A California Toolkit to Transform Maternity Care

Obstetric Hemorrhage Toolkit
HOSPITAL LEVEL IMPLEMENTATION GUIDE

THIS COLLABORATIVE PROJECT WAS DEVELOPED BY:
THE OBSTETRIC HEMORRHAGE TASK FORCE
THE MATERNAL QUALITY IMPROVEMENT PANEL
CALIFORNIA MATERNAL QUALITY CARE COLLABORATIVE
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CMQCC OBSTETRIC HEMORRHAGE TOOLKIT
HOSPITAL LEVEL IMPLEMENTATION GUIDE
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INTRODUCTION

CALIFORNIA MATERNAL QUALITY CARE COLLABORATIVE (CMQCC)
CMQCC’s mission is to transform maternity care in California to end preventable death and injury. To achieve this we will:

- Define and implement best practices for public health, communities and women with quality, safety and social justice as the clear priorities of every decision and action.
- Promote communication and collaboration between all maternity stakeholders.
- Gather, review and organize maternity data and statistics into actionable information.
- Build the next generation of maternal health leaders to continue the growth and scope of CMQCC.

We are devoted to eliminating preventable maternal death and injury and promoting equitable maternity care in California by bringing resources, tools, measures and quality improvement techniques to providers, administrators and public health leaders. This is a long-term collaborative effort of many organizations and individuals with Title V funding from the California Department of Public Health (Maternal, Child and Adolescent Health Program) and the California Perinatal Quality Care Collaborative (CPQCC). We are over 250 clinicians, public health leaders, key payers and representatives of the public all devoted to improving childbirth outcomes.

For more information about CMQCC, visit our website at www.cmqcc.org.

IMPACT OF OBSTETRIC HEMORRHAGE
The rate of maternal deaths has nearly tripled from 6 per 100,000 in 1996 to 17 per 100,000 annual births in 2006. (1) Alarmingly, the rate for African American women has risen from 27.7 to 45.7 per 100,000 live births between 1999 and 2006. (1) Obstetric hemorrhage is one of the leading causes for maternal death and is a major cause of maternal morbidity. In 1997, 2.4% of all live births in California were complicated by postpartum hemorrhage. (2) Nationwide, blood transfusions increased 92% during delivery hospitalizations between 1997 and 2005. (3)
COMPOSITE CASE
The following is an outline of a composite case (combined elements from multiple cases with indentifying features, including all person identifiers, removed to ensure patient confidentiality) that demonstrates how a normal low-risk pregnancy and birth can at times quickly escalate to an emergent situation and death. An outline of learning points and opportunities for quality improvement (QI) opportunities based on the case follows.

Composite Case Example: A 24yo woman, G2 P1 at 38 wks gestation was induced for “tired of being pregnant”:

- After 8hr active phase and 2hr 2\textsuperscript{nd} stage, she gave birth (NSVD) to an 8lb 6oz infant.
- After placental delivery, she had an episode of atony that firmed with massage. A second episode of atony responded to IM mertergine and the physician went home (now 1am).
- The nurses called the physician 30min later to report more bleeding and further mertergine was ordered.
- 60min after the call, the physician performed a D&C with minimal return of tissue. The woman received more mertergine.
- 45min later a second D&C was performed, again with minimal returns. EBL at this point >2,000 ml.
- Delays in blood transfusion occurred because of inability to find proper tubing.
- Anesthesia was delayed, but a second IV started for more crystalloid. VS became markedly abnormal, P=144, BP 80/30.
- One further mertergine given and patient taken for a 3\textsuperscript{rd} D&C. She received 2u PRBCs by this point.
- After D&C is complete, she had a cardiac arrest from hypovolemia/hypoxia and was taken to the ICU where she succumbed 3 hours later.

QI Opportunities and Learning Points from the above composite case: How to reducing Mortality and Morbidity from OB Hemorrhage?

- Need a medical indication before performing an induction
- No documentation of actual blood loss, e.g., what does “more bleeding” mean?
- Only a few treatments tried, e.g., Mertergine and D&C, and then repeated, even when they were ineffective
- Underestimation of blood loss
- Delay in administration of blood
- Lack of working equipment
- Delay in response from other team members
- Delays in adequate resuscitation
OB HEMORRHAGE TOOLKIT

- Lack of an organized standardized team approach

OBSTETRIC HEMORRHAGE TASK FORCE

DEVELOPMENT OF BEST PRACTICES, TOOLS, CARE GUIDELINES

The Obstetric Hemorrhage Task Force Tools and Best Practices were developed by a volunteer group of California-based leaders and experts in obstetrics including obstetricians, nurses and midwives under the direction of the California Maternal Quality Care Collaborative’s (CMQCC) Maternal Quality Improvement Panel (MQIP). This implementation guide was developed to support local leaders’ efforts to successfully implement the best practices and tools for obstetric hemorrhage into practice and to create active quality improvement processes to drive implementation.

The implementation guide is organized to address four broad objectives as described by the Hemorrhage Task Force:

1. Improve **readiness** to respond to an obstetric hemorrhage by implementing standardized policies and procedures (general and massive) and developing obstetric hemorrhage rapid response teams.
2. Improve **recognition** of OB hemorrhage by performing on-going objective quantification of actual blood loss and triggers of maternal deterioration during and after all births.
3. Improve **response** to hemorrhage by performing regular on-site inter-professional hemorrhage drills.
4. Improve **reporting** of OB hemorrhage by standardizing definitions and consistency in coding and reporting.

The following elements are critical to affecting change to ensure that improvements are adopted and sustained over time:

- **Leadership**
  - Identifying Leader and Clinician behaviors, including “Champions”
  - Defining the problem and making the case for change
  - Setting goals
  - Allocating resources

- **Policy & Procedure**
  - Agreeing on a plan
  - Creating consistency between departments to improve teamwork and cohesive quality of care; see Appendix for sample policy and protocol

- **Monitoring**
  - Creating audit tools that work; see Appendix for sample tools
  - Communicating progress toward goals
GETTING STARTED

MODEL FOR IMPROVEMENT

The goal of this implementation guide is to provide a simple step-by-step guide for creating quality improvement (QI) changes in your facility to improve care processes associated with obstetric hemorrhage. MAP-IT (Mobilize, Assess, Plan, Implement, Track)—a rapid cycle QI method for outlining change—is presented.(4)

RAPID CYCLE QI METHODOLOGY

MOBILIZE, ASSESS, PLAN, IMPLEMENT, TRACK (MAP-IT)

☐ **Step 1**
   Mobilize Quality Improvement Team
   Recruit champions: clinical staff who visualize the ideal, set goals and follow through to realize defined aims

☐ **Step 2**
   Assess the Situation
   Determine current practices for response to hemorrhage; identify **QI Data—process and outcome measures**—that inform baseline assessment, guide appropriate implementation, and provide data sufficient to track progress (see Fishbone Diagram, Pareto Chart, Process Flow Maps below)

☐ **Step 3**
   Plan Change Strategies and Tactics
   **Policy, Scheduling Process, Empowered Physician Leadership:** Implement relevant policies and procedures (P&P) or changes to P&P (e.g., ongoing quantitative measurement of blood loss, drills and debriefs) that support a protocol to respond quickly and effectively to obstetric hemorrhage

☐ **Step 4**
   Implement Strategies and Tactics
   Conduct **Clinician Education** and training about ongoing quantitative measurement of blood loss, drills and debriefs; education drives convergent department culture, supports buy-in and contributes to successful rollout of change tactics to accomplish the goal

☐ **Step 5**
   Track Progress
   Analyze data (see Audit Tools in Appendix) and present results to clinical staff via **Trend Charts** about obstetric hemorrhage (e.g, transfusions, massive transfusions). Review and repeat steps; when necessary, revise newly implemented tactics to ensure sustainable results

Figure 1: MAP-IT QI Methodology
GETTING STARTED

Mobilize

STEP 1. MOBILIZE QUALITY IMPROVEMENT TEAM

Essential team members include individuals with the following roles or skills:
- System Leadership
- Technical Expertise
- Day-to-Day Leadership

In obstetric service units, doctor and nurse leaders would fulfill these essential roles and skills. Utilizing the expertise and tacit knowledge of the front-line leaders and personnel, including nurses, general obstetricians, unit clerks, blood bank technicians is critical to successful implementation. A first step toward designating a team is identifying a system or administrative leader who leads MAP-IT cycles; e.g., meetings held, data collected, assignments completed, monitoring occurred. The following is a sample draft form to document your team:

The Obstetric (OB) Hemorrhage System or Administrative Leader for our birthing facility is:

__________________________________________________________

The nurse leader is:___________________________

The physician leader is:_________________________

The members of the team that will work with the system/administrative, nurse, and physician leaders to improve readiness, recognition, response, and reporting are:

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<tr>
<th>NAME</th>
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STEP 2. ASSESS THE SITUATION
In order to identify and prioritize quality improvement needs and next steps, teams can use these and other tools and methods:

- **Fishbone Cause and Effect Diagrams**: A team analysis of how individual process “problem areas” interact as a “whole” (5-7)
- **Process Flowcharts**: A team analysis of the numerous steps needed to complete a process. For example, the number of tasks a nurse must perform in order to obtain emergency medications (5, 7)
- **Failure Modes and Effects Analysis (FMEA)**: A systematic analysis of the potential ways in which a failure, e.g., delay in recognition of excessive treatment and delay in adequate treatment of a woman bleeding will occur. The FMEA includes classification by severity or the “effects” of the failure based on the “mode” or type of failure that could occur (5)
- **Pareto Analysis and Diagrams**: A method to quantify and rank which of the identified opportunities for improvement are the most problematic. The Pareto Principle is the 80/20 rule, e.g., 80% of the failures are caused by only 20% of the processes (5)

Examples of the Fishbone and Pareto tools are described below.

**A. Fishbone Cause and Effect Diagrams**:
Quality improvement begins by looking at the “Big Picture” then narrowing down the problem to specific tasks that are reasonable and achievable starting points for change. The fishbone diagram is a common tool for seeing both elements—the whole and its parts (5). The head of the fish points to the project goal and six (or more) bones extend from the side to capture the inter-relationships between PEOPLE, PROCEDURES, EQUIPMENT, MATERIALS, ENVIRONMENT AND MISCELLANEOUS factors that contribute to the problem. Fishbone diagrams are a good way to get group feedback and insights into the root cause of a problem.

**Example**:
*Use a Fishbone Diagram (Figures 2a, 2b) to identify areas for Quality Improvement using OB Hemorrhage Care Guidelines Checklist, starting with “Pre-Admission” and working through Stages of Hemorrhage to identify problems.*

*Diagrams can be as extensive and detailed as needed; alternately, diagrams can be drafted for each stage of hemorrhage; e.g., create one diagram that identifies processes of care surrounding Stage 1 Hemorrhage; create a second diagram that identifies processes of care surrounding Stage 2 Hemorrhage, etc.*

*First drafts can be simple, hand-written versions that are edited, honed and vetted within leadership teams and front line staff to finalize plans for changes.*
Labor and Delivery leaders and staff identify processes of care in need of improvement by filling in the “fishbone diagram” based on a step-by-step review of the OB Hemorrhage Care Guidelines Checklist (Figures 2a, 2b). This approach is a useful framework to:

- Identify and define clinical roles and assignments of responsibility during each stage (People, Management)
- Identify medications—usage and dosage—during each stage of hemorrhage; assess that all Obstetric Services clinicians at all levels know and understand medications, usage and dosage (Materials, Process); assess availability and ease of access to critical medication supplies.
- Identify procedures, such as fundal massage, intrauterine balloon, B-Lynch suturing, quantification of blood loss during each stage of hemorrhage (Process, Materials, Equipment)
- Identify blood products and blood replacement during each stage of hemorrhage (Process, Equipment, Materials, Environment); identify availability and ease of access to these products and the supplies needed to administer them.
- Identify procedures for communication between all areas of obstetric care including, but not limited to, communications with the Blood Bank.

Figure 2a.
B. Pareto Analysis and Diagrams

Pareto analysis, developed by Italian economist Vilfredo Pareto, is a statistical technique in decision-making to select limited tasks that will have a significant overall effect. The technique is based on the “Pareto Principle” or the “80/20” rule, which states, in quality improvement terms, that most (80%) of the problems are caused by a few (20%) key causes. There are many applications of the Pareto Principle in quality control including the Pareto Diagram, a key tool in Six Sigma (Motorola’s popular business management strategy).(5)

Example: Use Pareto Analysis to create a Pareto Diagram (Figure 3) to identify areas for Quality Improvement using OB Hemorrhage Care Guidelines Checklist.

Use the following steps (8) for completing a Pareto Analysis:

- Form a table (e.g., in a spreadsheet program) listing key causes of quality problems and their frequency as a percentage.
- Arrange the rows in the decreasing order of importance of the causes, i.e. the most important problems first.
- Add a cumulative percentage column to the table.
- Plot with causes on x-axis and cumulative percentage on y-axis.
- Join the above points to form a curve.
- Plot (on the same graph) a bar graph with causes on x-axis and percent frequency on y-axis.
• Draw a line at 80% on y-axis parallel to x-axis. Then drop the line at the point of intersection with the curve on x-axis (not shown). This point on the x-axis separates higher priority problems on the left of the line; to the right of the line are problems to be addressed after the higher priority items.

Example:
Use Pareto Analysis to create a Pareto Diagram (Figure 3) to Identify areas for Quality Improvement using OB Hemorrhage Care Guidelines Checklist. Note that in this example, a line drawn on the y-axis at 80% and then dropped down to intersect with the x-axis would bisect the “Carts” bar. Lack of ongoing quantification of blood loss and delayed availability of blood products become the higher priority issues to be addressed, followed by equipping carts for hemorrhage and fostering education and empowerment for staff about activating a massive hemorrhage protocol.

Figure 3.
STEP 3. DEVELOP A PLAN TO MEET YOUR PROJECT AIMS

An essential component of a plan is to develop aims or project objectives. The aims or project objectives include the use of specific terms, numerical goals and a time frame or deadline. Teams should work toward consensus agreement for the aims for your facility and have a willingness to refocus and modify the aims as needed.

As an example, the following are aims of the first CMQCC Obstetric Hemorrhage Multi-Hospital Collaborative that began in October 2009 (Appendix E):

- **Aim 1:** Reduce the number of massive hemorrhages and the number of major complications from massive hemorrhage, including transfusions and hysterectomies, for all birthing women in participating hospitals by 75% by September 30, 2010.

- **Aim 2:** All collaborative participants develop and implement a multidisciplinary team response to every massive obstetric hemorrhage by September 30, 2010.

Complete a MAP-IT planning worksheet for your project (See Appendix F). The plan should focus on specific objectives that will help you achieve the overall aims of the project. Developing a plan for each objective facilitates communication and tracking of the project. The MAP-IT plan needs to be regularly reviewed and re-adjusted based on feedback obtained during the rapid cycles of change and small tests of improvement. In Appendix F is a sample of a completed MAP-IT Plan for the objective to quantify blood loss in order to recognize an obstetric hemorrhage.
STEP 4. IMPLEMENT STRATEGIES AND TACTICS TO MITIGATE BARRIERS

A. Implementation Strategies and Tactics

There are three broad types of implementation strategies the project team can utilize during implementation: 1) Education, 2) Data, and 3) Discourse or Communication.

Within each strategy there are multiple implementation tactics that leaders can choose from. Tables 1, 2 and 3 below outline some specific strategies and tactics for improving obstetric hemorrhage practices. (9, 10)

Table 1. Examples of Implementation EDUCATION Tactics

<table>
<thead>
<tr>
<th>Educational Tactics Examples</th>
<th>Definition and Examples Specific to OB Hemorrhage</th>
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<tbody>
<tr>
<td>Grand Rounds</td>
<td>Physician educational sessions that are often held once a week.</td>
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<tr>
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<td>• Hold a multi-disciplinary Obstetric Hemorrhage grand rounds using the standard toolkit slide set</td>
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<td>• Make a copy of the slides and put them in a binder in L&amp;D for all staff to review</td>
</tr>
<tr>
<td>Classes or Conferences</td>
<td>Formal educational sessions developed on specific topics.</td>
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<tr>
<td></td>
<td>• Develop a class and skills station on quantification of blood loss – use hospital specific products</td>
</tr>
<tr>
<td>Simulation Training</td>
<td>Simulation training is education that allows clinicians to practice skills and knowledge through a fabricated situation that mimics a complicated situation that they will face and need to practice how to respond.</td>
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<td></td>
<td>• Organize and run multi-disciplinary drills that help teams learn to follow the CMQCC Obstetric Hemorrhage checklist so they have a more organized and systematic approach to hemorrhage</td>
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<td>• This strategy also helps teams uncover hidden systems problems within their facility and get teams excited about finding solutions.</td>
</tr>
<tr>
<td>Competency Fairs, Tests, Learning Fairs, Return Demonstrations</td>
<td>Clinicians demonstrate their knowledge of a new concept or demonstrate their ability to perform a clinical skill.</td>
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<td></td>
<td>• Develop methods of measuring and tracking competency of team members for the quantification of blood loss</td>
</tr>
<tr>
<td></td>
<td>• Be creative and make learning fun</td>
</tr>
<tr>
<td></td>
<td>• Provide clinicians with information on how to log-in to CMQCC’s website and have access to all of the CMQCC OB Hemorrhage resources: Table Chart, Check-list, Flow Chart, Compendium of Best Practices, and research articles</td>
</tr>
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### Table 2. Examples of Implementation DATA Tactics

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<thead>
<tr>
<th>Examples of Data Tactics</th>
<th>Definition and Examples Specific to OB Hemorrhage</th>
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</table>
| Audit and feedback (group and individual) | An examination of clinical records in order to gather specific pre-determined information. The information gathered are summarized and shared with the relevant group or individuals.  
• Revise charting methods to track critical data  
• Develop a quality improvement data collection plan using audit tools (refer to Appendices E1-E5)  
• Develop a quality improvement measurement grid (refer to Appendix F) |
| Public Release of Data | Details of care patterns and outcomes are reported openly to the community in such a way that anyone can access this information.  
• Improve how obstetric hemorrhage is defined and coded to make it comparisons among hospitals more accurate |

*Adapted from Bingham D. Measuring and increasing the effectiveness of the quality improvement implementation change practices of front-line maternity physician and nurse leaders, The University of North Carolina at Chapel Hill, 2009, 316 pages; AAT 3352932.

### Table 3. Examples of Implementation COMMUNICATION Tactics

<table>
<thead>
<tr>
<th>Examples of Communication Tactics</th>
<th>Definition</th>
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| Meetings                         | Group discussions, e.g., staff meetings.  
• Regularly discuss the goals of the project and chart audit results at staff meetings and at other gatherings  
• Present project data to senior leadership at hospital wide meetings |
| One-to-One Discussions           | A discussion between a change leader and someone else that they are seeking to influence to change.  
• Team members can promote the change by explaining the project goals during one-to-one discussions |
| Debriefs                         | A team discussion that takes place as soon as possible after an emergency as possible.  
• Complete a debrief form for every stage 2 and 3 obstetric hemorrhage emergency (refer to Appendix E.5) |
| Academic Detailing               | A review of relevant academic research by one leader meeting with one clinician at a time. A common tactic utilized by pharmaceutical representatives. |
| Policy and Procedure             | A document utilized by a hospital to set and communicate clinical standards.  
• Update policies and procedures |
| Reminders                        | A method for helping someone remember to perform specific tasks, e.g., checklists, order set.  
• Have blood loss markings added to the pouch on the under buttocks drape |
<table>
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<tr>
<th>Examples of Communication Tactics</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Newsletters</td>
<td>A formal written update that is periodically distributed.</td>
</tr>
<tr>
<td>Posters and Bulletin Boards</td>
<td>A collection of data and information that are organized for display on poster board or a bulletin board.</td>
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<tr>
<td></td>
<td>• Develop posters and post on the unit.</td>
</tr>
<tr>
<td>Emails</td>
<td>Electronic communications either one-to-one or by means of a “listserv” that is broadcast to many recipients.</td>
</tr>
<tr>
<td>Rewards</td>
<td>Something given in compensation for reaching a pre-determined goal, e.g., professional recognition, a bonus.</td>
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<tr>
<td></td>
<td>• Make learning fun – have some contests on assessing quantification of blood loss</td>
</tr>
<tr>
<td>Disciplinary Discussions</td>
<td>A discussion that is held by someone in the position to give employee feedback and a formal review of performance in order to outline how current behavior do not meet required expectations of job performance.</td>
</tr>
<tr>
<td></td>
<td>• Follow-up with individuals who refuse to adopt the new practice standards</td>
</tr>
</tbody>
</table>

*Adapted from Bingham D. Measuring and increasing the effectiveness of the quality improvement implementation change practices of front-line maternity physician and nurse leaders, The University of North Carolina at Chapel Hill, 2009, 316 pages; AAT 3352932.*
B. Potential Implementation Barriers
The most effective implementation plans include targetted strategies to mitigate potential and identified barriers. (10) Some types of barriers that have been identified are outlined in Table 4.

Table 4. Examples of Potential Implementation Barriers*

<table>
<thead>
<tr>
<th>Leader Barriers</th>
<th>Lack of Leader Knowledge to:</th>
<th>Design, plan, and implement Quality Improvement (QI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Perform QI data analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Assess how to enhance their individual QI leadership abilities</td>
</tr>
<tr>
<td>Leader Attitudes (Beliefs and Assumptions) that Affect:</td>
<td>Topic selection</td>
<td>QI topic goals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Selection of QI implementation tactics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Definitions of success</td>
</tr>
<tr>
<td>Leader Practices</td>
<td>Lack of clarity of QI project goals</td>
<td>Backing down or stop trying</td>
</tr>
<tr>
<td></td>
<td>Lack of time and other resources</td>
<td>Inadequate practices to ensure sustainability, e.g., new hires, staff returning from vacation, leaves of absences</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clinician Barriers</th>
<th>Lack of Clinician Knowledge:</th>
<th>About their own practices (lack adequate feedback)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>New or inexperienced</td>
<td>Lack knowledge of the QI project</td>
</tr>
<tr>
<td>Clinician Attitudes (Beliefs and Assumptions):</td>
<td>Not persuaded to change</td>
<td>Want autonomy</td>
</tr>
<tr>
<td>Clinician Practices:</td>
<td>Inertia – no motivation to change</td>
<td>Forget</td>
</tr>
<tr>
<td></td>
<td>Changes add more work or slow down usual work flow</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Characteristics of the QI Project</th>
<th>Positive or negative effect(s) on clinician income or time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Complexity of the QI project, e.g., how many groups’ work flow is affected by the QI project changes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Implementation Climate/Culture</th>
<th>Type of hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amount of resources, e.g., workload, lack of organizational support for time or supplies needed to implement change</td>
</tr>
<tr>
<td></td>
<td>Type of community or population of patients</td>
</tr>
<tr>
<td></td>
<td>History of previous unsuccessful change attempts or minimal previous history of successful change attempts</td>
</tr>
</tbody>
</table>

*Adapted from Bingham D. Measuring and increasing the effectiveness of the quality improvement implementation change practices of front-line maternity physician and nurse leaders, The University of North Carolina at Chapel Hill, 2009, 316 pages; AAT 3352932.
STEP 5. TRACK PROGRESS USING ESTABLISHED MEASURES

Essential components of measures include outcome, process and balance measures. When creating measures, teams should consider: What measures will be useful at your specific hospital based on your population of patients?

Below are some definitions of different types of measures.

- **Outcome Measures**: These measures tell you whether changes are actually leading to improvement – that is, helping to achieve the overall aim of reducing major complications of OB hemorrhage. Outcome measures answer questions like, “How many women had injuries?” and “How many women had markers that indicate potential morbidities (e.g., transfusions?)”. Outcome measures can sometimes be collected from administrative data.

- **Process Measures**: To affect the outcome measures of reducing major complications of OB hemorrhage, changes will be made to improve many core processes in the care system, as well as changes to improve the culture as it relates to safety. We will want to know if the parts/steps in the system are performing as planned. Measuring the results of these process changes will tell you if the changes are leading to an improved, safer system.

- **Balancing Measures**: Measures to make sure that changes to improve one part of the system are not causing new problems in other parts of the system. Balancing measures can also help teams to draw reasonable conclusions about the sustainability of the changes.

CMQCC developed Obstetric Hemorrhage quality improvement measurements for a multi-hospital collaborative. These measures are outlined in Appendix G. Hospital leaders can choose which of these measures are critical for tracking progress and whether they are achieving their aims and objectives.

The tracking phase can also utilize the analysis tools outlined under the assessment phase.
Repeat the MAP-IT Process

Evaluating results early and often at each stage of implementation—before, during and after—will guide decision-making for small tests of change. Small tests of change done over a short time frame and reviewed frequently provide necessary feedback to the team leaders. The feedback will help leaders re-adjust the MAP-IT Plan appropriately.
APPENDICES

APPENDIX A. SAMPLE HEMORRHAGE POLICY AND PROCEDURE

Obstetric Hemorrhage Care Guidelines: Sample Policy and Procedure

<table>
<thead>
<tr>
<th>POLICY INDEX:</th>
<th>Page 1 of X</th>
</tr>
</thead>
<tbody>
<tr>
<td>POLICY TITLE:</td>
<td>Obstetric Hemorrhage Care Guidelines</td>
</tr>
</tbody>
</table>

DEPARTMENT AND USERS DISTRIBUTION:
Maternal Child Health, Labor and Delivery, Emergency Department, Operating Room, Blood Bank, Intensive Care Unit, Post-Anesthesia Care Unit(s)

Original Date of Issue: ______________________________

<table>
<thead>
<tr>
<th>Reviewed Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Revised Date</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>

PURPOSE
The purpose of this protocol is to provide guidelines for the optimal response of the multidisciplinary team in the event of obstetric hemorrhage. This protocol will also aid in recognizing patients at risk for hemorrhage and identifying stages of hemorrhage and primary treatment goals.

POLICY STATEMENTS
Optimal response to obstetric hemorrhage requires the coordination of effort of team members from multiple disciplines and departments.

- Obstetric unit, anesthesia department, blood bank, operating room, and other appropriate services work together to identify necessary system supports and processes for mounting an efficient and coordinated response to obstetric hemorrhage.
- Obstetric physicians, obstetric RNs, certified nurse midwives, anesthesiologists, and other appropriately qualified clinicians are authorized to mobilize the team to respond to an obstetric hemorrhage.
- The OB hemorrhage critical pack/cart are always kept stocked, not expired, and available for an emergency in all areas of the hospital where women are treated for OB hemorrhage. Note: the assignments for stocking and checking the cart need to be clearly delineated by each hospital. For example: medications will be kept together in an emergency packet in the pharmacy cart on the unit; the emergency medication packet will be maintained by pharmacy; the adult resuscitation cart or a separate resuscitation cart will be designed with an OB hemorrhage supply component.
- The Obstetric (OB) Hemorrhage general and massive policies and procedures will be updated at least every three years.
DEFINITIONS
General Hemorrhage: ≥500 ml blood loss for vaginal birth; ≥1000 ml blood loss for cesarean birth
Massive Hemorrhage: ≥1500 ml blood loss for any birth

MONITORING
Perform annual assessment of readiness to respond to an obstetric hemorrhage.

SUMMARY OF STAGES OF OBSTETRIC HEMORRHAGE AND PRIMARY TREATMENT GOALS

Prenatal Screening and Treatment:
- Risk assessment
- Aggressive treatment of anemia
- Risk appropriate blood work on admission

Stage 0: Prevention and Recognition of OB Hemorrhage in All Births
- Active Management of Third Stage Labor
- Ongoing Quantitative Evaluation of Blood Loss
- Ongoing Evaluation of Vital Signs

Stage 1: Cumulative Blood Loss >500 ml vaginal birth or >1000 ml cesarean birth –OR–
- Vital Signs >15% change or HR ≥110, BP ≤85/45, O₂ sat <95% –OR–
  - Increased bleeding during recovery or postpartum
  - ACTIVATE HEMORRHAGE PROTOCOL, INITIATE PREPARATIONS, GIVE METHERGINE IM ONCE; IF NO RESPONSE, MOVE TO PROSTAGLANDINS (HEMABATE, CYTOTEC) (See Uterotonic Agent Information Table; Addendum A)

Stage 2: Continued Bleeding or Vital Sign instability and 1000-1500 ml cumulative blood loss
- SEQUENTIALLY ADVANCE THROUGH MEDICATIONS AND PROCEDURES;
  - MOBILIZE HELP & BLOOD BANK SUPPORT;
  - KEEP AHEAD WITH VOLUME AND BLOOD PRODUCTS

Stage 3: Cumulative Blood Loss >1500 ml, >2 units PRBCs given, Vital Signs unstable of suspicion for Disseminated Intravascular Coagulopathy
- ACTIVATE MASSIVE TRANSFUSION PROTOCOL AND INVASIVE SURGICAL APPROACHES TO CONTROL BLEEDING
PROCEDURES

Prenatal, Admission and Ongoing Risk Assessment

• Identify and prepare for patients with special considerations: Placenta Preview/Accreta, Bleeding Disorder, or those who decline blood products
• Screen and aggressively treat severe anemia: if oral iron fails, initiate IV Iron Sucrose Protocol (Best Practice: Iron Sucrose Protocol) to reach desired Hgb/Hct, especially for at-risk mothers

---

**Admission Assessment & Planning**

<table>
<thead>
<tr>
<th>Verify Type &amp; Antibody Screen from prenatal record</th>
<th>Evaluate for Risk Factors (see below)</th>
</tr>
</thead>
<tbody>
<tr>
<td>If not available, Order Type &amp; Screen (lab will notify if 2nd clot needed for confirmation)</td>
<td>If medium risk: Order Type &amp; Screen, Review Hemorrhage Protocol</td>
</tr>
<tr>
<td>If prenatal or current antibody screen positive (if not low level anti-D from Rho-GAM), Type &amp; Crossmatch 2 units PRBCs</td>
<td>If high risk: Order Type &amp; Crossmatch 2 units PRBCs, Review Hemorrhage Protocol, Notify OB Anesthesia</td>
</tr>
<tr>
<td>All other patients, Send Clot to blood bank</td>
<td>Identify women who may decline transfusion, Notify OB provider for plan of care, Early consult with OB anesthesia, Review Consent Form</td>
</tr>
</tbody>
</table>

---

**Ongoing Risk Assessment**

- Evaluate for development of additional risk factors in labor:
  - Prolonged 2nd Stage labor
  - Prolonged oxytocin use
  - Active bleeding
  - Chorioamnionitis
  - Magnesium sulfate treatment
- Increase Risk level (see below) and convert to Type & Screen or Type & Crossmatch
- Treat multiple risk factors as High Risk

---

**Admission Hemorrhage Risk Factor Evaluation**

<table>
<thead>
<tr>
<th>Low (Clot only)</th>
<th>Medium (Type and Screen)</th>
<th>High (Type and Cross)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No previous uterine incision</td>
<td>Prior cesarean birth(s) or uterine surgery</td>
<td>Placenta previa, low lying placenta,</td>
</tr>
<tr>
<td>Singleton pregnancy</td>
<td>Multiple gestation</td>
<td>Suspected placenta accreta or percreta</td>
</tr>
<tr>
<td>≤4 previous vaginal births</td>
<td>&gt;4 previous vaginal births</td>
<td>Hematocrit &lt;30 AND other risk factors</td>
</tr>
<tr>
<td>No known bleeding disorder</td>
<td>Chorioamnionitis</td>
<td>Platelets &lt;100,000</td>
</tr>
<tr>
<td>No history of PPH</td>
<td>History of previous PPH</td>
<td>Active bleeding (greater than show) on admit</td>
</tr>
<tr>
<td>Large uterine fibroids</td>
<td>Known coagulopathy</td>
<td></td>
</tr>
<tr>
<td>Estimated fetal weight greater than 4 kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morbid obesity (BMI &gt;35)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*If admitted patients are started on magnesium sulfate they are at higher risk of postpartum hemorrhage.*
PROCEDURES, CONTINUED

STAGE 0
Prevention & Recognition of Hemorrhage during all births

Active Management of Third Stage of Labor
1. Administer Oxytocin infusion: 10-20 Units/1000 ml solution for women with IV access. Note that the dosage and rates should be clearly specified by each hospital.
   a. Titrate infusion rate to uterine tone.
   b. Use 10 units IM for women without IV access.
   c. Do not give oxytocin as IV push
2. Provide vigorous fundal massage for at least 15 seconds

Ongoing Quantitative Measurement of Blood Loss at all Births
1. Assess blood loss at birth, prior to delivery of the placenta whenever possible.
2. Reassess cumulative blood loss after delivery of the placenta
3. Use formal methods to assess blood loss:
   a. Use graduated under-buttock drapes
   b. Weigh blood soaked materials on gram scale (1 gm = 1ml)
      i. Subtract known dry weight of materials
      ii. Use a hemorrhage report or Early Warning Chart (National Health Survey, NHS)
   *NOTE: if a dry chux is used to protect scale from blood-soaked material, ZERO the scale after placing dry chux and prior to placing saturated item(s).

Ongoing Evaluation of Vital Signs and Clinical Triggers

STAGE 1
Cumulative Blood Loss >500 ml vaginal birth or >1000 ml C/S -OR- Vital Signs >15% change or HR ≥110, BP ≤85/45, O2 sat <95% -OR- Increased bleeding during recovery or postpartum

Interventions:
Follow Obstetric hemorrhage care guidelines checklist to mobilize response, act to mitigate bleeding, and move sequentially through treatment.

Evaluate patient response to interventions:
1. If the patient is stable following Stage 1 interventions then perform increased postpartum surveillance.
STAGE 2
Proceed to STAGE 2 for any of the following when cumulative blood loss is <1500 mL:
1. Continued bleeding
2. Continued vital sign instability

Evaluate patient response to interventions:
1. If stabilized during Stage 2 (<1500 ml cumulative blood loss) then perform increased postpartum surveillance

STAGE 3
Proceed to STAGE 3 if cumulative blood loss >1500 mL OR:
1. >2 units PRBCs administered
2. Unstable vital signs after stage 2 interventions
3. Suspicion of DIC

Evaluate patient response to interventions:
1. If stabilized during Stage 3 (cumulative blood loss >1500 ml) then perform increased postpartum surveillance, consult with intensivist and/or transfer to ICU

Do not delay other interventions while waiting for response to medication(s).

Do not wait for laboratory values to initiate transfusions:
1. Transfuse based on clinical signs and patient response.
2. Transfuse aggressively with a high ratio of Fresh Frozen Plasma to PRBCs for massive hemorrhage (>1500 mL cumulative blood loss); key is high ratio of FFP to PRBC
   - Either 6:4:1 PRBCs:FFP:Platelets
   - Or 4:4:1 PRBCs:FFP:Platelets

COMMUNICATION and DOCUMENTATION
1. Verbally acknowledge actions you will take and orders received.
2. Provide ongoing updates about patient’s status with other departments.
3. Record intake and output records.
REFERENCES and RELATED DOCUMENTS:

1. CMQCC OB Hemorrhage Task Force: Care Guidelines and Compendium of Best Practices, OB Hemorrhage Care Guidelines Checklist: use the checklist to help think through possible etiologies and anticipate next steps and to identify Risk Factors: Prenatal, Admission and Ongoing Assessment
3. Casper, L., Lee, R., Carts, Kits and Trays
4. Gregory, K., et al, Definitions, Early Recognition, and Rapid Response Using Triggers
## UTEROTONIC AGENTS for POSTPARTUM HEMORRHAGE

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Route</th>
<th>Frequency</th>
<th>Side Effects</th>
<th>Contraindications</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pitocin® (Oxytocin)</td>
<td>10-40 units per 1000 ml, rate titrated to uterine tone</td>
<td>IV infusion</td>
<td>Continuous</td>
<td>Usually none Nausea, vomiting, hyponatremia (“water intoxication”) with prolonged IV admin. ↓ BP and ↑ HR with high doses, esp IV push</td>
<td>Hypersensitivity to drug</td>
<td>Room temp</td>
</tr>
<tr>
<td>Methergine® (Methylergonovine)</td>
<td>0.2 mg</td>
<td>IM (not given IV)</td>
<td>-Q 2-4 hours -If no response after first dose, it is unlikely that additional doses will be of benefit</td>
<td>Nausea, vomiting Severe hypertension, esp. with rapid administration or in patients with HTN or PIH</td>
<td>Hypertension, PIH, Heart disease Hypersensitivity to drug Caution if multiple doses of ephedrine have been used, may exaggerate hypertensive response w/possible cerebral hemorrhage</td>
<td>Refrigerate Protect from light</td>
</tr>
<tr>
<td>Hemabate® (15-methyl PG F2a)</td>
<td>250 mcg</td>
<td>IM or intramyometrial (not given IV)</td>
<td>-Q 15-90 min -Not to exceed 8 doses/24 hrs -If no response after several doses, it is unlikely that additional doses will be of benefit.</td>
<td>Nausea, vomiting, Diarrhea Fever (transient), Headache Chills, shivering Hypertension Bronchospasm</td>
<td>Caution in women with hepatic disease, asthma, hypertension, active cardiac or pulmonary disease Hypersensitivity to drug</td>
<td>Refrigerate</td>
</tr>
<tr>
<td>Cytotec® (Misoprostol)</td>
<td>800-1000mcg tablets</td>
<td>Per rectum (PR)</td>
<td>One time</td>
<td>Nausea, vomiting, diarrhea Shivering, Fever (transient) Headache</td>
<td>Rare Known allergy to prostaglandin Hypersensitivity to drug</td>
<td>Room temp</td>
</tr>
</tbody>
</table>
APPENDIX B: CMQCC OB HEMORRHAGE CARE GUIDELINES CHECKLIST

### Obstetric Hemorrhage Care Guidelines: Checklist Format

#### Prenatal Assessment & Planning
- Identify and prepare for patients with special considerations: Placenta Previa/Accreta, Bleeding Disorder, or those who Decline Blood Products
- Screen and aggressively treat severe anemia: if oral iron fails, initiate IV Iron Sucrose Protocol to reach desired Hgb/Hct, especially for at risk mothers.

#### Admission Assessment & Planning
- **Verify Type & Antibody Screen** from prenatal record if not available.
  - Order Type & Screen (lab will notify if 2nd clot needed for confirmation)
  - If prenatal or current antibody screen positive (if not low level anti-D from Rho-GAM), Type & Crossmatch 2 units PRBCs, All other patients, Send Clot to blood bank
- Evaluate for **Risk Factors** (see below)
  - If medium risk:
    - Order Type & Screen
    - Review Hemorrhage Protocol
  - If high risk:
    - Order Type & Crossmatch 2 units PRBCs
    - Review Hemorrhage Protocol
    - Notify OB Anesthesia
    - Identify women who may decline transfusion
    - Notify OB provider for plan of care
    - Early consult with OB anesthesia
    - Review Consent Form

#### Ongoing Risk Assessment
- Evaluate for development of additional risk factors in labor:
  - Prolonged 2nd Stage labor
  - Prolonged oxytocin use
  - Active bleeding
  - Chorioamnionitis
  - Magnesium sulfate treatment
- Increase Risk level (see below) and convert to Type & Screen or Type & Crossmatch
- Treat multiple risk factors as High Risk

### Admission Hemorrhage Risk Factor Evaluation

<table>
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<td></td>
</tr>
<tr>
<td>Morbid obesity (BMI &gt;35)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### STAGE 0: All Births: Prevention & Recognition of OB Hemorrhage

**Active Management of Third Stage**
- Oxytocin infusion: 10-20 units oxytocin/1000ml solution titrate infusion rate to uterine tone; or 10 units IM; do not give oxytocin as IV push
- Vigorous fundal massage for at least 15 seconds

**Ongoing Quantitative 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**
- **If: Cumulative Blood Loss >500ml vaginal birth or >1000ml C/S -OR-**
  - Vital signs >15% change or HR ≥110, BP ≥85/45, O2 sat <95% -OR-
  - Increased bleeding during recovery or postpartum,

  **proceed to STAGE 1**
### STAGE 1: OB Hemorrhage

**Cumulative Blood Loss >500mL vaginal birth or >1000mL C/S**
- OR-  
  **Vital signs >15% change or HR >110, BP >85/45, O2 sat <95%**
- OR-  
  **Increased bleeding during recovery or postpartum**

<table>
<thead>
<tr>
<th>MOBILIZE</th>
<th>ACT</th>
<th>THINK</th>
</tr>
</thead>
</table>
| **Primary nurse, Physician or Midwife to:** | | Consider potential etiology:
| ☐ Activate OB Hemorrhage Protocol and Checklist | | • Uterine atony
| ☐ Notify obstetrician (in-house and attending) | | • Trauma/Laceration
| ☐ Notify charge nurse | | • Retained placenta
| ☐ Notify anesthesiologist | | • Amniotic Fluid Embolism
| **Primary nurse:** | | • Uterine Inversion
| ☐ Establish IV access if not present, at least 18 gauge | | • Coagulopathy
| ☐ Increase IV fluids rates (Lactated Ringers preferred) and increase Oxytocin rate (500 mL/hour of 10-40 units/1000mL solution); Titrate Oxytocin infusion rate to uterine tone | | • Placenta Accreta
| ☐ Continue vigorous fundal massage | | • Uterine Rupture
| ☐ Administer Methergine 0.2 mg IM per protocol (if not hypertensive); give once, if no response, move to alternate agent; if good response, may give additional doses q 2 hr | | Once stabilized: Modified Postpartum management with increased surveillance
| ☐ Vital Signs, including O2 sat & level of consciousness (LOC) q 5 minutes | | |  
| ☐ Weigh materials, calculate and record cumulative blood loss q 5-15 minutes | | |  
| ☐ Administer oxygen to maintain O2 sats at >95% | | |  
| ☐ Empty bladder: straight cath or place Foley with uterometer | | |  
| ☐ Type and Crossmatch for 2 units Red Blood Cells STAT (if not already done) | | |  
| ☐ Keep patient warm | | |  
| **Physician or midwife:** | | |  
| ☐ Rule out retained Products of Conception, laceration, hematoma | | |  
| **Surgeon (if cesarean birth and still open):** | | |  
| ☐ Inspect for uncontrolled bleeding at all levels, esp. broad ligament, posterior uterus, and retained placenta | | |  

If: Continued bleeding or Continued Vital Sign instability, and <1500 mL cumulative blood loss proceed to STAGE 2

### UTEROTONIC AGENTS for POSTPARTUM HEMORRHAGE

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Route/Intrauterine</th>
<th>Frequency</th>
<th>Side Effects</th>
<th>Contraindications</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pitocin® (Oxytocin)</td>
<td>10-40 units per 1000 mL, rate titrated to uterine tone</td>
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<td>Methergine® (Methylergonovine)</td>
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<td>IM (not given IV)</td>
<td>Q 2-4 hours</td>
<td>-Q 15-90 min</td>
<td>Hypertension, PIH, Heart disease, Hypersensitivity to drug, Caution if multiple doses of ephedrine have been used, may exaggerate hypertensive response w/possible cerebral hemorrhage</td>
<td>Refrigerate from light</td>
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<td>Hemabate® (15-methyl PG F2a)</td>
<td>250 mcg</td>
<td>IM or intra-myometrial</td>
<td>Q 15-90 min</td>
<td>-Not to exceed 8 doses/24 hrs</td>
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<td>800-1000 mcg</td>
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California Maternal Quality Care Collaborative (CMQCC): Hemorrhage Taskforce (2009) visit: www.CMQCC.org for details
### STAGE 2: OB Hemorrhage

Continued bleeding or Vital Sign instability, and <1500 mL cumulative blood loss

<table>
<thead>
<tr>
<th>MOBILIZE</th>
<th>ACT</th>
<th>THINK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary nurse (or charge nurse):</strong></td>
<td>Team leader (OB physician):</td>
<td>Sequentially advance through procedures and other interventions based on etiology:</td>
</tr>
<tr>
<td>□ Call obstetrician to bedside</td>
<td>□ Additional uterotonic medication: Hemabate 250 mcg IM if not contraindicated OR Misonprostol 800-1000 mcg PR</td>
<td><strong>Vaginal birth</strong></td>
</tr>
<tr>
<td>□ Call Anesthesiologist</td>
<td>□ Can repeat Hemabate up to 3 times every 20 min; (note-75% respond to first dose)</td>
<td>If trauma (vaginal, cervical or uterine):</td>
</tr>
<tr>
<td>□ Activate Response Team:</td>
<td><strong>Do not delay other interventions (see right column) while waiting for response to medications</strong></td>
<td>• Visualize and repair</td>
</tr>
<tr>
<td><strong>PHONE #:</strong></td>
<td>□ Bimanual uterine massage</td>
<td>If retained placenta:</td>
</tr>
<tr>
<td>□ Notify Blood bank of hemorrhage; order products as directed</td>
<td>□ Move to OR (if on postpartum unit, move to L&amp;D or OR)</td>
<td>• D&amp;C</td>
</tr>
<tr>
<td><strong>Charge nurse:</strong></td>
<td>□ Order 2 units PRBCs and bring to the bedside</td>
<td>If uterine atony or lower uterine segment bleeding:</td>
</tr>
<tr>
<td>□ Notify Perinatologist or 2nd OB</td>
<td>□ Order labs STAT (CBC/Pits, Chem 12, PT/aPTT, Fibrinogen, ABG)</td>
<td>• Intrauterine Balloon</td>
</tr>
<tr>
<td>□ Initiate OB Hemorrhage Record</td>
<td>□ Transfuse PRBCs based on clinical signs and response, do not wait for lab results</td>
<td>If above measures unproductive:</td>
</tr>
<tr>
<td>□ If selective embolization, call- in Interventional Radiology Team and second anesthesiologist</td>
<td></td>
<td>• Selective embolization (Interventional Radiology if available &amp; adequate experience)</td>
</tr>
<tr>
<td>□ Notify nursing supervisor</td>
<td><strong>Primary nurse:</strong></td>
<td><strong>C-section:</strong></td>
</tr>
<tr>
<td>□ Assign single person to communicate with blood bank</td>
<td></td>
<td>• Uterine hemostatic suture, e.g., B-Lynch Suture, O’Leary, Multiple Squares</td>
</tr>
<tr>
<td>□ Call medical social worker or assign other family support person</td>
<td>□ Establish 2nd large bore IV, at least 18 gauge. Maintain adequate fluid volume with Lactated Ringers and adequate uterine tone with oxytocin infusion</td>
<td>• Intrauterine Balloon</td>
</tr>
<tr>
<td></td>
<td>□ Assess and announce Vital Signs and cumulative blood loss q 5-10 minutes</td>
<td>If Uterine Inversion:</td>
</tr>
<tr>
<td></td>
<td>□ Set up blood administration set and blood warmer for transfusion</td>
<td>• Anesthesia and uterine relaxation drugs for manual reduction</td>
</tr>
<tr>
<td></td>
<td>□ Administer meds, blood products and draw labs, as ordered</td>
<td>If Amniotic Fluid Embolism:</td>
</tr>
<tr>
<td></td>
<td>□ Keep patient warm</td>
<td>• Maximally aggressive respiratory, vasopressor and blood product support</td>
</tr>
<tr>
<td></td>
<td><strong>Second nurse (or charge nurse):</strong></td>
<td>If vital signs are worse than estimated or measured blood loss: possible uterine rupture or broad ligament tear with internal bleeding; move to laparotomy</td>
</tr>
<tr>
<td></td>
<td>□ Place Foley with urimeter (if not already done)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Obtain portable light and OB procedure tray or Hemorrhage cart</td>
<td></td>
</tr>
</tbody>
</table>
### STAGE 3: OB Hemorrhage

**Cumulative blood loss >1500ml, >2 units PRBCs given, VS unstable or suspicion for DIC**

<table>
<thead>
<tr>
<th>MOBILIZE</th>
<th>ACT</th>
<th>THINK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nurse or Physician:</td>
<td>Establish team leadership and assign roles</td>
<td>Selective Embolization (IR)</td>
</tr>
<tr>
<td></td>
<td>Team leader (OB physician + OB anesthesiologist, anesthesiologist and/or perinatologist and/or intensivist):</td>
<td>Interventions based on etiology not yet completed</td>
</tr>
<tr>
<td></td>
<td>□ Order Massive Hemorrhage Pack</td>
<td>Prevent hypothermia, Acidemia</td>
</tr>
<tr>
<td></td>
<td>(RBCs + FFP + 1 pheresis pack PLTS—see note in right column</td>
<td>Conservative or Definitive Surgery:</td>
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<tr>
<td></td>
<td>□ Move to OR if not already there</td>
<td>• Hysterectomy</td>
</tr>
<tr>
<td></td>
<td>□ Repeat CBC/PLTS; Chem 12, PT/aPTT, Fibrinogen, ABG STAT q 30-60 min</td>
<td>For Resuscitation: Aggressively Transfuse Based on Vital Signs, Blood Loss</td>
</tr>
<tr>
<td></td>
<td>Anesthesiologist (as indicated):</td>
<td>KEY: HIGH RATIO of FFP to RBC</td>
</tr>
<tr>
<td></td>
<td>□ Arterial blood gases</td>
<td>Either: 6:4:1 PRBCs: FFP: Platelets</td>
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<tr>
<td></td>
<td>□ Central hemodynamic monitoring</td>
<td>Or: 4:4:1 PRBCs: FFP: Platelets</td>
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<td></td>
<td>□ CVP or PA line</td>
<td>Unresponsive Coagulopathy:</td>
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<td></td>
<td>□ Arterial line</td>
<td>Once Stabilized: Modified Postpartum Management; consider ICU</td>
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<td></td>
<td>□ Vasopressor support</td>
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<td></td>
<td>□ Intubation</td>
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<td></td>
<td>Primary nurse:</td>
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<tr>
<td></td>
<td>□ Announce VS and cumulative measured blood loss q 5-10 minutes</td>
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<td></td>
<td>□ Apply upper body warming blanket if feasible</td>
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<td></td>
<td>□ Use fluid warmer and/or rapid infuser for fluid &amp; blood product administration</td>
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<td></td>
<td>□ Apply sequential compression stockings to lower extremities</td>
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<td></td>
<td>□ Circulate in OR</td>
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<td>Second nurse and/or anesthesiologist:</td>
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<td></td>
<td>□ Continue to administer meds, blood products and draw labs, as ordered</td>
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<td></td>
<td>Third Nurse (or charge nurse):</td>
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<td></td>
<td>□ Recorder</td>
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</tbody>
</table>

**BLOOD PRODUCTS**

| Packed Red Blood Cells (PRBC) | Best first-line product for blood loss | Best first-line product for blood loss |
| (approx. 35-40 min. for crossmatch—assuming no sample is in the lab and assuming no antibodies are present) | 1 unit = 450ml volume | 1 unit = 450ml volume and typically increases Hct by 3% |
| Transfuse O Negative blood if you cannot wait | If antibody positive, may take 1-24 hrs. for crossmatch | If antibody positive, may take 1-24 hrs. for crossmatch |

| Fresh Frozen Plasma (FFP) | Highly desired if >2 units PRBCs given, or for prolonged PT, aPTT >1.5x control | Highly desired if >2 units PRBCs given, or for prolonged PT, aPTT >1.5x control |
| (approx. 35-45 min. to thaw for release) | 1 unit = 180ml volume and typically increases Fibrinogen by 10mg/dL | 1 unit = 180ml volume and typically increases Fibrinogen by 10mg/dL |

| Platelets (PLTS) | Priority for women with Platelets <50,000 | Priority for women with Platelets <50,000 |
| Local variation in time to release (may need to come from regional blood bank) | Single-donor Apheresis unit (6 units of platelet concentrates) provides 40-50k transient increase in platelets | Single-donor Apheresis unit (6 units of platelet concentrates) provides 40-50k transient increase in platelets |

| Cryoprecipitate (CRYO) | Priority for women with Fibrinogen levels <80 | Priority for women with Fibrinogen levels <80 |
| (approx. 35-45 min. to thaw for release) | 10 unit pack typically raises Fibrinogen 80-100mg/dL | 10 unit pack typically raises Fibrinogen 80-100mg/dL |
| | Best for DIC with low fibrinogen and don’t need volume replacement | Best for DIC with low fibrinogen and don’t need volume replacement |
| | Caution: 10 units come from 10 different donors, so infection risk is proportionate. | Caution: 10 units come from 10 different donors, so infection risk is proportionate. |
APPENDIX C. CMQCC OBHEMORRHAGE CARE GUIDELINES FLOW CHART

OBSTETRIC HEMORRHAGE CARE SUMMARY: FLOW CHART FORMAT

Pre-Admission
- Identify patients with special consideration:
  - Placenta previa/accreta, Bleeding disorder, or
  - those who decline blood products
- Screen All Admissions for hemorrhage risk:
  - Low Risk, Medium Risk and High Risk

Time of admission
- Low Risk: Hold clot
- Medium Risk: Type & Screen, Review Hemorrhage Protocol
- High Risk: Type & Crossmatch 2 Units PRBCs, Review Hemorrhage Protocol

Stage 0
- All women receive active management of 3rd stage
- Oxytocin IV infusion or 10 Units IM
- Vigorous fundal massage for 15 seconds minimum

Blood Loss: >500 ml Vaginal
- >1000 ml CS
Stage 1
- Activate Hemorrhage Protocol
  - Increase IV rate (LR); Increase Oxytocin
  - Methylene 0.2 mg IM (if not hypotensive)
  - Continue Fundal massage; Empty Bladder; Keep Warm
  - Administer O₂ to maintain Sat >95%
  - Rule out retained POC, laceration or hematoma
  - Order Type & Crossmatch 2 Units PRBCs if not already done

Blood Loss: 1000-1500 ml
Stage 2
- Sequentially Advance through Medications & Procedures
  - Vaginal Birth:
    - Binational Fundal Massage
    - Retained POC: Dilation and Curettage
    - Lower segment/Implantation site/Atony: Intrauterine Balloon
    - Laceration/ Hematoma: Packing, Repair as Required
    - Consider IR (if available & adequate experience)
  - Cesarean Birth:
    - Continued Atony: B-Lynch Suture/Intrauterine Balloon
    - Continued Hemorrhage: Uterine Artery Ligation

Blood Loss: >1500 ml
Stage 3
- Activate Massie Hemorrhage Protocol
  - Unresponsive Coagulopathy:
    - After 10 Units PRBCs and full coagulation factor replacement,
      - may consider rFactor VFla

Conservative Surgery
- B-Lynch Suture/Intrauterine Balloon
- Uterine Artery Ligation
- Hypogastric Ligation (experienced surgeon only)
- Consider IR (if available & adequate experience)

To OR (if not there):
- Activate Massive Hemorrhage Protocol
- Mobilize Massive Hemorrhage Team
- TRANSFUSE AGGRESSIVELY
  - RBC/FFP Pts > 6.4:1 or 4.4:1

DEFINITIVE SURGERY
- Hysterectomy
  - Cumulative Blood Loss >1500 ml, 2 Units Given, Vital Signs Unstable

HEMORRHAGE CONTINUES
- Hysterectomy
  - Cumulative Blood Loss >1500 ml, 2 Units Given, Vital Signs Unstable

Verify Type & Screen on prenatal record:
- if positive antibody screen on prenatal or current labs (except low level anti-D from Rhogam), Type & Crossmatch 2 Units PRBCs

Ongoing Evaluation:
- Quantification of blood loss and vital signs
  - Cumulative Blood Loss >800 ml Vag; >500 ml CS
  - >15% Vital Sign change or
  - HR ±110, BP ±1345
  - O₂ Sat <95%, Clinical sx

INCREASED BLEEDING

- Standard Postpartum Management
  - Fundal Massage
  - CALL FOR EXTRA HELP
  - Continued heavy bleeding

- CALL FOR EXTRA HELP
  - Give Meds: Hemablate 250 mcg IM -or-
  - Misoprostol 800-1000 mcg PR

- Transfuse 2 Units PRBCs per clinical signs
- Do not wait for lab values
- Consider thawing 2 Units FFP

INCREASED POSTPARTUM SURVEILLANCE
- Consider ICU Care; Increased Postpartum Surveillance

California Maternal Quality Care Collaborative (CMQCC), Hemorrhage Taskforce (2009) visit: www.CMQCC.org for details
This project was supported by Title V funds received from the State of California Department of Public Health, Center for Family Health; Maternal, Child and Adolescent Health Division
## OB HEMORRHAGE TOOLKIT

### APPENDIX D. CMQCC OB HEMORRHAGE CARE GUIDELINES TABLE CHART

<table>
<thead>
<tr>
<th>Stage 0</th>
<th>Assessments</th>
<th>Meds/Procedures</th>
<th>Blood Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every woman in labor/giving birth</td>
<td>• Assess every woman for risk factors for hemorrhage</td>
<td>Active Management 3rd Stage: • Oxytocin IV infusion or 10u IM</td>
<td>• If Medium Risk: T&amp;Scr</td>
</tr>
<tr>
<td></td>
<td>• Ongoing quantitative evaluation of blood loss on every birth</td>
<td>• Fundal Massage-vigorous, 15 seconds min.</td>
<td>• If High Risk: T&amp;C 2 U</td>
</tr>
<tr>
<td>Stage 0 focuses on risk assessment and active management of the third stage.</td>
<td></td>
<td></td>
<td>• If Positive Antibody Screen (prenatal or current, exclude low level anti-D from RhoGam): T&amp;C 2 U</td>
</tr>
</tbody>
</table>

### Stage 1

**Blood loss: >500 ml vaginal or >1000 ml Cesarean, or VS changes (by >15% or HR ≥110, BP ≥85/45, O2 sat <95%)**

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Assessments</th>
<th>Meds/Procedures</th>
<th>Blood Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Act on hemorrhage protocol, initiate preparations and give Methylene IM.</td>
<td>• Activate OB Hemorrhage Protocol and Checklist</td>
<td>IV Access: at least 18gauge</td>
<td>• T&amp;C 2 Units PRBCs (if not already done)</td>
</tr>
<tr>
<td></td>
<td>• Notify Charge nurse, Anesthesia Provider</td>
<td>• Increase IV fluid (LR) and Oxytocin rate, and repeat fundal massage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• VS, O2 Sat q5’</td>
<td>• Methylene 0.2mg IM (if not hypertensive)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Calculate cumulative blood loss q5-15’</td>
<td>May repeat if good response to first dose, BUT otherwise move on to 2nd level uterine drug (see below)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Weigh bloody materials</td>
<td>Empty bladder: straight cath or place Foley with urinometer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Careful inspection with good exposure of vaginal walls, cervix, uterine cavity, placenta</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Stage 2

**Continued bleeding with total blood loss under 1500ml**

<table>
<thead>
<tr>
<th>Stage 2</th>
<th>Assessments</th>
<th>Meds/Procedures</th>
<th>Blood Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back to bedside (if not already there)</td>
<td>OB back to bedside (if not already there)</td>
<td>1st Level Uterotonic Drugs: • Hemabate 250 mcg IM or Misoprostol 800-1000 mcg PR</td>
<td>• Notify Blood Bank of OB Hemorrhage</td>
</tr>
<tr>
<td>Extra help: 2nd OB, Rapid Response Team (per hospital), assign roles</td>
<td>• Extra help: 2nd OB, Rapid Response Team (per hospital), assign roles</td>
<td>2nd IV Access (at least 18gauge)</td>
<td>• Bring 2 Units PRBCs to bedside, transfuse per clinical signs – do not wait for lab values</td>
</tr>
<tr>
<td></td>
<td>• VS &amp; cumulative blood loss q 5-10 min</td>
<td>Bimanual massage</td>
<td>• Use blood warmer for transfusion</td>
</tr>
<tr>
<td></td>
<td>• Weigh bloody materials</td>
<td>Vaginal Birth: (typical order)</td>
<td>• Consider thawing 2 FFP (takes 35+min), use if transfusing &gt;2u PRBCs</td>
</tr>
<tr>
<td></td>
<td>• Complete evaluation of vaginal wall, cervix, placenta, uterine cavity</td>
<td>• Move to OR</td>
<td>• Determine availability of additional PRBCs and other Coag products</td>
</tr>
<tr>
<td></td>
<td>• Send additional labs, including DIC panel</td>
<td>• Repair any tears</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• If in Postpartum: Move to L&amp;D/OR</td>
<td>• D&amp;C: r/o retained placenta</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Evaluate for special cases:</td>
<td>• Place intrauterine balloon</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Uterine Inversion</td>
<td>• Selective Embolization (Interventional Radiology)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Amn. Fluid Embolism</td>
<td>Cesarean Birth: (still intra-op)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(typical order)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Inspect broad lig, posterior uterus and retained placenta</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• B-Lynch Suture</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Place intrauterine balloon</td>
<td></td>
</tr>
</tbody>
</table>

### Stage 3

**Total blood loss over 1500ml, or >2 units PRBCs given or VS unstable or suspicion of DIC**

<table>
<thead>
<tr>
<th>Stage 3</th>
<th>Assessments</th>
<th>Meds/Procedures</th>
<th>Blood Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilize team</td>
<td>Mobilize team</td>
<td>Activate Massive Hemorrhage Protocol</td>
<td>Transfuse Aggressively Massive Hemorrhage Pack</td>
</tr>
<tr>
<td>-Advanced GYN surgeon</td>
<td>-Advanced GYN surgeon</td>
<td>Laparotomy</td>
<td>Near 1:1 PRBC:FFP</td>
</tr>
<tr>
<td>-2nd Anesthesia Provider</td>
<td>-2nd Anesthesia Provider</td>
<td>-B-Lynch Suture</td>
<td>1 PLT pheresis pack per 6 units PRBCs</td>
</tr>
<tr>
<td>-OR staff</td>
<td>-OR staff</td>
<td>-Uterine Artery Ligation</td>
<td>Unresponsive Coagulopathy:</td>
</tr>
<tr>
<td>-Adult Intensivist</td>
<td>-Adult Intensivist</td>
<td>-Hysterectomy</td>
<td>After 10 units PRBCs and full coagulation factor replacement: may</td>
</tr>
<tr>
<td>Repeat labs including coags and ABG’s</td>
<td>Repeat labs including coags and ABG’s</td>
<td>-Patient support</td>
<td>consider rFactor Vlla</td>
</tr>
<tr>
<td>-Central line</td>
<td>-Central line</td>
<td>-Fluid warmer</td>
<td></td>
</tr>
<tr>
<td>-Social Worker/ family support</td>
<td>-Social Worker/ family support</td>
<td>-Upper body warming device</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Sequential compression stockings</td>
<td></td>
</tr>
</tbody>
</table>

This Project was supported by Title V funds received from the State of California, Department of Public Health, Center for Family Health, Maternal, Child and Adolescent Health Division.

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CMQCC initiated a statewide Obstetric Hemorrhage Quality Improvement (QI) Collaborative in October 2009. The OB Hemorrhage QI Collaborative is using the Institute for Healthcare Improvement (IHI) Breakthrough Series Model for Improvement, which includes intensive expert and peer mentoring. The Expert Panel, with input from the collaborating hospitals, developed specific goals or aims for the 12-month initiative. The aims guided the development of measures that assess improvement over the life of the collaborative and beyond.

Aims and measures from this Collaborative are presented as a guide, but can be changed to meet facilities’ needs.

Refer to the appendix for checklists, flowcharts, audit tools and additional documents to use during implementation and change.
APPENDIX E.1. CMQCC IN HOSPITAL AUDIT TOOL: RISK ASSESSMENT FOR OB HEMORRHAGE

**Topic:** Risk Assessment for obstetric hemorrhage is documented in the chart at admission.

**Goal:** 100% of women are assessed for risk of obstetric hemorrhage on admission by [date].

**Instructions:** Audit 20 randomly selected charts per month (10 Vaginal, 10 cesarean).

<table>
<thead>
<tr>
<th>MR#</th>
<th>Vaginal Delivery</th>
<th>Cesarean Delivery</th>
<th>Vaginal Delivery</th>
<th>Cesarean Delivery</th>
<th>Vaginal Delivery</th>
<th>Cesarean Delivery</th>
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<th>Cesarean Delivery</th>
<th>Vaginal Delivery</th>
<th>Cesarean Delivery</th>
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<td>Yes ☐</td>
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<td>Yes ☐</td>
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</tbody>
</table>

**Total number of audited charts with:**

**Numerator:** _______ Risk Assessment Documented in Chart

**Denominator:** _______ Total Number of Charts Audited
**APPENDIX E.2. CMQCC IN HOSPITAL AUDIT TOOL: ACTIVE MANAGEMENT OF THIRD STAGE LABOR**

**Topic:** Active Management of Third Stage Labor* is documented in the chart at admission.

**Goal:** 100% of women are assessed for risk of obstetric hemorrhage on admission by [date].

**Instructions:** Audit 20 randomly selected charts per month (10 Vaginal, 10 cesarean). Select “All are recorded” check box only if all 3 elements of Active Management* were documented in the chart.

*Active Management of Third Stage Labor is defined as including ALL of the following:

1. Oxytocin (IV or IM) at delivery of shoulders or delivery of placenta (identify when administered)
2. Fundal Massage for 15 seconds minimum
3. Gentle Cord Traction

<table>
<thead>
<tr>
<th>MR#</th>
<th>Vaginal Delivery</th>
<th>Cesarean Delivery</th>
<th>MR#</th>
<th>Vaginal Delivery</th>
<th>Cesarean Delivery</th>
<th>MR#</th>
<th>Vaginal Delivery</th>
<th>Cesarean Delivery</th>
<th>MR#</th>
<th>Vaginal Delivery</th>
<th>Cesarean Delivery</th>
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(check if Yes):
- Oxytocin IV/IM Administered at delivery of (check one):
  □ Shoulders -OR- □ Placenta
- Fundal Massage (≥ 15 sec)
- Cord Traction

MR# | Vaginal Delivery | Cesarean Delivery | MR# | Vaginal Delivery | Cesarean Delivery | MR# | Vaginal Delivery | Cesarean Delivery | MR# | Vaginal Delivery | Cesarean Delivery |
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(check if Yes):
- Oxytocin IV/IM Administered at delivery of (check one):
  □ Shoulders -OR- □ Placenta
- Fundal Massage (≥ 15 sec)
- Cord Traction

Total number of audited charts with:

Numerator: _________ **All 3 elements of** Active Management of Third Stage Labor Documented in Chart
Denominator: _________ Total Number of Charts Audited
APPENDIX E.3. METHODS FOR DEVELOPING TRAINING AND TOOLS FOR QUANTITATIVE MEASUREMENT OF BLOOD LOSS

Recommended methods for ongoing quantitative measurement of blood loss:

1. Formally estimate blood loss by recording 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 pads, chux, etc.
2. Formally measure blood loss by weighing blood soaked pads/chux
3. Formally measure blood loss by collecting blood in graduated measurement containers

Quantifying blood loss by weighing (see images at right and below)
- Establish dry weights of common items
- Standardize use of pads
- Build weighing of pads into routine practice
- Develop worksheet for calculations

Quantifying blood loss by measuring (see image below right)
- Use graduated collection containers (C/S and vaginal deliveries)
- Account for other fluids (amniotic fluid, urine, irrigation)

Establish Dry Weights

<table>
<thead>
<tr>
<th>Item</th>
<th>Dry Weight in Grams</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Bundle (2 lg obst, 1 ice pack per pack, 2 small per pack)</td>
<td>396</td>
<td>• Weight all bloody items in grams • Subtract dry weights in grams • Remaining weight in grams = ml blood loss 1 gram = 1 ml</td>
</tr>
<tr>
<td>Small Chux (16 in X 34 in)</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>Large Chux (24 in X 54 in)</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Large Peripad (regular bleeding)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Small Peripad from OB Pack</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Ice Pack Peripad</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cloth Towel (Mitt)</td>
<td>34 - 115</td>
<td></td>
</tr>
<tr>
<td>Vinyl Packing from OB Packs</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>Fucker Sponge</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Training Tools

- 25 ml saturates about 50% area
- 50 ml saturates about 75% area
- 75 ml saturates entire surface
- 100 ml will saturate and drip

Used with kind permission of Bev VanderWal, CNS
### IN HOSPITAL AUDIT TOOL: CUMULATIVE BLOOD LOSS AND QUANTITATIVE MEASUREMENT METHODS

**Topic:** Cumulative blood loss is recorded in patient chart (in mls) during labor and delivery, until status is routine postpartum and patient is physiologically stable.

**Goal:** 100% of birthing mothers have on-going cumulative quantification of blood loss by September 30, 2010.

**Instructions:** Audit 20 randomly selected charts per month (10 Vaginal, 10 Cesarean; identify method of delivery below). Identify whether blood loss was evaluated; identify if blood loss was evaluated by visual estimation only; identify if blood loss was quantitatively evaluated using one or more of three recommended methods.*

Submit Cumulative Blood Loss Audit Data to CMQCC monthly using EXTRANET (do not submit medical record numbers)

#### Four methods for ongoing cumulative blood loss measurement:

1. Estimating blood loss by visual estimation methods only
2. Formally estimate blood loss by recording percent (%) saturation of blood soaked items with the use of visual cues such as pictures/posters to determine blood volume equivalence
3. Formally measure blood loss by weighing blood soaked pads/,vix
4. Formally measure blood loss by collecting blood in graduated measurement containers

<table>
<thead>
<tr>
<th>MR #</th>
<th>Vaginal Delivery</th>
<th>Cesarean Delivery</th>
<th>Measurement NOT recorded in chart</th>
<th>Estimated with Visual Cues Only</th>
<th>If you select Visual Estimation Only, do not select methods below</th>
<th>Select All that Apply:</th>
<th>Formally estimated by % saturation</th>
<th>Formally measured by weighing</th>
<th>Formally measured by collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative blood loss is recorded in patient chart in milliliters during labor and delivery and until status changes to routine postpartum and patient is physiologically stable.</td>
<td>☐</td>
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</tr>
</tbody>
</table>

*Select the Measurement Method(s) Recorded in Patient Chart

<table>
<thead>
<tr>
<th>MR #</th>
<th>Vaginal Delivery</th>
<th>Cesarean Delivery</th>
<th>Measurement NOT recorded in chart</th>
<th>Estimated with Visual Cues Only</th>
<th>If you select Visual Estimation Only, do not select methods below</th>
<th>Select All that Apply:</th>
<th>Formally estimated by % saturation</th>
<th>Formally measured by weighing</th>
<th>Formally measured by collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative blood loss is recorded in patient chart in milliliters during labor and delivery and until status changes to routine postpartum and patient is physiologically stable.</td>
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</tr>
</tbody>
</table>

*Select the Measurement Method(s) Recorded in Patient Chart

### Total number of audited charts with Blood Loss:

- **Numerator 1:** Not Measured
- **Numerator 2:** Estimated with Visual Cues Only
- **Numerator 3:** Measured using one or more of three recommended formal measurements (estimate by % saturation; measure by weight; measure by collection)

**Denominator (for all 3 numerators above):** Total Number of Charts Audited

---

This project was supported by Title V funds received from the California Department of Public Health, Maternal, Child and Adolescent Health Division.
APPENDIX E.5. CMQCC OBSTETRIC HEMORRHAGE TEAM DE-BRIEFING FORM

Topic: The de-brief form provides an opportunity for maternity service teams to review then document sequence of events, successes and barriers to a swift and coordinated response to obstetric hemorrhage.

Goal: De-brief completed in 100% of all obstetric hemorrhages that progress to Stage 2 or 3. All de-briefs have at least Primary RN, and Primary MD who participates in the de-briefing session.

Instructions: Complete as soon as possible, but no later than 24 hours after any Stage 2 or 3 hemorrhages. During de-brief, obtain input from participants (all or as many as possible).

Stage 2 or 3 hemorrhages are defined as bleeding that continues after administration of IV or IM Oxytocin, vigorous fundal massage, emptied bladder and Methergine 0.2 mg IM.

---

**Print this form double-sided; patient stamp on back of form will not be faxed with completed form. - Attach additional pages with notes as needed**

Were the following medications, procedures or blood products used? (Check if yes, check all that apply)

- **Medications**
  - High dose misoprostol (800-1000 mcg)
  - Carboprost tromethamine (Hemobate)

- **Blood Volume/Options**
  - Invasive hemodynamic monitoring
  - Blood warmer
  - Rapid fluid infuser (level one machine)
  - Blood cell salvage machine (cell saver)
  - Factor VIIa (non-standard treatment)

- **Procedures**
  - Intrauterine balloons
  - B-Lynch suture
  - Uterine artery ligation
  - Uterine artery embolization
  - Non-pneumatic Anti-shock Garments (NASG; non-standard treatment)

**Comments about medications, procedures, or blood products:**

Thinking about how the obstetric hemorrhage was managed…

Identify what went well (Check if yes, describe)

- Communication went well
- Teamwork went well
- Leadership went well
- Decision-making went well
- Assessing the situation went well
- Other

**Briefly describe:**

Identify opportunities for improvement: “human factors” (Check if yes, describe)

- Communication needed improvement
- Teamwork needed improvement
- Leadership needed improvement
- Decision-making needed improvement
- Assessing needed improvement
- Other

**Briefly describe:**

Identify opportunities for improvement: “non-human factors” (Check if yes, describe)

- Delay in blood products availability
- Equipment issues
- Medications issues

**Briefly describe:**

- Inadequate support (in-unit or other areas of the hospital)
- Delays in transporting the patient (within the hospital or to another facility)
- Other

**Volume of blood lost: _____ mls**

**Method of Blood Loss Measurement (Check all that apply)**

- Visually Estimated Only
- Formal Estimate using Posters/Pictures
- Formal Measure by weight
- Formal Measure by volume collection

**Blood Product Transfusion Ratios - Active Hemorrhage Treatment and Resuscitation Period (~the first 4-6 hours PP)**

Units of PRBCs: ______________
Units of FFP: ______________
Units of Platelets: ______________
Units of Cryo: ______________

**Thinking about how the obstetric hemorrhage was managed…**

Identify what went well (Check if yes, describe)

- Communication went well
- Teamwork went well
- Leadership went well
- Decision-making went well
- Assessing the situation went well
- Other

**Briefly describe:**

Identify opportunities for improvement: “human factors” (Check if yes, describe)

- Communication needed improvement
- Teamwork needed improvement
- Leadership needed improvement
- Decision-making needed improvement
- Assessing needed improvement
- Other

**Briefly describe:**

Identify opportunities for improvement: “non-human factors” (Check if yes, describe)

- Delay in blood products availability
- Equipment issues
- Medications issues

**Briefly describe:**

- Inadequate support (in-unit or other areas of the hospital)
- Delays in transporting the patient (within the hospital or to another facility)
- Other

**Briefly describe:**
Change Project MAP-IT Worksheet – Blank Form

MAP-IT Action Plan for: ______________(Hospital Name)
Date Created: _____ Developed by: ____________________________

Aims Statement or Objective: By (month)____ (day)____ (year)____ we will quantify blood loss on
all women who give birth at our hospital.

M: Mobilize

A: Assess

P: Plan

I: Implement

T: Track

First Cycle Due Date: ______________

SAMPLE of COMPLETED
OB Hemorrhage Change Project MAP-IT Planning Worksheet

MAP-IT Action Plan for: California’s Best Medical Center (Hospital Name)
Date Created: _____ Developed by: OB Hemorrhage QI Team

Aims Statement or Objective: **By (month)____ (day)____ (year)____ we will quantify blood loss on all women who give birth at our hospital.**

M: Mobilize
Get your change team together on a regular basis. Have the perspectives of a Hospital Administrator, Labor & Delivery leader and staff, Anesthesia, Blood Bank, Emergency Department, etc. represented on your team so that they can develop a plan for each of their departments.

A: Assess
Complete the Fishbone cause and effect diagram on quantification of blood loss. Complete a process flow chart on the current state of blood loss calculation and accuracy.

P: Plan
1. Review the policy and procedures to determine how they need to be revised.
2. Raise awareness among the staff of how inaccurate the blood loss measurements currently are. A. In a room on or near the unit set up a “Quantification of Blood Loss Skills Lab”. The skills lab can have multiple stations where there are pads, chux, etc. stained and saturated with red fluid. Have the clinicians guess the amounts of fluid on each of the items. Post the results for everyone to see. Make it fun! B. Have team members make rounds on all shifts and ask the clinicians who were at a delivery to quantify the blood loss. Weigh the items saturated with blood and compare the actual amounts to the estimated amounts.
3. Revise the chart forms to include method of determination of blood loss.
4. Identify who will be responsible to accomplish each of the above items.

I: Implement
1. Revise the policy and procedure to outline how blood loss will be quantified. Have a select group of staff test the draft procedure to see how the procedure needs to be refined and adjusted and what barriers are identified. Eliminate the barriers identified and revise the procedure as needed.
2. Assess all staff on their ability to accurately assess blood loss. Randomly compare estimated blood loss to actual blood loss.
3. Revise charting forms. Trial the new forms. Re-adjust as needed.
4. Keep each other apprised of the work that is accomplished and any barriers identified. Provide each other support for the implementation efforts.

T: Track
After implementing the above steps, assess the number of staff who quantify blood loss. Develop a new plan and implement that plan. Track progress and re-adjust the plan again and again until the goal is met and the change has become “how things are done around here.”

First Cycle Due Date: _______________
Purpose of the Measurement Grid:
The measurement grid outlines the measures to be collected over the 12-month life of the OB Hemorrhage multi-hospital collaborative. The grid includes the specific parameters for each measure.

Measurement for Improvement:
CMQCC multi-hospital improvement collaboratives are about making hospital systems safer for patients. Measurements play an important role. Always remember that measurements should be designed to accelerate improvement, not slow it down.

Timeline for Measurement:
The measurement grid is broken down into three categories: Outcome, Process and Balancing Measures. Teams may also develop additional measures based on the issues that are of most interest and importance to their hospital and patient population needs. Only the measures in the grid below will be submitted to CMQCC.

Outcome Measures: These measures tell you whether changes are actually leading to improvement – that is, helping to achieve the overall aim of reducing major complications of OB hemorrhage. Outcome measures answer questions like, “How many women had injuries?” and “How many women had markers that indicate potential morbidities (e.g., transfusions?”). Outcome measures can sometimes be collected from administrative data.

Process Measures: To affect the outcome measures of reducing major complications of OB hemorrhage, changes will be made to improve many core processes in the care system, as well as changes to improve the culture as it relates to safety. We will want to know if the parts/steps in the system are performing as planned. Measuring the results of these process changes will tell you if the changes are leading to an improved, safer system.

Balancing Measures: We will use these measures to make sure that changes to improve one part of the system are not causing new problems in other parts of the system. Balancing measures can also help us to draw reasonable conclusions about the sustainability of the change.

OB Hemorrhage Multi-Hospital Change Collaborative

**Aim 1:** Reduce the number of massive hemorrhages and the number of major complications from massive hemorrhage, including transfusions and hysterectomies, for all birthing women in participating hospitals by 75% by September 30, 2010.

**Aim 2:** All collaborative participants develop and implement a multidisciplinary team response to every massive obstetric hemorrhage by September 30, 2010.
<table>
<thead>
<tr>
<th>Measure</th>
<th>Calculation</th>
<th>Data Collection Plan/Sample Size</th>
<th>Data Collection Method</th>
<th>Goal</th>
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<tbody>
<tr>
<td><strong>Aim 1. Blood Product Transfusions</strong> Measures A, B. REQUIRED Measure Types: Outcome</td>
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<tr>
<td><strong>REQUIRED</strong></td>
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<tr>
<td>A. Percent of women (who gave birth ≥20 0/7 weeks gestation) who were transfused with any blood product during the birth admission</td>
<td><strong>A.1. Numerator:</strong> Number of women (who gave birth ≥20 0/7 weeks gestation) who were transfused with any blood product during the birth admission per month. <strong>Denominator:</strong> Total Number of Births (≥20 0/7 weeks gestation) per month</td>
<td><strong>Hospital Baseline:</strong> Collect A1, A2, B for January 9, 2009 to September 30, 2009 <strong>Concurrent:</strong> Report monthly data as defined (starting with October 2009)</td>
<td><strong>Blood Transfusion:</strong> data from internal source such as blood bank data, patient charts, medical records, Electronic Medical Record (EMR), etc. If available: Blood loss data recorded in patient record or delivery log.</td>
<td><strong>Goal:</strong> Reduce the number of major complications from massive hemorrhage, including transfusions, for all birthing women in participating hospitals by 75% by September 30, 2010.</td>
</tr>
<tr>
<td><strong>A.2. Total units of each type of blood product (PRBCs, Platelets, Plasma/FFP, Cryo) transfused during birth admissions per total births</strong></td>
<td><strong>A.2. Numerators:</strong> Total units of each type of blood product (PRBCs, Platelets, Plasma/FFP, Cryo) transfused during birth admissions per month. Select each blood product within the series from the drop-down menu: - <strong>Series 1:</strong> PRBCs units/month - <strong>Series 2:</strong> Platelets units/month - <strong>Series 3:</strong> Plasma/FFP units/month - <strong>Series 4:</strong> Cryo units/month <strong>Series are categories of data within a single measure</strong> <strong>Denominator:</strong> Total Number of Births (≥20 0/7 weeks gestation) per month</td>
<td><strong>OPTIONAL</strong> Additional Measurement: Number of Births/Days between occurrences of massive hemorrhage</td>
<td><strong>De-brief Form:</strong> For women who experience Stage 2 or 3 hemorrhage, identify units of PRBCs, Platelets, Plasma/FFP, Cryo (for each woman) on the De-brief Form</td>
<td></td>
</tr>
<tr>
<td><strong>B. Percent of women (who gave birth ≥20 0/7 weeks gestation) who were transfused with ≥5 units PRBCs during the birth admission</strong></td>
<td><strong>B) Numerator:</strong> Number of women (who gave birth ≥20 0/7 weeks gestation) who were transfused with ≥5 units PRBCs during the birth admission per month. <strong>Denominator:</strong> Total Number of Births (≥20 0/7 weeks gestation) per month.</td>
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**NOTE:** B is a subset of A.1
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<th>Calculation</th>
<th>Data Collection Plan/Sample Size</th>
<th>Data Collection Method</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aim 1. <strong>Peripartum Hysterectomies</strong></td>
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<td>Reduce the number of major complications from massive hemorrhage, including peripartum hysterectomies, for all birthing women in participating hospitals by 75% by September 30, 2010.</td>
</tr>
<tr>
<td>Measure C. REQUIRED</td>
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<tr>
<td>Measure Type: Outcome</td>
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</tbody>
</table>
| C. Rate of peripartum hysterectomies in women (who gave birth ≥20 0/7 weeks gestation) per 1000 births (hysterectomy performed during birth admission) stratified by risk of Placenta Previa and/or Placenta Accreta/percreta | C. Numerator: Number of peripartum hysterectomies (performed during birth admission) in women (who gave birth ≥20 0/7 weeks gestation) per month stratified by:  
  - **Series 1**: Women with Placenta Previa and/or Placenta Accreta/Percreta  
  - **Series 2**: Women without Placenta Previa and/or Placenta Accreta/Percreta  
  *Series are categories of data within a single measure*  
  Denominator: Total Number of Births (≥20 0/7 weeks gestation) per month  
  Risk Stratification/Adjustment:  
  Women who had a hysterectomy and placenta previa and/or accreta/percreta are reported separately from women who had a hysterectomy (and NO placenta previa/accreta/percreta)  
  Annotate** for each hysterectomy:  
  a) Indication for hysterectomy  
  b) Number of prior cesarean sections  
  c) Number of Days Post-Delivery (Days = 0 if procedure done on day of delivery) | Hospital Baseline: Number of peripartum hysterectomies (performed during birth admission) in women who gave birth ≥20 0/7 weeks gestation  
  Between 1/1/09 to 9/30/09  
  Concurrent: Report monthly data as defined | Peripartum Hysterectomy: Data Collection from internal source such as EMR, medical records, or other method determined by each site  
  **ICD-9 Procedure Codes**  
  68.3 Subtotal abdominal hysterectomy  
  68.39 Other and unspecified subtotal abdominal hysterectomy  
  68.4 Total abdominal hysterectomy  
  68.49 Other and unspecified total abdominal hysterectomy  
  **CPT Codes**  
  59525 Cesarean Hysterectomy  
  58150 Hysterectomy Total/Partial (Use Post-Partum or with Vaginal)  
  59160 D&C after delivery |
Aim 1. **Quantification of Blood Loss**

**Measures D, E, F. REQUIRED**

**Deliverables 1, 2, 3. REQUIRED**

**Measure Types: Outcome and Process**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Calculation</th>
<th>Data Collection Plan/Sample Size</th>
<th>Data Collection Method</th>
<th>Goal</th>
</tr>
</thead>
</table>
| **D.** Percent of Audited Charts in which quantification and documentation of blood loss is performed (during and after all births until immediate recovery status changes to routine postpartum care and woman is physiologically stable) using one or more of three preferred methods: | **D. Numerator:** Number of charts per month where on-going quantification is:  
1. Formally estimate blood loss by recording 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 pads, chux, etc.  
2. Formally measure blood loss by weighing blood soaked pads/chux  
3. Formally measure blood loss by collecting blood in graduated measurement containers | Audit 20 randomly selected charts per month (10 vaginal births and 10 cesarean births) | **Chart Review:** Refer to sample audit tool entitled: “In Hospital Audit Tool: Cumulative Blood Loss and Quantitative Measurement Methods”  
Data entered to Extranet | 100% of birthing women will have on-going cumulative quantification of blood loss by September 30, 2010. |
| **E.** % Non-MD clinicians and staff who are educated about Cumulative Blood Loss and Quantitative Measurement Methods | **E. Numerator:** Number of non-MD clinicians, (e.g., RNs, midwives) and staff (e.g., clerks, aides) who are educated about Cumulative Blood Loss and Quantitative Measurement Methods Audit Tool per month | | | |
F. % MDs (e.g., obstetricians, anesthesiologists) who are educated about Cumulative Blood Loss and Quantitative Measurement Methods

**Deliverables:**
1. Sign-off report among Labor & Delivery and Post-partum MD and Nursing staff includes whether a woman had a Stage 2 or Stage 3 hemorrhage
2. Blood loss is measured until the woman’s immediate recovery status changes to routine postpartum care and woman is physiologically stable
3. Documentation forms are updated for #1, #2

<table>
<thead>
<tr>
<th>women giving birth in your facility per month</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>F. Numerator:</strong> Number of MDs (e.g., obstetricians, anesthesiologists) who are educated about Cumulative Blood Loss and Quantitative Measurement Methods per month</td>
</tr>
<tr>
<td><strong>Denominator:</strong> Number of MDs who care for women giving birth in your facility per month</td>
</tr>
</tbody>
</table>

1. Deliverable: Submit in Extranet when completed
2. Deliverable: Submit in Extranet when completed
3. Deliverable: Submit in Extranet when completed

1. **Deliverable: Due 5/1/2010**
2. **Deliverable: Due 5/1/2010**
3. **Deliverable: Due 5/1/2010**
<table>
<thead>
<tr>
<th>Measure</th>
<th>Calculation</th>
<th>Data Collection Plan/Sample Size</th>
<th>Data Collection Method</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>**Aim 1. **OB Hemorrhage Risk Assessment on Admission&lt;br&gt;Measure G. RECOMMENDED&lt;br&gt;Measure Type: Process</td>
<td><strong>Numerator:</strong> Among the audited charts, the number of women admitted to Labor and Delivery whose risk of obstetric hemorrhage assessment is recorded in the medical record&lt;br&gt;<strong>Denominator:</strong> Total number of admission charts audited per month</td>
<td><strong>Suggestion:</strong> Audit 20 randomly selected charts per month (10 vaginal births and 10 cesarean births)</td>
<td>Chart Review Determined by individual hospital. Refer to Risk Assessment Audit Tool. Data entered to Extranet</td>
<td>100% of women are assessed for risk of obstetric hemorrhage on admission by September 30, 2010</td>
</tr>
</tbody>
</table>

| **Aim 1. **Active Management of Third Stage<br>Measure H. RECOMMENDED<br>Measure Type: Process | **Numerator:** Total number of women who receive Active Management of Third Stage Labor including<br>• Oxytocin (IV or IM) at delivery of shoulders or delivery of placenta (identify when administered)<br>• Fundal Massage for 15 seconds minimum<br>• Gentle Cord traction<br>Note: Need all three to be considered Active Management<br>**Denominator:** Total number of charts audited per month | **Suggestion:** Audit 20 randomly selected charts of women who gave birth vaginally per month | Chart review Determined by individual hospital. Refer to Active Management of Third Stage Labor Audit Tool. Data entered to Extranet | 100% of women giving birth will receive active management of labor by September 30, 2010 |
### Aim 2. Policies and Procedures and Drills

Measure I, J, K, L. REQUIRED
Deliverables 4, 5, 6, 7, 8. REQUIRED
Measure Type: Process

<table>
<thead>
<tr>
<th>Measure</th>
<th>Calculation</th>
<th>Data Collection Plan/Sample Size</th>
<th>Data Collection Method</th>
<th>Goal</th>
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<tbody>
<tr>
<td><strong>Deliverables:</strong></td>
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<tr>
<td>4. <strong>General and massive hemorrhage policies and procedures (P&amp;P) were updated after April 30, 2009.</strong></td>
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<td>5. <strong>Identify roles and multi-disciplinary team responders for stage 1, 2, and 3 hemorrhages</strong></td>
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<td>6. <strong>Determine and implement the most desirable method for maintaining accessibility to the needed OB hemorrhage supplies</strong></td>
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<tr>
<td><strong>Measures</strong></td>
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<tr>
<td><strong>I.</strong> % Non-MD clinicians and staff who are educated to the hemorrhage P&amp;Ps</td>
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<tr>
<td><strong>I. Numerator:</strong> Number of non-MD clinicians, (e.g., RNs, midwives) and staff (e.g., clerks, aides) who receive education on the hemorrhage P&amp;Ps per month</td>
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<td><strong>Denominator:</strong> Number of Non-MD clinicians and staff who are in the pool of possible responders per month (defined by hospital)</td>
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<td>4. <strong>Deliverable:</strong> Submit in Extranet when completed; Date completed; date received by CMQCC</td>
<td><strong>4. Determined by hospital, Due: 2/1/2010</strong></td>
<td>Hospital records and forms</td>
<td>100% of the collaborative participating hospitals will meet 100% of the P&amp;Ps and drills measurements by September 30, 2010</td>
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<tr>
<td>5. <strong>Deliverable:</strong> Roles defined for stage 1, 2, or 3 hemorrhages: Submit in Extranet when completed; date completed; date received by CMQCC</td>
<td><strong>5. Determined by hospital, Due: 3/1/2010</strong></td>
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<td>6. <strong>Deliverable:</strong> Provide the emergency supply maintenance plan to CMQCC: Submit in Extranet when completed; date completed; date received by CMQCC</td>
<td><strong>6. Determined by hospital, Due: 2/1/2010</strong></td>
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<tr>
<td>1. <strong>Determined by hospital</strong></td>
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<td>Deliverables</td>
<td>Measure</td>
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<tr>
<td>7. Create drills tailored to your hospital P&amp;Ps and responder roles</td>
<td>K. % Non-MD clinicians and staff who are involved in drill de-brief discussions</td>
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</table>
| 8. After Deliverables 4-7 are completed, run 1 multi-disciplinary drill per month for four consecutive months (two on night/evening shift and two on day shift) to identify system and process improvement opportunities. After each drill complete a drill de-brief form | **J. Numerator:** Number of MDs (e.g., obstetricians, anesthesiologists) who are educated to the hemorrhage P&Ps per month  
**Denominator:** Number of MDs who are in the pool of possible responders per month (defined by hospital) |
| **7. Deliverable:** Drill scenarios created: Submit in Extranet when completed; date completed; date received by CMQCC | **K. Numerator:** Number of non-MD clinicians (e.g., RNs, midwives) and staff (e.g., clerks, aides) who are involved in drill de-brief discussions per month |
| **8. Deliverable:** Drills are performed: Submit in Extranet when completed; dates completed. Maintain a list of problems identified by the drills and document how and when the problem is resolved. Submit the list to CMQCC. | **J. Determined by hospital** |
| **7. Determined by hospital, Due: 5/1/2010** | **8. Determined by hospital Due: 8/1/2010** |
| **K. Determined by hospital** | |
### Measure 2. De-Briefing after OB Hemorrhages

**Measure Type:** Process

**Aim:** De-briefing after OB Hemorrhages

**Measures M, N, O. REQUIRED**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Calculation</th>
<th>Data Collection Plan/Sample Size</th>
<th>Data Collection Method</th>
<th>Goal</th>
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</thead>
</table>
| **M.** Frequency of de-brief sessions that occurred after any hemorrhage with \( \geq \)500 mls for vaginal births and \( \geq \)1000 mls for cesarean section births that advanced beyond stage 1 to stage 2 or 3 hemorrhages. | **M. Numerator:** Number of de-brief forms submitted to CMQCC  
**Denominator:** Number of hemorrhages each month that required interventions, treatments, procedures outlined in Stage 2 or 3 of the CMQCC OB Hemorrhage checklist  
**Recommendation:** Completion of de-brief is encouraged to occur | Data entered to Extranet (for Measures M, N, O) | Fax de-brief form to CMQCC | De-brief completed in 100% of all obstetric hemorrhages that progress to Stage 2 or 3  
All de-briefs have at least one MD who participates in the de-briefing session.  
Improve communication, teamwork, use of equipment and overall management by de-briefing after every stage 2 and 3 hemorrhages.  
Identify barriers to and
and Methergine 0.2mg IM

**N.** Percent of de-briefs during which at least one primary MD participated (as checked on de-brief form)

<table>
<thead>
<tr>
<th>immediately after the patient is stabilized, but no later than 24 hours after event.</th>
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<tbody>
<tr>
<td><strong>Numerator:</strong> Number of Primary MDs who participated in de-brief</td>
</tr>
<tr>
<td><strong>Denominator:</strong> Total number of de-brief forms completed</td>
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</table>

**O.** Percent of de-briefs during which at least one primary RN participated (as checked on de-brief form)

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<tr>
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<tbody>
<tr>
<td><strong>Numerator:</strong> Number of Primary RNs who participated in de-brief</td>
</tr>
<tr>
<td><strong>Denominator:</strong> Total number of de-brief forms completed</td>
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</tbody>
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<th>Determined by hospital</th>
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<tr>
<th>solutions for:</th>
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<tbody>
<tr>
<td>a. Communication; Teamwork; Leadership; Decision-making; Assessment (situational)</td>
</tr>
<tr>
<td>b. Delays in blood product availability; Equipment issues; Medications issues; In-unit (and other) Support; Delays in patient transport</td>
</tr>
</tbody>
</table>
REFERENCES


