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A State-Wide Obstetric Hemorrhage Quality Improvement Initiative

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Abstract

Purpose—The mission of the California Maternal Quality Care Collaborative is to eliminate preventable maternal death and injury and promote equitable maternity care in California. This article describes CMQCC's statewide multi-stakeholder quality improvement initiative to improve readiness, recognition, response, and reporting of maternal hemorrhage at birth and details the essential role of nurses in its success.

Project Design and Approach—In partnership with the State Department of Maternal, Child, and Adolescent Health, CMQCC identified maternal hemorrhage as a significant quality improvement opportunity. CMQCC organized a multi-disciplinary, multi-stakeholder task force to develop a strategy for addressing obstetric (OB) hemorrhage.

Project Description—The OB Hemorrhage Task Force, co-chaired by nurse and physician team leaders, identified four priorities for action and developed a comprehensive hemorrhage guideline. CMQCC is using a multi-level strategy to disseminate the guideline, including an open access toolkit, a minimal support mentoring model, a county partnership model, and a 30-hospital learning collaborative.

Clinical Implications—In participating hospitals, nurses have been the primary drivers in developing both general and massive hemorrhage policies and procedures, ensuring the availability of critical supplies, organizing team debriefing after a stage 2 or greater hemorrhage, hosting skills stations for measuring blood loss, and running OB hemorrhage drills. Each of these activities requires effort and leadership skill, even in hospitals where clinicians are convinced that these changes are needed. In some hospitals, the burden to convince physicians of the value of

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these new practices has rested primarily upon nurses. Thus, the state-wide initiative where nurse and physician leaders work together models the value of teamwork and provides a real-time demonstration of the potential for effective interdisciplinary collaboration to make a difference in the quality of care that can be achieved. Nurses provide significant leadership in multi-disciplinary, multi-stakeholder quality projects in California. Ensuring that nurses have the opportunity to participate in formal leadership of these teams and are represented at all workgroup levels is critical to the overall initiative. Nurses brought key understanding of operational issues within and across departments, mobilized engagement across the state through the regional perinatal programs, and developed innovative approaches to solving clinical problems during implementation. Nursing leadership and integrated participation was especially critical in considering the needs of lower-resource settings, and was essential to the toolkit's enthusiastic adoption at the unit/service level in facilities across the state.

Keywords

Quality Improvement; Implementation; Hemorrhage; Practice Guidelines

Introduction

The rate of maternal deaths in the United States has nearly doubled from 7.6 per 100,000 in 1996 to 13.3 per 100,000 annual births in 2006 (California Department of Public Health [CDPH], 2010). This trend is particularly troubling since worldwide maternal mortality rates have decreased over the same time period (Hogan et al., 2010). In California maternal mortality rates nearly tripled from 6 per 100,000 in 1996 to 17 per 100,000 annual births in 2006 (CDPH, 2010). With these statistics as the background, the California Maternal Quality Care Collaborative (CMQCC) formed as a multi-stakeholder organization whose mission is to end preventable maternal death and injury and to promote equitable maternity care in California (www.cmqcc.org). CMQCC partners with the well established California Perinatal Quality Care Collaborative. Both organizations are administered by the Perinatal Programs of the Stanford University Medical School Division of Neonatal and Developmental Medicine.

CMQCC engages over 250 volunteer clinician, public health, community, and business stakeholder organization leaders. Each of these collaborators brings a vital and unique perspective to their commitment to achieving CMQCC's mission. CMQCC's methods are data- and action-driven. CMQCC defines and describes problems based on data; sets priorities for action; develops and disseminates best practice guidelines, resources, and other tools; develops quality measures; and supports the change efforts of clinicians, administrators and public health leaders who are striving to improve quality.

Selecting Hemorrhage as a Target for Improvement

Due to the rising maternal mortality trends in California, the State Health Department contracted with CMQCC to examine pregnancy-related mortality cases. To conduct this state-wide review, leaders from the maternal-child public health community and the perinatal quality improvement community formed the multi-disciplinary California Pregnancy-Related Maternal Mortality Review. Collaboration among public health and clinical quality improvement leaders on the review team ensured a broad lens for analysis and generated a strong commitment to identifying actionable opportunities for improvement in clinical care. Thus, beyond identifying who died, causes of death, and where and when deaths occurred, experts on the mortality review panel determine by consensus the degree to which each death may have been preventable. They also provide their best judgment of

contributing factors and quality improvement opportunities or lessons to be learned from each death.

The first California state-wide maternal mortality review began in February 2007. After the first year of case reviews were completed, the team identified that the deaths most often judged strongly preventable were linked to obstetric hemorrhage (CA-PAMR, 2011). This finding is consistent with reports from other country and state-wide reviews (Harper, Dugan, Espeland, Martinez-Borges, & McQuellon, 2007; Lewis, 2007). Maternal hemorrhage was the third leading cause of maternal mortality in California during 2002-2003 (CA-PAMR, 2011) and 70% of the obstetric hemorrhage deaths reviewed were judged to be potentially preventable. Obstetric hemorrhage is a leading cause of pregnancy-related mortality in the United States (Berg, Callaghan, Syverson, & Henderson, 2011) and the leading cause of maternal mortality worldwide (World Health Organization [WHO], 2005). The most recent published California data available indicated that 2.4% of all live births were complicated by postpartum hemorrhage in 1997 (Lu et al., 2005). More recent national studies indicate maternal hemorrhage remains a concern for women giving birth in the US: findings include a 27.5% increase in postpartum hemorrhage between 1994 and 2004 (Bateman, Berman, Riley & Leffert, 2010) and a 92% increase in maternal blood transfusions between 1998 and 2005 (Kuklina et al., 2009).

In 2008, CMQCC formed a Hemorrhage Task Force based on the mortality review findings and supporting literature. The goal of the task force was to eliminate preventable maternal hemorrhage deaths and injuries in California. This article describes the steps CMQCC physician and nurse leaders took to successfully engage hospitals in a state-wide OB Hemorrhage quality improvement initiative.

Project Design and Methods/Approach

Quality Improvement (QI) is a well-accepted approach to reducing harm and injury in health care (Institute of Medicine [IOM], 2001; Berwick, 1989, 2008). Key QI steps include: identifying a problem, gathering data, identifying possible solutions, implementing solutions, and making rapid assessments and adjustments based on the success or failure of implementation efforts (Eckes, 2003). This article uses the Measure, Assess, Plan, Implement, and Track (MAP-IT) model (Guidry, Vischi, Han, & Passons, 2001) to describe the execution of CMQCC's California OB Hemorrhage QI project.

Mobilize

CMQCC's Medical Director and Executive Director set the stage for the inclusive approach taken by the Hemorrhage Task Force in their early work forming the Collaborative. First, they conducted interviews and small group meetings with key informants who were demographically diverse (physician, nurse, and midwife leaders practicing in geographically diverse areas of the state of California in 2006-2007). The purpose of these meetings was to identify community concerns, raise awareness about data showing rising maternal mortality, and lay a foundation for mobilizing volunteers. The key informants identified the top QI priorities in their region, the type of improvement work they might be interested in participating in, and other leaders not present who might work in a collaborative fashion to improve maternity care in California.

In 2007 CMQCC also convened an Executive Committee and a Maternal QI Panel. The Executive Committee includes representatives from the state of California American Congress of Obstetricians and Gynecologists, Association of Women's Health, Obstetric and Neonatal Nurses California Section, American College of Nurse Midwives, March of Dimes, California Department of Public Health-Maternal Child and Adolescent Health

Division, and Kaiser Family Foundation, among others. The Executive Committee sets overall strategic direction and priorities for CMQCC.

The Maternal QI Panel is a team of expert physicians, nurses, and administrators who develop recommendations for action and oversee implementation of CMQCC initiatives. QI Panel leaders identified several possible topics for a state-wide QI initiative based on the key informant interviews, literature review, and mortality review findings. Topics were ranked by overall significance, research evidence, scope, availability of data, externalities (cost and liability), capacity to generate excitement among clinicians and the public, and relevance to women giving birth in California. The QI panel selected OB hemorrhage as the first CMQCC QI initiative based on these rankings, which included data from the mortality review on the probable preventability of many OB hemorrhage deaths. Nurse and physician leaders from the QI panel agreed to Co-Chair the OB Hemorrhage Task Force. Other task force members were selected on the basis of expertise and balancing clinical area (e.g. nurses, general obstetricians, perinatologists, midwives, anesthesiologists, pathologists, and public health specialists), geographic region, size of institution, and community or academic facilities. Including members representing differing clinical perspectives was essential to producing a comprehensive QI initiative and tool-kit.

Assess

Accurate data is a foundation for all successful QI initiatives (Eckes, 2003; Langley et al., 2009). Without accurate data, solutions to problems remain elusive and enormous energy can be expended without achieving desired results (Eckes, 2003; Langley et al., 2009). Emphasis on the need for accurate assessment is critical. Indeed, some of the first solutions brainstormed by Task Force members for improving hemorrhage care were focused on ensuring more women had access to high-technology approaches such as interventional radiology. Without data (sources described below), the task force may not have shifted their focus from these high-technology solutions to more universal low-tech solutions that can be implemented in virtually all care settings.

We faced several data assessment challenges. First, staffing and financial constraints limited how much data could be collected and analyzed. Second, some analysis steps, such as detailed diagramming of the care process (Carey & Lloyd, 2001; Langley, et al., 2009), were impractical for a statewide project designed to be implemented in approximately 300 hospitals. To be successful we needed to identify key common weaknesses and leverage points and then develop strategies and tools that could be implemented under a wide range of local conditions. Third, maternal mortality data is limited by including only the women who died and not the women who suffered morbidity. Fourth, the basic definition of OB hemorrhage varies among clinicians. Finally, administrative data from hospitals include inconsistencies in coding. The resulting wide variation in reported hemorrhage rates (Lu, et al., 2005) made it difficult to set a 'norm' for benchmarking improvement.

The Task Force used two data sources to generate a baseline assessment: a composite case study of QI opportunities provided by the mortality review panel and a survey of California Hospitals.

Composite case study—The mortality review panel developed a composite case study to illustrate the common elements of the maternal deaths reviewed (Box 1). This case study demonstrates the review panel finding that low-risk pregnancy and birth can quickly escalate to an emergent situation and death when the amount of blood loss goes unrecognized and when there are delays in administering appropriate treatments. These lessons served as powerful reminders to task force members to keep focused on the basics.

CMQCC baseline survey—The Maternal QI Panel developed a state-wide survey to assess the baseline status of hemorrhage-related structure and process indicators in California hospitals, and to obtain clinicians' perceptions of barriers to effective hemorrhage care. The Stanford University Institutional Review Board determined that the survey met criteria for exempt status. We administered the survey to nurse and physician representatives at all California hospitals reporting 50 or more annual births. The primarily nurse-led Regional Perinatal Programs of California were instrumental partners in collecting survey data. We obtained responses from 163 of the 261 target hospitals (66%).

Survey respondents throughout California articulated three key barriers to treating women: inadequate assessments, lack of accurate and consistent estimation of blood loss, and problems with communication and teamwork. Responses also revealed that clinicians across the state used inconsistent definitions of hemorrhage, and many hospitals lacked hemorrhage policies and procedures. Less than half of the hospitals were running hemorrhage drills, and few physicians participated in drills that were conducted. Many clinicians reported lack of familiarity with treatment methods such as intrauterine balloons and B-Lynch suturing. Respondents also noted inadequate systems to report and track hemorrhages.

Nurses and physicians reported difficulties communicating with each other due to imprecision in reports of blood loss. They stated that assessment of blood loss was too subjective, and reports to physicians that a woman is “bleeding a lot” are difficult to interpret. Others pointed out that OB hemorrhage is a high-risk, low-volume emergency, with resulting difficulty in ensuring that residents and inexperienced nurses gain competency in quantifying blood loss. These data (from both the composite case study and the survey) all pointed to systems where clinicians face significant difficulties in identifying and responding to hemorrhage in a timely and efficient manner.

Plan

The OB Hemorrhage Task Force met in-person and by phone. During these meetings we reviewed the baseline data and developed a QI plan. We also conducted a thorough literature review to identify best practices, developed a clinical guideline for OB hemorrhage, and delineated four behavioral objectives to guide implementation:

- Improve **readiness** for hemorrhage by implementing standardized protocols for general and massive hemorrhage.
- Improve **recognition** of OB hemorrhage by performing on-going objective quantification of actual blood loss during and after all births.
- Improve **response** to hemorrhage by performing regular on-site interprofessional hemorrhage drills.
- Improve **reporting** of OB hemorrhage by standardizing definitions and improving consistency in coding and reporting.

The task force broke down OB hemorrhage into its component sub-topics related to process, pathophysiology, and treatment. Each Task Force member self-selected the sub-topics they were most interested in researching and synthesizing. Self-determined work groups reviewed the available literature, graded the evidence, and prepared draft recommendations for review by the entire task force. Although the resulting fragmentation of topics was at times a management challenge, this approach established a participatory model that we believe was useful in generating sustained enthusiasm for collaborative work, critical to successful achievement of the volume of work accomplished by the task force, and facilitates information retrieval for clinicians.

Draft recommendations and strength of evidence were reviewed and discussed by the task force until consensus on best practices was achieved. Members were reminded not to let the “perfect” get in the way of the “good” since gold standard tests of treatment (randomized trials) were often limited or not available for this problem (Neuhauser & Diaz, 2007). Consensus on best practices was thus based on integration of research evidence, available data, and expert clinical judgment. The resulting recommendations were catalogued in the Compendium of Best Practices and synthesized into an OB Hemorrhage Care Guideline for prevention, recognition, and response to OB hemorrhage. The guideline, best practices, and cognitive aids covering key steps of the guideline comprise an open-source CMQCC OB Hemorrhage Toolkit.

The OB Hemorrhage Care Guideline is presented in three formats: a comprehensive bedside checklist to guide team care, and two cognitive aids (a table and a flowchart) that present the most critical points (Harrison, Manser, Howard, & Gaba, 2006) in different formats for ease of use by clinicians. While the Compendium outlines the evidence base and rationale for recommendations in 15 focused articles, the Care Guidelines walk the user through action steps to be taken at the point of care.

The practical organization of information needed by clinicians at the bedside is central to the adoption and implementation of the toolkit by clinicians working in California hospitals. For example, the breakdown of information by sub-topics makes it possible for nurses to quickly identify critical treatment issues, such as recommendations for blood product replacement. In addition, these tools provide guidance on how to assess risk and how to prepare for less common situations such as birth in women who decline blood transfusions. The emphasis on presenting practical information in various formats was born of having substantive involvement of practicing nurses and physicians on the task force from its inception, and from hewing closely to the lessons from the mortality review composite case.

The mortality review data identified denial, delays, and cycling through the same small set of ineffective interventions as characteristic of maternal hemorrhage deaths deemed preventable. To assist clinicians to move efficiently and appropriately through their response to maternal hemorrhage, the bedside checklist outlines team member roles and responsibilities according to stage (severity of hemorrhage) and by three categories of action: “Mobilize” “Act” and “Think.” The “Mobilize” column lists team members to engage. The “Act” column outlines specific actions, medications and treatment responsibilities by team member role. The “Think” column encourages team members to maintain situation awareness and future planning by suggesting etiologies and escalating treatments to consider even as they deal with immediate critical tasks. Key points such as medication dosing, aggressive volume replacement, maintenance of normal body temperature and recommended ratios for blood product replacement are clearly identified in the actions steps and treatment recommendations.

Implement

CMQCC utilizes four models to support the implementation of the OB hemorrhage toolkit in California hospitals.

Minimal implementation support—Clinicians or hospital leaders use the OB hemorrhage toolkit to implement change themselves. The toolkit implementation guide includes policies and procedures, a discussion of tactics to identify and mitigate implementation barriers, audit tools, and a measurement grid for tracking progress. CMQCC hosts an informational website, sends out eNews announcements, hosts free education webinars, and disseminates the tools at conferences and grand rounds. Other leaders, such as

state-funded Directors of Regional Perinatal Programs of California support implementation by promoting, distributing, and discussing the OB hemorrhage Toolkit.

Moderate implementation support—In addition to the above supports, CMQCC provides a web-based data-repository at a modest subscription fee to collect and bench-mark hospital-level data and generate real-time reports.

Support for county public health-community partnership—In this model, CMQCC provides technical support to Maternal Child Health county public health leaders. The county leaders convene the groups and provide the day-to-day oversight for OB hemorrhage projects while CMQCC provides data management and analysis. The State Health Department provides Title V funding support through the Local Assistance for Maternal Health projects. Los Angeles County has used this Local Assistance funding to work with local hospitals to improve response to obstetric hemorrhage since 2008.

Intensive implementation support—Hospital-based groups register and pay to work together over a 12-18 month period, following the Institute for Healthcare Improvement (IHI) Breakthrough Series model (IHI, 2003). Project leaders (a nurse, physician, anesthesiologist, and administrator) submit baseline pre-collaborative and on-going monthly data through a web-based tool. Project leaders attend three in-person meetings and monthly conference phone calls. They receive both expert and peer mentoring during the meetings, and report their implementation challenges and successes.

Regardless of the implementation model chosen, change champions - local hospital front-line nurse and physician leaders actively engaged in leading change in their facilities - are critical to success (IOM, 2001; Buchanan, 2003; Leape & Berwick, 2005; Rogers, 2003). For example, nurses are leading the Collaborative's efforts to move away from estimated blood loss (EBL) in favor of quantification of blood loss (QBL). This seemingly simple change has required sustained effort. While the concept to "quantify the blood" is relatively straightforward, workflow is affected. Clinicians need to determine how they will weigh blood-soaked materials (e.g. baby scale or other scale), how they will measure fluids in containers accurately, and whether their documentation systems support an ongoing record of quantification. Thus the initiative to measure rather than estimate blood loss entails a myriad of decisions about practical integration of new tasks into the already complex set of tasks nurses perform during and after birth.

The clinical knowledge and problem solving skills of staff nurses and clinical nurse specialists has been critical to successful implementation of routine QBL. Nurses designed several tactics to reduce the steps needed to measure blood loss, including standardizing supplies and having laminated cards listing dry weights attached to scales to eliminate steps in weighing dry products or zeroing the scale with dry products. Teams that have implemented QBL are reporting experiences in which careful QBL led to women receiving earlier and more effective treatments. Collaborative participants also report the implementation of QBL improves team communication and situation awareness during critical events and at handoffs. It will take time and continued evaluation research to determine more broadly how routine QBL affects hemorrhage care, resource use, and women's health outcomes in California.

In hospitals participating in the implementation collaborative, nurses have been the primary drivers in developing both general and massive hemorrhage policies and procedures, ensuring the availability of critical supplies, organizing team debriefing after a stage 2 or greater hemorrhage, hosting skills stations for measuring blood loss, and running OB hemorrhage drills. Each of these activities requires effort and leadership skill, even in

hospitals where clinicians are convinced that these changes are needed. In some hospitals, the burden to convince physicians of the value of these new practices has rested primarily upon nurses. Thus, the state-wide initiative where nurse and physician leaders work together models the value of teamwork and provides a real-time demonstration of the potential for effective interdisciplinary collaboration to make a difference in the quality of care that can be achieved.

Track

Evaluating the success of implementation is critical for determining how to modify improvement plans. CMQCC uses several methods of evaluation. The evaluation method for the minimal implementation support model is necessarily restricted by funding and data limitations. Hospital-based key informants self-report their progress on pre-determined benchmarks. The CMQCC data measurement grid includes process and outcome measures, and forms the basis for tracking progress for the other implementation models. Recommended process measures include existence of up-to-date general and massive hemorrhage policies and procedures, the number of clinicians who have participated in drills, percent of charts audited where quantification of blood loss is recorded and the number and type of maternal blood transfusions. An outcome measure is the number of women experiencing peripartum hysterectomy. For the county-community partnership model, county health leaders obtain supplemental data obtained from participating hospitals. For the intensive implementation support model, hospital leaders report structure, process, and outcome measures. The collaborative learning meetings are recorded and transcribed in order to analyze the implementation efforts of participating teams. Leaders from participating hospitals submit data via a CMQCC debrief form for serious hemorrhage (stage 2 or greater). These debrief forms capture real-time, “good catch” and “near miss” data that can be shared widely in order to increase learning and potentially eliminate preventable deaths. Tracking debriefings encourages teams to quickly yet systematically analyze local cases for what went well and what needs improvement. Collecting debriefing data allows CMQCC to assess statewide trends that may provide critical additional insights.

Clinical Implications

A recent epidemiologic examination of postpartum hemorrhage in a nationally representative US study found that postpartum hemorrhage was associated with almost 20% of post-birth in-hospital deaths (Bateman, et al., 2010). Atony was the leading cause of hemorrhage in this study (79% of cases), yet risk factors for atony other than age and cesarean birth were present in less than 40% of affected women. In 2004 the hemorrhage rate was 2.9%, an increase of 27.5% from 1995 (Bateman et al, 2010). These data suggest that obstetric hemorrhage remains a pressing health concern for childbearing women.

CMQCC identified four domains for improving hemorrhage care in California obstetric services: readiness, recognition, response, and reporting. The mortality review composite case indicated readiness for OB hemorrhage was impaired because emergency supplies were not always immediately available and teams tended to cycle through the same set of ineffective interventions without escalating treatment intensity. Survey data indicated many facilities lacked equipment, knowledge, and policy to guide response to hemorrhage. Mortality review and survey data indicated accurate measurement of blood loss is critical for determining treatment effectiveness and what needs to be done when. However blood loss was frequently contested or inaccurately reported, and there was no consensus on the definition of hemorrhage. Each of these domains became a target for improvement and CMQCC developed tools to support clinicians in addressing them. Groups outside of California may find either the tools or the processes used to develop them useful in their own efforts to reduce OB hemorrhage-related morbidity and mortality.

- **Improving readiness** is achieved by having critical supplies available and developing general and massive hemorrhage policy and procedures. The CMQCC OB Hemorrhage Toolkit outlines suggested contents of a supply kit, provides templates for policy and procedure, and provides a guide for implementation.
- **Improving recognition** of hemorrhage is achieved by assessing, recording, and reporting quantified blood loss. The toolkit includes a best practice statement on quantification of blood loss and sample set up for skills stations to improve recognition of excessive blood loss.
- **Improving response** is achieved by practicing for events using interprofessional drills based on written care guidelines, and debriefing with the care team after each hemorrhage. Drills make it possible to practice how to respond during emergencies and to identify systems issues such as delays in obtaining supplies. Formal debriefings provide timely review of what went well or what could be improved during actual emergencies (Dekker, 2002; Klein, 1998; Leonard, Graham, & Bonacum, 2004). Both drills and debriefings provide an opportunity to capture and share lessons learned. CMQCC serves as a clearing house for tracking lessons learned from all the hospitals participating in the learning collaborative. Collection and diffusion of lessons learned form the basis of future refinements to the guidelines and best practice documents.
- **Improving reporting** is achieved by standardizing definitions to more accurately measure how many women are affected by hemorrhage.

OB hemorrhage remains a leading cause of preventable maternal morbidity and mortality. The most effective OB hemorrhage QI implementation efforts require the on-going leadership of nurses, physicians, and others. Change is achieved through the individual actions of nurses and physicians embracing and incorporating evidence based practices in their routine care; through the group actions of nurses and physicians working together to improve care on their service or unit; and through the collective commitment of nurses, physicians, administrators, and public health leaders at the hospital, county, and state-wide level (Fried & Carpenter, 2006). Many dedicated nurses, physicians, midwives, and public health leaders have made strides toward better quality care from within their disciplinary silos. Only by breaking down disciplinary silos and working together can we make the transformative changes needed to ensure safe, high quality, high value maternity care for all women and their families.

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Callouts (5)

Maternal mortality rates have nearly tripled in California, rising from 6 per 100,000 in 1996, to 17 per 100,000 annual births in 2006.

CMQCC has engaged over 250 clinician, public health, community, and business stakeholder organization leaders in the effort to eliminate preventable maternal injury and death in California.

Initial ideas centered on increasing access to high-tech services, but the data demonstrated attention to basic care processes such as recognition and responsiveness was more important state-wide.

The Task Force identified four objectives for changing OB hemorrhage care: improving readiness, recognition, responsiveness, and reporting.

Nurses have a critical role to play in successful quality improvement efforts at all levels of the health care system.

Box 1**SAMPLE CASE HISTORY OF A MATERNAL DEATH**

The following is a description of a composite case history (combined elements from multiple de-identified cases from the California Pregnancy Associated Mortality Review) 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.

A 24 year old woman, Gravida 2 Para 1 at 38 wks gestation was induced for “tired of being pregnant”:

After an 8hr active phase and 2hr 2nd stage, she gave birth (spontaneous vaginal delivery) to an 8 pound, 6 ounce infant. After placental delivery, she had an episode of uterine atony that firmed with massage. A second episode of uterine atony responded to intramuscular methylergonovine (Methergine) and the physician went home at 1 AM. The nurses called the physician 30 minutes later to report more bleeding and further methylergonovine was ordered. 60 minutes after the call, the physician performed a dilatation and curettage (D&C) with minimal return of tissue. The woman received more methylergonovine. 45 minutes later a second D&C was performed, again with minimal returns. Estimated blood loss (EBL) at this point was >2,000 ml. Further delays in blood transfusion occurred because of inability to find proper blood administration tubing. Anesthesia was delayed, but a second IV started for more crystalloid. Vital signs became markedly abnormal: pulse =144 beats per minute, blood pressure 80/30 mm Hg. One further dose of methylergonovine was given and the woman was taken for a 3rd D&C. She had received 2units of packed red blood cells by this point. After the D&C she had a cardiac arrest from hypovolemia and hypoxia, and was taken to the ICU, where she died 3 hours later despite intensive supportive care and resuscitative efforts.

Examples of QI Opportunities and Learning Points

- No medical indication for the induction of labor
- No documentation of actual blood loss, e.g., *what does “more bleeding” mean?*
- Only a few treatments tried, e.g., Methergine and D&C, and these treatments were repeated several times, 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
- Lack of an organized standardized team approach