory F, van Roosmalen J. Severe maternal morbidity among immigrant women in the Netherlands: Patients' perspectives. *Reproductive Health Matters*. 2011;19(37):144-153.
- Pil T. Babel: The voices of a medical trauma. In: Gross PG, Diane, ed. *Pulse: Voices from the heart of medicine. More voices: A second anthology*. New Rochelle, NY: Voices from the Heart of Medicine Inc. 2012:158-167.
- Souza J, Cecatti JG, Faundes A, et al. Maternal near miss and maternal death in the World Health Organization's 2005 global survey on maternal and perinatal health. *World Health Organization Bulletin*. 2010;Feb (88(2)):113-119.
- Thompson JF, Ford JB, Raynes-Greenow CH, Roberts CL, Ellwood DA. Women's experiences of care and their concerns and needs following a significant primary postpartum hemorrhage. *Birth*. 2011;38(4):327-335.
- Tuncalp O, Hindin MJ, Adu-Bonsaffoh K, Adanu R. Listening to women's voices: The quality of care of women experiencing severe maternal morbidity, in Accra, Ghana. *PLoS One*. 2012;7(8):e44536.
- Janevic T, Zeitlin J, Egorova N, Hebert PL, Balbierz A, Howell EA. Neighborhood racial and economic polarization, hospital of delivery, and severe maternal morbidity. *Health Affairs*. 2020;39(5):768-776.
- Leonard SA, Main EK, Scott KA, Profit J, Carmichael SL. Racial and ethnic disparities in severe maternal morbidity prevalence and trends. *Annals of Epidemiology*. 2019;33:30-36.
- Main EK, Chang, SC, Dhurjati R, Cape V, Profit J, Gould, JB. Reduction in racial disparities in severe maternal morbidity from hemorrhage in a large-scale quality improvement collaborative. *American Journal of Obstetrics and Gynecology*. 2020;223(1):123 e121-123 e114.
- HealthTalk Online. Conditions that threaten women's lives in childbirth & pregnancy. HealthTalk Online: People's Experiences Web site. <http://healthtalkonline.org/peoples-experiences/pregnancy-children/conditions-threaten-womens-lives-childbirth-pregnancy/topics>. Published 2014. Accessed 4/29/2021.
- Wang E, Glazer KB, Sofaer S, Balbierz A, Howell EA. Racial and ethnic disparities in severe maternal morbidity: A qualitative study of women's experiences of peripartum care. *Women's Health Issues*. 2021;31(1):75-81.
- Chambers BD, Arabia SE, Arega HA, et al. Exposures to structural racism and racial discrimination among pregnant and early post-partum Black women living in Oakland, California. *Stress Health*. 2020;36(2):213-219.

16. Vedam S, Stoll K, Rubashkin N, et al. The Mothers on Respect (MOR) index: Measuring quality, safety, and human rights in childbirth. *SSM Population Health*. 2017;3:201-210.
17. Vedam S, Stoll K, Taiwo TK, et al. The Giving Voice to Mothers study: Inequity and mistreatment during pregnancy and childbirth in the United States. *Reproductive Health*. 2019;16(1):77.
18. Sakala C, Declercq E, Turon J, MP C. Listening to Mothers in California: A population-based survey of women's childbearing experiences, full survey report. Washington, D.C. 2018.
19. New York City Department of Health and Mental Hygiene. Women's experiences with severe maternal morbidity in New York City: A qualitative report. New York, NY2020.
20. Birth equity [Video]2020.
21. Kountanis JA, Muzik M, Chang T, et al. Relationship between postpartum mood disorder and birth experience: A prospective observational study. *International Journal of Obstetric Anesthesia*. 2020;44:90-99.
22. Morton CH, Hall MF, Shaefer SJM, et al. National Partnership for Maternal Safety: Consensus bundle on support after a severe maternal event. *Journal of Obstetric, Gynecologic, and Neonatal Nursing: JOGNN*. 2021;50(1):88-101.
23. Amori G. Disclosure of Unanticipated Events in 2013. In: American Society for Healthcare Risk Management, ed. *Disclosure: American Society for Healthcare Risk Management*; 2013.
24. Critchell CD, Marik, PE. Should family members be present during cardiopulmonary resuscitation? A review of the literature. *American Journal of Hospital Palliative Care*. 2007;24(4):311-317.
25. Duran CR, Oman KS, Abel JJ, Koziel VM, Szymanski D. Attitudes toward and beliefs about family presence: A survey of healthcare providers, patients' families, and patients. *American Journal of Critical Care*. 2007;16(3):270-279.
26. Sak-Dankosky N, Andruszkiewicz P, Sherwood PR, Kvist T. Integrative review: Nurses' and physicians' experiences and attitudes towards inpatient-witnessed resuscitation of an adult patient. *Journal of Advanced Nursing*. 2013.
27. Sacchetti A, Paston C, Carraccio C. Family members do not disrupt care when present during invasive procedures. *Academic Emergency Medicine*. 2005;12(5):477-479.
28. Davidson JE, Powers K, Hedayat KM, et al. Clinical practice guidelines for support of the family in the patient-centered intensive care unit: American College of Critical Care Medicine Task Force 2004-2005. *Critical Care Medicine*. 2007;35(2):605-622.
29. Jabre P, Belpomme V, Azoulay E, et al. Family presence during cardiopulmonary resuscitation. *New England Journal of Medicine*. 2013;368(11):1008-1018.
30. Merlevede E, Spooren D, Henderick H, et al. Perceptions, needs and mourning reactions of bereaved relatives confronted with a sudden unexpected death. *Resuscitation*. 2004;61(3):341-348.
31. Meyers T, Eichhorn D, Guzzetta C. Do families want to be present during CPR? A retrospective survey. *Journal of Emergency Nursing*. 1998;24(5):400-405.
32. Wagner JM. Lived experience of critically ill patients' family members during cardiopulmonary resuscitation. *American Journal of Critical Care*. 2004;13(5):416-420.
33. Doolin CT, Quinn LD, Bryant LG, Lyons AA, Kleinpell RM. Family presence during cardiopulmonary resuscitation: Using evidence-based knowledge to guide the advanced practice nurse in developing formal policy and practice guidelines. *Journal of the American Academy of Nurse Practitioners*. 2011;23(1):8-14.
34. American Association of Critical-Care Nurses. Family presence during CR and invasive procedures. AACN Practice Alert 2010. <http://www.aacn.org/wd/practice/docs/practicealerts/family%20presence%2004-2010%20final.pdf>. Published 2010. Accessed January 22, 2014.
35. Emergency Nurses Association. Family presence during invasive procedures and resuscitation. Des Plaines: ENA; 2012.
36. American Academy of Pediatrics Committee on Pediatric Emergency Medicine, American College of Emergency Physicians Pediatric Emergency Medicine Committee, O'Malley P, Brown K, Mace SE. Patient- and family-centered care and the role of the emergency physician providing care to a child in the emergency department. *Pediatrics*. 2006;118(5):2242-2244.
37. Brasel KJ, Entwistle JW, 3rd; Sade, R. M. Should Family Presence Be Allowed During Cardiopulmonary Resuscitation? *Annals of Thoracic Surgery*. 2016;102(5):1438-1443.
38. Morton CH, Nack A, Banker J. The social invisibility of maternal morbidities in US motherhood narratives: Giving voice to lived experience. *Motherhood Conference*; March 6-8, 2014, 2014; New York City.
39. Council on Patient Safety in Women's Health Care. Patient safety bundle: Support after a severe maternal event. National Partnership for Maternal Safety Web site. <https://safehealthcareforeverywoman.org/patient-safety-bundles/support-after-a-severe-maternal-event-supported-by-aim/>. Published 2016. Accessed 4/20/2020.
40. Elmir RS, Schmeid V, Wilkes L, Jackson, D. Women's perceptions and experiences of a traumatic birth: A meta-ethnography. *Journal of Advanced Nursing*. 2010;66(10):2142-2153.

41. Terlizzi K. Personal hemorrhage story. In: CMQCC Obstetric Hemorrhage 3.0 Task Force, ed. Palo Alto, CA; 2020.
42. Medical Mutual Insurance Company of Maine. Disclosure of unanticipated outcomes: Adverse event communication and support. Northwell Health Corporate Risk Management. System Policy and Procedure Manual Web site. <https://www.medicalmutual.com/risk/practice-tips/tip/disclosure-of-unanticipated-outcomes-adverse-event-communication-and-support/34>. Published 2019. Accessed 4/29/2021.
43. Moyes A. Disclosure of Adverse Events and Medical Errors. <http://www.emdocs.net/disclosure-of-medical-errors>. Published 2021. Accessed 4/29/2021.
44. State of California. California Evidence Code Section 1160. In:2017.
45. California Nurses Association. Medical error disclosure: Acknowledging mistakes can help promote optimal resolution Healthcare Perspective. 2017.
46. Oppenberg AA. Adverse outcomes: What do you do? California Physician. 1992.
47. ACOG. Disclosure and discussion of adverse events. Committee Opinion No. 681 of the American College of Obstetricians and Gynecologists. Obstetrics and Gynecology. 2016;128(6):e257-e261.
48. AWHONN. Save your life: Get care for these post-birth warning signs. <https://www.awhonn.org/wp-content/uploads/2020/02/pbwssylhandoutenglish.pdf>. Published 2018. Accessed.
49. Crew E, Chowfla A, DuPlessis H, et al. Mother and Baby Substance Exposure Toolkit. In: Stanford, CA: California Maternal Quality Care Collaborative and California Perinatal Quality Care Collaborative; 2020: <https://nastoolkit.org/>. Accessed 4/29/2021.

Secondary Postpartum Hemorrhage and Readmission

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Key Principles

1. Immediate hemorrhage during the birth hospitalization is a significant risk factor for subsequent readmission both for Postpartum Hemorrhage (PPH) and for all causes of postpartum readmission.
2. When women present to the emergency department (ED), it is important to **identify whether they have been pregnant in the previous 6 weeks**. If yes, assess immediately.
3. An interdepartmental team of ED and OB clinicians should discuss assessment, consultation, and transfer practices that would work best for their hospital, using mutually developed workflows to create a policy that is available to all clinicians.
4. There is a significant and clinically relevant increased risk for women to develop post-traumatic stress disorder (PTSD) after experiencing severe postpartum hemorrhage. Many women who experience severe postpartum hemorrhage would benefit from supportive care at home, provided by home visiting nurses or others, who can assess issues around physical recovery, breastfeeding and mental health.

Background

There has been relatively little investigation of the incidence and risk of secondary hemorrhage, or severe bleeding that occurs between 24 hours and 42 days after birth, and occurs in 1% of pregnancies.^{1,2} The overall risk for postpartum readmission is increasing – from 1.72% in 2004 to 2.16% in 2011, and hemorrhage or retained products of conception are the primary or associated diagnoses in 13% of all postpartum readmissions.³ A recent study using population data on births occurring between 2010-2014 was

the first to focus on how postpartum hemorrhage is associated with hospital readmission and found that 82% of readmissions occurred \leq 20 days after discharge.⁴ This study also found that PPH during birth was a risk factor for readmission, and PPH with transfusion was associated with a particularly high likelihood of readmission.⁴ Factors associated with PPH readmissions included maternal age, public insurance, pre-gestational diabetes and hypertensive diseases of pregnancy.⁴

Postpartum hemorrhage in the emergency department

Patients with delayed postpartum hemorrhage often present in the emergency department (ED) after discharge home from their birth admission.⁵ When women present to the emergency department it is important to **identify whether they have been pregnant in the previous 6 weeks**. If yes, assess immediately. Importantly, do not phrase the question as “Have you given birth in the last 6 weeks?” Those that have experienced a pregnancy loss may not appropriately answer in the affirmative. Place a striking graphic to inform women or their families to alert the triage nurse if they are recently postpartum. A graphic may help to ensure timely diagnosis and treatment. Appendix L: HEM ED Visit Stop Sign on page 225 contains an example of a stop sign graphic. Emergency department personnel should be familiar with the risk factors and signs and symptoms of PPH, including evaluation of postpartum bleeding and assessment of clots.⁶

Since each hospital has different resources and workflows, an interdepartmental team of ED and OB clinicians should discuss assessment, consultation and transfer practices that would work best for their hospital.⁷ Ideally, the interdepartmental team should use mutually developed workflows to create a policy that is available to all clinicians. It may be appropriate to keep a hemorrhage cart in the ED or implement a process for transferring one to the ED. (See Section: Obstetric Hemorrhage Carts, Kits and Trays on page 69.) The ED staff should be trained in the activation of an obstetric rapid response (OB-RRT) if such a team exists in the facility and should participate in annual hemorrhage drills. (See Section: Definition, Early

Recognition, and Rapid Response to Obstetric Hemorrhage Using Triggers on page 93 and Section: Obstetric Hemorrhage Simulation and Drills on page 71.) Facilities that do not offer obstetric service should coordinate with regional facilities to develop protocols and trainings.

Sheehan syndrome

Sheehan syndrome, also known as postpartum hypopituitarism is a rare but potentially life-threatening complication. The enlarged pituitary gland of pregnancy is at risk for infarction due to hypovolemic shock following obstetric hemorrhage. Postpartum hypopituitarism can present as a failure to lactate immediately postpartum. Other clinical manifestations include amenorrhea/oligomenorrhea, hypotension and hypothyroidism, and can develop anytime between the postpartum period and several years post-birth.⁸

Women’s experiences of secondary postpartum hemorrhage

After experiencing a severe hemorrhage, some women fear being discharged because they will be alone at home with the baby, especially if the hemorrhage occurred at home postpartum. Women who passed out or called paramedics report feeling vulnerable and isolated in the postpartum period.⁹ Policy makers should consider providing ongoing benefits for women and their families following a severe event, such as postpartum home visiting or other support services.¹⁰

Recommendations

1. Emergency department personnel should be familiar with the risk factors and signs and symptoms of PPH, including evaluation of postpartum bleeding and assessment of clots.⁶
2. Have a system in place for identification of postpartum patients in the emergency department.
3. An obstetric and emergency interdepartmental team should work to mutually develop workflows to create a care policy for hemorrhage patients presenting to the ED that is available to all clinicians.

EVIDENCE GRADING LEVEL OF EVIDENCE: C

References

1. Debost-Legrand A, Riviere O, Dossou M, Vendittelli F. Risk Factors for Severe Secondary Postpartum Hemorrhages: A Historical Cohort Study. *Birth*. 2015;42(3):235-241.
2. ACOG. Postpartum hemorrhage. Practice Bulletin No. 183 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology*. 2017;130(4):e168-e186.
3. Clapp MA, Little SE, Zheng J, Robinson JN. A multi-state analysis of postpartum readmissions in the United States. *American Journal of Obstetrics and Gynecology*. 2016;215(1):113 e111-113 e110.
4. Fein A, Wen T, Wright JD, et al. Postpartum hemorrhage and risk for postpartum readmission. *Journal of Maternal-Fetal and Neonatal Medicine*. 2021;34(2):187-194.
5. Rampersad F, Narine S, Rampersad D, Diljohn J, Ali R. Uterine arteriovenous malformation mimicking retained products of conception - treated with embolization. *Radiology Case Reports*. 2020;15(11):2076-2079.
6. Patel N, Radeos M. Severe delayed postpartum hemorrhage after cesarean section. *Journal of Emergency Medicine*. 2018;55(3):408-410.
7. Dillard AC. Obstetric hemorrhage in the rural emergency department: Rapid response. *Journal of Emergency Nursing*. 2017;43(1):15-20.
8. Matsuzaki S, Endo M, Ueda Y, et al. A case of acute Sheehan's syndrome and literature review: a rare but life-threatening complication of postpartum hemorrhage. *BMC Pregnancy and Childbirth*. 2017;17(1):188.
9. Morton CH, Nack A, Banker J. The social invisibility of maternal morbidities in US motherhood narratives: Giving voice to lived experience. *Motherhood Conference*; March 6-8, 2014, 2014; New York City.
10. Morton CH, Hall MF, Shaefer SJM, et al. National Partnership for Maternal Safety: Consensus bundle on support after a severe maternal event. *Journal of Obstetric, Gynecologic, and Neonatal Nursing: JOGNN*. 2021;50(1):88-101.



Reporting and Systems Learning

This domain is designed to aid hospital leaders in their review of cases to identify opportunities for quality improvement.

In this section you will find the following:

- ▶ Debriefs and Multidisciplinary Case Review Guidelines
- ▶ Using Outcome Metrics for Hemorrhage-Related QI Projects

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Debrief and Multidisciplinary Case Review Guidelines

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Key Principles

1. Debriefs and case reviews create a culture of learning and continuous improvement that is crucial to developing and maintaining safe processes of care.
2. Debriefs should occur after all major events, including postpartum hemorrhage, involve the team members involved in care and occur as near as real-time as possible.
3. Multidisciplinary case reviews occur after the event and are focused on system improvements which can be shared with a wider audience, separate from the peer-review process.
4. Both debrief and case reviews should promote just culture and be protected from legal discovery.

Background

Perinatal leaders at facilities that provide obstetric care must prioritize systems-learning and integrate quality improvement into their work culture to achieve optimal patient outcomes and reduce severe maternal morbidity (SMM). Part of developing and promoting a just culture occurs when debriefing is consistently done after severe maternal events.^{1,2} This practice fosters continuous quality improvement and ensures the clinical team is utilizing evidence-based protocols and procedures.

The goal of multidisciplinary review is to formally assess the overall care that the health care team provided and review for potential gaps in the care system. Using these reviews to guide quality improvement initiatives or system enhancements will improve care throughout the facility.

Debriefs occurring right after the hemorrhage or at a minimum before shift change with the

involved clinical team members and conducting severe maternal event case reviews on a regular basis by a designated perinatal quality committee or physician and nurse reviewers are two key workflows that are strongly encouraged.³⁻⁶

Debrief

Debriefs serve many purposes:

- ▶ Allow the team to come together to discuss a case, celebrate successes, identify areas for improvement and identify immediate safety concerns that need to be addressed.
- ▶ Highlight the importance of teamwork by including the multidisciplinary team involved in patient care. This type of debriefing can strengthen relationships by fostering interdisciplinary communication and collaborative problem solving. Adverse clinical outcomes can be stressful and debriefing as a

team can help clinicians work through these difficult events and feel supported.^{7,8}

- ▶ Many hospitals have “second victim” support programs to help clinicians recover from emotional trauma they have experienced during and after an adverse, or unexpected severe event.⁹⁻¹¹ The Joint Commission has an Issue Brief on the topic and urges health care organizations to address second victim effects, such as difficulty sleeping, reduced job satisfaction, guilt and anxiety (including fear of litigation or job loss) – all of which affect medical judgment and subsequently compromise patient safety.¹²⁻¹⁶

This debrief description focuses on hemorrhage cases, but the principles are the same for other events with adverse or unexpected outcomes.

The goal of a debrief should be to establish and maintain a just culture that promotes debriefing as a key part of the culture of safety.² Debriefing should be a routine part of the obstetric workflow. This repetition will diminish the fear of blame that can often lead to avoidance of debriefs, as well as hardwire familiarity with hemorrhage protocols, increased comfort discussing complications and efficiency in conducting the debrief. Simulation activities usually include a debrief which helps to ensure a familiarity with the debriefing process to be used for real cases.⁶ (See Section: Obstetric Hemorrhage Simulations and Drills on page 71.)

What events should be debriefed?

Clearly defining what severe maternal events should be debriefed is recommended. This makes the expectation of debriefing the standard of care, particularly after a difficult case or when there is reluctance to proceed with the debrief. Keeping track of compliance with debriefs for these specified cases can be a useful process measure to track. In addition, definition of when debriefs are performed

meets The Joint Commission standard.¹⁷ (See Section: Implementing and Sustaining Maternal Quality, Safety and Performance Improvement for Obstetric Hemorrhage on page 20.) It is important to remember to align with defined organizational perinatal risk types (i.e., patient safety reporting) to optimize existing workflows that may already be in place that promote debriefing for unexpected clinical events [i.e., TeamSTEPPS®, Comprehensive Unit-based Safety Program (CUSP)]. It is highly recommended that perinatal QI leaders learn more about the primary drivers of SMM at the birth facility so that, if necessary, other case criteria can be added to the examples below.

Examples of hemorrhage cases to be debriefed:

- ▶ All cases utilizing a Massive Transfusion Protocol (MTP) or transfusion of > 4 units PRBCs (recommended at all sites)
- ▶ All obstetric hemorrhage with blood transfusion vs. all PPH with > 1 uterotonic (dependent on clinical volume)
- ▶ Any PPH requiring transfer to the OR
- ▶ Any obstetric hemorrhage requiring transfer to a higher level of care

A standard “time-out” or shortened “recap” after every birth in front of the patient allows for postpartum plans to be shared (medications, specimens, and disposition) and patient questions addressed. The staff can conduct a separate debrief together in a private space to discuss the processes in greater detail.

This process is similar to the WHO-recommended “sign-out” at the end of every surgery.¹⁸

When should the debrief occur?

Once the patient is stable, the debrief should occur as soon as possible. The more time elapses, the more difficult it is to get all members of the team together, and the important aspect of team building and support is diminished. Providers may have competing clinical responsibilities, so the sooner the debrief occurs, the less likely it is that the obstetric providers will get caught up in the subsequent patient care activities. It is crucial to have their participation in debriefing for a thorough picture of events.

Who should be at the debrief?

Everyone involved in the event should be expected to participate in the debrief, including obstetric providers, anesthesia providers, nurses, obstetric support staff and other services involved (e.g., blood bank, lab, ICU). If the bedside nurse is involved with direct patient care duties, a mechanism for coverage by the charge nurse or resource nurse should be put in place so that the bedside nurse is able to attend. If the hemorrhage occurred in the OR, ensure that both OR and labor and delivery staff are present. Although the obstetric provider may have conflicting clinical responsibilities, it is crucial for them to be present.

Where should the debrief occur?

For privacy and candor, the debrief should be held in a work room, conference room, or break room, but not in direct patient care areas. If providers are not able to be on site, secure video-conferencing can be used (utilizing a password or the “waiting room” function can ensure security). Follow the institutional guidelines for secure remote conferencing.

Who should lead the debrief?

Developing and promoting the practice of debriefing is the shared responsibility of the perinatal clinical care team. Any team

member should be empowered to initiate and lead a debrief. In particular, the bedside or charge nurse should be empowered to initiate the debrief if the physician does not. Once a culture of debriefing is established, all team members will be comfortable and respected when calling for a debrief.

What happens at the debrief?

A debrief should always begin with a statement acknowledging the difficult clinical situation that just occurred, and a reminder that the intent of the debrief is not to point fingers or assign blame, but to review events with the goal for future improvements. The importance of confidentiality and the legally protected nature of the conversation should also be made clear with the goal of identifying opportunities for improvement.^{19,20}

A debrief form is useful to guide the discussion. Some forms ask for more clear review of the clinical steps used, while others focus more on the teamwork and communication.²¹ (See Appendices CC and DD: CMQCC Sample Hemorrhage Rapid Debrief on page 270 and Sample Labor and Delivery Event Debrief Form on page 273.)

A useful debrief should address both the clinical and communication processes and highlight both successes and challenges encountered. A pre-printed paper form is useful because it:

- ▶ Guides the conversation
- ▶ Prompts issues to review (can be modified to highlight particular issues at the institution, with blood bank, or medications, etc.)
- ▶ Serves as a place to document findings and should be passed along to a perinatal QI Committee or designated physician/nurse reviewers for review so that any solutions that are brainstormed at the time can be considered; major issues can then be explored

REPORTING AND SYSTEMS LEARNING

- ▶ Can be used to further measure compliance with the hemorrhage protocol itself²²
- ▶ Documents the interdisciplinary communication that occurred around challenges and multidisciplinary solutions, which can be useful for getting buy-in when new processes or QI initiatives are suggested
- ▶ Identifies cases of severe morbidity that require further multidisciplinary review
- ▶ Can be used to track the observed vs. expected number of debriefs as a process measure which further emphasizes the importance the unit places on a culture of debriefs

Tracking these events using forms can also be helpful for identifying trends. If the site is utilizing paper forms, it is important to create a standardized workflow for documentation management (i.e., scanning and saving on a secure drive) and compiling the data into a centralized tracker for data analysis on an ongoing basis. Whenever possible, optimize existing technology platforms to centralize data and minimize administrative burden.



Multidisciplinary case review

Multidisciplinary case reviews allow clinical team members to identify opportunities for improvement and share systems-learnings that in turn enhance the provision of timely, safe, efficient, effective, equitable and patient-centered care. Case reviews provide opportunities to learn from severe maternal events to improve patient outcomes, mitigate risks, address inequities and enhance clinical decision making. Many facilities have a perinatal quality and safety committee or a perinatal morbidity and mortality (PM and M) review committee which are an ideal forum to review cases and communicate systems learning to a broad audience. For maternal events, a formal root cause analysis (RCA) or peer review may also be conducted. An RCA or peer review has a separate workflow and purpose. We strongly recommend casting a wider net than sentinel events for formal case review. The purpose of the case review is to identify system issues and improve overall patient care.²³ For hospitals participating in CMQCC's Maternal Data Center, there are a myriad of case review tools available to you within the Maternal Data Center interface, including a SMM Case Review PDF Form. See sample resources at the end of this section.

How are cases for a multidisciplinary case review identified?

Cases can be identified through the debrief process, facility incident reporting, facility specific data reports that track key clinical data elements, or through a SMM review. In the context of obstetric hemorrhage, the Council on Patient Safety in Women's Health Care and The Joint Commission recommend multidisciplinary, systems-focused reviews for all severe obstetric hemorrhages defined as transfusion of four or more units of PRBCs or admission to an intensive care unit.²⁴

What is presented during a multidisciplinary case review?

Utilizing the framework of Readiness, Recognition and Response, the key aspects of the case including patient's history and details of the event are presented and discussed. Experts provide information regarding best practices, professional guidelines and expert opinions that were contributing factors in the case. During the review, system issues and/or opportunities for improvement are identified and shared to enhance situational awareness and systems-learning. This is also an opportunity to identify if racism and/or implicit bias impacted patient care.

Who should participate in the multidisciplinary case review?

Multidisciplinary case reviews are intended to provide an opportunity for systems-learning and should be open to perinatal clinical team members (e.g., OBs, anesthesiology, RNs, quality, patient safety and risk management, leadership). Whenever possible, include a patient and/or family advocate. Small centers may consider partnering with a regional perinatal center to conduct the review. All case reviews should be conducted by a designated perinatal committee that is supported by leadership, protected from discovery and kept confidential. Teaching facilities should invite residents, fellows and medical students to learn the principles of case review and patient safety.²⁵ It is highly encouraged that facilities provide ongoing training to staff (OB, RN, resident, medical students) on how to conduct an effective severe maternal case review to identify opportunities for improvement, address systems issues and share systems-learnings.

A deep dive into blood loss during case review

In order to understand the course of bleeding during the labor and delivery process and for analytics/review it can be helpful to define “periods” of quantitative blood loss measurements. Each period can be defined by the following: 1) Pre-delivery QBL; 2) Procedural QBL; 3) Recovery QBL (first 2 hours post-delivery or post OR) and 4) Post-recovery QBL. These delineations should allow us to describe the timing of when the significant events occurred during the total Cumulative Blood Loss (still the important trigger for progressive hemorrhage management).

Let's look at a hypothetical patient: Sally presents in active labor at term with vaginal bleeding and is taken to the operating room (OR) for a cesarean with the diagnosis of possible placental abruption. Her total cumulative blood loss (CBL) is 2,507 mL. She had 258 mL lost by pre-delivery QBL; 735 mL in the OR (procedural QBL); 1427 mL recovery QBL (first two hours) and 87 mL post-recovery QBL. In reviewing this case, it appears Sally was stable and moved to OR in a timely fashion. The intraoperative blood loss was acceptable, but the CBL required intervention (reaching Stage 3) in the recovery area, and was controlled by the time Sally reached the post recovery time period. This would suggest answering possible process improvements in 1) Was bleeding truly controlled in the OR?; or 2) Were there opportunities to improve recognition and response in the recovery area?

Recommendations

1. Debriefs should occur after all major events, including postpartum hemorrhage, and should involve the team members involved in care and occur shortly after the event.
2. Multidisciplinary case reviews occur after the event and are focused on system improvements which can be shared with a wider audience, separate from the peer-review and formal root cause analysis processes.
3. Both debrief and case reviews should occur in a safe environment, free from blame and protected from legal discovery in alignment with the concept of a just culture environment.

Systems learning acquired from debriefs and multidisciplinary reviews should be acted on, with findings and action steps shared back with staff. This creates a culture where debriefing and case reviews are seen as a positive and worthwhile step in quality improvement.

Educational tools and sample resources

[American College of Obstetricians and Gynecologists Obstetric Team Debriefing Form](#)

[The Joint Commission's Framework for Root Cause Analysis and Action Plan](#)

[U.S. Department of Veterans Affairs Root Cause Analysis](#)

[National Patient Safety Foundation RCA2: Improving Root Cause Analyses and Actions to Prevent Harm](#)

[Council on Patient Safety in Women's Health Care Severe Maternal Morbidity Review Form](#)

[CMQCC Severe Maternal Morbidity Case Review Form](#)

EVIDENCE GRADING

LEVEL OF EVIDENCE: C

References

1. Duffy W. Improving patient safety by practicing in a just culture. *AORN Journal*. 2017;106(1):66-68.
2. Paradiso L, Sweeney N. Just culture: It's more than policy. *Nursing management*. 2019;50(6):38-45.
3. McQuaid-Hanson E, Pian-Smith MC. Huddles and debriefings: Improving communication on labor and delivery. *Anesthesiology Clinics*. 2017;35(1):59-67.
4. Liberati EG, Tarrant C, Willars J, et al. Seven features of safety in maternity units: A framework based on multisite ethnography and stakeholder consultation. *British Medical Journal of Quality and Safety*. 2020.
5. Liberati EG, Tarrant C, Willars J, et al. How to be a very safe maternity unit: An ethnographic study. *Social Science and Medicine*. 2019;223:64-72.
6. Trejo FE, Igel CM, Chuang M, Bajaj K, Bernstein PS. Checklists, huddles, and debriefs: Critical tools to improve team performance in obstetrics. *Clinical Obstetrics and Gynecology*. 2019;62(3):518-527.
7. Morton CH, Hall MF, Shaefer SJM, et al. National Partnership for Maternal Safety: Consensus bundle on support after a severe maternal event. *Journal of Obstetric, Gynecologic, and Neonatal Nursing: JOGNN*. 2021;50(1):88-101.
8. Slade P, Balling K, Sheen K, et al. Work-related post-traumatic stress symptoms in obstetricians and gynaecologists: Findings from INDIGO, a mixed-methods study with a cross-sectional survey and in-depth interviews. *British Journal of Obstetrics and Gynaecology*. 2020;127(5):600-608.
9. Edrees HH, Morlock L, Wu AW. Do hospitals support second victims? Collective insights from patient safety leaders in Maryland. *Joint Commission Journal of Quality and Patient Safety*. 2017;43(9):471-483.
10. Pratt S, Kenney L, Scott SD, Wu AW. How to develop a second victim support program: A toolkit for health care

- organizations. *Joint Commission Journal of Quality and Patient Safety*. 2012;38(5):235-240, 193.
11. Scott SD, Hirschinger LE, Cox KR, et al. Caring for our own: Deploying a systemwide second victim rapid response team. *Joint Commission Journal of Quality and Patient Safety*. 2010;36(5):233-240.
 12. Joint Commission. Supporting second victims. *Quick Safety*. 2018;39:1-3.
 13. Burlison JD, Quillivan RR, Scott SD, Johnson S, Hoffman JM. The effects of the second victim phenomenon on work-related outcomes: Connecting self-reported caregiver distress to turnover intentions and absenteeism. *Journal of Patient Safety*. 2016.
 14. Busch IM, Moretti F, Purgato M, Barbui C, Wu AW, Rimondini M. Psychological and psychosomatic symptoms of second victims of adverse events: A systematic review and meta-analysis. *Journal of Patient Safety*. 2020;16(2):e61-e74.
 15. Quillivan RR, Burlison JD, Browne EK, Scott SD, Hoffman JM. Patient safety culture and the second victim phenomenon: Connecting culture to staff distress in nurses. *Joint Commission Journal of Quality and Patient Safety*. 2016;42(8):377-386.
 16. Ullstrom S, Andreen Sachs M, Hansson J, Ovretveit J, Brommels M. Suffering in silence: A qualitative study of second victims of adverse events. *British Medical Journal of Quality and Safety*. 2014;23(4):325-331.
 17. Joint Commission. Provision of care, treatment, and services standards for maternal safety. https://www.jointcommission.org/-/media/tjc/documents/standards/r3-reports/r3_24_maternal_safety_hap_9_6_19_final1.pdf2019.
 18. World Health Organization. WHO Surgical Safety Checklist. In:2008.
 19. Bajaj K, Meguerdichian M, Thoma B, Huang S, Eppich W, Cheng A. The PEARLS Healthcare Debriefing Tool. *Academic Medicine: Journal of the Association of American Medical Colleges*. 2018;93(2):336.
 20. Salas E, Klein C, King H, et al. Debriefing medical teams: 12 evidence-based best practices and tips. *Joint Commission Journal of Quality and Patient Safety*. 2008;34(9):518-527.
 21. ACOG. Obstetric team debriefing form. Maternal Safety Bundles Web site. https://www.who.int/patientsafety/safesurgery/ss_checklist/en/. Published 2019. Accessed 2/18/2021.
 22. Shields LE, Wiesner S. Obstetrical hemorrhage reporting and systems learning. *Seminars in Perinatology*. 2019;43(1):60-64.
 23. Kilpatrick SJ, Berg C, Bernstein P, et al. Standardized severe maternal morbidity review: Rationale and process. *Journal of Obstetric, Gynecologic, and Neonatal Nursing: JOGNN*. 2014;43(4):403-408.
 24. Joint Commission. Quick Safety 6: Reviewing maternal mortality. *Quick Safety* Web site. <https://www.jointcommission.org/resources/news-and-multimedia/newsletters/newsletters/quick-safety/quick-safety--issue-6-reviewing-material-morbidity/reviewing-maternal-morbidity/>. Published nd. Accessed 2/28/2021.
 25. Ogunyemi D, Hage N, Kim SK, Friedman P. A multidisciplinary model for reviewing severe maternal morbidity cases and teaching residents patient safety principles. *Joint Commission Journal of Quality and Patient Safety*. 2019;45(6):423-430.

Using Outcome Metrics for Hemorrhage-Related QI Projects

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Key Principles

1. Identification and frequent monitoring of outcome measures is an essential component of any hemorrhage-related quality improvement (QI) project.
2. Key measures for tracking unit progress include the CDC's *Severe Maternal Morbidity* metric, various iterations of SMM, and transfusion metrics. These measures are not only useful for identifying trends over time but can also serve to flag cases for review.
3. These measures are only useful if the coding on which they are based is accurate and complete. It is critical that hospital coding departments utilize ICD-10-PCS procedure codes for blood transfusions in obstetric patients.

Background

Evaluating the effectiveness of implementation activities is a vital component of any quality improvement strategy—enabling hospital teams to identify what works and what doesn't. Outcome measures are clearly defined statistics that should be tracked by hospitals to monitor progress and ensure any gains are sustained over time.

Hemorrhage-related quality improvement and sustainability can be evaluated with the following outcome measures—described in the summary

table below and in more detail within the body of this section.

For those hospitals that are members of the Maternal Data Center, the Severe Maternal Morbidity (SMM) measures are automatically calculated based on your routine data submissions. Massive Transfusions can be calculated with minor supplemental data submissions.

Table 1: Outcome measures

Measure	Purpose	Summary Definition
<i>Severe Maternal Morbidity: Including Transfusion Cases</i>	Monitor trends and identify cases with severe short- and long-term complications resulting from the labor and birth process	Cases with one of 21 severe complications (defined by the CDC) among <u>all</u> deliveries
<i>Severe Maternal Morbidity: Excluding Transfusion-Only Cases</i>	As above, but excluding those cases whose sole complication was having a transfusion	Cases with one of 20 complications (excluding transfusion-only cases) among all deliveries
<i>Severe Maternal Morbidity: Including Transfusion Cases among Hemorrhage Cases</i>	As above, but limited to identifying severe complications only among those cases that experienced a hemorrhage	Cases with one of 21 severe complications among those deliveries that had a hemorrhage
<i>Severe Maternal Morbidity: Excluding Transfusion-Only Cases among Hemorrhage Cases</i>	As above, but excluding those hemorrhage cases whose sole complication was having a transfusion	Cases with one of 20 complications (excluding transfusion-only cases) among those deliveries that experienced a hemorrhage
<i>Massive Transfusions</i>	Identify records for case review required of sentinel events	Cases who received 4+ units of blood products among all deliveries

(Used with permission from CMQCC)

Note that all of the recommended measures are calculated using ICD-10 diagnosis and procedure codes. As such, it is extremely important for perinatal QI leaders to work with the hospital's coding departments to ensure complete and accurate coding. Coding of transfusion procedure codes (one of the 21 SMM complications) has been particularly challenging for some hospitals with the transition to ICD-10, as described in more detail in the *Coding Accuracy* section below.

Additionally, CMQCC splits Severe Maternal Morbidity into two iterations:

- ▶ *Severe Maternal Morbidity: Including Transfusion Cases*
- ▶ *Severe Maternal Morbidity: Excluding Transfusion-Only Cases*

While the CDC uses Severe Maternal Morbidity: Including Transfusion Cases as their sole SMM measure (they use the title Severe Maternal Morbidity without the qualifier regarding transfusions), the distinction between including and excluding transfusion-only cases is important. By excluding transfusion-only cases, this enables the QI team to focus on cases with the most severe outcomes. Cases where the only SMM complication was a transfusion may still merit review, but they are not as acute as cases with one of the other 20 SMM complications.

Measures

Severe Maternal Morbidity: Including Transfusion Cases Rate

Severe maternal morbidity (SMM), as defined by the Centers for Disease Control and Prevention (CDC), is an outcome measure that reflects unanticipated outcomes of the labor and birth process that result in significant short- or long-term consequences to a birthing person’s health. The measure includes 21 indicator groups of severe complications based on ICD-10 diagnosis and procedure codes. These complications include, but are not limited to, transfusions, hysterectomy, disseminated intravascular coagulation and shock.

Severe maternal morbidity: including transfusion cases

- Denominator population: All deliveries (birth hospitalization)
- Numerator population: Among the denominator, those who had a severe maternal morbidity (as defined by the CDC)
- Method of data collection: Administrative data set (and supplemental transfusion data if needed)

If looking to compare a hospital’s SMM rate to other hospitals, it is best to use a risk-adjusted version of SMM.¹ Because the SMM measure encompasses 21 different complication categories, hospitals leaders seeking to reduce SMM rates can find it challenging to know where to start. Parsing the measure into its component parts is recommended. There are two options shown in Box 1 below.

Box 1: Severe maternal morbidity complications vs. underlying cause

#1 By SMM Complication Category
Calculate and track the measure based on each of the 21 complications (or summary buckets of the complication categories). For example, the hospital may have more hemorrhage-related complications than sepsis complications. This helps QI teams identify the most common severe complications occurring within the facility, and thus where to focus efforts. In CMQCC’s Maternal Data Center, the complications have been summarized into 8 categories: hemorrhage, transfusion, hypertension, sepsis, cardiac, respiratory, other OB, and other medical.

Continued on next page...

SMM Complication Categories:

- ▶ Hemorrhage: Disseminated Intravascular Coagulation (DIC), Shock, Hysterectomy
- ▶ Transfusion: Transfusions
- ▶ Hypertension: Eclampsia, Acute Renal Failure
- ▶ Sepsis: Sepsis
- ▶ Cardiac: Acute Heart Failure, Acute Myocardial Infarction, Aneurysm, Cardiac Arrest, Conversion of Cardiac Rhythm
- ▶ Respiratory: Acute Respiratory Distress, Pulmonary Edema, Temporary Tracheostomy, Ventilation
- ▶ Other OB: Air and Thrombotic Embolism, Amniotic Fluid Embolism, Complications of Anesthesia
- ▶ Other Medical: Puerperal Cerebrovascular Disorders, Sickle Cell Crisis

#2 By SMM Underlying Cause

Calculate and track the measure based on the “underlying cause” that led to the SMM. For quality improvement purposes, it can be useful to focus on the **underlying cause** of the complication rather than the complication itself. For example, rather than focusing on the hysterectomy complication category, hospital leaders might instead focus on preventing the conditions that prompted the hysterectomies. CMQCC’s Maternal Data Center has developed and tested a SMM Underlying Cause algorithm based on ICD-10 diagnosis and procedure codes to identify drivers of SMM complications. Based on that algorithm, it appears that hemorrhage is the underlying cause of 35-40% of SMM cases, even when excluding transfusion-only cases.

SMM Underlying Cause*

- ▶ **Obstetric Hemorrhage:** atony, hematomas, or lacerations during any type of birth, post-op bleeding, myomas
- ▶ **Placental Hemorrhage:** previa, accreta, abruption, retained placenta
- ▶ Hemorrhage as a result of **Infection and Chorio:** sepsis, endometritis, pyelonephritis, pneumonia, fasciitis, chorioamnionitis
 - Example: Infection/chorio → uterine atony → hemorrhage requiring transfusion
- ▶ Hemorrhage as a result of **Preeclampsia/Eclampsia:** complications from preeclampsia with severe features, eclampsia, HELLP
 - Example: Preeclampsia → magnesium infusion → hemorrhage
 - Example: HELLP/DIC → low platelets → hemorrhage
- ▶ **Anemia on Admission:** only if anemia was present on admission – not if developed intra/postpartum
- ▶ Hemorrhage as a result of **Other Hematologic Conditions:** ITP, TTP, hypercoagulable state, factor deficiencies, sickle cell

**This list is not all-inclusive and is provided as an example.*

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Severe Maternal Morbidity: Excluding Transfusion-Only Cases Rate

More than half of all SMM cases are classified as such solely because they received a transfusion.² As a result, SMM is often divided into SMM with transfusions and without transfusions. The version “*Severe maternal morbidity without transfusions*” excludes those patients that only had a transfusion and no other SMM complication.

Severe maternal morbidity excluding transfusion-only cases

- Denominator population: All deliveries (birth hospitalization)
- Numerator population: Among the denominator, those who had a severe maternal morbidity (as defined by the CDC), excluding those whose only SMM was transfusion
- Method of Data Collection: Administrative data set

This version of the SMM measure is aimed at removing those patients who may have only had 1-2 units transfused and may not be as ill as those with other SMM complications (e.g., Acute Respiratory Distress Syndrome [ARDS], Disseminated Intravascular Coagulation [DIC], ventilation, etc.). This version of the SMM measure is increasingly being used by national stakeholders in order to ensure the focus remains on those most severely ill. To use this measure to support QI, follow the same approaches as described above for SMM Overall.

Severe Maternal Morbidity Among Hemorrhage Cases (including transfusion or excluding transfusion-only cases)

If focusing on hemorrhage-related quality improvement, it can be useful to concentrate on the hemorrhage cases at the facility accompanied by a SMM complication. As such, the measure “*Severe Maternal Morbidity Among Hemorrhage Cases*” is defined as follows:

Severe maternal morbidity including transfusion cases among hemorrhage cases

- Denominator population: All deliveries (birth hospitalization) with an obstetric hemorrhage (based on ICD-10 coding) or a transfusion (based on either ICD-10 coding or supplemental data). Exclude those with sickle cell anemia
- Numerator population: Among the denominator, those that had a severe maternal morbidity (as defined by the CDC)
- Method of data collection: Administrative data set (and supplemental transfusion data if needed)

Severe maternal morbidity excluding transfusion-only cases among hemorrhage cases

- Denominator population: All deliveries (birth hospitalization) with an obstetric hemorrhage (based on ICD-10 coding) excluding transfusion-only cases and those with sickle cell anemia
- Numerator population: Among the denominator, those that had a severe maternal morbidity without transfusion (as defined by the CDC)
- Method of data collection: Administrative data set

Obstetric hemorrhage cases need to have received an obstetric hemorrhage ICD-10 code in order to be flagged. In order to identify those cases with a hemorrhage (and thus identify the denominator case), CMQCC’s Maternal Data Center utilizes the following hemorrhage ICD-10 codes shown in Table 2 on page 179.

Table 2: ICD-10 codes to identify hemorrhage cases (i.e., placenta accreta spectrum, previa with hemorrhage, and antepartum and postpartum hemorrhage)*

Placenta Accreta Spectrum or Previa with Hemorrhage	Postpartum Hemorrhage
O43.21x Placenta accreta	O72.0 Third stage-hemorrhage
O43.22x Placenta increta	O72.1 Other immediate postpartum hemorrhage
O43.23x Placenta percreta	O72.2 Delayed and secondary postpartum hemorrhage
O44.1x Complete placenta previa with hemorrhage	O72.3 Postpartum coagulation defects
O44.3x Partial placenta previa with hemorrhage	
O44.5x Low lying placenta with hemorrhage	
Abruptio Placentae	Antepartum Hemorrhage
O45.00x Premature separation of placenta with coagulation defect, unspecified	O46.00x Antepartum hemorrhage with coagulation defect
O45.01x Premature separation of placenta with afibrinogenemia	O46.01x Antepartum hemorrhage with afibrinogenemia
O45.02x Premature separation of placenta with disseminated intravascular coagulation	O46.02x Antepartum hemorrhage with disseminated intravascular coagulation
O45.09x Premature separation of placenta with other coagulation defect	O46.09x Antepartum hemorrhage with other coagulation defect
O45.8Xx Other premature separation of placenta	O46.8Xx Other antepartum hemorrhage
O45.9x Premature separation of placenta, unspecified	O46.9x Antepartum hemorrhage, unspecified

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**Note that ICD codes are routinely updated; this list is subject to change. These codes are included as an example; California hospitals can refer to the Maternal Data Center for the most updated list of hemorrhage codes.*

To guard against underuse of hemorrhage diagnosis codes, transfusion recipients are included in the denominator of *SMM among Hemorrhage Cases*, but the measure specifically excludes patients with sickle cell anemia who may need a transfusion outside of the context of hemorrhage. As described in more detail below, transfusion coding may be inconsistent or incomplete, and should be reviewed for accuracy. Also note that not every case in Table 2 on page 179 will have a significant hemorrhage. For example, some patients with an abruption or postpartum coagulation defect may only have modest bleeding. However, every case that meets the criteria for an obstetric hemorrhage should have at least one of these codes.

Massive Transfusions Indicator

While there is a move towards examining SMM excluding transfusion-only cases, tracking blood transfusions during the birth hospitalization is also central to understanding the drivers of maternal morbidity.

The Joint Commission (TJC) revised definition of ≥ 4 units of blood transfused qualifies as an OB Sentinel Event (January 2020).⁷ CMQCC is aligned with TJC guidance that all massive transfusions (≥ 4 units of blood) should be thoroughly reviewed for quality improvement opportunities. It is important to recognize that an OB Sentinel Event is not a quality or performance measure, but rather an indicator for in-depth case review. In California, massive transfusions are very low frequency (1-3 per 1,000 deliveries) and are quite dependent on the hospital rate of placenta accreta spectrum (often concentrated in referral centers) which makes it very hard to use as a performance measure.

Massive Transfusions

- Denominator population:
All deliveries (birth hospitalization)
- Numerator population:
Among the denominator cases, those that received 4 or more units of red blood cells
- Method of data collection:
Blood bank or EMR data

When reviewing any transfusion case, consider whether the transfusion could have been avoided. This may be more realistic in a case where only 1 unit got transfused as opposed to a massive transfusion case.

It is also important to note that the use of the ICD-10 procedure codes does not denote how many units were transfused. The total number of units transfused can be ascertained from either blood bank data sets or through chart review.

Those considering utilizing ICU admissions as a

quality measure should note its limitations as a meaningful indicator for hospital comparison due to variation in ICU admission practices and case mix. Some hospitals may admit patients to the ICU that would otherwise remain on an obstetric floor at a different hospital. However, unanticipated ICU admissions may be used as an indicator for case review as a sentinel event.

Using the outcome measures

Outcome measures can be used to evaluate the quality of care for obstetric hemorrhage patients, and can help to identify opportunities for improvement in the following ways:

- ▶ Observe trends over time
 - Rationale: to evaluate the impact of new QI interventions and identify upticks in complications as soon as possible
- ▶ Identify which complications are driving the rate
 - Rationale: to tailor QI intervention to address the main drivers of measures in question
- ▶ Compare facility rate to peer hospitals
 - ▶ Rationale: to contextualize local rate and identify whether there are opportunities for improvement when comparing outcomes to hospitals with similar resources and patient populations
- ▶ Flag cases for a multidisciplinary case review (See Section: Debrief and Multidisciplinary Case Review Guidelines on page 167.)
 - Rationale: to provide education, guidance and feedback to staff through the case review process, and identify what went well and what can be done differently in future cases

Using a risk-adjusted version of *Severe Maternal Morbidity including Transfusion Cases and Severe Maternal Morbidity Excluding Transfusion-Only Cases* is recommended because acuity of patients

is taken into account. Until a risk-adjusted version of SMM among hemorrhage cases is available, it is best to use the hospital's own historical data for comparison.

SMM by race and ethnicity

A disproportionate number of Black women experience severe maternal morbidities compared to white women.³ A study examining SMM rates from 2008-2010 found that Black women had 2.1 times higher rates of SMM when compared to non-Hispanic white women, and there were similar differences in outcomes when comparing other non-white racial/ethnic groups.⁴ This doubled rate has persisted, with the rate of SMM among Black women being 112% higher than the rate of SMM among white women in 2015.⁵ It is important for perinatal QI leaders at hospitals and hospital systems to disaggregate SMM rates by race and ethnicity to identify potential inequities in provision of care. Sample sizes may be small, so trends may only be apparent when looking over longer periods of time (i.e., quarterly vs. monthly).

It is also important to note that a large portion of the observed differences are likely due to care received currently or in the past and/or their experiences of structural, systemic, and interpersonal racism, and should not be attributed to race itself.⁶ The purpose of stratifying outcomes by race is to challenge us, as care providers, to provide as much care and support as needed to overcome what came before and to ensure that birthing people receive care that is equitable and truly patient-centered.

Coding accuracy

As with any quality metrics, it is essential that the coding they are based on is accurate and as complete as possible. While most SMM codes are applied accurately, there are opportunities for many hospitals to improve ICD-10-PCS coding for transfusion procedures.

Because blood bank data are often not available in data sets used by national and state agencies, public health and safety initiatives rely on widely available administrative data sets [i.e., the Uniform Hospital Discharge Data Set (UHDDS), which include ICD-10-CM and ICD-10-PCS codes] to easily identify national, statewide and local SMM rates.

Prior to October 2015, hospitals utilized ICD-9 procedure codes to document transfusions. However, under current ICD-10 codes:

- ▶ ICD-10-PCS transfusion procedure codes are not required for hospital reimbursement
- ▶ The number of available transfusion codes increased substantially and, theoretically, correct utilization of the codes requires greater specificity in documentation (e.g., documenting the vein or artery and the approach used to administer the transfusion). Coding department leaders were concerned that this more exact information would not be easily available in the medical record.
- ▶ Hospital leaders assumed they could access transfusion data from internal blood bank systems as needed for internal purposes.

As such, some hospitals opted to cease using ICD-10 PCS codes for blood transfusions. However, now that SMM and related variations are being adopted as national performance measures, it is critical that hospitals utilize ICD-10-PCS procedure codes for blood transfusions in maternity patients.

The ICD-10-PCS codes for use in coding transfusions in maternity patients are listed in Table 3 on page 182, with the two most common administration routes highlighted. Coders can apply the appropriate code **only if** the physician documents the specific type of blood product: frozen plasma, fresh plasma, plasma cryoprecipitate, red blood cells, frozen red blood cells, platelets and fibrinogen, as well as whether the blood product was non-autologous (most common) or autologous (patient’s own previously saved blood, less common).

Table 3: Typical ICD-10-PCS codes used for obstetric blood transfusions[^]

Description	ICD-10 PCS Code
Transfusions into a Peripheral vein (usual approach)	
Transfusion of Non-autologous Frozen Plasma into Peripheral Vein, Percutaneous	30233K1
Transfusion of Non-autologous Fresh Plasma into Peripheral Vein, Percutaneous	30233L1
Transfusion of Non-autologous Plasma Cryoprecipitate into Peripheral Vein, Percutaneous	30233M1
Transfusion of Non-autologous Red Blood Cells into Peripheral Vein, Percutaneous	30233N1
Transfusion of Non-autologous Frozen Red Cells into Peripheral Vein, Percutaneous	30233P1
Transfusion of Non-autologous Platelets into Peripheral Vein, Percutaneous	30233R1
Transfusion of Non-autologous Fibrinogen into Peripheral Vein, Percutaneous	30233T1
Transfusion of Non-autologous Whole Blood into Peripheral Vein, Percutaneous	30233H1
Transfusions into a Central Line (typically only used in massive hemorrhages)	
Transfusion of Non-autologous Frozen Plasma into Central Vein, Percutaneous	30243K1
Transfusion of Non-autologous Fresh Plasma into Central Vein, Percutaneous	30243L1
Transfusion of Non-autologous Plasma Cryoprecipitate into Central Vein, Percutaneous	30243M1
Transfusion of Non-autologous Red Blood Cells into Central Vein, Percutaneous	30243N1
Transfusion of Non-autologous Frozen Red Cells into Central Vein, Percutaneous	30243P1
Transfusion of Non-autologous Platelets into Central Vein, Percutaneous	30243R1
Transfusion of Non-autologous Fibrinogen into Central Vein, Percutaneous	30243T1
Autologous Red Blood Cells (previously self-donated blood)	
Transfusion of Autologous Red Blood Cells into Peripheral Vein, Percutaneous	30233N0
Transfusion of Autologous Red Blood Cells into Central Vein, Percutaneous	30243N0
Transfusions of Autologous Whole Blood into Peripheral Vein, Percutaneous	30233H0

(Used with permission from CMQCC)

[^]Note that ICD codes routinely get updated, and this list is subject to change. These codes are included as an example, but refer to the Maternal Data Center for the most updated list of codes.

For perinatal QI leaders seeking to improve coding of transfusions, guidance from the American Health Information Management Association (AHIMA) and Coding Clinic may help. These standards allow for the development of facility-specific coding guidelines that establish a default code based on common

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practice. Refer to additional coding guidance in Appendix EE: Alert on Blood Transfusion Procedure Coding on page 275.

Suggested Steps:

- ▶ Meet with clinical staff to identify common clinical practices for blood transfusions in maternity patients.
- ▶ If internal clinical staff agree that peripheral vein transfusions represent common practice within the facility, the coding department can create a written internal policy indicating this should be the default code.
- ▶ The important data element that can change in coding transfusions is for the type of blood product, rather than the body part or approach. The type of blood product should be well documented within an EMR, and the correct ICD-10-PCS code referencing that blood product type can be applied.

Recommendations

1. All cases with ≥ 4 units of RBC transfusion require a detailed review, such as a root cause analysis.
2. Routinely review hemorrhage cases that progressed to a severe maternal morbidity.
3. For large volume hospitals with numerous cases where the only SMM complication is a transfusion, a reasonable option is to review all hemorrhage cases with SMM excluding transfusion-only cases and review all cases with ≥ 4 units of RBC transfusion.
4. Ensure that transfusions are being coded appropriately for use in metrics and quality improvement.

EVIDENCE GRADING LEVEL OF EVIDENCE: C

References

1. Leonard SA, Kennedy CJ, Carmichael SL, Lyell DJ, Main EK. An expanded obstetric comorbidity scoring system for predicting severe maternal morbidity. *Obstetrics and Gynecology*. 2020;136(3):440-449.
2. Callaghan WM, Creanga AA, Kuklina EV. Severe maternal morbidity among delivery and postpartum hospitalizations in the United States. *Obstetrics and Gynecology*. 2012;120(5):1029-1036.
3. Joint Commission. Sentinel Events. *Comprehensive Accreditation Manual for Hospitals*. 2020. https://www.jointcommission.org/-/media/tjc/documents/resources/patient-safety-topics/sentinel-event/20200101_2_camh_24_se.pdf. Published January 1, 2020. Accessed 2/14/2021.
4. Howell EA. Reducing disparities in severe maternal morbidity and mortality. *Clinical Obstetrics and Gynecology*. 2018;61(2):387-399.
5. Creanga AA, Bateman BT, Kuklina EV, Callaghan WM. Racial and ethnic disparities in severe maternal morbidity: A multistate analysis, 2008-2010. *American Journal of Obstetrics and Gynecology*. 2014;210(5):435 e431-438.
6. Fingar KF, Hambrick MM, Heslin KC, Moore JE. Trends and disparities in delivery hospitalizations involving severe maternal morbidity, 2006-2015. *HCUP Statistical Brief #243*. In: Agency for Healthcare Research and Quality, ed. Rockville, MD 2018.
7. Hardeman RR, Karbeah J. Examining racism in health services research: A disciplinary self-critique. *Health Services Research*. 2020;55 Suppl 2:777-780.



Appendices

- ▶ Appendix A: Classification of Evidence Grading
- ▶ Appendix B: Obstetric Hemorrhage Care Guidelines: Checklist Format
- ▶ Appendix C: Obstetric Hemorrhage Care Guidelines: Table Format
- ▶ Appendix D: Obstetric Hemorrhage Care Guidelines: Flowchart Format
- ▶ Appendix E: Checklist: Carts, Kits and Trays
- ▶ Appendix F: Simulations and Drills: Guidelines for Simulation Scenario Development
- ▶ Appendix G: Simulations and Drills Sample Scenarios
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Appendix A: Classification of Evidence Grading

Level of Recommendations:

A	Recommendations based on high quality and consistent evidence
B	Recommendations based on limited or inconsistent evidence
C	Recommendations based primarily on consensus and expert opinion

These recommendations align with those used by American College of Obstetricians and Gynecologists (ACOG).

Appendix B: Obstetric Hemorrhage Care Guidelines: Checklist Format

Prenatal Assessment & Planning
<ul style="list-style-type: none"><input type="checkbox"/> Evaluate for risk factors prenatally and identify/prepare for patients with special considerations: Placenta previa/accreta, bleeding disorder, or those who decline blood products<ul style="list-style-type: none"><input type="checkbox"/> Screen and aggressively treat severe anemia: if oral iron fails, initiate “IV Iron Protocol” to reach optimal Hgb/Hct, especially for at risk patients<input type="checkbox"/> Provide counseling/education<input type="checkbox"/> Consider site of delivery<input type="checkbox"/> Plan for blood salvage if appropriate
Admission Assessment & Planning
Admission Hemorrhage Risk Factor Assessment
<ul style="list-style-type: none"><input type="checkbox"/> Evaluate for risk factors on admission<input type="checkbox"/> Verify type & antibody screen from prenatal record<ul style="list-style-type: none"><input type="checkbox"/> If not available: Order type and screen (lab will notify if 2nd specimen needed for confirmation)<input type="checkbox"/> Send specimen to blood bank as indicated by institutional practices. Blood bank recommendations should be highly localized. <i>Many institutions no longer hold a specimen in the blood bank; others utilize automated technology to type and screen all obstetric patients.</i><input type="checkbox"/> If prenatal or current antibody screen positive (not low-level anti-D from RhoGam)<ul style="list-style-type: none"><input type="checkbox"/> Type and crossmatch 2 units PRBCs<input type="checkbox"/> Identify patients who may decline blood products<ul style="list-style-type: none"><input type="checkbox"/> Notify OB provider for plan of care<input type="checkbox"/> Early consult with OB anesthesia<input type="checkbox"/> Review consent form<input type="checkbox"/> Ensure readiness

ADMISSION & LABOR RISK FACTORS		
MONITOR FOR HEMORRHAGE <i>Routine obstetric care</i>	NOTIFY CARE TEAM <i>Personnel that could be involved in response are made aware of patient status and risk factors</i>	NOTIFY CARE TEAM MOBILIZE RESOURCES <i>Consider anesthesia attendance at delivery</i>
Low	Medium	High
No previous uterine incision	Prior cesarean(s) or uterine surgery	Placenta previa, low lying placenta
Singleton pregnancy	Multiple gestation	Suspected/known placenta accreta spectrum
≤ 4 vaginal births	> 4 vaginal births	Abruption or active bleeding (> than show)
No known bleeding disorder	Chorioamnionitis	Known coagulopathy
No history of PPH	History of previous postpartum hemorrhage	History of > 1 postpartum hemorrhage
	Large uterine fibroids	HELLP Syndrome
	Platelets 50,000 - 100,000	Platelets < 50,000
	Hematocrit < 30% (Hgb < 10)	Hematocrit < 24% (Hgb < 8)
	Polyhydramnios	Fetal demise
	Gestational age < 37 weeks or > 41 weeks	2 or more medium risk factors
	Preeclampsia	
	Prolonged labor/Induction (> 24 hrs)	
If low risk: <input type="checkbox"/> Specimen on Hold in Blood Bank	If medium risk: <input type="checkbox"/> Order Type & Screen <input type="checkbox"/> Review Hemorrhage Protocol	If high risk: <input type="checkbox"/> Order Type & Crossmatch 2 units PRBCs <input type="checkbox"/> Review Hemorrhage Protocol <input type="checkbox"/> Notify OB Anesthesia

Stage 0: All Births – Prevention & Recognition of OB Hemorrhage

Prophylactic Oxytocin, Quantitative Cumulative Evaluation of Blood Loss & Close Monitoring

- Perform *ongoing* risk assessment at the start of the second stage of labor, at transfer to postpartum care, and **any time the patient's condition changes**
 - If new risk factors develop, increase risk level and convert to type and screen or type and crossmatch (see above)
- Active management of third stage
 - Oxytocin IV infusion or 10 units IM; do not give oxytocin as IV push
- Ongoing quantitative cumulative evaluation of blood loss
 - Using formal methods, such as graduated containers, visual comparisons and weight of blood-soaked materials (**1gm = 1mL**)
- Ongoing evaluation of vital signs

ADDITIONAL DELIVERY & ONGOING POSTPARTUM RISK FACTORS

Low	Medium	High
ROUTINE CARE	INCREASED SURVEILLANCE POSTPARTUM CARE TEAM ASSESSES RESPONSE READINESS	
	Cesarean birth during this admission – <i>especially if urgent/emergent/2nd stage</i>	Active bleeding soaking > 1 pad per hour or passing a ≥ 6 cm clot
	Operative vaginal delivery	Retained placenta
	Genital tract trauma including 3 rd & 4 th degree lacerations	Non-lower transverse uterine incision for cesarean birth
	Quantitative Cumulative Blood Loss 500-1000 mL with a vaginal delivery	Quantitative Cumulative Blood Loss ≥ 1000 mL or treated for hemorrhage
		Received general anesthesia
		Uterine rupture

Triggers to Proceed to STAGE 1:

CBL ≥ 500mL vaginal / ≥ 1000 mL cesarean with continued bleeding or Signs of concealed hemorrhage: VS abnormal or trending (HR ≥ 110, BP ≤ 85/45, O2 sat < 95%, shock index 0.9) or Confusion

STAGE 1: Activate Hemorrhage Protocol		
Clinical Trigger: CBL ≥ 500 mL vaginal / ≥ 1000 mL cesarean with <i>continued bleeding</i> <u>or</u> Signs of concealed hemorrhage: VS abnormal <u>or</u> trending (HR ≥ 110, BP ≤ 85/45, O2 sat < 95%, shock index 0.9) <u>or</u> Confusion		
MOBILIZE	ACT	THINK
<p>Primary nurse, Physician or Midwife:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Activate OB Hemorrhage Protocol and Checklist <p>Primary nurse:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Notify obstetrician or midwife (in-house and attending) <input type="checkbox"/> Notify charge nurse <input type="checkbox"/> Notify anesthesiologist <p>Secondary nurse:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Assist primary nurse as needed or assign staff member(s) to help 	<p>Primary nurse or designee:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Establish IV access if not present, at least 18 gauge <input type="checkbox"/> Increase IV oxytocin rate per hospital treatment guidelines <input type="checkbox"/> Increase fluids <input type="checkbox"/> Apply vigorous fundal/bi-manual massage <p><u>MOVE ON</u> to 2nd level uterotonic if no response (see Stage 2 meds below)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Vital Signs, including O2 sat & level of consciousness (LOC) q5 minutes <input type="checkbox"/> Record quantitative cumulative blood loss q5-15 minutes <input type="checkbox"/> Administer oxygen to maintain O2 sat at > 95% <input type="checkbox"/> Empty bladder: straight catheter or place Foley with urometer <input type="checkbox"/> Convert to high risk: Type and Crossmatch for 2 units PRBCs STAT (where clinically appropriate if not already done) <input type="checkbox"/> Keep patient warm <p>Physician or midwife:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Bimanual massage <input type="checkbox"/> Careful inspection with good exposure: Rule out retained products of conception, laceration, hematoma <p>Surgeon (if intra-op)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Inspect for uncontrolled bleeding at all levels, esp. broad ligament, posterior uterus, and retained placenta 	<p>Consider potential etiology:</p> <ul style="list-style-type: none"> • Uterine atony • Trauma/laceration • Retained placenta • Amniotic fluid embolism • Uterine inversion • Coagulopathy • Placenta accreta <p>Convert to high risk and take appropriate precautions. Consider type and cross 2 units PRBCs where clinically appropriate if not already done.</p> <p>Once stabilized: Postpartum management with increased surveillance and response readiness assessment.</p>
<p>Triggers to Proceed to STAGE 2: <i>Continued bleeding w/ CBL < 1500 mL <u>or</u> VS remain abnormal</i></p>		

STAGE 2: Mobilize Team and Blood Bank Support

Clinical Trigger: Continued bleeding or Vital Sign instability, and < 1500 mL cumulative blood loss

MOBILIZE	ACT	THINK
<p>Perform duties by assigned role:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Activate OB Rapid Response Team: <p>PHONE #: _____</p> <p>If not included in OB RRT:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Call obstetrician or midwife to bedside <input type="checkbox"/> Call Anesthesiologist <input type="checkbox"/> Notify Perinatologist or 2nd OB <input type="checkbox"/> Notify nursing supervisor <input type="checkbox"/> Notify blood bank of hemorrhage; order products as directed <input type="checkbox"/> Bring hemorrhage cart to the patient's location <input type="checkbox"/> Initiate OB hemorrhage record scribing <input type="checkbox"/> Assign single person to communicate with blood bank <input type="checkbox"/> Assign a family support person/medical social worker per procedure 	<p>ESTABLISH TEAM LEADERSHIP AND ASSIGN ROLES</p> <p>Administer 2nd level uterotonic medication:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Methylergonovine 0.2 mg IM per protocol (if not hypertensive) <input type="checkbox"/> If hypertensive or Methylergonovine dose ineffective: carboprost 250 mcg IM <ul style="list-style-type: none"> <input type="checkbox"/> Can repeat carboprost up to 3 times every 20 min (note: 75% respond to first dose) <input type="checkbox"/> Only if hypertensive and asthmatic: Misoprostol 800 mcg SL <input type="checkbox"/> Continue IV oxytocin and provide additional IV crystalloid solution <input type="checkbox"/> Administer tranexamic acid (TXA) 1 gram IV over 10 minutes – may give a second dose of 1 gm if bleeding continues after 30 minutes or if bleeding stops and then restarts within 24 hours of completing the first dose <p>Team leader:</p> <p>Do not delay other interventions while waiting for response to medications (see right column - THINK)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Order labs STAT (CBC/Plts, Chem 12 panel, Coag Panel II, ABG) <input type="checkbox"/> Bimanual uterine massage <input type="checkbox"/> Vaginal Delivery: Complete evaluation of vaginal wall, cervix, placenta, uterine cavity (if not already done) <input type="checkbox"/> Intra-op cesarean: Inspect for uncontrolled bleeding at all levels, esp. broad ligament, posterior uterus, and retained placenta (if not already done) <input type="checkbox"/> Move to OR or location where higher level of care can be adequately provided <input type="checkbox"/> Order 2 units PRBCs and bring to the bedside - consider use of Emergency Release products (un-crossmatched) <ul style="list-style-type: none"> <input type="checkbox"/> Transfuse PRBCs based on clinical signs and response, do not wait for lab results; KEEP AHEAD W/ VOLUME & BLOOD PRODUCTS <p>Primary nurse (or designee):</p> <ul style="list-style-type: none"> <input type="checkbox"/> Establish 2nd large bore IV, at least 18 gauge <input type="checkbox"/> Assess and announce Vital Signs and quantitative cumulative blood loss q5-15 minutes <input type="checkbox"/> Set up blood administration set and blood warmer for transfusion <input type="checkbox"/> Administer meds, blood products and draw labs, as ordered <input type="checkbox"/> Keep patient warm <p>Second nurse:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Obtain hemorrhage cart if not already in the room <input type="checkbox"/> Obtain portable light <input type="checkbox"/> Place Foley with urometer (if not already done) <input type="checkbox"/> Obtain blood products from the blood bank (or send designee) <input type="checkbox"/> Assist with move to OR or higher level of care (if indicated) <p>Blood Bank:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Prepare to activate massive transfusion protocol if needed 	<p>Sequentially advance through procedures and other interventions based on etiology:</p> <p>Vaginal birth</p> <p>If trauma (vaginal, cervical or uterine):</p> <ul style="list-style-type: none"> • Visualize and repair <p>If retained placenta:</p> <ul style="list-style-type: none"> • D&C <p>If uterine atony or lower uterine segment bleeding:</p> <ul style="list-style-type: none"> • Intrauterine balloon <p>Intra-op C-section:</p> <ul style="list-style-type: none"> • Uterine suture • Intrauterine balloon • Uterine artery ligation <p>If uterine inversion:</p> <ul style="list-style-type: none"> • Anesthesia and uterine relaxation drugs for manual reduction <p>If amniotic fluid embolism:</p> <ul style="list-style-type: none"> • Maximally aggressive respiratory, vasopressor and blood product support <p>If vital signs derangement inconsistent with measured blood loss consider concealed hemorrhage: lower uterine genital tract hematoma with extension; uterine rupture, broad ligament laceration; or other source of internal bleeding; move to laparotomy.</p> <p>Consider activating MTP if there is continued bleeding.</p> <p>Once stabilized: Postpartum management with increased surveillance and response readiness assessment.</p>

Re-Evaluate Bleeding and Vital Signs

Triggers to Proceed to STAGE 3:

Continued bleeding with CBL > 1500mL or > 2 units PRBCs given or abnormal VS or suspicion of DIC

STAGE 3: Initiate Massive Transfusion Protocol & Surgical Approaches		
Clinical Trigger: <i>Continued bleeding</i> with CBL > 1500mL <u>or</u> > 2 units PRBCs given <u>or</u> abnormal VS <u>or</u> suspicion of DIC		
MOBILIZE	ACT	THINK
Perform duties by assigned role: <input type="checkbox"/> Activate Massive Transfusion Protocol PHONE #: _____ Ensure additional team experts available. Examples: <input type="checkbox"/> Advanced Gyn surgeon (e.g., Gyn Oncologist) <input type="checkbox"/> Second anesthesiologist <input type="checkbox"/> Main OR staff <input type="checkbox"/> Adult intensivist <input type="checkbox"/> Supervisor, CNS, or manager <input type="checkbox"/> Reassign staff as needed <input type="checkbox"/> If considering selective embolization, call-in Interventional Radiology team and second anesthesiologist Blood Bank: <input type="checkbox"/> Prepare to issue additional blood products as needed in accordance with MTP – stay ahead <input type="checkbox"/> If patient at risk for multiorgan failure or residual coagulopathy – contact ICU regarding transfer. <input type="checkbox"/> Continue family support	Reidentify team leadership and micro brief with additional team members Team leader: <input type="checkbox"/> Order Massive Transfusion Pack <input type="checkbox"/> (PRBCs + FFP + 1 pheresis pack Plts—see note in right column) <input type="checkbox"/> Move to OR if not already there <input type="checkbox"/> Repeat CBC/Plts, Coag Panel II STAT and Chem 12 panel q30-60 min <input type="checkbox"/> Repeat ABGs <input type="checkbox"/> Consider cell saver if preplanned or immediately available; notify transfusionist Anesthesiologist (as indicated): <input type="checkbox"/> Ongoing monitoring of VS <i>and communication to team</i> <input type="checkbox"/> Arterial blood gases <input type="checkbox"/> Consider central hemodynamic monitoring <input type="checkbox"/> CVP or PA line <input type="checkbox"/> Arterial line <input type="checkbox"/> Vasopressor support <input type="checkbox"/> Intubation <input type="checkbox"/> Calcium replacement <input type="checkbox"/> Electrolyte monitoring <input type="checkbox"/> Ensure large bore IV for transfusion Primary nurse: <input type="checkbox"/> Announce cumulative quantitative blood loss q5-10 minutes <input type="checkbox"/> Apply upper body warming blanket <input type="checkbox"/> Use fluid warmer and/or rapid infuser for fluid & blood product administration <input type="checkbox"/> Apply sequential compression stockings to lower extremities <input type="checkbox"/> Circulate in OR Second nurse and/or anesthesiologist: <input type="checkbox"/> Continue to administer meds, blood products and draw labs as ordered Third Nurse: <input type="checkbox"/> Recorder	Interventions based on etiology not yet completed Prevent hypothermia, acidemia Conservative or Definitive Surgery: <ul style="list-style-type: none"> • Uterine sutures • Uterine artery ligation • Hysterectomy <div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>For Resuscitation: Aggressively Transfuse Based on Vital Signs, Blood Loss After the first 2 units of PRBCs use Near equal FFP and PRBC for massive hemorrhage: 1 PRBC to 1 FFP 1 platelet apheresis pack per 4-6 units PRBCs</p> </div> <p>If above measures unproductive: Interventional Radiology (IR) for selective embolization as appropriate if patient stable for transport and team <i>immediately available</i> - physician who is able to immediately call for and move to surgery should be in house. Unresponsive Coagulopathy: <ul style="list-style-type: none"> • Role of rFactor VIIa is very controversial. After 8-10 units PRBCs and coagulation factor replacement with ongoing hemorrhage, may consider risk/benefit of rFactor VIIa in consultation with hematologist or trauma surgeon Once Stabilized: Modified postpartum management with increased surveillance; consider ICU </p>

Postpartum

If patient is:

Status post hemorrhage and at risk for multi-organ failure:

- Admit to ICU or location for advanced care and continue MTP

Stable for transition to postpartum care after experiencing hemorrhage:

- Perform risk assessment on transfer to postpartum care considering all prenatal, delivery and immediate postpartum factors
- Provide increased surveillance and ensure adequate response readiness is in place

Stable for admission to postpartum post-delivery:

- Perform risk assessment on transfer to postpartum care considering all prenatal, delivery and immediate postpartum factors
- Provide routine care or increased surveillance and ensure adequate response readiness is in place based on risk assessment

BLOOD PRODUCTS

<p>Packed Red Blood Cells (PRBC) Approx. 35-40 min. for crossmatch—once sample is in the lab and assuming no antibodies present</p>	<p>Best first-line product for blood loss</p> <p>1 unit = 200 mL volume</p> <p>If antibody positive, may take hours to days for crossmatch. In some cases, such as autoantibody crossmatch compatible may not be possible. Use “least incompatible” in urgent situations.</p>
<p>Fresh Frozen Plasma (FFP) Approx. 35-45 minutes to thaw for release</p>	<p>Highly desired if > 2 units PRBCs given, or for prolonged PT, PTT</p> <p>1 unit = 180 mL volume</p>
<p>Platelets (Plts) Local variation in time to release (may need to come from regional blood bank)</p>	<p>Priority for women with Platelets < 50,000</p> <p>Single-donor apheresis unit (= 6 units of platelet concentrates) provides 40-50,000 transient increase in platelets</p>
<p>Cryoprecipitate (Cryo) Approx. 35-45 minutes to thaw for release</p>	<p>Priority for women with Fibrinogen levels < 80</p> <p>10-unit pack (or 1 adult dose) raises Fibrinogen 80-100 mg/dL</p> <p>Best for DIC with low fibrinogen and where volume replacement is not needed.</p> <p>Caution: 10 units come from 10 different donors, so infection risk is proportionate.</p>

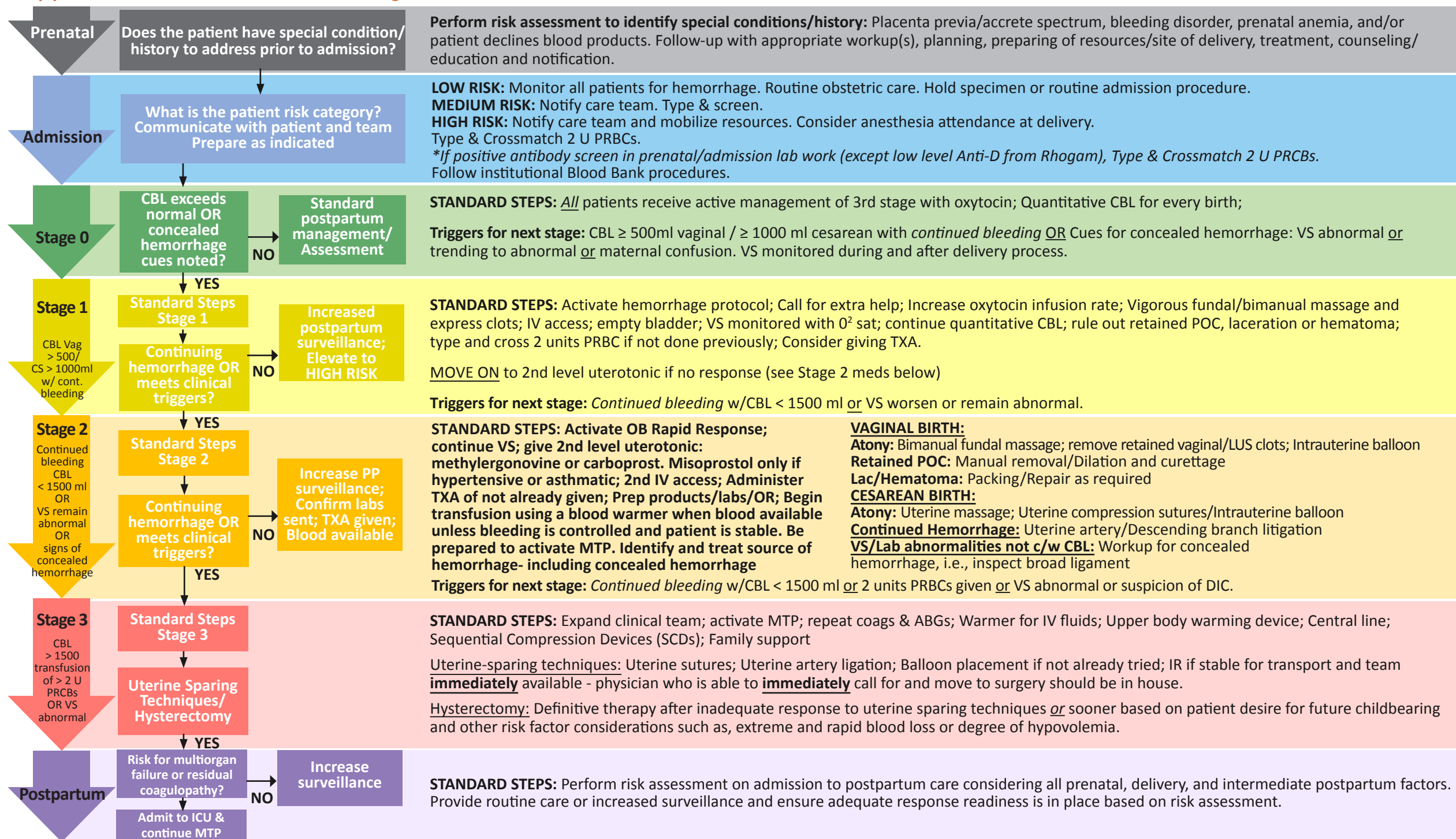
This table was adapted from the Improving Health Care Response to Obstetric Hemorrhage: A California Quality Improvement Toolkit, funded by the California Department of Public Health, 2015; supported by Title V funds.

Appendix C: Obstetric Hemorrhage Care Guidelines: Table Format

	Assessments	Meds/Procedures	Blood Bank
Stage 0	All births		
<ul style="list-style-type: none"> Risk assessment Active management of 3rd stage 	<ul style="list-style-type: none"> Prepare for every patient according to hemorrhage risk factors Measure quantitative cumulative blood loss for every birth 	<ul style="list-style-type: none"> Active Management of 3rd Stage Oxytocin IV infusion or 10u IM 	<ul style="list-style-type: none"> Medium Risk: T&S High Risk: T&C 2 U Positive Antibody Screen (prenatal or current, exclude low level anti-D from RhoGam): T&C 2 U
Stage 1	Triggers: CBL ≥ 500mL vaginal / ≥ 1000 mL cesarean with <i>continued bleeding</i> or Signs of concealed hemorrhage: VS abnormal or trending (HR ≥ 110, BP ≤ 85/45, O2 sat < 95%, shock index 0.9) or Confusion		
<ul style="list-style-type: none"> Activate hemorrhage protocol Rule out hemorrhage causes besides atony 	<ul style="list-style-type: none"> Activate OB hemorrhage protocol and checklist Notify charge nurse, OB/CNM, anesthesiologist VS, O2 Sat q5 min Record quantitative cumulative blood loss q5-15 min Careful inspection with <u>good exposure</u> of vaginal walls, cervix, uterine cavity, placenta. If intra-op, inspect broad ligament, posterior uterus and placenta. 	<ul style="list-style-type: none"> IV Access: Minimum 18 gauge Increase IV fluid (LR) and oxytocin rate Fundal/bimanual massage MOVE ON to 2nd level uterotonic if no response (see Stage 2 meds below) Empty bladder: Straight cath or Foley with urometer 	<ul style="list-style-type: none"> Convert to High Risk and take appropriate precautions <p>Consider T&C 2 Units PRBCs <i>where clinically appropriate if not already done</i></p>
Stage 2	Triggers: <i>Continued bleeding</i> w/ CBL < 1500 mL or VS remain abnormal		
<ul style="list-style-type: none"> Sequentially advance through medications and procedures Mobilize team and blood bank support Keep ahead with volume and blood products Determine source of bleeding including concealed hemorrhage 	<ul style="list-style-type: none"> OB to bedside Mobilize team: 2nd OB, OB Rapid Response, assign roles Continue VS & record cumulative quantitative blood loss q5-15 min Complete evaluation of vaginal wall, cervix, placenta, uterine cavity Send additional labs including DIC panel If in Postpartum: Move to L&D/OR Evaluate for special cases: <ul style="list-style-type: none"> Uterine inversion Amniotic fluid embolism 	<ul style="list-style-type: none"> 2nd Level Uterotonic: <ul style="list-style-type: none"> Methylergonovine 0.2mg IM (<i>if no HTN</i>) or Carboprost 250 mcg IM (<i>if no asthma</i>) or <i>Only if hypertensive and asthmatic</i> Misoprostol 800 mcg SL 2nd IV access (minimum 18 gauge) Bimanual/uterine massage TXA 1 gram - may repeat in 30 min Vaginal: (typical order) <ul style="list-style-type: none"> Move to OR Repair any tears D&C: r/o retained placenta Place intrauterine balloon Intra-op Cesarean: (typical order) <ul style="list-style-type: none"> Inspect broad ligament, posterior uterus, and placenta Uterine sutures Place intrauterine balloon Uterine artery ligation 	<ul style="list-style-type: none"> Notify Blood Bank of OB hemorrhage Bring 2 Units PRBCs to bedside, consider use of Emergency Release products (un-crossmatched) and transfuse per clinical signs – <i>do not wait for lab values</i> Use blood warmer for transfusion Consider activating MTP if there is <u>continued bleeding</u>
Stage 3	Triggers: <i>Continued bleeding</i> with CBL > 1500mL or > 2 units PRBCs given or abnormal VS or Suspicion of DIC		
<ul style="list-style-type: none"> Initiate Massive Transfusion Protocol Invasive surgical approaches 	<ul style="list-style-type: none"> Expand team <ul style="list-style-type: none"> Advanced GYN surgeon 2nd anesthesia provider OR staff Adult intensivist Repeat coags & ABGs Central line Family support 	<ul style="list-style-type: none"> Selective embolization (IR) Laparotomy <ul style="list-style-type: none"> Uterine sutures Uterine artery ligation Hysterectomy Patient support <ul style="list-style-type: none"> Warmer for IV fluids Upper body warming device SCDs 	<ul style="list-style-type: none"> Activate Massive Transfusion Protocol Transfuse aggressively Near 1:1 PRBC: FFP 1 PLT apheresis pack per 4-6 units PRBCs

This table was adapted from the Improving Health Care Response to Obstetric Hemorrhage: A California Quality Improvement Toolkit, funded by the California Department of Public Health, 2015; supported by Title V funds.

Appendix D: Obstetric Hemorrhage Care Guidelines: Flowchart Format



This figure was adapted from the Improving Health Care Response to Obstetric Hemorrhage: A California Quality Improvement Toolkit, funded by the California Department of Public Health, 2015; supported by Title V funds.

Appendix E: Checklist: Carts, Kits and Trays

OB Hemorrhage Cart: Recommended Supplies	
<ul style="list-style-type: none"> ▶ IV start supplies ▶ Angiocaths ▶ IV tubing ▶ IV extension set ▶ Blood product transfusion tubing ▶ Blood warmer tubing ▶ Urinary catheter kit with urometer ▶ Flashlight ▶ Lubricating jelly ▶ Assorted sizes sterile gloves ▶ Lab tubes: CBC, coagulation studies, etc. ▶ Venipuncture supplies ▶ Pressure infuser bags ▶ Chux ▶ Peri-pads ▶ Vaginal packing (consider arm banding to indicate packing used) ▶ Hemorrhage balloon and supplies ▶ Skin marker 	<ul style="list-style-type: none"> ▶ Syringes ▶ Needles ▶ Tegaderm ▶ 2x2 gauze ▶ Adhesive bandages ▶ Alcohol swabs ▶ Paper tape ▶ Cloth tape ▶ Manual BP cuff ▶ Stethoscope ▶ Povidone iodine ▶ Personal Protection Equipment (PPE) ▶ Operating room towels ▶ Sterile speculum ▶ Diagrams depicting various procedures (e.g., B-Lynch, uterine artery ligation, balloon placement) ▶ IV fluids for administration and hemorrhage balloons as your institution permits
Recommended Instruments	
<ul style="list-style-type: none"> ▶ Set of vaginal retractors (long right angle); long weighted speculum ▶ Sponge forceps (minimum: 2) ▶ Sutures (for cervical laceration repair and B-Lynch) 	<ul style="list-style-type: none"> ▶ Banjo curettes, several sizes ▶ Long needle holder ▶ Uterine forceps
Binder Contents	Associated Equipment
<ul style="list-style-type: none"> ▶ Cart content list ▶ Quick reference documents (dry weights, QBL guide, etc.) ▶ Consent forms ▶ Blood Bank forms ▶ Advanced GYN surgeon on-call schedule 	<ul style="list-style-type: none"> ▶ Bright task light on wheels ▶ Ultrasound machine

Continued on next page...

OB Hemorrhage Medication Kit:

Available in the L&D and Postpartum automated dispensing cabinet/refrigerator

Consider kit labeling to include:

Carboprost (Hemabate) - "Avoid with Asthma"

Methylergonovine (Methergine) - "Avoid with Hypertension"

- ▶ Oxytocin (Pitocin) 10-40 units per 500-1000 mL NS, 2 pre-mixed bags
- ▶ Oxytocin (Pitocin) 10-unit vial, 2 vials
- ▶ Methylergonovine (Methergine) 0.2 mg/mL, 1 ampule*
- ▶ 15-methyl PGF₂α (Hemabate, carboprost) 250 mcg/mL, 1 ampule*
- ▶ Tranexamic Acid (TXA) 1000 mg/10 mL vial, 1-2 vials** (also available as 1000 mg/100 mL IVPB)
- ▶ Misoprostol (Cytotec) 200 mcg tablets, 5 tabs

*Carboprost requires refrigeration. Methylergonovine injection is stable for only 14 days outside of refrigeration conditions.

**While manufacturer endorses room temperature storage, military data is supportive of refrigeration, which is helpful in the creation of kits.

Oxytocin and methylergonovine are considered 'Special Handling' for the health care worker (Hazardous Drug—Potential Reproductive Risk). Provide institution-specific PPE and disposal guidelines and appropriate ancillary labeling.

Continued on next page...

Available in L&D OR Suite (or on the hemorrhage cart if the OR suite is off the delivery unit)

Hysterectomy Tray:	
<ul style="list-style-type: none"> ▶ 4 Mosquito, curved, 5" ▶ 4 Towel Clips, Backhaus (perforating) 5 ¼" ▶ 2 Clamp, Mixer 9" ▶ 2 Clamp, Tonsil ▶ 2 Clamp, Allis, Extra-long 10" ▶ 2 Clamp, Allis 6" ▶ 2 Clamp, Babcock 8" ▶ 2 Clamp, Babcock 6 1/4" ▶ 2 Clamp, Lahey 6" ▶ 2 Clamp, Heaney-Rezak, straight, 8" ▶ 2 Kocher, straight, 8" 	<ul style="list-style-type: none"> ▶ 6 Forceps, Heaney, curved 8 1/4" ▶ NH, Mayo Hegar 8" ▶ 4 Sponge Stick 9 1/2" ▶ 1 Scissor, Jorgensen, curved 9" ▶ 1 Scissors, bandage 7" ▶ 1 Scissors, curved dissecting, Metzenbaum ▶ 1 Scissors, Mayo, curved ▶ 1 Scissors, sharp/blunt, straight 5 ½" ▶ 1 Scissors, Curved Metzenbaum 12" ▶ 1 Scissors, Mayo straight 11" ▶ 1 Scissors, Mayo curved 11"
<ul style="list-style-type: none"> ▶ 8 Kelly, curved 5 3/4" ▶ 2 Kelly, straight 5 3/4" ▶ 8 Pean, curved, 6 1/4" 	<ul style="list-style-type: none"> ▶ 1 Knife Handle #3 ▶ 1 Knife Handle #4 ▶ 1 Knife Handle #3 long
<ul style="list-style-type: none"> ▶ 2 Forceps, Debakey 9 1/2" ▶ 1 Forceps, Tissue with teeth 9 3/4" ▶ 1 Forceps, Russian 8" ▶ 1 Forceps, smooth 8" ▶ 1 Forceps, Ferris Smith ▶ 2 Forceps with teeth 6" ▶ 1 Forceps, Russian 6" ▶ 2 Forceps, Adson with teeth ▶ 1 Forceps, Tissue, smooth 7" 	<ul style="list-style-type: none"> ▶ 1 Retractor, Kelly, large ▶ 1 Retractor, Deaver, large 3" x 12" ▶ 1 Retractor, Deaver, medium ▶ 2 Retractor, medium/large Richardson ▶ 1 Retractor, Balfour blades ▶ 2 Retractor, Goulet 7 1/2" ▶ 1 Suction, Yankauer Tip ▶ 1 Suction, Pool Tip

Cystoscopy Tray:
<ul style="list-style-type: none"> ▶ 1 Cystoscope 30 degree, 4mm, 30cm ▶ 1 Cystoscope 70 degree, 4mm, 30cm ▶ 1 Cystoscope sheath, 22fr ▶ 1 Cystoscope obturator, 22fr ▶ 1 Cystoscope bridge ▶ 1 Luer lock tubing connector with stopcock ▶ 1 Luer lock tube connector ▶ 2 Sealing caps

This appendix was adapted from the Improving Health Care Response to Obstetric Hemorrhage: A California Quality Improvement Toolkit, funded by the California Department of Public Health, 2015; supported by Title V funds.

Appendix F: Simulations and Drills: Guidelines for Simulation Scenario Development

Julie Arafeh, MSN, RN, Center for Advanced Pediatric and Perinatal Education (CAPE)

The scenario is the structure of simulation-based training (SBT). In general, scenarios are comprised of an overview, set up instructions for the simulation, guidelines for running the scenario for participants, debriefing aids and the documents that support the content in the scenario. Below is a brief discussion of the components of the scenario with suggestions and examples for generation of new scenarios or the alteration of existing scenarios to better meet the needs of your participants (learners). For more in-depth review and instruction on scenario development we recommend you attend a simulation instructor program.

Scenario Overview

The scenario overview provides basic information about the scenario. Contents of the overview include the patient history or story, learning objectives, target audience (participants the scenario is written for) and approximate time of the scenario.

The patient history or story can be taken directly from an existing scenario or from a deidentified patient case. Of all the information contained in the scenario, the most important are the learning objectives. Learning objectives guide development of the scenario. They assist the simulation instructors in determining what cues are needed in the scenario, what type of manikin or task trainer should be used, how many actors are needed in the scenario, and what critical behaviors should be accomplished by the participants in the scenario. The learning objectives directly guide debriefing questions that set the stage for the participants to engage

in discussion that promotes learning. Below are examples of learning objectives that are specific to hemorrhage. These learning objectives can be used as is or altered to meet the specific learning needs of your participants.

Learning objectives are broken down into three categories based on the skills that should be demonstrated in the scenario or drill. Selection of learning objectives should be based on who is being trained, what you want them to learn and what areas for improvement are being targeted. Target areas are identified by risk management data, patient safety data, and data collection from the patient care unit or root cause analysis. Also, different disciplines may require additional learning objectives specific to their skill set or role. Limiting the number of learning objectives per category to no more than three (additional discipline specific learning objectives may be added as stated above) helps to keep the scenario from becoming too lengthy and facilitates thorough debriefing.

In addition, consider providing information found in the cognitive learning objectives in advance (unit policies, bulletins, monographs or current literature) for participant review to allow more debriefing time to focus on technical and behavioral skills. You may also want to consider the addition of metrics or measurements in the scenario to illuminate unit issues, issues with unit policies or procedures or for report generation on the simulation training session(s). Open-ended questions are listed with each set of learning objectives that can be used during debriefing.

Examples of Learning Objectives for Hemorrhage

Cognitive Skills (what you want participants to know)

Sample Learning Objectives

- ▶ Knowledge of signs and symptoms of hemorrhage during pregnancy
- ▶ States major causes of hemorrhage in pregnancy
- ▶ Lists changes in maternal physiology that may mask symptoms of hemorrhage
- ▶ Knowledge of hospital policies and procedures for hemorrhage management, placement of tamponade devices and blood transfusion particularly massive transfusion

Metrics

- ▶ Test for fund of knowledge on hemorrhage or a specific policy such as the massive transfusion guideline

Use in report on simulation training: identify gaps in knowledge to help prioritize learning objectives for next training session, guide on-going education plan for participants

Debriefing Questions

- ▶ What is the status of this patient at this time?
- ▶ What is the etiology or what is your differential diagnosis at this time?
- ▶ How do the changes in maternal physiology affect the signs and symptoms of hemorrhage?
- ▶ Based on this assessment, what are your priorities for patient care OR what is your plan for care?
- ▶ What prevented the team from carrying out the priorities for care or your management plan? (This question also has implications for behavioral skill discussion, for example was there not enough help, what prevented the team from calling for help?)

Technical Skills (what you want participants to be able to do)

Sample Learning Objectives

- ▶ Provide adequate and continuous uterine massage
- ▶ Administer uterotonic medications in correct dose, route and time
- ▶ Application of devices (tamponade devices, uterine packing) to control bleeding per guideline or protocol
- ▶ Quantify blood loss
- ▶ Order blood components or massive transfusion bucket according to guideline or protocol
- ▶ Set up and initiate rapid blood transfuser

Metrics

- ▶ Measurements of time
- ▶ Time of diagnosis of hemorrhage to administration of first medication
- ▶ Time help paged to time help arrived in room
- ▶ Amount of time uterine massage was stopped unless directed by physician
- ▶ Time from request for tamponade device to completion of insertion
- ▶ Time from request for blood to blood in patient room
- ▶ Time from request for rapid infuser to start of volume infusion

These metrics do not measure INDIVIDUAL performance but look for excessive lengths of time for a task that may indicate a knowledge gap, lack of system support or flawed guideline/protocol

- ▶ Measurement of ability to accurately complete current protocol /procedure
 - Key points from protocol placed in a checklist that is reviewed during scenario or after

Helpful to see where it is difficult for learners to comply with protocol and can guide adjustments to unit processes to better support patient care

- ▶ Correct measurement of volume of blood loss
 - Comparison of the amount of blood used in scenario to the amount measured by participants during the scenario

Helpful to see where unit or system can be adjusted to better support adoption of blood loss measurement

Debriefing Questions

- ▶ What supported or prevented continuous uterine massage?
- ▶ What facilitated or delayed medication administration?
- ▶ What uterotonic medications have major contraindications?
- ▶ Why would a uterine tamponade device be considered at this time?
- ▶ What blood loss management strategies are options for this patient?
- ▶ How was the quantified blood loss information used in this situation?
- ▶ What supported or hampered measurement of blood loss?
- ▶ What is the massive transfusion protocol/guideline in this institution?
- ▶ Under what circumstances would this guideline/protocol be activated?
- ▶ What supported or delayed implementation of the massive transfusion policy?
- ▶ What is a fast process for getting rapid transfuser in room and setting it up?

Behavioral Skills (how you want the team to perform)

Sample Learning Objectives

- ▶ Communication between team members is directed to a person and acknowledged
- ▶ Communication during hand off is acknowledged by the receiver

- ▶ Concerns voiced about the patient or management plan are acknowledged by the team leader
- ▶ The team leader announces assumption of the role
- ▶ Team leader assigns roles if not already assigned or key role not filled
- ▶ Team leader communicates plan of care to the team
- ▶ All team members assume a role or ask leader how they can assist

Metrics

- ▶ Number of thin air or open-air commands
 - ▶ Number of thin air or open-air communications
 - ▶ Number of people in scenario without a role
 - ▶ Roles not assigned or not filled during scenario
 - ▶ Number of questions or concerns voiced about the management plan
 - ▶ Number of changes in leaders
- Information obtained from these metrics can be used to report adoption of key behavioral skills, recommend further training or educational offerings or alteration of unit practices***

Debriefing Questions

- ▶ How did communication improve or delay care of the patient?
- ▶ How did the communication between the leader and the team member giving report to leader impact patient care?
- ▶ Who is the leader? If leadership changed, what circumstances caused the change? What effect did the change have on patient care? What roles were filled and unfilled at this time?
- ▶ What strategies can the team use to fill key roles that were not filled?

Scenario Set-UP

This section of the scenario describes how the simulation area should be set up for the scenario. If several simulation training sessions are going to occur that require consistency taking a picture of the set up can be helpful. Having a list of items needed for the scenario and keeping those items in a bag or bin will facilitate set up. Clear directions should be included for set up of the manikin or task trainer. These directions should include any 'moulage' or make-up that is required. For hemorrhage scenarios this may include making artificial blood or using a red cloth to simulate bleeding.

Running the Scenario

This section gives clear direction to the person running the manikin or providing vital sign information to the participants. There should also be discussion with the person responsible for video recording to insure they are aware of the key parts of the scenario that should be captured on video. Actors or the voice of the patient will need clear roles and instruction. Lastly, be sure to designate where in the scenario the objectives are achieved to the point that the scenario can be stopped. For example, in a hemorrhage scenario this may be when 'blood' arrives for administration to the patient or when the 'blood' has been loaded into a rapid infuser.

Debriefing Aids

Developing open-ended questions in advance based on the learning objectives will help guide debriefing. In addition, use of metrics and critical behavior checklists will also assist in generating discussion pertinent to the learning objectives.

Evidence for Scenario Content

The last section of the scenario includes the evidence that supports the content in the scenario. Evidence may be in the form of unit protocols and procedures, current literature or association guidelines such as those found in Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN), the American College of Obstetricians and Gynecologists (ACOG) or the American Society of Anesthesiologists (ASA).

This appendix was adapted from the Improving Health Care Response to Obstetric Hemorrhage: A California Quality Improvement Toolkit, funded by the California Department of Public Health, 2015; supported by Title V funds.

Appendix G: Simulations and Drills Sample Scenarios

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Three sample postpartum hemorrhage scenarios are presented in this document:

- ▶ Uterine Atony Utilizing Manikin
- ▶ In Situ Postpartum Unit Hemorrhage
- ▶ In Situ Labor and Delivery Unit Hemorrhage

Sample Drill #1: Postpartum Hemorrhage - Uterine Atony Utilizing Manikin

Scenario Overview

Patient description: ‘Renee Harper’, 32 y.o. G2P1, 38 weeks’ gestation, admitted for spontaneous labor, OB history remarkable for previous postpartum hemorrhage requiring transfusion.

Labor course: Epidural for pain management, spontaneous vaginal birth after a five-hour labor. No complications for mother or infant during the birth, occurring 30 minutes ago, epidural catheter removed, patient is holding infant.

History:

Medical: Unremarkable, OB history remarkable for previous postpartum hemorrhage

Surgical: Unremarkable

Social: Smoker for 5 years, stopped before first pregnancy

Baseline lab values: Labs WNL except Hct 24

Learning Objectives

Cognitive:

- ▶ States major causes of postpartum hemorrhage
- ▶ Lists changes in maternal physiology that may mask symptoms of hemorrhage
- ▶ Knowledge of policies and procedures for hemorrhage management, placement of tamponade devices and blood transfusion particularly massive transfusion

Technical:

- ▶ Provide adequate and continuous uterine massage.
- ▶ Administer uterotonic medications in correct dose, route and time
- ▶ Application of tamponade device to control bleeding per protocol

Behavioral:

- ▶ Communication during hand off is acknowledged by the receiver
- ▶ Concerns voiced about the patient or management plan are acknowledged by the team leader
- ▶ Team leader assigns roles if not already assigned or key role not filled

Target Trainees: Obstetricians, Labor & Delivery/Postpartum nurses

Anticipated Duration: 10 minutes

Scenario Set-Up

Room configuration: LDR bed against right wall, manikin in bed, IV pump with mainline, fetal monitor and patient monitor next to bed, wooden bedside cabinet next to bed

Equipment:

- ▶ Manikin, neonatal manikin swaddled
- ▶ IV (1000 mL LR with 20 units oxytocin) with IV pump set up with dump bucket
- ▶ Monitor for maternal VS (BP cuff, pulse oximeter)
- ▶ Red fabric
- ▶ Postpartum hemorrhage medication kit
- ▶ Tamponade device with stopcock, tubing, fluid for inflation
- ▶ Hemorrhage Cart

Manikin/task trainer preparations: Manikin in bed with thin amount of baby powder on face to give appearance of paleness, red cloth in uterus with approximately ½ yard in bed, Uterus boggy, starts to firm with medication administration, firm after tamponade device placed

Presets: Patient monitor: BP 120/90 → 80/40, HR 120 → 140, RR 24 → 32, SaO₂ 96% → 92%. With correct actions, bleeding resolves and vital signs return to preset levels. If correct actions not taken, vital signs continue to deteriorate and bleeding continues.

Pump: Mainline IV at 125 mL/hour

Initial Presentation: Patient in recovery room with infant, pale and shaky, diaphoretic

Miscellaneous: Medication cabinet for medication kit, second IV with blood tubing available if ordered

Chart Contents: Summary of Labor Course

Demonstration items needed in debriefing room: Tamponade device with items for placement, pelvis to demonstrate placement

Scenario Logistics (Running the Scenario)

Expected interventions:

- ▶ Fundal massage, extraction of clots
- ▶ Administration of medications (methylergonovine, carboprost)
- ▶ Order and placement of uterine tamponade device
- ▶ Assessment of patient response using clinical exam, VS, laboratory tests

Likely progression:

- ▶ Bedside nurse assesses patient, detects hemorrhage, starts uterine massage
- ▶ Calls for help
- ▶ Help arrives, hand off given to leader
- ▶ Roles established for other responders
- ▶ Medications given as ordered
- ▶ Bleeding continues and vital signs not responding
- ▶ Uterine tamponade device placed
- ▶ Patient improves

Expected endpoint: Tamponade device in place.

Distracters (if needed): Uncooperative family member

Additional/optional challenges (if needed): Delayed response to tamponade device, massive transfusion protocol activated

Video guidelines (Priorities to capture on video):

- ▶ Maternal vital signs
- ▶ Bleeding from pelvis
- ▶ Team communication
- ▶ Administration of medications
- ▶ Placement of tamponade device

Actor Roles:

- ▶ Family member
- ▶ RNs 2-3
- ▶ OB physician
- ▶ Information liaison

Debriefing Questions

Cognitive:

- ▶ What could cause bleeding or what is the differential diagnosis at this time?
- ▶ How do the changes in maternal physiology affect the signs and symptoms of hemorrhage?
- ▶ Based on this assessment, what are your priorities for patient care OR what is the plan for care?
- ▶ What prevented the team from carrying out the priorities for care or your management plan?

Technical:

- ▶ What supported or prevented continuous uterine massage?
- ▶ What facilitated or delayed medication administration?
- ▶ What uterotonic medications have major contraindications?
- ▶ Why would a uterine tamponade device be considered at this time?
- ▶ What blood loss management strategies are options for this patient?

Behavioral:

- ▶ How did communication improve or delay care of the patient?
- ▶ How did the communication between the leader and the team member giving report to leader impact patient care?
- ▶ What roles are filled and unfilled?
- ▶ What strategies can the team use to fill key roles that are not filled?

Scenario Support Materials

Reference List:

- ▶ Unit protocols, policies, and procedures
- ▶ Current bulletins and monographs from professional organizations, current literature used to guide practice
- ▶ Critical Behavior Checklist (below)
- ▶ Uterine Metrics List (below)
- ▶ Visual aids/cognitive aids: Manufacturer guidelines from uterine tamponade device used on your unit
- ▶ Hemorrhage guideline/algorithm

Scenario Support Materials

A. Critical Behaviors Checklist			
Behavior	Met	Unmet	Comment
Detection of hemorrhage			
Call for help, asks for specific help needed			
Uterine massage begins upon detection of boggy uterus, stopped upon physician order			
Handoff given in SBAR format			
Leader announces role to team			
Team roles are assumed			
Uterotonic medications given per policy			
Uterine tamponade device inserted per procedure			
Leader acknowledges team concerns			

Scenario Support Materials

B. Uterine Atony Metrics			
Metric Item	Measurement	Measurement	Comment
Time of diagnosis of hemorrhage to administration of first medication	Time Started:	Time Complete:	
Time help paged to time help arrived in room	Time Started:	Time Complete:	
Amount of time uterine massage was stopped unless directed by physician	Time Started:	Time Complete:	
Time from request for tamponade device to completion of insertion	Time Started:	Time Complete:	
Number of thin air or open air commands			
Number of thin air or open air communications			
Number of people in scenario without a role			
Roles not assigned or not filled during scenario			
Number of questions or concerns voiced about the management plan			

Sample Drill #2: In Situ Postpartum Unit Hemorrhage

Scenario Overview

Patient description: 'April March', 36 y.o. G6P4024 at 41w1d. On PPD1, patient called RN because she felt gush of fluid and it hasn't stopped.

Labor course: Admitted for active labor. Vaginal precipitous delivery within 4 hours of start of contractions. Baby's weight 4000g. EBL 500 mL.

History: No significant medical history.

Baseline lab values: WNL

Learning Objectives

Cognitive:

- ▶ States major causes of postpartum hemorrhage
- ▶ Knowledge of policies and procedures for hemorrhage management

Technical:

- ▶ Provide adequate and continuous uterine massage.
- ▶ Administer uterotonic medications in correct dose, route and time

Behavioral:

- ▶ Communication during hand off is acknowledged by the receiver
- ▶ Concerns voiced about the patient or management plan are acknowledged by the team leader
- ▶ Team leader assigns roles if not already assigned or key role not filled

Target Trainees: Obstetricians, Postpartum nurses

Anticipated Duration: 20 minutes

Scenario Set-Up

Room configuration: LDR bed with "patient"

Equipment (available but not location in the room):

- ▶ IV (1000 mL LR with 20 units oxytocin) with IV pump set up
- ▶ Monitor for maternal VS (BP cuff, pulse oximeter)
- ▶ Postpartum hemorrhage medication kit
- ▶ Hemorrhage Cart

Task trainer preparations: "Patient" in bed

Presets: Patient vitals on assessment: Temp 98.9F BP 85/40, P 130, RR 26, SaO2 88%. Pain 5/10. With correct actions, bleeding resolves and vital signs return to preset levels. If correct actions not taken, vital signs continue to deteriorate and bleeding continues.

Pump: Mainline IV at 125 mL/hour

Initial Presentation:

- ▶ Boggy fundus with fundal massage
- ▶ Pads weighed (600mL, 500mL, 200mL...etc.)

Miscellaneous: Medication kit, second IV with blood tubing available if ordered

Chart Contents: Summary of Labor Course

Scenario Logistics (Running the Scenario)

Expected interventions:

- ▶ MD is leader once they arrive
- ▶ Roles clearly defined for RNs, organized per policy

Examples:

- ▶ Primary bedside nurse – SBAR, delegate roles to extra RNs, documentation
- ▶ 2nd nurse – second IV, meds and hemorrhage cart
- ▶ 3rd nurse (PCA) – QBL
- ▶ 4th nurse (Tech) – run for blood if needed
- ▶ Anesthesia – could start second IV, can start pressors...etc.
- ▶ Fundal massage, extraction of clots
- ▶ Administration of medications (methylergonovine, carboprost)
- ▶ Assessment of patient response using clinical exam, VS, laboratory tests

Likely progression:

- ▶ RN checks on patient
- ▶ Upon assessment: Pale, diaphoretic and nauseated
- ▶ Primary RN calls for help
- ▶ Extra RN
- ▶ Physicians
- ▶ Emergency activation/phones/pagers used
- ▶ Follow hemorrhage guideline and use safety checklist

Expected endpoint: Hemorrhage protocol activated, all equipment located, and medication administered correctly.

Distracters (if needed): Baby crying and support person not present

Additional/optional challenges (if needed):

- ▶ Hemorrhage cart or other equipment missing or in an unexpected location

Video guidelines (Priorities to capture on video):

- ▶ Maternal vital signs
- ▶ Team communication
- ▶ Administration of medications

Actor Roles:

- ▶ Patient
- ▶ RNs 2-3
- ▶ OB physician

Debriefing Questions

Cognitive:

- ▶ What could cause bleeding or what is the differential diagnosis at this time?

- ▶ How do the changes in maternal physiology affect the signs and symptoms of hemorrhage?
- ▶ Based on this assessment, what are your priorities for patient care OR what is the plan for care?
- ▶ What prevented the team from carrying out the priorities for care or your management plan?

Technical:

- ▶ What supported or prevented continuous uterine massage?
- ▶ What facilitated or delayed medication administration?
- ▶ What uterotonic medications have major contraindications?

Behavioral:

- ▶ How did communication improve or delay care of the patient?
- ▶ How did the communication between the leader and the team member giving report to leader impact patient care?
- ▶ What roles are filled and unfilled?
- ▶ What strategies can the team use to fill key roles that are not filled?

Scenario Support Materials

Reference List:

- ▶ Unit protocols, policies, and procedures
- ▶ Current bulletins and monographs from professional organizations, current literature used to guide practice
- ▶ Critical Behavior Checklist (below)
- ▶ Uterine Metrics List (below)
- ▶ Visual aids/cognitive aids: QBL aides
- ▶ Hemorrhage guideline/algorithm

Scenario Support Materials

A. Critical Behaviors Checklist			
Behavior	Met	Unmet	Comment
Detection of hemorrhage			
Call for help, asks for specific help needed			
Uterine massage begins upon detection of boggy uterus, stopped upon physician order			
Handoff given in SBAR format			
Leader announces role to team			
Team roles are assumed			
Uterotonic medications given per policy			
Uterine tamponade device inserted per procedure			
Leader acknowledges team concerns			

Scenario Support Materials

B. Uterine Atony Metrics			
Metric Item	Measurement	Measurement	Comment
Time of diagnosis of hemorrhage to administration of first medication	Time Started:	Time Complete:	
Time help paged to time help arrived in room	Time Started:	Time Complete:	
Amount of time uterine massage was stopped unless directed by physician	Time Started:	Time Complete:	
Time from request for tamponade device to completion of insertion	Time Started:	Time Complete:	
Number of thin air or open air commands			
Number of thin air or open air communications			
Number of people in scenario without a role			
Roles not assigned or not filled during scenario			
Number of questions or concerns voiced about the management plan			

Sample Drill #3: In-Situ Labor and Delivery Unit Hemorrhage

Scenario Overview

Patient description: 'Carmela Bella', 28-year-old G3P2012 who was admitted for active labor at 40+1 weeks. Patient is 30 minutes postpartum and just called out that she feels more bleeding and is lightheaded.

Labor course: Uncomplicated spontaneous vaginal delivery after 6 hours in labor. 2nd degree laceration with repair. Placenta was noted to be intact. Infant male 3900 grams. IV 18 gauge in place and running Lactated Ringers with oxytocin 125mL/hr. Measurement of Quantitative Blood Loss (QBL) at delivery was 450mL.

History:

- ▶ No significant medical history
- ▶ No known drug allergies
- ▶ No pregnancy complications

Baseline lab values:

Hemoglobin: 10.8

Hematocrit: 35.6

WBC: 14,000

Platelets: 224,000

Learning Objectives

Cognitive:

States causes of hemorrhage in pregnancy

- ▶ Lists changes in maternal physiology that may mask symptoms of hemorrhage
- ▶ Demonstrates knowledge of policies and procedures for hemorrhage management, placement of tamponade devices and blood transfusion particularly massive transfusion

Technical:

- ▶ Provides adequate and continuous uterine massage
- ▶ Initiates OB Rapid Response
- ▶ Administers uterotonic medications in correct dose, route and time
- ▶ Initiates Massive Transfusion Protocol

Behavioral:

Communication during hand off is acknowledged by the receiver

- ▶ Concerns voiced about the patient or management plan are acknowledged by the team leader
- ▶ Team leader assigns roles if not already assigned or key role not filled
- ▶ Demonstrates teamwork and communication skills during simulation

Target Trainees: Obstetricians, Labor and Delivery Nursing Staff

Anticipated Duration: 20 minutes

Scenario Set-Up

Room configuration: LDR bed with "patient", IV pump with mainline, fetal monitor and patient monitor next to bed

Equipment:

- ▶ IV (1000 mL LR with 20 units oxytocin) with IV pump set up
- ▶ Monitor for maternal VS (BP cuff, pulse oximeter)
- ▶ Postpartum hemorrhage medication kit
- ▶ Hemorrhage Cart with appropriate supplies

Task trainer preparations: “Patient” in bed

Presets: Patient vitals on assessment: Temp 99.9F BP 80/40, P 144, RR 28, SaO2 90%. Pain 8/10. With correct actions, bleeding resolves and vital signs return to preset levels. If correct actions not taken, vital signs continue to deteriorate and bleeding continues.

Pump: Mainline IV at 125 mL/hour

Initial Presentation:

- ▶ Boggy fundus with fundal massage
- ▶ Pads weighed (200mL, 300mL, 200mL...etc.)
- ▶ Patient appears to be in and reports an unexpected amount of pain

Miscellaneous: Medication kit, second IV with blood tubing available if ordered

Chart Contents: Summary of Labor Course

Scenario Logistics (Running the Scenario)**Expected interventions:**

- ▶ Assessment of patient response using clinical exam, VS, laboratory tests
- ▶ Fundal massage, extraction of clots
- ▶ Administration of medications (oxytocin, methylergonovine)

Likely progression:

- ▶ Bedside nurse assesses patient, detects hemorrhage, starts uterine massage
- ▶ Calls for help (initiates OB Rapid Response)
- ▶ Help arrives, hand off given to leader
- ▶ Roles established for other responders
- ▶ Ongoing assessment for clots, retained products of conception, uterine tone
- ▶ Medications given as ordered
- ▶ Bleeding continues and vital signs deteriorate
- ▶ Initiate Massive Transfusion Protocol
- ▶ Uterine tamponade
- ▶ Patient improves

Expected endpoint: Hemorrhage protocol activated, medication administered correctly, uterine tamponade device utilized, pain origin assessed.

Distracters (if needed):

- ▶ Patient expressing pain loudly and moving around a lot

Additional/optional challenges (if needed):

- ▶ Atony complicated by or in addition to the presence of chorioamnionitis/infect or vaginal hematoma

Video guidelines (Priorities to capture on video):

- ▶ Maternal vital signs
- ▶ Team communication
- ▶ Administration of medications

Actor Roles:

- ▶ Patient
- ▶ RNs 2-3
- ▶ OB physician

Debriefing Questions**Cognitive:**

- ▶ What could cause bleeding or what is the differential diagnosis at this time?
- ▶ How do the changes in maternal physiology affect the signs and symptoms of hemorrhage?
- ▶ Based on this assessment, what are the priorities for patient care OR what is the plan for care?
- ▶ What prevented the team from carrying out the priorities for care or your management plan?

Technical:

- ▶ What supported or prevented continuous uterine massage?
- ▶ What facilitated or delayed medication administration?
- ▶ What uterotonic medications have major contraindications?
- ▶ Why would a uterine tamponade device be considered at this time?
- ▶ What blood loss management strategies are options for this patient?

Behavioral:

- ▶ How did communication improve or delay care of the patient?
- ▶ How did the communication between the leader and the team member giving report to leader impact patient care?
- ▶ What roles are filled and unfilled?
- ▶ What strategies can the team use to fill key roles that are not filled?

Scenario Support Materials**Reference List:**

- ▶ Unit protocols, policies, and procedures
- ▶ Current bulletins and monographs from professional organizations, current literature used to guide practice
- ▶ Critical Behavior Checklist (below)
- ▶ Uterine Metrics List (below)
- ▶ Visual aids/cognitive aids: QBL aides
- ▶ Hemorrhage guideline/algorithm

Scenario Support Materials

A. Critical Behaviors Checklist			
Behavior	Met	Unmet	Comment
Detection of hemorrhage			
Call for help, asks for specific help needed			
Uterine massage begins upon detection of boggy uterus, stopped upon physician order			
Handoff given in SBAR format			
Leader announces role to team			
Team roles are assumed			
Uterotonic medications given per policy			
Uterine tamponade device inserted per procedure			
Leader acknowledges team concerns			

Scenario Support Materials

B. Uterine Atony Metrics			
Metric Item	Measurement	Measurement	Comment
Time of diagnosis of hemorrhage to administration of first medication	Time Started:	Time Complete:	
Time help paged to time help arrived in room	Time Started:	Time Complete:	
Amount of time uterine massage was stopped unless directed by physician	Time Started:	Time Complete:	
Time from request for tamponade device to completion of insertion	Time Started:	Time Complete:	
Number of thin air or open air commands			
Number of thin air or open air communications			
Number of people in scenario without a role			
Roles not assigned or not filled during scenario			
Number of questions or concerns voiced about the management plan			

This appendix was adapted from the Improving Health Care Response to Obstetric Hemorrhage: A California Quality Improvement Toolkit, funded by the California Department of Public Health, 2015; supported by Title V funds.

Appendix H: Checklist for Patients Who May Decline the Use of Blood Products

Prenatal Care
<input type="checkbox"/> Comprehensive discussion with a checklist specifying acceptable interventions <input type="checkbox"/> Clear documentation of patient wishes <input type="checkbox"/> Aggressively screen for anemia and optimize hemoglobin prior to delivery (See toolkit section on Management of Iron Deficiency Anemia.) <ul style="list-style-type: none"> • Consider aggressively correcting any hemoglobin below 12.0 g/dL rather than using the general obstetric threshold of 11.0 g/dL <input type="checkbox"/> Coordinate consultants (consider MFM, Hematology, Anesthesiology)
Labor and Delivery
<input type="checkbox"/> Inform the entire care team and have a plan! <ul style="list-style-type: none"> • Obstetrics, MFM, Anesthesia, Neonatology, ICU, Main OR Team (Charge RN), Blood Bank <input type="checkbox"/> Coordinate planning with blood bank (can be done earlier per facility protocol) <input type="checkbox"/> Reassessment of hemorrhage risk and gather baseline labs (e.g., CBC) <input type="checkbox"/> Review previous discussion of options and patient wishes (or have a discussion based on shared decision-making if not done prior to admission) <input type="checkbox"/> Quantify blood loss at delivery for accurate measurement of hemorrhage stage <input type="checkbox"/> Limit blood draws/laboratory testing when possible (e.g., use low-volume pediatric microtainers) <input type="checkbox"/> Ensure quick access to uterotonics and other medications/tools for managing blood loss (e.g., TXA, fibrin glues) and consider earlier utilization
Postpartum
<input type="checkbox"/> Maintain volume with crystalloids <input type="checkbox"/> Limit blood draws/laboratory testing when possible <input type="checkbox"/> Aggressively treat anemia (see toolkit section Management of Iron Deficiency Anemia) <input type="checkbox"/> Continue close monitoring for vital signs changes and postpartum bleeding

Checklist: Acceptable interventions for those who decline to use blood products

Components of human blood		
	YES	NO
Packed Red Blood Cells		
Fresh Frozen Plasma		
Platelets		
Cryoprecipitate		
Albumin		
Plasma Protein Fraction		

Medications which contain a fraction of human blood		
	YES	NO
RhoGam (contains proteins from human blood)		
Human Immunoglobulin		
Tisseel (fibrin sealant containing proteins from plasma)		

Techniques for blood conservation/processing <i>These interventions involve your own blood being removed from your body and put back in.</i>		
	YES	NO
Cell saver		
Autologous (your own) banked blood transfusion		
Cardiopulmonary bypass		
Plasmapheresis		
Hemodialysis		
Other: _____		

Surgical interventions* <i>These are interventions that may be used to save your life, but do not involve blood products. Note that they may be used more readily in patients who cannot receive a transfusion.</i>		
	YES	NO
Bakri intrauterine balloon		
Uterine compression sutures		
REBOA (resuscitative endovascular balloon occlusion of the aorta)		
Hysterectomy		
Interventional Radiology		
Fibrin/thrombin glues		
Other: _____		

*See Section: Placenta Accreta Spectrum: Incidence, Risks, Diagnosis, Counseling and Preparation for Delivery on page 51
Improving Health Care Response to Obstetric Hemorrhage, a CMQCC Quality Improvement Toolkit, 2022

Appendix I: Discharge Planning for Women with Hemorrhage During the Birth Hospital Stay

Tammy Turner, RN, Martin Luther King, Jr. Community Hospital
Christine Morton, PhD, Stanford University School of Medicine, CMQCC
Kristen Terlizzi, National Accreta Foundation

Call your doctor or midwife if you have:	
<ul style="list-style-type: none">▶ Bleeding /soaking a pad an hour▶ Large blood clots (golf ball-sized)▶ Feeling dizzy when you stand up▶ Abdominal pain (if you had surgery, this means more pain than you have been having from surgery)	<ul style="list-style-type: none">▶ A headache that does not go away with over-the-counter medication▶ Visual changes (blurry vision or seeing spots)▶ Feeling detached, numb, afraid, depressed, anxious, or very stressed

Routine follow-up care:

1. Women who have had a significant complication such as hemorrhage, preeclampsia, ICU admission, or unplanned or extensive surgery may need early postpartum follow-up to assess their physical and emotional recovery (within one week of discharge).

- ▶ Early postpartum check-up scheduled with: _____ on _____ at _____
- ▶ 6-week postpartum check-up scheduled with: _____ on _____ at _____

2. A difficult birth and maternal exhaustion can impact your breastfeeding experience if you choose to breastfeed your child.

- ▶ Breastfeeding support scheduled with: _____ on _____ at _____

3. You may require follow-up with a specialist in this field: _____

- ▶ Your specialist follow-up is with: _____ on _____ at _____

4. Patients who experienced complications during their delivery hospitalization may benefit from counseling and support resources.

Counseling:

Peer Support Group:

Psychiatry/Psychology:

Patient Organization/Foundation Resource:

Improving Health Care Response to Obstetric Hemorrhage, a CMQCC Quality Improvement Toolkit, 2022

Appendix J: Sample Obstetric Outpatient Intravenous Iron Infusion Order Set

Note: This is a SAMPLE developed for a particular facility as an example to work from. You may need to adjust based on the individual circumstances of your facility.

**May be modified for an inpatient order set*

Facility Name: _____

Patient Name: _____ DOB: _____ Date: _____

Physician Name: _____

Physician Call Back Number for Emergencies: _____

Diagnosis (check):

- Iron deficiency anemia in pregnancy: GA 14 - 27.6 weeks (ICD10: 099.012, D50.9)
- Iron deficiency anemia in pregnancy: GA \geq 28 weeks (ICD10: 099.013, D50.9)
- Postpartum anemia (outpatient) (ICD10: 090.81)
- Other: _____

Hgb/Hct: _____ Ferritin Level: _____ Phosphate (if to receive ferric carboxymaltose) _____

Iron Order: (Note: Populate with your institution's current formulary selections or select agents depending on payor mix; choices may consider patient convenience and/or compliance. See below for an example of an iron sucrose dosing calculation if desiring to calculate an individualized dose rather than simply using a typical 1-gram dose which most iron deficient anemic pregnant patients will need.)

- Low Molecular Weight Iron Dextran (LMWID, InFed) 1000 mg IVPB IV x 1. Administration: Give first 25 mg (___ mL) IV over 15 minutes. If no reaction following a few minutes to 15-minute observation, infuse the rest of bag contents (975 mg) to complete infusion over 1 hour (range 1-4 hours)
- Iron Sucrose (Venofer): 500 mg in 250 mL NS IVPB, Infuse over 4 hours x 2 doses on Day 1 and Day _____ (within 1-7 days of Day 1 dose)
- Iron Sucrose (Venofer): 200 mg in 100 mL NS IVPB, Infuse over 30-90 minutes x 5 doses on Day 1 and Days _____ (doses within 1-7 days)
- Ferric Carboxymaltose (Injectafer) (Patients \geq 50 kg): 750 mg in 250 mL NS IVPB (must not be less than 2 mg/mL), Infuse over 15-30 minutes x 2 doses on Day 1 and Day 7
- Ferric Carboxymaltose (Injectafer) (Patients < 50 kg): 15 mg/kg/dose _____ in _____ mL NS IVPB (must not be less than 2 mg/mL), Infuse over 15 –30 minutes x 2 doses on Day 1 and Day 7

Pre-medications: NO medications are needed in most patients

- ▶ Administer MethylPREDNISolone 125 mg (SOLU-Medrol) IV x1 prior to iron infusion IF:
 - Patient is on any medication for asthma OR
 - Patient has 2+ allergies OR
 - Allergies defined by unexpected reactions (e.g., rash, swelling, anaphylaxis, itching). Does NOT include expected side effects to medications.

Treatment of Mild/Moderate Infusion Reactions: defined as any of the following:

- ▶ Fishbane reactions: myalgias (e.g., backpain/back tightness), flushing, dyspnea, arthralgias OR
- ▶ Non-allergic complement activated pseudoallergy reactions: urticaria, pruritis, rash, nausea, headache, mild hypotension/hypertension
 - Stop the infusion. Lay patient on side. Monitor for 15 minutes for symptom resolution
 - If symptoms resolve after 15 minutes:
 - Resume the infusion at half the rate. If patient tolerates the infusion for the first 15 minutes, may increase the rate slowly to original rate.
 - If symptoms DO NOT resolve after 15 minutes:
 - Administer MethylPREDNISolone (SOLU-Medrol) 125mg IV PRN x1 and notify the physician. Do not resume the infusion.
 - If symptoms do not resolve after MethylPREDNISolone administration, contact the physician for symptom-specific treatment (e.g., antihistamine for itching)

Treatment of Severe Infusion Reactions: defined as any of the following:

- ▶ Persistent significant hypotension (SBP drop of 30 mmHg from baseline or SBP < 90 mmHg) OR
- ▶ Angioedema of tongue or airway OR
- ▶ Symptom involvement of 2+ organ systems that are cardiovascular, respiratory, gastrointestinal, or skin in origin (e.g., chest pain with bronchospasm)
- ▶ Stop the infusion and administer rescue medications:
 - MethylPREDNISolone (SOLU-Medrol) 125mg IVPRN x1 AND
 - EPINEPHrine 0.3 IM PRN x1 AND
 - NS bolus 1000 mL IV PRN x1
- ▶ **Notify the physician, activate Code Blue and transfer to the emergency room**

Baseline vitals and per unit standard

Observe patient for at least 30 minutes following completion

Physician Signature: _____ Date: _____

Ganzoni Formula:

Calculate total Fe dose need:

Fe need = wt. (kg) x 0.24 x (target Hgb – current Hgb in gm/L) + 500 mg

Example: 70 kg (pre-pregnancy weight) woman with Hgb of 7.0 gm/L and a target of 11.0 gm/L

= 70 kg x 0.24 x (target: 11.0 gm/L — actual: 7.0 gm/L) + 500 mg

Remember: 7 gm/dL = 70 gm/L

Remember: Use **pre-pregnancy** weight (kg)

= 672 mg + 500 mg = 1172 mg (This is usually rounded to 100 or 200 mg increments)

Ganzoni A. M. Intravenous iron-dextran: therapeutic and experimental possibilities. *Schweizerische Medizinische Wochenschrift*. 1970;100(7):301–303.

Courtesy of Long Beach Miller Children's/Miller Children's and Women's Hospital 2021

(Used with permission of Miller Children's and Women's Hospital)

Appendix K: Obstetric Hemorrhage Risk Factor Assessment Screen

(Risk factors added since Obstetric Hemorrhage Toolkit V2.0, 2015, are shaded)

Blood bank recommendations should be highly localized. Many institutions no longer hold a specimen in the blood bank, others utilize automated technology to type and screen all obstetric patients. An example of a risk-based approach is included in the table below.

ADMISSION AND LABOR RISK FACTORS		
Low	Medium	High
MONITOR FOR HEMORRHAGE <i>Routine obstetric care</i>	NOTIFY CARE TEAM <i>Personnel that could be involved in response are made aware of patient status and risk factors</i>	NOTIFY CARE TEAM MOBILIZE RESOURCES <i>Consider anesthesia attendance at delivery</i>
<i>Specimen on hold in blood bank</i>	<i>Type and screen</i>	<i>Type and cross, 2 units on hold</i>
No previous uterine incision	Prior cesarean(s) or uterine surgery	Placenta previa, low lying placenta
Singleton pregnancy	Multiple gestation	Suspected/known placenta accreta spectrum
≤ 4 vaginal births	> 4 vaginal births	Abruption or active bleeding (> than show)
No known bleeding disorder	Chorioamnionitis	Known coagulopathy
No history of PPH	History of previous postpartum hemorrhage	History of > 1 postpartum hemorrhage
	Large uterine fibroids	HELLP Syndrome
	Platelets 50,000 - 100,000	Platelets < 50,000
	Hematocrit < 30% (Hgb < 10)	Hematocrit < 24% (Hgb < 8)
	Polyhydramnios	Fetal demise
	Gestational age < 37 weeks or > 41 weeks	2 or more medium risk factors
	Preeclampsia	
	Prolonged labor/Induction (> 24 hrs)	
ADDITIONAL BIRTH AND ONGOING POSTPARTUM RISK FACTORS*		
ROUTINE CARE	INCREASED SURVEILLANCE POSTPARTUM CARE TEAM ASSESSES RESPONSE READINESS	
	Cesarean during this admission – <i>especially if urgent emergent/2nd stage</i>	Active bleeding soaking > 1 pad per hour or passing a ≥ 6 cm clot
	Operative vaginal birth	Retained placenta
	Genital tract trauma including 3rd and 4th degree lacerations	Non-lower transverse uterine incision for cesarean
	Quantitative cumulative blood loss 500-1000 mL with a vaginal birth	Quantitative cumulative blood loss ≥ 1000 mL or treated for hemorrhage
		Received general anesthesia
		Uterine rupture

*The Joint Commission requires that an assessment using an evidence-based tool for determining maternal hemorrhage risk be completed on admission to labor and delivery and on admission to postpartum. These delivery and ongoing postpartum factors should be included in addition to admission factors in the risk assessment.

This table was adapted from the Improving Health Care Response to Obstetric Hemorrhage: A California Quality Improvement Toolkit, funded by the California Department of Public Health, 2015; supported by Title V funds.



Tell us if you
ARE PREGNANT *or*
HAVE BEEN PREGNANT
within the past 6 weeks



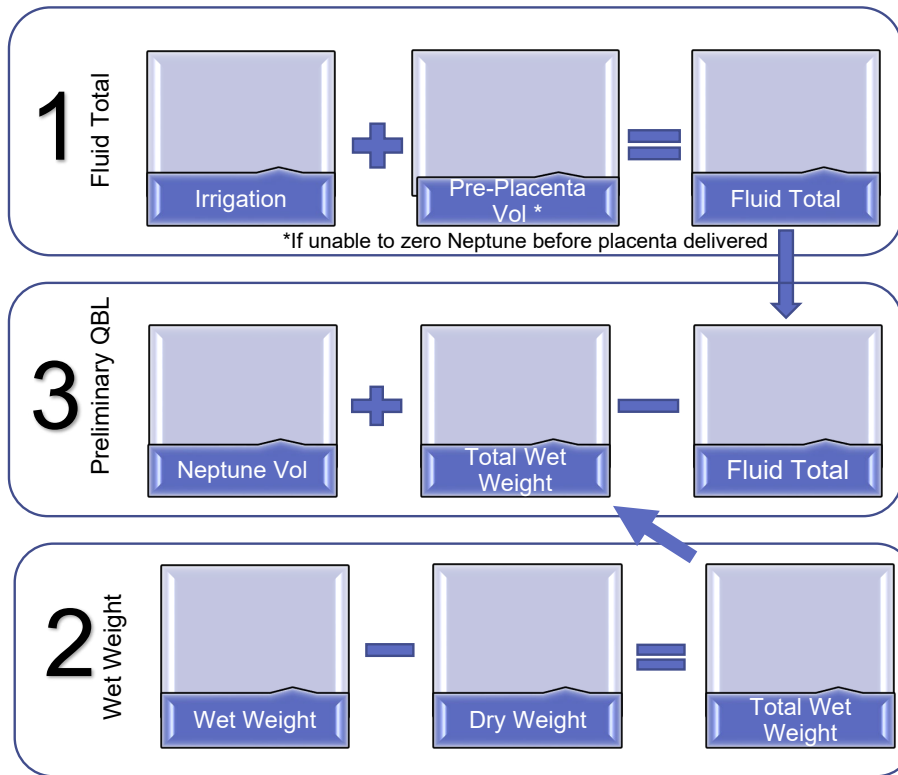
Come to the front of the line if you have:

- ▶ Persistent headache
- ▶ Visual change (floaters, spots)
- ▶ History of preeclampsia
- ▶ Shortness of breath
- ▶ History of high blood pressure
- ▶ Chest pain
- ▶ Heavy bleeding
- ▶ Weakness
- ▶ Severe abdominal pain
- ▶ Confusion
- ▶ Seizures
- ▶ Fevers or chills
- ▶ Swelling in hands or face

Appendix M: Sample QBL Worksheet

Note: This is a SAMPLE developed for a particular facility as an example to work from. You may need to adjust based on the individual circumstances of your facility.

QBL Worksheet: C-Section



4 Final QBL

Kidney Basin Volume (subtract 20 gm for kidney basin dry weight)	
Preliminary QBL	
Final QBL	

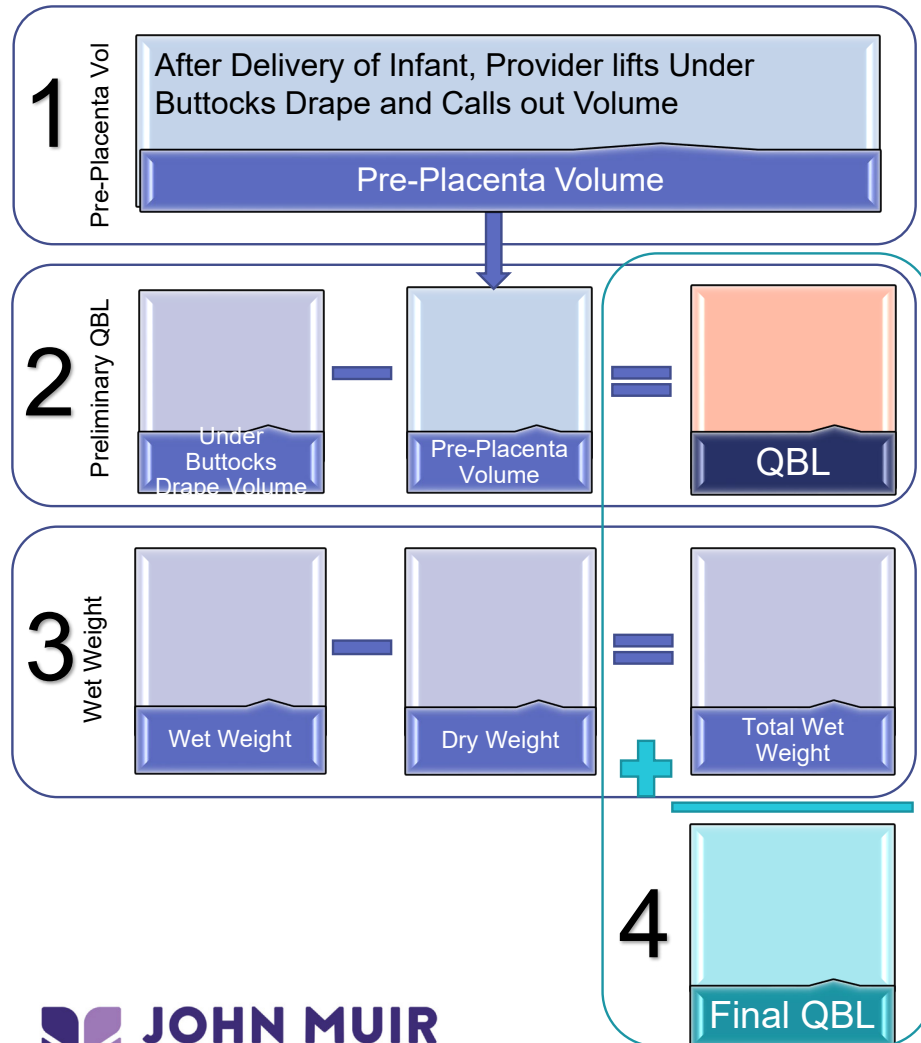
Miscellaneous Dry Weights (grams)	
Under Buttocks Drape (UBD)	130
Blue Chux	15
Peripads	10
Large White Underpad	120
Mesh Underpants (Large)	10
Blue towel	55
Plastic kidney basin	20
Vaginal Packing (2"x 15')	30
4 X 4 Sponge	3
Perineal Ice Pack	180
Lap	20
Blue lap holder	20
Blue lap holder w/ 10 dry laps	220
Bath blanket	560
Bath towel	440
Fitted sheet	170

Weighed Items: the table to the right is the most commonly used items in a C/S, be sure to add in dry weights from the Miscellaneous Dry Weights table if applicable

Item (commonly use in C/S)	Dry Weight (gm)	Total Weight
Lap holder #1 + 10 laps	220	
Lap holder #2	20	
Lap (1)	20	
4 x 4	3	
Sub Total	263	



QBL Worksheet: Vaginal Delivery



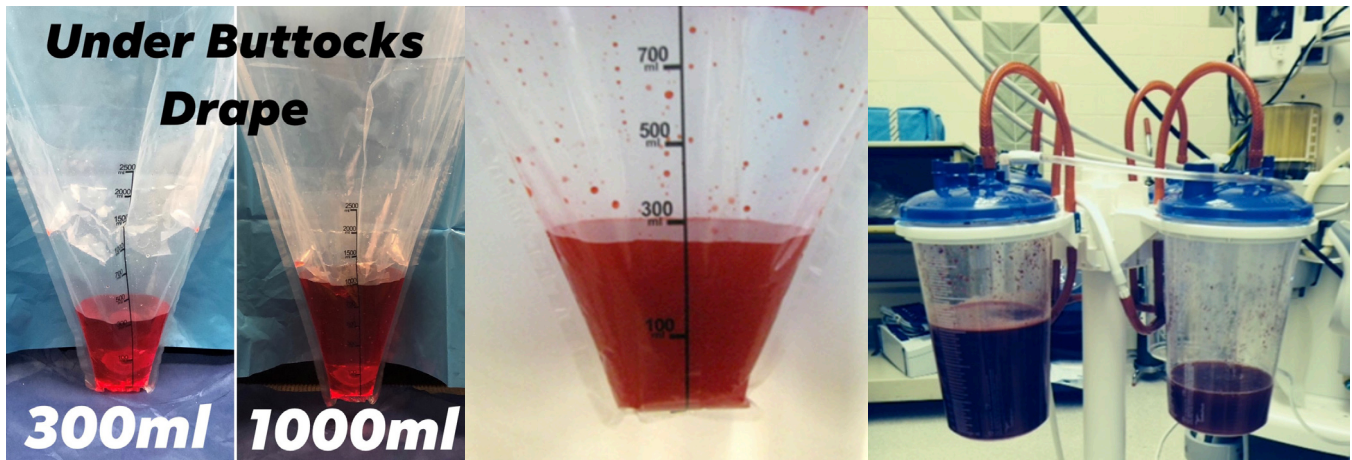
- Step 1:** Determine pre-placenta volume in under buttocks drape
- Step 2:** At end of repair, when patient is stable, determine under buttocks drape volume and subtract pre-placental volume for preliminary QBL
- Step 3:** If 4x4's, laps, towels etc. were saturated, weigh them and subtract dry weight for Total Wet Weight.
- Step 4:** Add Total Wet Weight to Preliminary QBL

Miscellaneous Dry Weights (grams)	
Under Buttocks Drape (UBD)	130
Blue Chux	10
Peripads	10
Large White Underpad	120
Mesh Underpants (Large)	10
Blue towel	55
Plastic kidney basin	20
Vaginal Packing (2"x 15')	30
4 X 4 Sponge	3
Perineal Ice Pack	180
Lap	20
Bath blanket	560
Bath towel	440
Fitted sheet	170

Appendix N: Techniques for Quantitative Assessment of Blood Loss (QBL)

Quantify blood loss by measuring

- ▶ Under buttock drapes with graduated markings – may have to lift bottom of drape out of the kick bucket to see markings
- ▶ Graduated collection containers
- ▶ Account for other fluids (amniotic fluid, urine)
- ▶ At C/S hold irrigation until after blood loss calculated



Quantify blood loss by weight

- ▶ Make scales available in all delivery rooms
- ▶ Standardize supplies and establish dry weights of commonly used items (Chux, peripads, lap holder, etc.)
- ▶ Incorporate weighing of appropriate materials into routine practice
- ▶ Build electronic calculator into electronic health record (EHR)



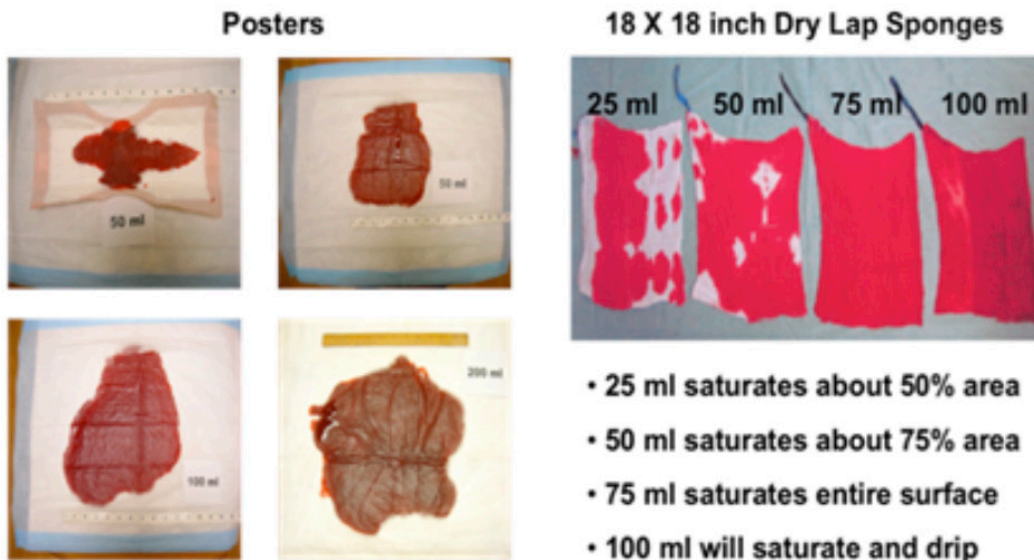
Quantify Blood Loss by colorimetric analysis system

- ▶ Use of a computer system programmed with a color density-based algorithm to quantify hemoglobin content in cannisters, containers, and absorbed by surgical sponges.

Use formal estimation only if other methods are unavailable

- ▶ Record percent (%) saturation of blood-soaked items with the use of visual cues such as pictures/posters to determine blood volume equivalence of saturated/blood-soaked item.




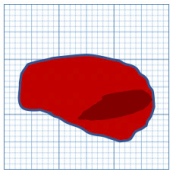

Training Tools



(Photos courtesy of Leah Romine, RN and Jennifer McNulty, MD and used with permission)

This was adapted from the Improving Health Care Response to Obstetric Hemorrhage: A California Quality Improvement Toolkit, funded by the California Department of Public Health, 2015; supported by Title V funds.

Appendix O: Terms and Techniques for Describing Blood Loss

<p>EBL</p>		<p>ESTIMATED BLOOD LOSS: Traditional estimation of blood loss by looking at the items such as sponges, drapes, blood in containers and determining blood loss. Tends to be normalized by over-estimating small losses and under-estimating large losses.</p>	<p>EBL measurements typically done at the end of the case by multiple observers. Research has shown training can improve the technique but that accuracy fades unless repeatedly trained.</p>
<p>QBL Gravimetric</p>		<p>QUANTITATED BLOOD LOSS BY GRAVIMETRIC TECHNIQUE: The blood loss is determined by weighing items and subtracting the dry weight of the sponge, gauze or contained to determine weight.</p>	<p>The method of QBL measurement has been made easier by embedded calculation tools in the electronic record and by making sure scales are readily available.</p>
<p>QBL Volumetric</p>		<p>QUANTITATED BLOOD LOSS BY VOLUMETRIC TECHNIQUE: The blood loss is determined by observing the total amount of volume containing blood and subtracting the volume represented by amniotic fluid or irrigation.</p>	<p>The method of QBL measurement can be made more accurate and easier if workflow observations, such as brief determinations of volumes of amniotic fluid collection before blood suctioning at CS or before shoulders delivered in vaginal delivery.</p>
<p>QBL Colorimetric</p>		<p>QUANTITATED BLOOD LOSS BY COLORIMETRIC TECHNIQUE: The blood loss is determined by a device which scans items or containers and estimates the amount by the size of spot (pixels) and intensity of color.</p>	<p>The method of QBL measurement requires specialized equipment and training. Workflow adjustments should be made to ease staff work in the OR and postpartum units.</p>
<p>CBL</p>		<p>CUMULATIVE BLOOD LOSS: The ongoing blood loss is determined by adding up the individual EBL or QBL measurements for the events and is used to drive management steps and transfusion.</p>	<p>CBL is the best term to communicate the patient's blood loss and should be visible in the patient electronic record and verbalized in communication between providers during events and handoffs.</p>

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Appendix P: Sample Paper Calculators for Quantifying Blood Loss

Note: This is a SAMPLE developed for a particular facility as an example to work from. You may need to adjust based on the individual circumstances of your facility

Vaginal QBL	
Volume	Calculations/Totals
Total Drape Volume (Completion of Delivery)	
Volume before Placenta Delivery (mostly amniotic fluid)	(Subtract amniotic fluid)
Drape QBL #1	=
Additional Drape Volumes:	
Bloody Lap Sponges, Total weight in grams	
Number of lap sponges _____ x _____ grams	(Subtract dry weight)
Lap Sponges QBL	=
Other bloody item, weight in grams	
Dry item, weight in grams	(Subtract dry weight)
Other item QBL	=
(From above: Drape QBL + Lap Sponge QBL + Other item QBL) Total Delivery QBL	
Bloody Standard Postpartum Perineal Pack in grams (Peripad + quilted blue under pad)	
Dry weight in grams	(Subtract dry weight)
Hospital Standardized Dry Weights in Grams	
Item	Dry Weight in Grams
Lap Sponge	
Standard Postpartum Perineal Pack (peripad + quilted blue under pad)	
Peripad	
Quilted blue under pad	
Blue Towel	
Baby Blanket	
Sheet	
Gown	

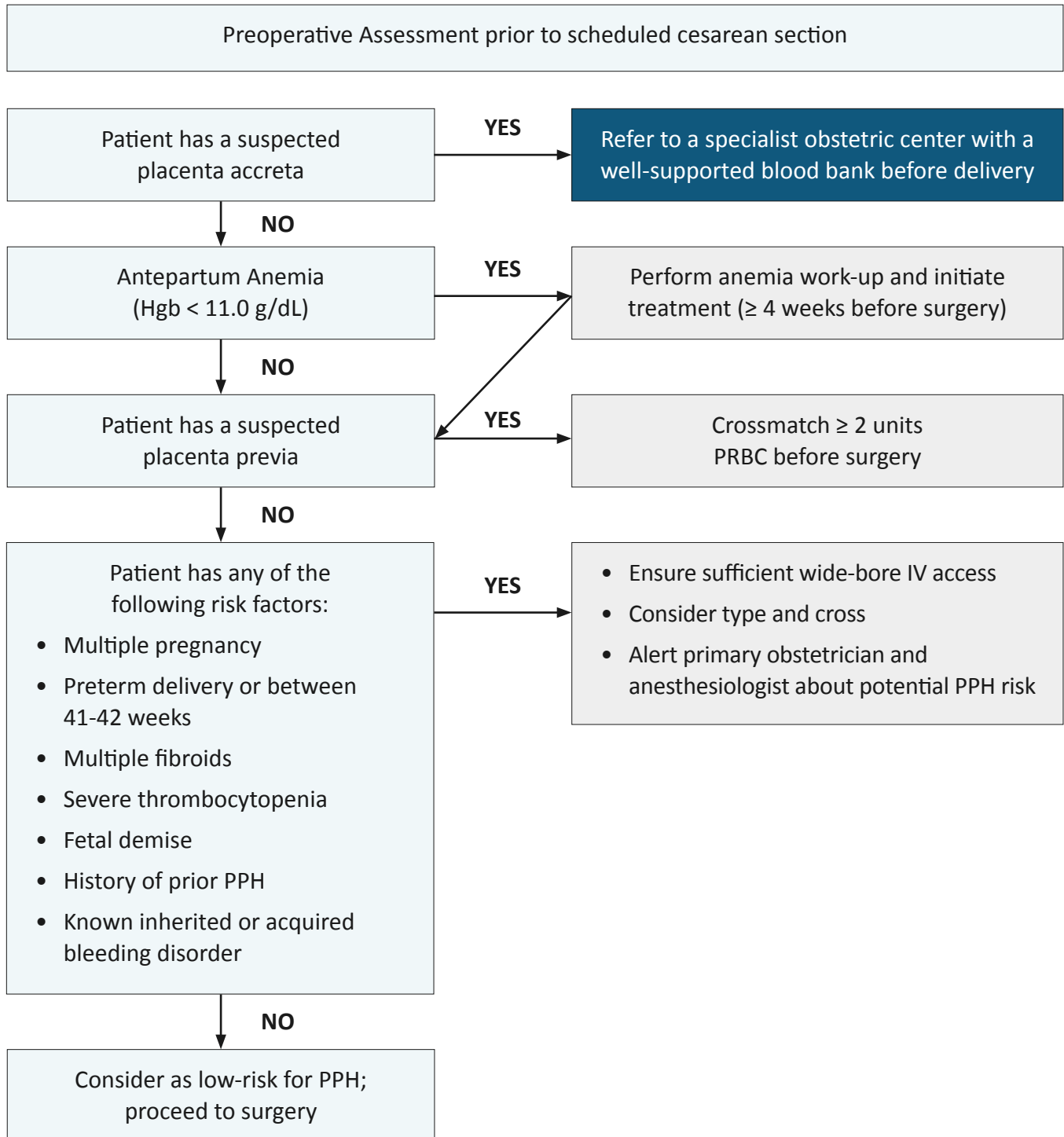
Cesarean Section QBL	
Volume in Canister (before irrigation preferably)	Calculations/Totals
Volume in Canister before Placenta Delivery (mostly amniotic fluid)	(subtract amniotic fluid)
Irrigation (IF included in canister volume)	(subtract irrigation)
Canister QBL #1	=
Additional Canister Volumes:	
Bloody Lap Sponges + sponge bag holders, Total weight in grams	
Number of lap sponges weighed _____ x ____ grams	(Subtract dry weight)
Number of sponge counter bag weighed _____ x _____ grams	(Subtract dry weight)
Lap Sponges QBL	
Dry item, weight in grams	(Subtract dry weight)
Other item QBL (If applicable)	=
(From above: Canister QBL + Lap Sponge QBL + Other item QBL) Total Delivery QBL	
Bloody Standard Postpartum Perineal Pack, weight in grams. (Peripad + quilted blue under pad)	
Dry standard postpartum perineal pack, weight in grams	(Subtract dry weight)
Recovery QBL	

Hospital Standardized Dry Weights in Grams	
Item	Dry Weight in Grams
Lap Sponge	
Sponge Counter Bag	
Standard Postpartum Perineal Pack (peripad + quilted blue under pad)	
Peripad	
Quilted blue under pad	
Blue Towel	
Baby Blanket	
Sheet	
Gown	

(Used with permission of Jennifer McNulty, MD)

Appendix Q: Sample Schematic: Preadmission Planning for Women Undergoing Scheduled Cesarean Section

Note: This is a SAMPLE developed for a particular facility as an example to work from. You may need to adjust based on the individual circumstances of your facility.



Appendix R: Medications for Postpartum Hemorrhage

Medications for Postpartum Hemorrhage						
Drug	Dose	Route	Frequency	Side Effects	Contraindications	Special Storage Considerations
Oxytocin (Pitocin™) 10 units/mL	10-40 units per 500-1000 mL, rate titrated to uterine tone	IV infusion	Continuous	Usually none Nausea, vomiting, hyponatremia (“water intoxication”) with prolonged IV admin. ↓ BP and ↑ HR with high doses, especially IV push	Hypersensitivity to drug	None
Methylergonovine (Methergine®) 0.2 mg/mL	0.2 mg	IM (not given IV)	-q2-4 hours -If no response after first dose, it is unlikely that additional doses will be of benefit	Nausea, vomiting, severe hypertension, especially with rapid administration or in patients with HTN	Hypertension, Preeclampsia, Heart disease Hypersensitivity to drug Caution if multiple doses of ephedrine have been used, may exaggerate hypertensive response w/ possible cerebral hemorrhage	Refrigerate Protect from light
Carboprost (Hemabate®) (15-methyl PG F2a) 250 mcg/mL	250 mcg	IM or intramyometrial (not given IV)	-q15-90 min -If no response after 3 doses, it is unlikely that additional doses will be of benefit	Nausea, vomiting, diarrhea, fever (transient), headache, chills, shivering, hypertension, bronchospasm	Caution in women with hepatic disease, asthma, hypertension, active cardiac or pulmonary disease Hypersensitivity to drug	Refrigerate
Misoprostol (Cytotec®) 100 or 200 mcg tablets	600-800 mcg	SL or PO	One time	Nausea, vomiting, diarrhea, shivering, fever (transient), headache	Rare Known allergy to prostaglandin Hypersensitivity to drug	None
Tranexamic Acid (TXA)	1 gram	IV infusion (over 10 min)	-One dose within 3 hrs of hemorrhage recognition -A 2nd dose may be administered if bleeding continues after 30 min or if bleeding stops and then restarts within 24 hrs of completing the 1st dose	Nausea, vomiting, diarrhea, hypotension if given too rapidly	A known thromboembolic event in pregnancy History of coagulopathy Active intravascular clotting	None

Appendix S: Sample Massive Transfusion Policy – Torrance

Note: This is a SAMPLE developed for a particular facility as an example to work from. You may need to adjust based on the individual circumstances of your facility.

DEPARTMENT: LABORATORY
SECTION: BLOOD BANK - TRANSFUSION SERVICE
POLICY: EMERGENCY RELEASE AND MASSIVE TRANSFUSION

PROTOCOL

Purpose:

This document describes the responsibilities of the departments during an Emergency Release of Red Blood Cells (RBCs) and Massive Transfusion Protocol.

Scope:

All hospital personnel must be competent in this procedure.

Definitions:

- ▶ **Emergency Release of Red Blood Cells:** upon receipt of order from a physician, 2 units of RBC are released within 10 minutes from time of phone call to the Blood Bank.
Platelets and Thawed Frozen Plasma will be made available only if requested.
- ▶ **Massive Transfusion Protocol (MTP):** upon receipt of order from a physician, 2 units of RBC are released within 10 minutes from time of phone call to the Transfusion Service/ Blood Bank.
The following blood products will be provided after the initial release of 2 units of RBC:

- 4 units RBCs in a cooler
- 4 units of thawed Frozen Plasma (within 45 minutes)
- 1 unit of Platelets immediately or as soon as they can be procured.

***Until the Hemorrhage Protocol has been called-off, the following products will be provided:

- 4 units RBCs in a cooler
- 4 units thawed Frozen Plasma
- 1 unit platelets
- 2 units thawed pooled cryoprecipitate

Notes: Each blood product component should be kept at the following temperatures:

- ▶ **RBCs: in a 1-6C RBC cooler**
- ▶ **Freshly thawed plasma: should be kept in a separate cooler than RBCs**
- ▶ **Platelets are kept at 20-24C cooler**

Policy:

- ▶ The ordering department must inform the Transfusion Service (TS) if it is an “Emergency Release of RBCs” versus a “Massive Transfusion Protocol (MTP)”
- ▶ If there is no current ABORh and Antibody Screen (Type and Screen) specimen in the Transfusion Service, patient sample must be sent to Transfusion Service STAT. Un-crossmatched blood is dispensed until testing is completed.

Overview of Responsibilities:

Responsible Party	Description of Responsibility
<p>Attending Physician/ Surgeon/ Designee</p>	<ul style="list-style-type: none"> ▶ Recognizes the need to activate the Emergency Release or MTP ▶ Updates nursing or responsible team of blood product needs ▶ Cancels MTP as indicated ▶ Ordering MD must sign and return to the Transfusion Service the Emergency Blood Release/ Waiver Form as soon as possible when crisis subsides ▶ Orders must be placed in Cerner Millennium as soon as possible for lab work and transfusions
<p>Unit Lead or designee</p>	<ul style="list-style-type: none"> ▶ Alerts the staff of the Emergency Release or MTP ▶ Ensures collection, proper labeling and transport of Transfusion Service specimen (if not already obtained) ▶ Assigns a person who will communicate with the Transfusion Service for the duration of the crisis ▶ Maintains communication with the physician/surgeon or designee ▶ Ensures maintenance of blood products within acceptable temperatures <ul style="list-style-type: none"> • RBCs: in a 1-6C RBC cooler • Freshly thawed plasma: should be kept in a separate cooler than RBCs • Platelets are kept at 20-24C cooler ▶ Ensures cancellation of the protocol as directed by the physician/surgeon or designee ▶ Ensures prompt return of coolers and unused blood products to the Transfusion Service ▶ Maintains all transfused bags for later reconciliation of products transfused. This information is placed in the patient medical record. ▶ Ensures that orders are placed in Cerner Millennium for all lab work and transfusions ▶ Examines the process for feedback and improvement.
<p>Person assigned to communicate with the Transfusion Service</p>	<ul style="list-style-type: none"> ▶ Calls the Transfusion Service and provides them with the following info: <ul style="list-style-type: none"> • Contact Name and phone extension • Patient Name and MRN • Ordering Physician Name • Location where blood is to be transfused • Confirm if this is an Emergency Dispense or MTP ▶ Completes orders for blood products ▶ Prints the Patient Product Inquiry (procurement form) or other acceptable form to pick-up blood products ▶ Ensures TS specimen is transported immediately ▶ Maintains close communication with Transfusion Service

Responsible Party	Description of Responsibility
Transporter	<ul style="list-style-type: none"> ▶ Transports TS specimen immediately ▶ Receives blood products from TS and delivers to patient location immediately ▶ Waits for additional instructions from the person communicating with the TS and nursing floor
Transfusion Service Personnel	<ul style="list-style-type: none"> ▶ Alerts the TS staff and Supervisor of Emergency Release or MTP ▶ Assesses the need for assistance ▶ Prepares RBCs for immediate dispense. These may be: <ul style="list-style-type: none"> • Crossmatched RBCs if available • Un-crossmatched ABORh compatible in there is a current sample with at least an ABORh test performed with matching patient’s Blood Bank ID# • Un-crossmatched group O neg or O pos (depending on patient’s Rh type/gender and availability of supply) ▶ If Un-crossmatched RBCs had been dispensed, CLS must perform the crossmatch ASAP. Any incompatible crossmatch result must be called to the physician or contact person. ▶ For MTP only: If Thawed Frozen Plasma is not available, 4 units will be thawed immediately <ul style="list-style-type: none"> • Platelets will be dispensed if available or ordered from blood supplier STAT • Will dispense 4 units of RBCs, 4 units of thawed Frozen Plasma, 1 unit of platelets Until the Hemorrhage Protocol has been called off, will dispense the following as needed: 4 RBCs: 4 thawed FFPs: 1 Plt: 2 Cryo ▶ When crisis is over, sends to the Emergency site the Emergency Blood Release /Waiver Form for the ordering physician to sign ▶ Will reconcile all blood products issued versus the orders in Cerner Millennium ▶ Will communicate to the nursing floor all orders/forms needed to be completed
On-site Lab Supervisor/ Senior CLS/ Lead CLS	<ul style="list-style-type: none"> ▶ Ensures the policy and procedures are followed ▶ Ensures adequate staffing in the TS while protocol is in effect ▶ Provides assistance as needed ▶ Updates TS Director/on-call pathologist of the protocol status as needed ▶ Examines the process for feedback and improvement

(Used with permission from Torrance Memorial Medical Center, CA)

Appendix T: Sample Massive Transfusion Procedure Miller Children’s and Women’s Hospital

Note: This is a SAMPLE developed for a particular facility as an example to work from. You may need to adjust based on the individual circumstances of your facility.

SUBJECT:		BLOOD AND BLOOD COMPONENTS: EMERGENT MASSIVE TRANSFUSION PROCEDURE (MTP): ADULT	REFERENCE # PL-524
	SYSTEM	MILLER CHILDREN’S AND WOMEN’S HOSPITAL LONG BEACH	PAGE: 1 OF: 2
X	CAMPUS		
	DEPARTMENT		
OWNER:		Patient Care Services; Blood Bank	EFFECTIVE: FEBRUARY 2016

I. Scope

- A. This procedure applies to adult patients with an order for the Massive Transfusion Procedure or an emergent transfusion when cross matched units are not available.
- B. The Physician or his / her designee is responsible for ordering blood or activating the Massive Transfusion Procedure (MTP) by contacting the Blood Bank (BB). Compliance with this procedure is the responsibility of licensed staff.

II. Policy

- A. The purpose of this policy is to ensure quality patient care by providing an expedited process to obtain an appropriate mix of blood and / or blood components for a patient who is experiencing significant blood loss or an emergent transfusion; to facilitate the ordering and release of blood products in an emergent situation in the most timely and efficient manner; to outline the process of providing rapid restoration of intravascular blood volume, maintain oxygen carrying capacity, and coagulability of the blood.
- B. Emergency transfusions / the MTP will be initiated by the Physician if clinical indications exist, in order to prevent complications associated with large blood volume replacements. The MTP is indicated specifically for a critically-ill patient likely to require the rapid transfusion of greater than 6- 10 units of blood and blood components within two (2) hours, and has the potential to progress to consumptive coagulopathy and uncontrolled hemorrhage.
- C. If a patient safety event not primarily related to the natural course of the patient’s illness or underlying condition (i.e., placenta previa) occurs intrapartum through the immediate postpartum period (24 hrs), that requires the transfusion of 4 or more units of packed red blood cells and/or admission to the intensive care unit (ICU) it may be classified as severe maternal morbidity and meet the criteria of a Sentinel Event (i.e., hemorrhage that is unexpected.)

III. Procedure

A. Emergency Transfusions: When blood is urgently needed and cross matched units are not available, CALL BLOOD BANK, Ext. 30815. Specify the following:

- Patient's name and medical record number
- Patient's location
- Number of units and type of component needed.
- Ordering physician's name

The Blood Bank will supply the most compatible blood, based on the blood type information currently available for the patient.

1. Only uncrossmatched O negative (for female patients of childbearing age up to 55 years) or O positive (all other patients) Red Blood Cells (RBCs) will be delivered as quickly as possible.
2. Crossmatching will be completed as rapidly as possible and any incompatibility will be reported to the nurse / physician by phone / intercom. BEDSIDE PATIENT IDENTIFICATION remains an extremely important step prior to transfusion. The attached armband with the patient's name and medical record number MUST be compared with label on the blood component and found to be identical before starting the transfusion.
3. When uncrossmatched Red Blood Cells are delivered, Blood Bank will place an EPIC order: "Emergency Release of Blood Products. This order will be signed by the ordering physician as soon as time permits.

B. Massive Transfusion Procedure (MTP)

1. Initiation of MTP:
 - a. Physician or designee will initiate the MTP by verbal or telephone order if he / she deems it necessary, after a clinical evaluation of the patient. This evaluation can occur upon MD evaluation and / or upon patient arrival into the area, e.g., in the Operating Room (OR), BirthCare Center, or in the Intensive Care Unit (ICU).
 - b. The Physician or his / her designee is responsible for contacting the BB and activating the MTP. An order should be given and timed on the chart to document initiation of the MTP.
 - c. The MTP form (BB FMG102), "Massive Transfusion Protocol Disposition Log" is to be used to track all blood products transfused.
2. Blood Bank Response: The goal of this procedure is to transfuse a 1:1 ratio of packed red blood cells (RBCs) to fresh frozen plasma (FFP), and to transfuse 1 unit of platelets (PLTs) for every 6 units of FFP and RBCs. When the MTP is initiated by physician order, the Blood Bank will do the following:
 - a. Immediately deliver 4 units of uncrossmatched RBCs, 4 units of FFP and 1 unit of platelets to the patient location.
 - b. Continue preparing uncrossmatched RBCs, thawed Plasma, and platelets to "keep ahead" products as follows: also shown in the table below.
 - c. The BB will automatically deliver the Initial Response (Pack 1) after the MTP is activated. Pack 2 will be automatically delivered as soon as it is available. After Pack 2, the BB will wait for a call from the Physician or designee on whether to continue preparing and delivering MTP Packs.

- d. Prepare cryoprecipitate pools as ordered.
- e. The Blood Bank will continue to thaw Plasma in a 1:1 ratio with RBCs and prepare platelets until instructed to stop by the ordering physician, anesthesiologist, or his/her designee.
- f. The Blood Bank will also place an “Activate Massive Transfusion Procedure / Protocol” order in EPIC for the physician to sign whenever EPIC is accessed.

Blood Bank Initial and Keep Ahead Response			
	Initial Response (Pack 1)	(Pack 2)	Keep Ahead
RBCS	4	6	6
FFP	4	6	6
PLTS	1	1	1

3. Transfusionist Response

- a. Notify BB after Pack 2, if additional packs need to be prepared.
- b. Draw labs as indicated. Include a CBC, PT, PTT, and FIB (fibrinogen). (All of these tests can be ordered at once as an Acute Bleeding Panel in EPIC for patients where EPIC is accessible).
- c. Order cryoprecipitate from Blood Bank as needed, based on lab results. Utilize the guidelines in section 4 to determine transfusion amounts.
- d. The nurse must complete the MTP form (BBFMG102), “Massive Transfusion Protocol Disposition Log”. Applying each individual unit number sticker on each separate line of the form is acceptable unit number documentation for each blood product transfused.
- e. If possible, continue to draw acute bleeding panel and ionized Calcium level after every 6 RBC transfusions (after each pack is completely transfused).
- f. All blood products will be administered through a large bore intravenous catheter via a warming device or rapid infuser.
- g. Monitor temperature every 30 minutes to help prevent hypothermia. In addition to using a warming device for blood infusion, utilize a warming blanket and other measures as necessary.
- h. Enter all blood / blood products that were transfused into EPIC.
- i. Continue to monitor CBC, PT, and PTT for a minimum of every 8 hours for 24 hours after termination of the MTP, or more frequently if the patient’s condition warrants.
- j. Notify the Blood Bank if the patient is transported to another area in the medical center during the MTP process (i.e., radiology, OR, ICU).
- k. Return completed MTP form and any unused blood products to the Blood Bank as soon as possible to prevent wastage.

4. Maintenance of MTP

- a. The Physician will utilize the lab (fibrinogen) results to guide cryoprecipitate transfusion decisions. Fibrinogen levels below 100 mg / dL should be corrected using the table below with the goal of maintaining a fibrinogen level greater than 100 mg / dL. Consider maintaining a level of at least 200 mg/ dL in patients with complex coagulopathy.

b. Guideline recommendations are as follows:

Blood Product	Lab Value	Blood Product Amount
Cryoprecipitate	Fibrinogen < 50	30 units
	Fibrinogen < 100	20 units
	Fibrinogen 100 - 200	10 units

5. Medication Considerations for massive bleeding

a. Tranexamic Acid (TXA)

i. In the presence of diffuse non-surgical bleeding with continuous blood product utilization requirements, TXA (an anti-fibrinolytic agent) should be considered.

ii. Dosing for TXA in trauma associated hemorrhage

a. Loading dose: 1 gm infused over 10 minutes (mix in a 50 ml NS bag)

b. Maintenance dose: 1 gm mixed in 250ml NS infused over 8 hours. Begin immediately following loading dose.

iii. Hypotension is a potential adverse effect. Infusion rate must be limited to 100 mg / minute.

b. Prothrombin Complex Concentrate: Factor IX (Kcentra)

i. In the presence of life-threatening bleeding with, known warfarin (Coumadin) use, and an elevated INR, (Kcentra) should be used to rapidly reverse the effects of warfarin (Coumadin).

ii. Vitamin K (10 mg IVPB over 20 minutes) should be administered concurrently with Kcentra to maintain Vitamin K-dependent clotting factor levels

iii. Repeat dosing with Kcentra is not supported by clinical trials and is NOT recommended.

iv. Dosing for Kcentra in trauma associated hemorrhage:

Kcentra® Dosing in Adults			
Pre-treatment INR	2 to < 4	4 to 6	> 6
Dose of Kcentra® (units of Factor IX) per kg body weight*	25	35	50
Maximum dose (units of Factor IX)	Not to exceed 2500	Not to exceed 3500	Not to exceed 5000

* Dose based on body weight but not exceeding 100 kg.

6. Termination of the MTP

- a. The MTP must be terminated by the ordering physician or his / her designee. This termination occurs when the physician notifies the Blood Bank via telephone.
- b. The nurse or designated recorder / scribe is responsible for documenting the termination of the MTP in the patient's chart.
- c. All Trauma patients who receive the MTP will be subject to Performance Improvement review to assure quality is maintained. Quality indicators will include: timeliness of blood product delivery and utilization, appropriateness of products used as per MTP guidelines, wastage, adjunct use (warmer, infuser), development of hypothermia, and documentation.

IV. Documentation

Complete Massive Transfusion Protocol Disposition Log and return a copy of the form to Blood Bank.

V. References/Authority

A. AABB Standards

B. Code of Federal Regulations

C. College of American Pathologists (CAP) Standards

D. Joint Commission Comprehensive Manual for Accreditation of Acute Care Hospitals

E. State of California Biologics Regulation

Reviewed/approved by:	
Pathology Department	September 2015
Trauma Service	September 2015
Pharmacy & Therapeutics Committee	September 2015
Clinical Policy & Procedure Committee	October 2015
Nursing Executive Council	December 2015
Medical Executive Committee	February 2016

Massive Transfusion Protocol Disposition Log

Date: ___/___/___

Page _____ of _____

Employee ID#	Taken out of Refrigerator? (circle)	Donation Identification Number (unit #)	Time Start / Finish	PRBC	FFP	PLT	Cryo	Volume	Entered in Epic (Ö)
	YES NO								
	YES NO								
	YES NO								
	YES NO								
	YES NO								
	YES NO								
	YES NO								
	YES NO								
	YES NO								
	YES NO								
	YES NO								

All units must be entered into EPIC. Please return the form to Blood Bank X3xxxx.

PATIENT LABEL HERE

(Used with permission of Miller Children's and Women's Hospital)

Long Beach Memorial Medical Center
Long Beach, CA.

BB FMG102 11-5-15

Appendix U: Sample Code Crimson Postpartum Hemorrhage Management



Note: This is a SAMPLE developed for a particular facility as an example to work from. You may need to adjust based on the individual circumstances of your facility.

SUBJECT:	Code Crimson: Management of Postpartum Hemorrhage (PPH)	
The following MemorialCare affiliates have adopted this: <input checked="" type="checkbox"/> Policy & Procedure or <input type="checkbox"/> Policy (only) or <input type="checkbox"/> Procedure (only)	<input type="checkbox"/> MemorialCare Shared Services <input type="checkbox"/> Long Beach Medical Center <input checked="" type="checkbox"/> Miller Children’s & Women’s Hospital Long Beach <input type="checkbox"/> Orange Coast Medical Center <input type="checkbox"/> Saddleback Medical Center <input type="checkbox"/> MemorialCare Medical Foundation <input type="checkbox"/> Select Health Plan <input type="checkbox"/> Memorial Medical Center Foundation <input type="checkbox"/> Saddleback Memorial Foundation	REFERENCE: PAGE: 1 OF: 2 EFFECTIVE: PENDING
	MANUAL:	
	OWNER:	Patient Care Services

I. Policy

- A. Goals for postpartum hemorrhage (PPH) management include timely optimal patient care through preparation, early identification and prompt intervention.
- B. One third of women who have a hemorrhage have no risk factors; therefore, regardless of risk factors, every birth has to be considered to have risk, reinforcing the need for universal vigilance.
- C. Code Crimson is triggered upon reaching a quantitative blood loss of 500 ml following vaginal delivery, or 1000 ml following cesarean delivery and patient is still bleeding.
- D. Code crimson is activated by any member of the healthcare team by dialing *2 and informing the PBX operator: “Code Crimson” followed by unit where the patient is bedded. Staff on that unit direct responders to the room of the event. A physician order is not required.
- E. The overhead page of Code Crimson mobilizes resources to the bedside/patient location and sets in motion evidence-based interventions based on responder role (Attachment U-1).
- F. Code Crimson responders include:
- | | |
|--------------------------------------------|-----------------------------------|
| 1. Maternal Fetal Medicine (MFM) physician | 5. Women’s OR coordinator |
| 2. OB Hospitalist | 6. Mother Baby Unit coordinator |
| 3. OB Resident | 7. Labor and Delivery Coordinator |
| 4. Women’s anesthesiologist | 8. BirthCare Center RN staff |

G. PPH evidence-based emergency response medications, suggested diagnostic testing, treatments and interventions, including activation of Massive Transfusion Procedure (MTP) are contained within the *ACUTE POSTPARTUM HEMORRHAGE OBGYN (LBM/MCH) [1254] order set*.

H. Standardized PPH Carts are stocked and available for emergency use in Labor & Delivery (L&D), Women's Operating Room (WOR), BCC PACU and Mother-Baby Unit (MBU).

I. Evidence based PPH emergency response medications are immediately available in all obstetrical units.

J. It is generally expected that most PPH events will occur in the BirthCare Units, however, the other locations where an PPH event could occur are in the Long Beach Medical Center (LBMC) Emergency Department, Intensive Care Unit (ICU), Critical Cardiac Unit (CCU), Post Anesthesia Recovery Unit (PACU) or Operating Rooms (OR).

1. An OB care team consisting of an OB RN and physician provide initial obstetrical assessment, interventions, and documentation appropriate to the clinical situation, which includes guidance on the management/oversight of the PPH and activation of Code Crimson in the ICU/CCU and OR/PACU.
2. OB RN will continue to be available of ongoing obstetrical assessments as needed, including needs and provision for lactation assistance.

K. Escalation: The Labor and Delivery team of obstetricians, nurses and anesthesiologists are generally considered as first responders, but there may be a number of clinical circumstances which require consultation with other specialties and transfer to a higher level of care. The Maternal Fetal Medicine physician who responds to the Code Crimson event determines if patient requires specialized interventions not available in the BirthCare Units and collaborates/consults with providers in those specialty units to ensure both obstetrical and medical conditions are being addressed.

L. All staff and providers who treat pregnant/postpartum patients will receive role-specific education regarding the hospital's evidence-based PPH procedures at orientation, whenever changes to the procedure occur, or every two years.

II. Definitions

A. BMI: body mass index

B. Code Crimson: The term used to define the management of PPH events in the BirthCare Center (BCC).

C. Code Crimson Stage 1: QBL > 500 ml for Vaginal delivery or > 1000mls for Cesarean Section AND still bleeding.

D. Code Crimson Stage 2: QBL > 1500 ml Vaginal Delivery or Cesarean Delivery AND still bleeding.

E. Massive Hemorrhage: Blood loss of 1500 ml or greater regardless of mode of delivery

F. Massive Transfusion Procedure (MTP): MCWH Policy, Massive Transfusion Procedure, PL-524 addresses the appropriate mix of blood and blood components for a patient experiencing significant blood loss. Implementation of the MTP is indicated for a patient who is likely to require the rapid transfusion of greater than 6 units of blood and blood components within two hours and has the potential to progress to consumptive coagulopathy and uncontrolled hemorrhage.

G. Postpartum Hemorrhage (PPH): The cumulative blood loss of greater than 500 ml with vaginal birth or greater than 1000 ml with cesarean birth

H. QBL: Quantified Blood Loss determined by direct measurement in graduated containers or by weight of blood-soaked items.

III. Procedure for birthcare units

A. Equipment required:

1. Scale
2. PPH Cart (See cart checklist in related documents)
3. Calculator

B. Evaluate hemorrhage risk factors upon admission, after delivery, prior to transfer, and thereafter once per shift.

C. Verify blood type and antibody screen from prenatal record.

D. Verify that patient will accept blood/blood products and document acceptance in the electronic health record (EHR).

E. For patients who indicate non-acceptance of blood:

1. Provide educational handout A patient's guide to blood transfusion.
2. Obtain signature on the refusal to permit blood transfusion form.
3. Determine what, if any, alternative treatments and/or therapies the patient will accept.
4. Inform the primary care provider of patient's refusal status and what alternative treatments and/or therapies the patient will accept.

F. Obtain physician order(s) for the blood bank based on the following conditions/PPH Final Risk Assessment result:

1. Low - medium risk, order Type and Screen.
2. High risk patient, order Type and Cross match for 2 units Packed red blood cells (PRBC).
3. If antibody screen positive (not low-level anti-D from Rho-GAM), order Type & Cross match for 2 units PRBC.

G. Obtain patient consent when blood transfusion is ordered.

H. Ongoing Risk Assessment:

1. Notify the physician to update orders when additional hemorrhage risk factors are identified after prior assessment that would change the PPH Risk Assessment score.
2. Consider classification of patients with multiple risk factors as high risk.

I. Perform Quantification of Blood Loss (QBL) (see Attachment U-2), at delivery, the immediate postpartum period, and in delayed postpartum hemorrhage events. QBL is a team effort.

J. Preferred methods and processes for QBL include weighing of blood-soaked items and direct measurement with graduated collection devices as described in Attachment U-2.

K. When QBL meets Stage 1 Code Crimson criteria, activate and initiate interventions, including uterotonic medications for uterine atony and any blood products to infuse, with physician order, as described in Code Crimson response matrix Attachment U-1.

L. When QBL meets Stage 2 Code Crimson, escalate interventions as defined by the response matrix Attachment B, which may include activation of Massive Transfusion Procedure (MTP).

M. Initiate order set ACUTE POSTPARTUM HEMORRHAGE OBGYN (LBM/MCH) [1254] and/or see policy Blood and Blood Components: Emergent/Massive Transfusion Procedure (MTP): Adult (PL-524).

N. Provide support to mother and partner in care by:

1. Allowing families and/or partner in care to remain present during the event whenever possible for added emotional support of the mother. If families must separate (return to the OR, infant to the nursery, transfer to another department) make every attempt to provide an estimate for when they may be reunited.
2. Providing full information to patient and partners about the medical condition and prognosis of both the mother and the infant as it happens and as it continues.
3. Reassure patients and families and provide social services or spiritual care referrals when appropriate.

O. For all cases of ongoing hemorrhage, document, tally, and report intake and output measurements to the team at frequent intervals.

P. Initiate a team debrief for Code Crimson Stage 2 events utilizing the MCWH debriefing tool.

1. Upon completion of the debriefing tool, return form to designated location on the unit.
2. Collect forms regularly and send to the Perinatal Performance Improvement Patient Safety Collaborative Committee for review of effectiveness of the care, treatment, and services provided by the hemorrhage response team.

Q. Provide education to all patients (and their families including the designated support person whenever possible) about the signs and symptoms/when to alert the healthcare team of postpartum hemorrhage (sudden gush of blood or clots, heavy bleeding into pad, lightheadedness or dizziness).

R. At discharge, provide printed discharge instructions with the signs and symptoms of delayed postpartum hemorrhage and when to seek immediate care. Review these instructions with patient and their support person (if possible) to validate understanding.

IV. Documentation

A. Document in the EHR:

1. PPH risk assessments.
2. QBL:
 - a) Record Method of Quantification as “Direct measure” or “Weight of blood-soaked items”.
 - b) Complete QBL documentation in the EHR by the primary care RN or designee. Record ongoing quantification of blood loss during delivery and in the immediate postpartum period routinely for all patients.

c) Blood loss recorded on the Delivery Summary or on the Recovery Record will appear on Intake & Output (I&O) Report and Hemorrhage Report in the EHR.

d) After completing calculations, record volume of blood loss in EHR. For cases of ongoing hemorrhage, calculate intake and output measurements, document sequentially in the EHR and report to the team at frequent intervals.

3. Code Crimson/PPH interventions and a significant event note by the primary care RN and/or the designated scribe.

V. References/authority

A. Association of Women's Health and Obstetric and Neonatal Nursing Practice Brief: Quantification of Blood Loss: AWHONN Practice Brief Number 1; Nursing for Women's Health. (Feb-Mar 2015) 19 (1):96-98.

B. California Maternal Quality Care Collaborative (CMQCC) Improving Healthcare Response to Obstetrical Hemorrhage Version 2.0. A California Quality Improvement Toolkit. (2015)

C. Main, E. K., Goffman, D., Scavone, B. M., Low, L. K., Bingham, D., Fontaine, P. L., Gorlin, J.B., Lagrew, D.C. & Levy, B. S. (2015). National partnership for maternal safety consensus bundle on obstetric hemorrhage. *Journal of midwifery & women's health*, 60(4), 458-464.

D. Shields, L. E., Goffman, D., & Caughey, A. B. (2017). Postpartum Hemorrhage. *Obstetrics and Gynecology*, 130(4), E168-E186.

E. Smith, C. M., Borders, A. E., & King, T. L. (2019). ACOG committee opinion no. 794. Quantitative blood loss in obstetric hemorrhage. *Obstet Gynecol*, 134(794), 150-156.

Attachment U-1

CODE CRIMSON Stage 1: QBL > 500ml Vaginal Delivery Or > 1000ml Cesarean Section AND STILL BLEEDING										
Responder	Time	Primary RN:	L&D/MBU Coord:	QBL Role:	Scribe Role:	2nd RN:	OB First Responder:	Anesthesiologist:		
Tasks		Call *2 = Code Crimson	To bedside-Receive SBAR	QBL w/Call Out q5-10min	Begin Scribe	OBH Cart to Location	To bedside-Receive SBAR	To bedside-Receive SBAR		
		Continuous Fundal Massage	Assign Roles to Responders w/Call Out			Ensure IV access/#16 or 18g-restart/2nd line/Labs	Patient assessment	Ensure IV access #16 or 18g-restart/2nd line/Labs		
		VS w/Call Out q5-10min	Request Primary OB to bedside			Apply Warm Blankets	Assist/support Primary OB	Provide Pain Management		
		Apply O ₂ & Pulse Ox	Provide Family Support. Notify Social Services for follow up.			Administer meds as directed per MD:	Bimanual uterine massage	Assist/Manage/Direct Hemodynamic Intervention in tandem with MFM		
		SBAR to Responders	L&D Coordinator will bring ultrasound machine to location of event.			Methergine 0.2mg IM (methylergonovine maleate) (Do not give if asthmatic)	Provide orders as appropriate			
		Standardized PPH dosing of IV Dose				remabate 250mcg IM (carboprost tromethamine) (Do not give if asthmatic) ; may repeat q20min	Perform procedural interventions as required			
		Per MD order, initiate ACUTE POSTPARTUM HEMORRHAGE OBGYN (LBM) [1254] order set.					TXA 1gm IV in 10ml over 10min (tranexamic acid = Cylklok apron) (May repeat if still bleeding p30min or stopped and restarted within 24hrs of the first dose)	Decision to move pt to higher level of care and/or location		
		If MTP activated per MD order, initiate Adult Rapid Response Team (RRT) to run Rapid Infuser via *2 call.					Cytotec (Misoprostol 1000mcg per rectum)			
		Adult Rapid Response Team (RRT) *2					Insert Foley Catheter w/ Urimeter			Delivery Time: _____
							Obtain Blood Warmer			Delivery QBL: _____
						Notify Blood Bank / Type&Cross / Obtain blood products & administer via blood warmer per MFM Order				
Code Crimson Pages To: L&D Coordinator, MBU Coordinator, WOR Coordinator, OBC Resident, MFM Physician and Anesthesiologist.										
CODE CRIMSON Stage 2: QBL > 1500ml Vaginal Delivery Or Cesarean Section AND STILL BLEEDING										
Responder	Time	Primary RN/Circulator:	L&D/MBU Coordinator:	QBL Role:	Scribe Role:	2nd RN/Circulator:	RRT (RN/RCP/House Sup):	OB First Responder:		
Tasks		Move pt to next location	Activate MTP per MD Order/Notify RRT	QBL with Call Out q5-10min	Continue scribe	Apply SCDs	To bedside-Receive SBAR	Procedural / Surgical Interventions		
		Assist Anesthesiologist	Notify DR/IR			Apply Bair Hugger	Activate MTP per MD Order			
			Notify 2nd Anesthesiologist			Repeat Labs per MD Order	Transfuse via Rapid Infuser	Anesthesiologist:		
			Notify Social Services & Spiritual Care				ISTAT as appropriate	Continue pain management		
								Assume hemodynamic management		
								Assume VS w/Call Out q5-10min		

WOR Desk x32740	L&D Coordinator x85120	ICU Desk x37180	CCU Desk x33003	Blood Bank x30815	Central Equipment Supply x81395
WOR Coordinator x82128	MBU Coordinator x35898	ICU RN Cisco x82569	CCU RN Cisco x82405	Venipuncture x30744	Central Supply x31957
Anesthesia x85126				Interventional Radiology x31550	

Attachment U-2

Quantitative Blood Loss Methods and Procedures in the Obstetrical Patient

1. Measure by weight of blood-soaked items. This is the most accurate and practical method of determining blood loss. Blood loss: 1 gram = 1 mL

Vaginal Delivery

- ▶ At the conclusion of the delivery, weigh sponges, underpad, and other bloody items.
- ▶ Place underpad or red bag on scale and “zero”.
- ▶ Place bloody items on underpad or in red bag and record weight.
- ▶ Refer to dry weights of common items posted on scales.
- ▶ Calculate total dry weight and subtract from weight of bloody items.
- ▶ Add amount of blood loss determined by weight plus amount determined by direct measure (see number 4. below for direct measure) and record on Delivery Summary.
- ▶ Identify method of quantification as “Weight of blood-soaked items” and “Direct measure” in the EHR.

Cesarean Delivery

- ▶ During a case, OR Scrub staff passes bloody lap sponges off scrub table.
- ▶ Circulator places in hanging lap sleeve bags (5 sponges/sleeve), see policy Count Policy, PC-062.
- ▶ Zero scale prior to weighing bloody sponges/lap sleeves.
- ▶ Circulator weighs bloody sponges and lap sleeve bags all together near end of case (sponges left in sleeves).
- ▶ Enter total weight, # sponges weighed, # hanging sleeves weighed, in EHR calculator.
- ▶ EHR auto calculates QBL from entered data.

Immediate Postpartum Vaginal or Cesarean Delivery Recovery Period

- ▶ Following delivery, use standard pack of items with known dry weight (underpad, absorbent pad, peri-pad, ice pack, etc.).
- ▶ At the conclusion of the recovery period, or sooner if excessive blood loss is suspected, or at any time of removal/changing of peri-pads, weigh all bloody items.
- ▶ Place clean underpad or red bag on scale and “zero” the scale.
- ▶ Place bloody items on underpad or in red bag and record weight.
- ▶ Refer to dry weights of standard pack and other common items posted on scales.
- ▶ Calculate total dry weight of items and subtract dry weight from weight of blood-soaked items.
- ▶ Record blood loss on Recovery Record.
- ▶ Record Method of Quantification as “Weight of blood-soaked items”.

2. Direct Measure (measured with graduated containers)

Vaginal Delivery

- ▶ Use graduated “pouch” under the buttock’s drapes for vaginal deliveries.
- ▶ Physician or nurse notes the volume in the pouch at the time of delivery of the infant whenever clinically possible (attributed to amniotic fluid, amnioinfusion, and/or urine).
- ▶ Upon completion of delivery of the placenta, immediate stabilization and repairs, note the volume in the pouch.

- ▶ Subtract the volume at the time of delivery from the final volume.
- ▶ In most deliveries, rupture of membranes has occurred well before delivery of the infant. Therefore, amniotic fluid volume collected in the pouch is usually minimal. If such is the case, even if volume is not noted, record QBL by direct measure after delivery of the placenta.
- ▶ Add amount of blood loss determined by direct measure plus the amount determined by weight, if any (see number 3 for weight measurement.) and record on Delivery Summary in the EHR.

Cesarean Delivery

- ▶ Set up a surgical suction system and set to “zero” prior to start of surgery.
- ▶ After delivery of the infant, but before delivery of the placenta, scrub tech and/or assistant surgeon suction amniotic fluid into the system’s canister and circulator either notes the volume in the canister or resets the cannister to zero.
- ▶ Before use of any irrigation, note the volume in the system cannister, and subtract the volume at the time of delivery (amniotic fluid) from the final volume (if the cannister wasn’t zero’ d).
 - a) If cannister volume was not obtained prior to use of irrigation, subtract irrigation volume used from the cannister volume.
- ▶ Add amount of blood loss determined by direct measure plus the amount determined by weight.
- ▶ Report final volume to anesthesiologist for documentation in the EHR.

Attachment U-3

Inventory: Obstetric Hemorrhage Cart Expiration Log Month: _____

Year: _____

Drawer 1			Drawer 4		
1	Tamponade Balloon-EBB	EXP	1	IV pressure bag	
1	Tamponade Balloon -Bakri	EXP	2	IV start kit (macro)	EXP
			1ea	Med Adm kit: TXA, methylergonovine, carboprost	EXP
2	60 ml syringes	EXP	2	21 gauge 1" needle	EXP
			2	21 gauge 1.5" needle	EXP
1	500 ml NS	EXP	-	-	-
1	1000 ml NS	EXP	3	Filter needles	EXP
1	Dry erase marker		2	IV cath #16	EXP
	MEDs ALL AVAILABLE IN ACUDOSE		4	IV cath #18	EXP
	OBH MED BOX:		1	1000 ml LR	EXP
	Select Patient, then OVERRIDE, you will see		1	1000 ml NS	EXP
	OBH Meds. Pull the whole package of meds		1	500 ml Normal Saline	EXP
2	Yellow locks for after cart is stocked		1	Y-type blood set with pump	EXP
Drawer 2			2	Twin-site extension set	EXP
3	Ring forcep (sponge stick)	EXP	1	Trifuse extension set	EXP
			2	Primary IV set (pump tubing)	EXP
			2	Primary IV set (free flow)	EXP
2	Vaginal packing (2 inch)		1	Transfusion Recommendations	
2	Mini-Lap sponges		2	Lab draw set w/3 tubes (red,blue,lavender/covers coag's/cbc)	EXP
				Additional Lab tubes in the drawer(CMP:add mint green;T&C:add pink)	EXP
2	Large lap sponges			Please list earliest EXP date of all lab tubes	
			1	Lab Test Guide (hanging on cart)	
			4	Blunt fill needles	EXP
1	Medium Speculum		2	10ml syringes	EXP
1	Large Speculum		2	5 ml syringes	EXP
			2	3 ml syringes	EXP
1	Hunters or Bumm curette		1	1 ml syringe	EXP
1	Right angle retractor		2	NS flush 10ml syringe	EXP

1	Jackson retractor			Alcohol wipes/Gauze 2x2's/ tape	
1	Eastman retractor			-	-
			1	Betadine	EXP
1	Flashlight (open and check batteries)	EXP	Drawer 5		
			1	Foley catheter kit 16 fr	EXP
Drawer 3			1	Drainage bag (for tamponade balloon)	EXP
2 ea	Sterile gloves size 6, 6 ½, 7, 7 ½, 8, 8½	EXP	1	Urometer with bag (for foley)	EXP
6	Lubricating jelly	EXP	1	Rapid Infuser set up	EXP
			1ea	All BP cuff sizes	
2	Surgical Gowns		2	Stethoscopes	
2	Gown Sleeves		1	Oxygen mask	
3	Mask w/shield		4	Pulse Ox sensor	EXP
	-	-	1	Oxisensor cable	
2	Red bio-hazard bags (or roll is fine)		1	Bedpan	
			1	Pillow case	
			1	Utz Gel	EXP
			1	Pkg of White or blue chux	
				B-Lynch sutures: 0 & #1 Vicryl on CTXB	EXP
				B-Lynch sutures: #1Vicryl on CTB-1	EXP
				WEIGHTED speculum	
Top Side of Cart					
	Bakri instructions			Scale	
	EBB instructions			Calculator	
	Code Crimson Workflow			OBH binder	
				MTP instructions	
<p>FIRST OF THE MONTH: open cart and check all supplies; any to expire in the month REPLACE. Please mark the date of all items with an expiration. This current month log sheet is to be kept in the OBH Binder ON the OBH cart. To be filed with Daily Cart Log at the end of the month.</p>					
Thank you for being part of the solution :)			Women's.CARTS. OBHemorrhage Cart 1.07.2020		

Appendix V: A Guide to Recognizing Acute Stress Disorder in Postpartum Women in the Hospital Setting

Introduction

The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (APA, 2013) outlines the criteria for Acute Stress Disorder, beginning with the first criterion that a person must be exposed to actual or threatened death or serious injury; for many women, giving birth fits this standard. While some women can experience normal childbirth as traumatic, women who experience birth traumas such as postpartum hemorrhage and other complications are at an even greater risk of having a traumatic stress response following childbirth. In order to give postpartum women the services and support they need, it is imperative that healthcare professionals recognize the signs of Acute Stress Disorder, **note them accurately in the patient’s chart**, and enlist the help of a mental health professional immediately. Because women who have experienced birth trauma must temporarily remain in the setting in which the trauma occurred (i.e., the hospital), it is vital that professionals recognize signs of traumatic stress early and provide necessary support.

Signs of Acute Stress Disorder

Symptom	Behavioral Signs	Support Needed
Intrusion Symptoms (Memories, dreams, flashbacks)	A woman can re-experience the birth trauma by having <i>involuntary</i> recurrent images, thoughts, illusions, dreams/nightmares, and/or flashbacks related to the event. Intrusive symptoms can be a cause of sleep difficulty and can exacerbate symptoms of anxiety and depression (such as poor concentration, hyper vigilance, exaggerated startle response, and negative mood). Signs can include agitation upon waking and fitful sleep.	<p>Do: If you suspect your patient is experiencing intrusive symptoms, consult with a mental health professional. Ask sensitive, open-ended questions about her current state, such as “I noticed you tossed and turned in your sleep last night. How was your sleep?”</p> <p>Avoid: Being insensitive, dismissive, or judgmental. Do not say things such as “it’s over, just don’t think about it,” or “try to think happy thoughts before you fall asleep.”</p>

Continued on next page...

Symptom	Behavioral Signs	Support Needed
Distress with Exposure to Stimuli	While still in the hospital, a postpartum woman who has experienced birth trauma will be surrounded by stimuli related to the event. Signs of distress can be physical (accelerated heart rate, perspiration) or can manifest as irritability, fear, or unwillingness to comply with requests; an exaggerated startle response to stimuli can be seen. Stimuli that can trigger distress include alarms/beeping or other sounds, medical instruments, medical professionals who were present during the trauma, bright lights, smells, and procedures.	<p>Do: Recognize that your patient has experienced a jarring medical event and that it could have been traumatic for her. Many aspects of the hospital environment were present during her traumatic event, and she is still in this environment. Be sensitive and use a warm voice when providing instructions, etc. Do not force any intervention. If patient shows signs of significant distress, contact a mental health professional.</p> <p>Avoid: Forcing any procedure or saying things like “You just need to comply – it’s for your own (or your baby’s) good.”</p>
Negative Mood	Inability to experience positive emotions. The woman may show little to no joy during time with her baby or family. She may be detached or seem numb to the events happening around her; aloof; withdrawn. Women who have experienced birth trauma can feel a flood of different and sometimes conflicting emotions, including: Fear, sadness, terror, guilt, disappointment, happiness, anger, elation, joy, sorrow, embarrassment, and confusion. She may express these different emotions at times, or be overwhelmed by them and express nothing, seeming numb, cold, or detached.	<p>Do: Gently “check in” with your patient, inquiring about how she is feeling (not only physically, but emotionally). Ask her if she would like to speak to someone about her feelings and try to normalize this for her (sometimes a woman might refuse because she feels a stigma for talking to a counselor). A woman can benefit from verbalizing her thoughts, feelings, and experiences about the trauma – if she feels safe in doing so.</p> <p>Avoid: Do not say things like: “Cheer up!” “Put on a happy face!” or “You should be glad or grateful that you survived/your baby survived/that the bad part is over.” These only minimize the patient’s feelings and could shame her into staying silent about her inner experiences.</p>

Continued on next page...

Symptom	Behavioral Signs	Support Needed
<p>Dissociative Symptoms (altered sense of reality or disturbance in memory)</p>	<p>When dissociation occurs, it can seem like your patient is “out of it” or spacey, dazed, robotic, or confused about basic facts or her surroundings. Sometimes people lose concept of time (which can easily happen in the hospital setting). Some women might speak of an “out-of-body” experience, like floating above one’s own body or seeing the procedures happening to them. When patients experience flashbacks, they may have significant distress after seeing images, reacting as if the event were actually occurring.</p>	<p>Do: Be calm and clear with your communication and be accurate when entering psychosocial comments in her records. Pay attention to her behaviors and document them appropriately. Dissociative symptoms exist on a continuum: your patient can seem a little dazed, or at the extreme, she can lose complete awareness of her surroundings. It is important to consult with a mental health professional immediately if you see signs of dissociation.</p> <p>Avoid: Minimizing or ignoring these symptoms or trying to distract your patient from these experience by suggesting she “just watch TV to get her mind off of it.” Do not mistake dissociation for normal, compliant, or agreeable behavior. These are serious symptoms that need to be addressed by a mental health professional.</p>
<p>Avoidance Symptoms (Avoiding distressing memories/ thoughts/ feelings or external reminders of the event)</p>	<p>Women who have experienced birth trauma may attempt to avoid any memories or discussion about the birth experience or may try to avoid reminders of the experience. She may refuse certain procedures, parts of the hospital, people who were present during the trauma – and at the extreme – she may want to avoid spending time with the baby.</p>	<p>Do: Be sensitive to your patient’s feelings, recognizing her current context. Stay focused on providing excellent care and be calm and direct when requesting compliance. While it is important to be supportive, it may also be necessary to challenge your patient to follow her plan of care. You may need to consult with a mental health professional.</p> <p>Avoid: Forcing your patient to comply, or to “face her fears” regarding specific reminders of the trauma. Statements such as “There is nothing to be afraid of!” or “You just have to do it!” are not supportive of your patient.</p>

Continued on next page...

Symptom	Behavioral Signs	Support Needed
Arousal Symptoms		
Sleep Disturbance	Insomnia is common following a trauma. Signs of high arousal following a birth trauma can include fitful sleep or inability to go to sleep, which can indicate nightmares or an overly-active sympathetic nervous system.	<p>Do: Ask her how she slept, and if she is having any problems with both the amount and the quality of her sleep.</p> <p>Avoid: Assuming that because her eyes are closed, she is asleep. After a birth trauma, your patient may often need to lie quietly with her eyes closed – with little stimulation.</p>
Poor concentration	Because of the intense stimulation and activation of the sympathetic nervous system that occurs during a birth trauma, a woman may have difficulty concentrating on cognitive tasks or stimuli. She may ask you to repeat information or instructions several times or seem aloof with medical professionals or family/friends.	<p>Do: Be patient if you need to repeat information or instructions, recognizing her current emotional state. Ask her if she is having any difficulty concentrating, and if there is anything you can do to help.</p> <p>Avoid: Taking it personally or getting agitated/impatient if you have to alter your communication to meet her current needs.</p>
Hyper vigilance and Exaggerated Startle Response	Because of a birth trauma, a woman can become hypersensitive to stimuli around her. As a result, her behaviors can become exaggerated in an attempt to detect threats in the environment. Her sympathetic nervous system was likely activated for an extended period of time during the trauma, and her instinct is to protect herself at signs of threat. A traumatized individual can react instantly to stimuli that might not bother others, such as sudden noises or movements. Signs of exaggerated startle response include jumping, flinching, shaking, and accelerated heart rate in response to stimuli such as sudden speech or movements by others, noises from hallway, alarms or beeping, and physical connection.	<p>Do: Keep your movements careful. If you notice hyper vigilance and an exaggerated startle response in your patient, you should slow down your pace and be mindful of noise, bright lights, and effects of physical touch. Ask her about preferences and make accommodations if possible. This may include turning down alarms/monitors or dimming the lights. If you notice these symptoms, consult a mental health professional.</p> <p>Avoid: Doing “business as usual” when your patient is clearly negatively impacted by stimulation. Do not make off-hand remarks such as “Wow! Aren’t you jumpy today!” or any other statement that would minimize her current state.</p>

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General Suggestions

If your patient has experienced a birth trauma, she has been through a difficult, painful, and scary experience. If she experienced a postpartum hemorrhage or other serious complication, she may have felt close to her own death and feared for the wellbeing of her newborn. *While these situations require the help and guidance of a mental health professional*, there are ways that medical professionals can help support the healing of women who have experienced birth traumas.

A few general guidelines include:

- ▶ Maintain empathy. Remain cognizant of your patient's experience and of the many intense emotions she may be feeling;
- ▶ Communicate with warmth and patience;
- ▶ Stay focused on her treatment. Avoid engaging in sidebar conversations with other staff members;
- ▶ Minimize discomforts and harsh stimuli;
- ▶ Ask her how she is feeling – *emotionally*. Ask her if she would like to speak with someone; and
- ▶ Know the signs of Acute Stress Disorder and enlist the help of a mental health professional.

This appendix was adapted from the Improving Health Care Response Obstetric Hemorrhage: A California Quality Improvement Toolkit, funded by the California Department of Public Health, 2015; supported by Title V funds.

(Used with permission of Michelle Flaum, EdD, LPCC-S, Xavier University)

Appendix W: Patient and Family Support Checklist for Postpartum Hemorrhage

Patient and Family Support Checklist for Postpartum Hemorrhage



Insert Hospital
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Supporting patients and families during a serious maternal event is a vital aspect of patient care. Use this checklist to help ensure patients and their family members have their emotional needs met when a postpartum hemorrhage occurs.

Prior to the Event

- Identify a staff person who will provide continuous updates to the family and facilitate completion of the below listed support items. ***Whenever possible, identification of this person should occur during morning huddle (using a previously prescribed process) so that the assigned individual is immediately ready to support families in the event of an emergency. ***

Immediately Following the Event

- Introduce yourself and your role to the family
- Offer to move the family to a new room, away from where the hemorrhage took place; explain that the purpose of maintaining soiled linens etc. is to enable accurate measurement of blood loss
- Explain to the family what has happened and what they can expect to occur in the next few hours, including the length of surgery (if applicable) and how often you will be in touch with them (at least every hour); provide them with your contact information; act as a liaison between the family and other units in order to provide timely updates

If the Patient is in Critical Care

- Prepare family members for what they might see (e.g., patient is intubated)
- Communicate with the family about what the patient already knows (e.g., does she know she's had a hysterectomy)
- Provide the patient with updates about her baby and provide pictures, etc.; if possible, bring baby to patient and identify ways she can be involved with the care of her baby (e.g., first bath)
- If patient is intubated or unable to speak clearly, provide a whiteboard or comparable way for her to communicate
- Ask patient what her needs are and facilitate support (e.g., ensure mom wanting to breastfeed has lactation support)
- Assess patient's understanding of her medical status/care plan and provide support as needed (e.g., patient may fear extubation and need reassurance from clinician)
- Offer emotional support by way of a social worker, psychologist or chaplain

Prior to Discharge

- Acknowledge the trauma of what the patient has experienced and provide anticipatory guidance to patient and family regarding physical and emotional recovery
- Provide postpartum resources about "what to expect" after discharge (e.g., PQCNC resource, *Life After Postpartum Hemorrhage*)
- Encourage early follow-up with provider upon discharge
- Invite patient to schedule time with her provider to debrief the event

Appendix X: Life After Postpartum Hemorrhage

Life After Postpartum Hemorrhage

Use this tool to learn what to expect and to identify topics you would like more information on.



Insert Hospital
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		I Would Like More Information About This Topic
Key Points about Postpartum Hemorrhage (PPH)	Losing a lot of blood quickly can cause a severe drop in your blood pressure. It may lead to shock and death if not treated.	<input type="checkbox"/>
	Quickly finding and treating the cause of bleeding can often lead to a full recovery.	<input type="checkbox"/>
	Postpartum hemorrhage can occur up to 12 weeks after birth. Talk to your healthcare provider about your risk and symptoms to watch for.	<input type="checkbox"/>
Physical Recovery	Losing a lot of blood can leave you feeling tired and weak. Your provider may want to do tests to find out how your body is coping with blood loss. This will help them decide what treatment to recommend.	<input type="checkbox"/>
	When your body is having trouble coping with blood loss, it is normal to: <ul style="list-style-type: none"> • Feel weak and get tired more easily • Feel dizzy • Be grumpy, cranky or angry • Have headaches • Look very pale • Feel out of breath • Have trouble focusing or concentrating • Have ringing in ears 	<input type="checkbox"/>
	If you have any of the symptoms listed above, your healthcare provider may want you to take iron. If your iron levels are very low, you may be offered iron by injection, IV or even a blood transfusion.	<input type="checkbox"/>
	Even if you are taking iron pills, your diet can be an important source of iron. Examples of iron-rich foods include: beef, shrimp, spinach, lentils, and almond butter.	<input type="checkbox"/>
		<input type="checkbox"/>
Emotional Recovery	The “baby blues” and postpartum depression and anxiety can affect anyone. You may be more likely to have postpartum depression, anxiety or even post-traumatic stress disorder (PTSD) after a postpartum hemorrhage.	<input type="checkbox"/>
	Some symptoms of postpartum depression, anxiety and PTSD include: <ul style="list-style-type: none"> • Feeling low (depressed mood) or angry most days • Loss of interest in activities that you used to enjoy • Having trouble concentrating • Having trouble falling asleep or staying asleep • Anxiety or excessive worry • Loss of confidence or self esteem • Loss of appetite or overeating • Recurrent thoughts of suicide or death • Reliving the event 	<input type="checkbox"/>
	If you have any of the symptoms listed above, contact your healthcare provider right away.	<input type="checkbox"/>
	Whether you’ve had a hysterectomy or face a higher risk of postpartum hemorrhage with future pregnancies, there is often a grieving process to work through. Talk to your healthcare provider about support available.	<input type="checkbox"/>

Continued on next page...

Call Your
Healthcare
Provider

	I Would Like More Information About This Topic
If you have heavy bleeding that soaks 1 maternity pad in an hour for 2 hours in a row.	<input type="checkbox"/>
If you pass large blood clots.	<input type="checkbox"/>
If you are breathing faster than normal, or your heart is beating faster than normal.	<input type="checkbox"/>
If you are urinating less than usual, or not at all.	<input type="checkbox"/>
If you feel dizzy.	<input type="checkbox"/>
If you have questions or concerns about your condition or care.	<input type="checkbox"/>

Go to the
Emergency
Department

If you have heavy bleeding that soaks 1 maternity pad in 15 minutes or less.	<input type="checkbox"/>
If you are suddenly short of breath and feel lightheaded.	<input type="checkbox"/>
If you have sudden chest pain.	<input type="checkbox"/>

Some women find it helpful to speak with their healthcare provider about the events surrounding their hemorrhage after they have had time to heal. Having this opportunity after you leave the hospital can help you fill in gaps of time you don't remember and allow for answers to questions that didn't come up until after you spent some time at home. If you would like an opportunity to meet with your healthcare provider, we encourage you to call his or her office to schedule an appointment when the time feels right to you. Be sure to let the scheduler or your provider's nurse know what information you would like to receive during the appointment, so that your healthcare provider can come prepared to answer your questions.

Your Steps to Success



BUILD

Build a team to support you that includes trusted providers, friends and family, and peer support.



LEARN

Learn what to expect and what you can do to advocate for your physical and emotional health and well-being.



SHARE

Share your informational and emotional support needs with your healthcare provider.



SUCCEED

Partner with your support team to make a plan for addressing your physical and emotional needs.

Visit www.pqcnc.org to learn about North Carolina's Postpartum Hemorrhage Initiative (AIM OBH) and to find out how patients and families are partnering with healthcare providers to help make North Carolina the best place to give birth and be born.



Resources for Postpartum Hemorrhage Survivors



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Women who have had a Postpartum Hemorrhage (PPH) often have many informational and emotional needs after they leave the hospital. This list of resources was compiled by women who have experienced a hemorrhage following the birth of their child. It includes a selection of websites and online support groups that they have found helpful.

After the ICU: <http://www.aftertheicu.org/>

This site was created by a group of doctors, former patients and other healthcare professionals, working together to provide Intensive Care Unit (ICU) patients, their families and other medical professionals with information about the road to recovery after critical illness. Resources are provided that address physical, emotional and cognitive needs following an ICU discharge.

After Trauma: <http://www.aftertrauma.org/>

This site is meant to provide a community for survivors of traumatic injury and their families to support and connect with one another. Information and resources are also provided to help survivors and families on the recovery journey.

Amniotic Fluid Embolism Foundation: <http://afesupport.org/>

This site includes resources for family members (caregivers), survivors, and those who have experienced a loss related to Amniotic Fluid Embolism (AFE). Guides and resources help survivors and families from the crucial moments after AFE, through the hours, days and weeks following.

Birth Trauma Association: <http://www.birthtraumaassociation.org.uk/>

Resources on this site are meant to support women who have suffered difficult births by offering information, advice and peer support to all women who are finding it hard to cope with their childbirth experience.

Healthtalk.org: <http://www.healthtalk.org/peoples-experiences/pregnancy-children/conditions-threaten-womens-lives-childbirth-pregnancy/topics>

This section of healthtalk.org addresses the experience of conditions that threaten women's lives in pregnancy and childbirth by seeing and hearing people share their personal stories on film. The Teaching Resources area of the site includes key learning messages from interviews with patients who have experienced a near miss.

Hope for Accreta: <http://www.hopeforaccreta.org/>

This site includes photos and stories submitted by Accreta survivors, as well as helpful links and ways to connect with peers both virtually and through local chapters.

March of Dimes: <http://www.marchofdimes.org/pregnancy/postpartum-hemorrhage.aspx>

This section of marchofdimes.org discusses the signs and symptoms, risk factors and treatment of postpartum hemorrhage. Information regarding related conditions is also provided.

Medically Induced Trauma Support Services: <http://www.mitss.org/>

The Medically Induced Trauma Support Services (MITSS) site includes a section devoted to patients and families. Resources focus primarily on therapeutic needs and support. In addition to accessing informational support, visitors to the site can read or watch videos of patient and family stories and connect to online support groups.

Postpartum Support International: <http://www.postpartum.net/>

The site provides links to information about perinatal mood and anxiety disorders, including risk factors, symptoms and treatments. Visitors to the site are able to identify local resources, chat with an expert or join an online support group. Highlights include resources for special groups such as military families, women of color, fathers, and more.

Preeclampsia Foundation: <https://www.preeclampsia.org/get-support>

This site includes multiple resources on preeclampsia and other hypertensive disorders of pregnancy. Visitors can link with health experts for advice and connect with other preeclampsia survivors through the Community Forum or Share Your Story thread.

Prevention and Treatment of Traumatic Childbirth (PATTCh): <http://pattch.org/>

Information on this site helps explain the components of traumatic birth and describes the symptoms, risk factors, treatment and prevention of traumatic birth.

Solace for Mothers: <http://www.solaceformothers.org/>

The resources available through this site are meant to offer immediate, personal support to mothers and others who are struggling with birth trauma, PTSD after childbirth and anxiety caused by their birthing experiences.

Facebook Support Groups

HFA Hysterectomy due to Childbirth Support Group: <https://www.facebook.com/groups/787583127981280/>

This is a Facebook Group for women who required a hysterectomy due to childbirth.

Maternal Near-Miss Survivors: <https://www.facebook.com/groups/maternalnearmiss/>

This Facebook Group is designed to be a safe place where survivors of a maternal near miss find comfort and offer support to one another. A maternal near miss is defined as an event where a woman nearly dies due to pregnancy or childbirth related complications.

Postpartum Hemorrhage: <https://www.facebook.com/groups/pphsupport>

This Facebook Group is for people who have experienced a postpartum hemorrhage or excessive blood loss following childbirth. Members include parents, birth workers and health providers.

Postpartum Hemorrhage and Hysterectomy: <https://www.facebook.com/groups/55913304922/>

This is a Facebook Group for women who have experienced a postpartum hemorrhage and hysterectomy.

Unexpected Project: <https://www.facebook.com/UnexpectedProject/>

This Facebook Page is a place for the survivors and loved ones of pregnancy-related death and near-death in the USA to share their stories and raise awareness. Members include women who survived a near-miss, individuals who support near-miss survivors, and loved ones who lost a woman due to complications of pregnancy.

Visit www.pqcnc.org to learn about North Carolina's Postpartum Hemorrhage Initiative (AIM OBH) and to find out how patients and families are partnering with healthcare providers to help make North Carolina the best place to give birth and be born.



Appendix Z: Sample Patient Summary Form: Obstetric Hemorrhage Event

Patient Summary: Obstetrical Hemorrhage Event			
Patient Name			
Type of Birth	<input type="checkbox"/> Vaginal <input type="checkbox"/> Cesarean	Date of Hemorrhage	
Provider Name			Phone
Clinical Summary			
Procedure	<input type="checkbox"/> Balloon <input type="checkbox"/> Interventional Radiology <input type="checkbox"/> D&C <input type="checkbox"/> Other	<i>Date</i>	
		<i>Type/ Details</i>	
		<i>Comment</i>	
Procedure	<input type="checkbox"/> Balloon <input type="checkbox"/> Interventional <input type="checkbox"/> Radiology <input type="checkbox"/> D&C <input type="checkbox"/> Other	<i>Date</i>	
		<i>Type/ Details</i>	
		<i>Comment</i>	
Additional Treatments, Surgical Interventions, or Medications			
Blood Transfusion	<i>Type and Number of Units of Blood Products</i>		
	Red Blood Cells _____ units	Platelets _____ units	Plasma _____ units
ICU Admission	<input type="checkbox"/> No <input type="checkbox"/> Yes Dates _____ <i>Comment:</i> _____ _____		
Follow-Up	<input type="checkbox"/> Subspecialist _____		
	<input type="checkbox"/> Subspecialist _____		
	<input type="checkbox"/> Support Group _____		
	<input type="checkbox"/> Peer Counselor _____		
	<input type="checkbox"/> Social Worker _____ <input type="checkbox"/> Other: _____		
Patient Resource Personnel			
Patient Resource Personnel			Phone
<i>*This is the person designated to be the point of contact for the patient after discharge. This individual may provide resources, answer questions, and help the patient in navigating and processing their experience.</i>			
Patient Friendly Narrative Summary (e.g., What happened?, Why did I need these interventions?, etc.)			
Reference: CMS Patient Clinical Summary Guidelines			

Appendix AA: Sample Script: Provider - Patient Postpartum Hemorrhage Post-Event Discussion

Christa Sakowski, MSN, RN, C-ONQS, C-EFM, CLE, C-ONQS
Angelyn Thomas, MD, Alta Bates Medical Center

When discussing a traumatic event with patients and families, it is helpful to consider the following components in formulating a plan for debriefing with the patient.

Initial patient family meeting (after the event):

- ▶ Review clinical course (treatments/ procedures)
- ▶ Clarify facts
- ▶ Include patient and patient approved support persons
- ▶ Discuss the healthcare providers who were involved
- ▶ Utilize skilled communicators/interpreters as appropriate
- ▶ Decide who will lead the discussion

Plan what to say:

- ▶ Manage your emotions
- ▶ Acknowledge something unexpected and untoward has occurred
- ▶ Express regret and concern
- ▶ Listen to the family/patient respond to their needs/questions
- ▶ Address next steps
- ▶ Clearly delineate the contact person(s) for the family and when they can expect a follow-up discussion

This is an example of a *possible* conversation:

Assess patient understanding

Can you tell me in a few words what you understand about hemorrhage and what you experienced after your delivery? What is your biggest concern?

Overarching description

Postpartum hemorrhage is when a person has heavy bleeding after giving birth. In a non-hemorrhage situation, your uterus starts to contract after the placenta comes out. As the uterus contracts, it closes off blood vessels inside your uterus. In a postpartum hemorrhage, your uterus has some trouble contracting after your placenta comes out, which leaves the blood vessels inside your uterus open. You may remember us talking about risk assessment for hemorrhage when you were admitted to the birth center. Although you did not have any of the risk factors we look for, you still experienced a hemorrhage. This happens about 40% of the time.

What happened

Your healthcare team was able to stop the heavy bleeding by rubbing on your belly, giving you medication in your IV, the shot that you may remember in your leg, and using a special balloon that we placed inside your uterus to put pressure on the bleeding vessels. The rubbing on your belly and the medications both work to help the uterus contract. We also gave you 2 units, or bags, of blood because blood carries oxygen around the body, and we want to make sure your body receives plenty of oxygen,

especially in this postpartum healing phase. I know that rubbing your belly and putting the balloon in can be very uncomfortable. I apologize for that and hope that the extra medication we put in your epidural helped.

What to expect

Your nurse will be checking on you frequently, as she has been since the hemorrhage. We will be monitoring your blood work to be sure that you do not require additional blood. In the blood work, we are looking at your hemoglobin level – hemoglobin is the part of the blood that carries oxygen. The blood work will tell us if you are anemic, or if your hemoglobin level is too low. When people lose a good amount of blood, it can affect how they feel and recover.

I understand that the balloon can be uncomfortable and we will remove it as soon as possible, likely in a few hours. We will be able to give you some pain medication to keep you comfortable in the meantime. If you are breastfeeding, any medication we give you will be safe for breastfeeding. Most people do not experience more hemorrhaging once the balloon is removed, but we will be carefully watching to be sure that everything is as it should be. Your IV will stay in, in case we have to give you more medications, fluid, or blood. At this time, I don't think that you will have to stay in the hospital longer than you planned.

Pause for questions

I have just given you a lot of information. What questions do you have about what I have just said? What is your expectation going forward?

Emphasize care and safety

It's important for your postpartum recovery and long-term health that you understand what happened to you. If you start bleeding more when you get home and need to go to the emergency room, it's essential that you tell them that you recently gave birth and that you had a postpartum hemorrhage. If you decide to have more children, it will be important for you to discuss what happened in this pregnancy and delivery with your obstetric provider in your next pregnancy. It's also an intense experience, and I want to make sure you have the information you need in order to best process what happened. I know it may be difficult to remember everything we talked about, so you will be given a paper with this information on it to take home with you.

I will check in with your nurse during each shift and she will report anything unusual to me in the meantime. I (or introduce the provider partner who will be assuming care) will be back in the morning to see you. If you think of any more questions, write them on white board or share with your nurse and we (or the provider partner) can talk again tomorrow. I'm also happy to connect you with resources that may support you and provide a contact person who can answer future questions you may have about the care you received here.

Improving Health Care Response to Obstetric Hemorrhage, a CMQCC Quality Improvement Toolkit, 2022

Appendix BB: FAQ What Do Patients Need to Know?

Kristen Terlizzi, National Accreta Foundation

This patient facing content is published and maintained at www.accretafoundation.org/faq



National Accreta Foundation's Accreta Patient FAQ

What do accreta patients need to know? National Accreta Foundation produced this patient facing FAQ based on the latest literature and evidence-based care recommendations for women with placenta accreta.

What is “Placenta Accreta Spectrum?”

Placenta Accreta Spectrum (PAS) refers to the full range of accreta diagnoses, including placenta accreta (adherent placenta) as well as increta and percreta (invasive placenta). PAS historically has had many terms, such as placenta creta, Morbidly Adherent Placenta (MAP), and Abnormally Invasive Placenta (AIP) to name a few. Placenta Accreta Spectrum has become a terminology of choice due to its inclusiveness of all forms of the condition.

Any Updates on how many women get accreta?

While once a rare diagnosis, prevalence of accreta is increasing with accreta now affecting as many as 1 in 272 pregnancies. Experts generally agree that this increase is mostly due to the increasing rate of cesarean delivery over the last 3-4 decades.

What are risk factors for developing accreta?

Women at highest risk of developing accreta are those who have a history of cesarean delivery and the presence of placenta previa (placenta located low in the uterus, covering the cervix). Level of risk increases with number of prior cesareans, for women with placenta previa and history of two prior cesareans the risk of developing accreta is as high as 40%. Here's a study that includes more detail on risk percentages. Non-cesarean risk factors include advanced maternal age, multiparity (having prior pregnancies), IVF and any prior uterine surgery or curettage. Placenta previa is an independent risk factor for accreta, with 3% of woman with previa and no prior cesareans developing accreta.

What is the mortality rate of accreta?

We get asked this a lot. Earlier studies have estimated the maternal death rate of accreta as high as 7%. A recently published study based on accreta deliveries between 1998-2011 found that while accreta was associated with as much as a 19-fold increase in adverse outcomes (including hysterectomy, transfusion and prolonged hospital stay), there were very few maternal deaths in their sample.

Here's what the recent ACOG & SMFM Accreta Care Consensus says:

“Placenta accreta spectrum is becoming increasingly common and is associated with significant morbidity and mortality ... It is worth noting that even in the most optimal setting, substantial maternal morbidity and, occasionally, mortality occur.” This is part of why it is so important to deliver at a hospital that is capable of managing accreta. More on that later.

Can blood work detect if I have accreta?

Unfortunately, there is not yet a reliable blood test for placenta accreta. Elevated maternal serum

alpha fetoprotein (AFP) and low pregnancy associated plasma protein A (PAPP-A) have been linked to an increased risk of accreta, however they are poor predictors and can be abnormal in many other scenarios. A very exciting recent study discovered “a unique and distinct plasma protein signature” in patients with placenta accreta. National Accreta Foundation is very interested in continuing to follow research on biomarkers with the possibility of accurately diagnosing accreta early in pregnancy.

Diagnosis:

Ultrasound is the primary diagnostic tool for accreta, with most cases identified in the second and third trimesters, although it’s important to know that ultrasound is not perfect. Women with higher risk of accreta – for example, two or more cesarean sections with placenta previa – still have considerable risk for accreta even without ultrasound evidence. It is important for both care teams and patients to be prepared that they may encounter accreta at delivery, regardless of ultrasound findings. It is unclear whether MRI adds additional diagnostic value beyond ultrasound, one study found that “MRI confirmed an incorrect diagnosis or incorrectly changed a diagnosis based on ultrasonography in 38% of cases.” In some situations (poor visibility due to scar tissue or obesity, posterior placenta, etc.) MRI can be helpful. Diagnosis of accreta is a critical first step in obtaining proper level care. One study at an accreta center of excellence found that outcomes in expected cases of accreta were better than in cases where accreta was unexpected, even when the diagnosed cases had more severe placental invasion

When is delivery recommended?

If no bleeding, early labor or other complications, planned cesarean delivery or hysterectomy for women with placenta previa and suspected accreta is recommended between 34 weeks and 35 weeks and 6 days. As many as 30-50% of accreta moms will deliver earlier due to bleeding or labor.

Should I be admitted to the hospital early?

Women who experience bleeding, preterm labor or rupture of membranes are most likely to benefit from hospitalization. Those who have to travel distance or have logistical considerations may be good candidates for hospitalization or local housing as well. The ACOG & SMFM Accreta Care Consensus states: “Decisions about hospitalization and activity should be based on each patient’s individual preference.”

Are some hospitals better than others at treating accreta?

Accreta literature has previously indicated that better outcomes are achieved at a placenta accreta center of excellence, or at facilities with experience and expertise in treating accreta. There currently is no official listing of accreta centers of excellence but check out this National Accreta Foundation produced article on how to assess your hospital’s capability in treating accreta. The ACOG & SMFM Accreta Care Consensus continues to support that “optimal management involves a standardized approach with a comprehensive multidisciplinary care team accustomed to management of placenta accreta spectrum.”

Care teams generally include:

- ▶ A facility with access to a blood bank that is capable in massive transfusion protocols
- ▶ Experienced Obstetricians
- ▶ Maternal-Fetal Medicine Specialists
- ▶ Gynecological Oncologists
- ▶ Urologists
- ▶ Interventional Radiologists
- ▶ Obstetric Anesthesiologists
- ▶ Critical Care
- ▶ Trauma Surgeons
- ▶ Neonatologists
- ▶ Strong Nursing Leadership

“The use of a consistent multidisciplinary team improves maternal outcomes and can drive internal continuous quality improvement as progressive experience is gained by that same group.”

National Accreta Foundation cannot stress enough the importance of delivering at a hospital that is experienced and capable in treating accreta.

Should I expect a vertical or horizontal incision?

The decision of incision type will likely be based on your main surgeon’s operating preference. A vertical incision is often preferred in accreta cases for better access and visualization, although a recent study suggests that horizontal incision for cesarean hysterectomy was associated with shorter operative times and found no difference in other factors. Talk to your care team.

Will I need a hysterectomy?

Unfortunately, most women with accreta lose their uterus due to the life-threatening potential of the condition. It is important to note that in general, accreta moms keep their ovaries and do not go into menopause from an accreta related hysterectomy.

Will I still be able to produce breast milk if I had a hysterectomy?

Yes, most women are able to produce breast milk after an accreta delivery, even if it involved a hysterectomy. For those who are interested, we recommend engaging with a lactation consultant at your hospital before delivery. Ask what resources are available and make a plan for assistance and equipment. Keep in mind that accreta moms often have many factors that can make breastfeeding more challenging (premature / NICU baby, blood loss at delivery etc.), so be kind to yourself. Note that breast milk production is triggered by hormonal changes (drop in

progesterone) after the placenta is delivered, so treatment methods that involve retained placenta many have an impact on milk supply.

What is delayed interval hysterectomy?

Interval hysterectomy is a treatment plan that involves delivering the baby and leaving placenta inside the uterus (“in situ”) with expectation to perform hysterectomy at a later time, when the risk of blood loss and tissue damage may be decreased. While still considered investigational, this approach can be a strategy for percreta cases with severe invasions.

Are there uterus preserving treatment options?

Most cases of accreta require hysterectomy. In rare and individualized cases conservative and expectant management may be considered. Conservative management is when a portion of the placenta is removed, expectant management is when the placenta is left inside the uterus. The ACOG & SMFM Accreta Care Consensus states: “Conservative management or expectant management should be considered only for carefully selected cases of placenta accreta spectrum after detailed counseling about the risks, uncertain benefits, and efficacy and should be considered investigational.” If you are going down this path, do know that current literature DOES NOT recommend use of methotrexate for placental reabsorption due to the possibility of maternal harm.

(Used with permission of the National Accreta Foundation)

Appendix CC: Sample Hemorrhage Rapid Debrief Form



Guidance for rapid debrief tools: A resource from CMQCC Maternal Data Center

The debrief form is a tool for clinicians to learn from critical events. The purpose is not to fill out another form, but rather to guide a discussion of the care provided. Some debriefs will highlight the optimal teamwork of your staff, some will provide an opportunity to provide education, and others will highlight processes that may require improvement beyond reinforcement of existing systems. Debriefs that bring to light concerning issues can help focus deeper case review in which specific times, values, and documentation will be required to evaluate the care more thoroughly.

Debriefing is appropriate both for simulation drills and live events and is required by The Joint Commission's New Standards for Perinatal Safety (Effective January 1, 2021). To facilitate debriefing, participants should have a safe private area for discussion, understand that all input is valued, self-reflection is important, and be assured that all discussions during debriefings are confidential. (Gardner, 2013)

The sample rapid debrief tools have been designed to encourage consistent completion for all events meeting debrief criteria per institutional policy. When considering the *possible* criteria that could trigger the need for a debrief, it will be useful to have discussion with your perinatal quality improvement team. Appropriateness and relevance of criteria will vary among facilities. We recommend listing your facility's selected debrief triggers directly on the debrief form for quick reference.

There are a series of check boxes specific to the event type to allow for a rapid, yet thorough, debrief and avoid missing key information. When debrief tools are non-specific, they often yield incomplete reviews of the event when providers and staff are under pressure to move on to the next case, and unable to include essential information. The questions and case details provide prompts so that the debrief can be a seamless collection of necessary information. It is important to have all members of the care team involved in the case, and especially the provider, present for the debrief so that all points of view are shared. Debriefing should be completed as soon as possible after the patient's health has stabilized and before the provider leaves the unit. A timely discussion assures that detail recall is accurate, and all members of the team are able to immediately process the care provided up to the present.

Reference: Gardner R. Introduction to debriefing. *Semin Perinatol.* Jun 2013;37(3):166-174.

We recommend listing your facility's chosen debrief criteria directly on the form for quick reference. This is a list of example criteria for triggering the completion of a Hemorrhage Debrief. Criteria will vary among facilities often based on volume and should be decided on by your perinatal QI team.

Hemorrhage Debrief

Example criteria for completing a hemorrhage debrief:

- ▶ **Cumulative Blood Loss > 500mL *with continued bleeding***
- ▶ Cumulative Blood Loss > 1,000mL
- ▶ Use of uterotonics (beyond standard postpartum oxytocin dose) or procedures (e.g., D&C, tamponade balloon, B-Lynch suture, interventional radiology)
- ▶ Transfusion
- ▶ Transfusion > 2 units PRBCs

Date: _____

Team members present for debrief (OB provider, primary nurse, and anesthesiologist are key):

Hemorrhage risk assessment category? Low Medium High Not Completed

OB Hemorrhage code called? Yes No _____

Blood loss measured quantitatively? Yes No _____

Did you have the RN/OB Provider support/consultation you needed? Yes No _____

Did you have the supplies you needed? Yes No _____

Did the team work and communicate effectively together? Yes No _____

Delay: None Recognition Notification Provider Response Receiving Blood Products
 Medication/Supplies Availability

Case Details:

Gestational Age: _____ weeks

Labor: Spontaneous Augmented Induced No Labor

Delivery: Cesarean Vaginal Operative Vaginal

Transfusion: Yes No

If "Yes" - Crossmatched Type Specific O Type Emergency Release MTP

Meds: Oxytocin Methylergonovine Carboprost TXA Misoprostol Other

Intrauterine Device (e.g., balloon, suction): Yes No _____

D&C: Yes No Hysterectomy: Yes No

Other surgical or radiology procedures: Yes No _____

Transfer to higher level of care (i.e., ICU): Yes No _____

Continued on next page...

Successes of Management:

Opportunities for Improvement:

Additional Feedback:

Debrief must be returned to Educator, Supervisor, or CNS at end of shift.

Submitted by (optional): _____

Educator, Supervisor, or CNS

Successes and Lessons learned shared with providers and staff through:

Staff Meeting

E-blast

Educational programming

Quality Board

Other _____

(Used with permission of CMQCC)

Appendix DD: Sample Labor and Delivery Event Debrief Form

Note: This is a SAMPLE developed for a particular facility as an example to work from. You may need to adjust based on the individual circumstances of your facility.

Suggested events to debrief:

- ▶ Hemorrhage with administration of blood products
- ▶ Cord prolapse
- ▶ Maternal code, rapid response, or ICU admission
- ▶ Eclamptic seizure
- ▶ Surprise ICN admission
- ▶ Any other unusual clinical scenario

Patient Name: _____ MRN: _____ Date: _____

Type of Event/Complication? _____

Instructions: Delivery attending to complete form as soon as possible after event, with all participants including nursing. Ask charge nurse to relieve bedside nurse if necessary.

List participant names.

OB attending:	OB residents
CNM:	Anesthesia:
Bedside nurse:	Charge nurse:
Other:	

If the event was a hemorrhage, was the hemorrhage protocol consulted? YES / NO

Was active management of the 3rd stage used? YES / NO

Was methylergonovine or carboprost used as first-line uterotonics (with oxytocin)? YES / NO

Was TXA given in a timely fashion? YES / NO

Recognition:

Was the emergency recognized early?
Were there early warning signs that were missed?
Was the attending made aware of concerns?

Response:

Was the clinical response adequate?
Were there enough people to help?
Were supplies, medications, and blood available quickly?

Teamwork:

Was there role clarity for decision-making?
Was communication clear?
Did the team communicate respectfully?

What was done well?	
Issues Identified:	Possible Solutions:

Please feel free to use the back of this form for more detailed information.
This is a confidential document protected under evidence codes # 1156 and 1157
Please encourage participants who need extra support after a difficult case to reach out.

(Used with permission of Melissa Rosenstein, MD)

Appendix EE: Alert on Blood Transfusion Procedure Coding

Recommendation: Hospital coding personnel should apply ICD-10-PCS transfusion procedure codes to all maternity cases that receive a transfusion.

Rationale

Coding of transfusion procedures is necessary for tracking *Severe Maternal Morbidity (SMM)*—a national public health measure developed by the Centers for Disease Control (CDC), and the basis for the *Maternal Complications* measure being developed by national performance reporting and accreditation organizations. [See the list of ICD-10 codes used by the CDC here.](#)

Although ICD-10 transfusion procedure codes are not required for billing purposes, they are necessary for accurate quality measurement for the *SMM* measure. Per the *Standards of Ethical Coding* published by the *American Health Information Management Association (AHIMA)*, coders should “Gather and report all data required for internal and external reporting, in accordance with applicable requirements and data set definitions.”

Background

U.S. maternal mortality and maternal morbidity rates have doubled in the last 15 years. The rate of *Severe Maternal Morbidity (SMM)* has become a key indicator of maternal health outcomes, and decreasing the *SMM / Maternal Complications* rate has become a national priority—with several public health and quality improvement organizations initiating projects to address the high rates. These organizations include The Joint Commission and the Agency for Healthcare Research and Quality (AHRQ), among others.

Tracking *blood transfusions* during the delivery hospitalization is central to understanding the drivers of maternal morbidity. Because blood bank data are not available in data sets used by national and state agencies, the new public health and safety initiatives rely on widely available administrative data sets (i.e., the Uniform Hospital Discharge Data Set (UHDDS), which include ICD-10-CM and ICD-10-PCS codes) to easily identify national, statewide and local *SMM* rates.

Why did some hospitals reduce transfusion procedure coding under ICD-10?

Prior to October 2015, hospitals utilized ICD-9 procedure codes to document transfusions. However, under ICD-10:

- ▶ ICD-10-PCS transfusion procedure codes are not required for hospital reimbursement
- ▶ The number of transfusion codes increased substantially, and correct utilization of the codes requires greater specificity in documentation (e.g., documenting the vein or artery and the approach used to administer the transfusion). Coding departments were concerned that this more exact information would not be easily available in the medical record.
- ▶ Hospitals assumed they could access transfusion data from internal blood bank systems as needed

As such, some hospitals opted to cease using ICD-10 PCS codes for blood transfusions. However, now that *SMM / Maternal Complications* is being adopted as a national performance measure, it is critical that hospitals utilize ICD-10-PCS procedure codes for blood transfusions in maternity patients.

How can we work with Coding Staff to ensure use of the transfusion codes?

AHIMA standards and Coding Clinic allow for the development of facility-specific coding guidelines that establish a *default* code based on common practice (*see references on Page 3 below*). In the case of maternity patients, most blood transfusions are administered via a peripheral vein using a percutaneous approach. This type of default internal policy can be developed and applied without significantly impacting coder productivity.

Suggested Steps

- ▶ Meet with clinical staff to identify common clinical practices for blood transfusions in maternity patients. In all likelihood, the most common route of administration will be the peripheral vein using a percutaneous approach, although the central vein may be used for high-acuity patients.
- ▶ If internal clinical staff agree that peripheral vein transfusions represent common practice within the facility, the coding department can create a written internal policy stating that should be the default code used.
- ▶ The important data element that can change in coding transfusions is that for the type of blood product, rather than the body part and approach. The type of blood product should be well documented within an EMR, and the correct ICD-10-PCS code referencing that blood product type can be applied.

The potential codes for use in coding transfusions in maternity patients are listed below, with the two most common routes highlighted. Again, it is important to distinguish the type of blood product: frozen plasma, fresh plasma, plasma cryoprecipitate, red blood cells, frozen red blood cells, platelets, and fibrinogen.

Typical ICD-10-PCS Codes used for Obstetric Blood Transfusions	ICD-10 PCS Code
Transfusions into a Peripheral vein (<i>usual approach</i>)	
Transfusion of Nonautologous Frozen Plasma into Peripheral Vein, Percutaneous Approach	30233K1
Transfusion of Nonautologous Fresh Plasma into Peripheral Vein, Percutaneous Approach	30233L1
Transfusion of Nonautologous Plasma Cryoprecipitate into Peripheral Vein, Percutaneous Approach	30233M1
Transfusion of Nonautologous Red Blood Cells into Peripheral Vein, Percutaneous Approach	30233N1
Transfusion of Nonautologous Frozen Red Cells into Peripheral Vein, Percutaneous Approach	30233P1
Transfusion of Nonautologous Platelets into Peripheral Vein, Percutaneous Approach	30233R1
Transfusion of Nonautologous Fibrinogen into Peripheral Vein, Percutaneous Approach	30233T1
Transfusions into a Central Line (<i>typically only used in massive hemorrhages</i>)	
Transfusion of Nonautologous Frozen Plasma into Central Vein, Percutaneous Approach	30243K1
Transfusion of Nonautologous Fresh Plasma into Central Vein, Percutaneous Approach	30243L1
Transfusion of Nonautologous Plasma Cryoprecipitate into Central Vein, Percutaneous Approach	30243M1
Transfusion of Nonautologous Red Blood Cells into Central Vein, Percutaneous Approach	30243N1
Transfusion of Nonautologous Frozen Red Cells into Central Vein, Percutaneous Approach	30243P1
Transfusion of Nonautologous Platelets into Central Vein, Percutaneous Approach	30243R1
Transfusion of Nonautologous Fibrinogen into Central Vein, Percutaneous Approach	30243T1
Autologous Red Blood Cells (previously self-donated blood)	
Transfusion of Autologous Red Blood Cells into Peripheral Vein, Percutaneous Approach	30233N0
Transfusion of Autologous Red Blood Cells into Central Vein, Percutaneous Approach	30243N0

AHIMA and Coding Clinic References to Support Use of ICD-10 PCS for Transfusions

Coding Clinic Supporting Development of Default Codes based on Common Practice

Excision of Saphenous Vein for Coronary Artery Bypass Graft

Coding Clinic, Third Quarter 2014: Page 8

Coding advice or code assignments contained in this issue effective with discharges September 15, 2014.

Question:

Please provide clarification for coding the harvest of the saphenous vein for coronary artery bypass grafting (CABG). In the operative note, the physician documents harvest of left saphenous vein from the leg with no further specificity. Is there any guidance when the documentation does not state upper/ greater, or lower/ lesser saphenous vein?

Answer:

ICD-10-PCS does not have an “unspecified” or “not otherwise specified” designation for procedures performed on the saphenous vein. If the documentation does not specify which saphenous vein was harvested, query the physician for clarification so that the appropriate body part may be reported.

Facilities may also work with providers to develop facility-specific coding guidelines, which will establish a default code based on common practice.

AHIMA Standard Supporting Development of Internal Coding Policies

1. Apply accurate, complete, and consistent coding practices that yield quality data.

1.2. Develop and comply with comprehensive internal coding policies and procedures that are consistent with requirements.

AHIMA Standard Supporting Use of ICD-10 Codes for Performance Reporting

2. Gather and report all data required for internal and external reporting, in accordance with applicable requirements and data set definitions.

AHIMA Standard Supporting Use of Codes to Present a Complete Clinical Picture

Coding professionals shall not:

5.3. Misrepresent the patient’s clinical picture through intentional incorrect coding or omission of diagnosis or procedure codes, or the addition of diagnosis or procedure codes unsupported by health record documentation, to inappropriately increase reimbursement, justify medical necessity, improve publicly reported data, or qualify for insurance policy coverage benefits.

AHIMA Standard Supporting Collaboration with Providers to Ensure Complete Coding

6. Facilitate, advocate, and collaborate with healthcare professionals in the pursuit of accurate, complete and reliable coded data and in situations that support ethical coding practices.

AHIMA Standard Supporting Use of Provider Queries to Ensure Complete Coding

4. Query and/or consult as needed with the provider for clarification and additional documentation prior to final code assignment in accordance with acceptable healthcare industry practices.

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Appendix FF: Obstetric Hemorrhage Sample Order Set Staged

Note: This is a SAMPLE developed for a particular facility as an example to work from. You may need to adjust based on the individual circumstances of your facility.

POSTPARTUM HEMORRHAGE ORDER-SET (Procedure #0000)

Boxes must be checked to activate optional orders.

Medications:

- Oxytocin in saline (PITOCIN)** 30 units/500 mL (60 milli-units/mL) infusion
0-999 milli-units/min (0-999 mL/hr), at 0-999 mL/hr, Intravenous, TITRATED
- Oxytocin (PITOCIN)** injection 10 units IM
- Methylergonovine (Methergine)** injection 0.2 mg, Intramuscular, PRN, Bleeding, if BP < 140/90, may repeat x 1. May give only after delivery. **Consult provider if patient is hypertensive.**
- Carboprost (Hemabate)** injection 250 mcg, Intramuscular, EVERY 15 MIN PRN, Post-partum hemorrhage, may give only after delivery. May repeat every 15-90 minutes. Not to exceed 3 doses. **Do not give if history of asthma.**
Give 4 mg of loperamide with first dose of carboprost.
 - Loperamide (IMODIUM)** capsule 2-4 mg, Oral, PRN, Diarrhea
May give only after delivery. Give 4mg with 1st dose of carboprost (HEMABATE), then 2 mg PRN after each loose stool up to a maximum of 16 mg/day (do not give stool softeners or laxatives until diarrhea is resolved).
- Misoprostol (Cytotec)** 800 mcg (four 200 mcg tablets) sublingual x 1 dose. **Only if hypertensive and asthmatic**

Stage 1

1. Nursing Orders:

Activate the OB Hemorrhage Protocol
Notify OB Provider, Anesthesia Provider, and Charge Nurse
Vital signs, including SpO₂, level of consciousness every 5 minutes
Administer oxygen to maintain SpO₂ greater than 95%
Weight materials, calculate and record cumulative blood loss every 5-15 minutes
Establish IV access if not present- minimum 18 gauge
Increase oxytocin administration rate
Administer 1st level uterotonic
Apply vigorous fundal massage
Empty bladder straight cath or place indwelling urinary catheter

2. Stat Labs:

- Type and Screen STAT, if not previously done

3. Blood Bank:

- Cross match ___ units PRBC (Packed Red Blood Cells) STAT if not already done

Continued on next page...

<p>Stage 2</p> <p>1. Nursing Orders: Activate OB Rapid Response Team (or equivalent) Assess and announce vital signs and cumulative blood loss every 5-10 minutes Administer oxygen to maintain SpO2 greater than 95% Weight materials, calculate and record cumulative blood loss every 5-15 minutes Administer 2nd level uterotonic Move to Operating Room Establish second large bore IV – minimum 18 gauge Administer TXA Set up blood administration set and blood warmer for transfusion Prepare intrauterine device Transfuse red blood cells as ordered</p>
<p>2. Labs:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Type and Screen STAT if not previously done <input type="checkbox"/> CBC no differential, STAT <input type="checkbox"/> Protome INR, STAT <input type="checkbox"/> PTT, STAT <input type="checkbox"/> Fibrinogen, STAT <input type="checkbox"/> Calcium, Ionized, STAT <input type="checkbox"/> Basic Metabolic panel STAT <input type="checkbox"/> ABGs
<p>Stage 3</p>
<p>1. Nursing Orders: Activate Massive Hemorrhage Protocol Notify Blood Bank of “Massive Hemorrhage Protocol” Ensure that all clinicians from Stage 2 are notified plus advanced GYN surgeons Run IVs through fluid warmer Apply upper body warming blanket Apply sequential compression stockings to lower extremities Transfuse MTP Product as directed by the ordering Provider</p>
<p>2. Labs:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Type and Screen STAT if not previously done <input type="checkbox"/> CBC no Differential STAT <input type="checkbox"/> Protome INR STAT <input type="checkbox"/> Fibrinogen <input type="checkbox"/> Calcium, Ionized Calcium STAT <input type="checkbox"/> Basic Metabolic Panel STAT <input type="checkbox"/> ABGs <p>Hourly Labs x 4</p>
<p>3. Blood Bank:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Massive Transfusion Protocol (6R: 4F: 1P) <input type="checkbox"/> Red Blood Cells - Prepare STAT, ONE TIME, Total Number of Units: 6 <input type="checkbox"/> Fresh Frozen Plasma - Prepare Total Number of Units: 4 <input type="checkbox"/> Platelets - Prepare Total Number of Units: 1