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Facility-Based Identification of Women With Severe Maternal Morbidity:

It Is Time to Start

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Abstract

Although maternal deaths have been the traditional indicator of maternal health, these events are the “tip of the iceberg” in that there are many women who have significant complications of pregnancy, labor, and delivery. Identifying women who experience severe maternal morbidity and reviewing their care can provide critical information to inform quality improvement in obstetrics. In this commentary, we review methods to identify women who experienced severe complications of pregnancy. We propose a simple validated approach based on transfusion of four or more units of blood products, admission to an intensive care unit, or both as a starting point for identification and review of severe maternal morbidity in health care settings for the purpose of understanding successes and failures in systems of care.

Maternal morbidity, broadly defined, encompasses physical and psychological conditions resulting from or aggravated by pregnancy that have an adverse effect on the woman’s health. Although maternal deaths have been the traditional indicator of maternal health, these tragic events have been likened to the “tip of the iceberg.” For every death, there are many women who have significant complications of pregnancy, labor, and delivery. Moreover, the most severe complications such as acute renal failure, cardiac events, thromboembolism, and hemorrhage as indicated by transfusion of blood products have increased dramatically in recent years.¹ Identifying women who experience severe maternal morbidity and reviewing their care has the potential to influence the delivery of health services by improving the understanding of the primary etiologies and contributing factors of these morbid events and informing improvements in systems of care. Although the concept of a continuum from health to morbidity to severe morbidity to death is easily

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understood, there is no simple and systematic way to identify what maternal conditions count as “severe morbidity.” Conceptually, maternal morbidity includes a broad spectrum of severity and can include complications and conditions associated with any pregnancy outcome.

Not surprisingly, there has been considerable variation in definitions of and approaches for ascertaining severe maternal morbidity. However, whether the terminology is “severe maternal morbidity,”¹ “severe acute maternal morbidity,”² or “maternal near miss,”^{3–5} most algorithms designed to identify women who have complications at the severe end of the morbidity spectrum have coalesced around indicators of organ system failure.

Geller et al,^{3,6} in an effort to account for the most severe end of the morbidity spectrum (“near miss” in their lexicon, because it identified women who “nearly missed” death), identified women with a broad range of morbidity at a single regionalized perinatal network center in Chicago over a 7-year period. They then used in-depth clinical case reviews by an expert panel to identify cases considered to have near-miss morbidity. Finally, they developed a scoring system based on 11 clinical factors. Each factor was coded as a dichotomous variable, and the sensitivity and specificity of each for differentiating near-miss morbidity from severe, but not life-threatening, morbidity was examined using the clinical (ie, as determined by expert opinion) classification of these categories as the gold standard. Whereas a five-factor scoring system (at least one organ system failure, intensive care unit [ICU] admission, transfusion of four or more units, intubation for at least 12 hours, and unanticipated surgical intervention) had high sensitivity (100%) and specificity (93%), even two-factor systems based on ICU admissions and either organ system failure or transfusion of four or more units had excellent sensitivity (100%) and reasonable specificity (78%). This scoring system was recently validated in another setting with 79% sensitivity and 96% specificity using ICU admission alone and 63% sensitivity and 99% specificity using transfusion of four or more units alone.⁷ Although the creation of a gold standard is important and the replication of the Geller et al construct adds credibility to such a standard, severity is inherently subjective and any such gold standard will necessarily be qualitative.

Another approach to defining severe maternal morbidity is one based on International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM) codes. These are diagnosis and procedure codes recorded at discharge that reflect the events of the hospitalization and are used for billing and other administrative purposes. Several reports have designed algorithms to identify delivery hospitalizations, and more recently postpartum admissions, that could then be linked to diagnoses and procedure codes that were thought to indicate severe life-threatening diagnoses, procedures associated with life-threatening conditions, or both.^{1,8,9} As the United States moves to ICD-10, the currently proposed algorithms will require updating. The concept of using ICD codes is attractive, particularly for public health surveillance, because hospital, state, and nationwide data sets with codes are available. However, the accuracy of codes in obstetric settings is variable¹⁰ and not all severely morbid events may be captured by the codes that exist. Although codes for relatively rare and well-characterized diagnoses and procedures are likely better than general obstetric codes, maternal morbidity as defined by ICD-9-CM codes has not been validated against a gold standard for severe morbidity. Although such a system can be important for

surveillance and tracking, it cannot be used for real-time identification and review, which is likely preferable for facility-level quality improvement.

Recently, the World Health Organization (WHO) published a guide that presented a standardized “near-miss approach” for improving maternal health care that included identifying cases with severe maternal complications, critical interventions or ICU use, or life-threatening conditions.⁴ In this context, “maternal near miss” is defined as “a woman who nearly died but survived a complication of pregnancy childbirth or postpartum up to 42 days.” The approach is comprehensive and may represent an opportunity to combine the timeliness of real-time identification with the large number of diagnoses and procedures put forward in the ICD-9-CM–based algorithms. However, real-time in-hospital detection of near-miss cases will require systems to identify women who meet the variety of criteria for various indicators of organ system failure. Although it is certainly conceivable to design the appropriate data collection systems to identify women who can have a wide variety of indicators of organ system failure, such systems will be resource-intensive. Moreover, it is not clear whether these cases could be identified equally well by a smaller set of indicators that would enhance the use of this approach for health care facilities.

An operational definition for cases of severe maternal morbidity in hospitals should meet several criteria. The definition should be clear and reflect actual severe and clinically important conditions so that rates can be reported, understood, and compared. Although many large hospitals and hospital systems may have sophisticated databases that could be adapted to identify women with severe morbidity, there are many hospitals that have limited resources for creating such a database. Approximately 70% of U.S. hospitals that offer obstetric services have fewer than 1,400 births per hospital.¹¹ As such, identification of cases needs to be efficient and simple, regardless of whether the methods of ascertainment use information that is already extant or derived from a new system of data collection. Finally, because identification of cases and estimation of frequencies by themselves are insufficient to denote quality (or lack thereof), the definition needs to provide for opportunities to improve quality based on insights obtained on review of care. Because identifying women with severe maternal morbidity has not been done as a routine part of ongoing quality improvement activities, any recommendation about the approach to severe maternal morbidity will be a first step. Inherent in all quality improvement efforts are processes for analysis and refinement.

RECOMMENDATIONS

- **Terminology:** We propose to use the term *severe maternal morbidity*, because this language resonates with U.S. health care providers. It can encompass the concepts expressed by the WHO Near-Miss Approach without necessitating the level of granularity proposed by the WHO for identifying organ system failure. This also avoids the confusion introduced by the alternative use of near-miss, that is, medical errors that are detected and corrected before resulting in patient harm.¹²
- **Identification of severe maternal morbidity:** All hospitals should identify women who are admitted to an ICU during pregnancy or who have been transfused with four or more units of blood products. This recommendation follows as an

adaptation of the work of Geller et al³ that has subsequently been validated.⁷ These events can be easily identified in real time and have sensitivity and specificity for identifying women with the highest severity of morbidity. This recommendation is made with full consideration that facilities will have variability in thresholds for admitting women to ICUs and hence, head-to-head comparisons among hospitals will not always be appropriate. Although a database dedicated to registering such cases would need to be established, the events are still relatively rare and easy to recognize, thus limiting resource expenditures. The data reported by You et al⁷ translate into approximately two transfusions of four or more units per 1,000 deliveries and three to four ICU admissions per 1,000 deliveries. A report using population-based data from Maryland found approximately four obstetric-related ICU admissions per 1,000 deliveries.¹³ Recommending these two criteria is not meant to disallow an individual site from using additional clinical criteria to identify additional indicators of morbidity. Using this approach, not all diagnoses that some might consider to be severe maternal morbidity would be included. For example, an intrapartum hysterectomy for an accreta that was well anticipated and only required two units of blood transfusion would not be considered severe maternal morbidity to trigger case review. However, the lack of at least four units of transfusion or ICU admission would indicate that there was low likelihood of uncovering systems improvement opportunities for this case.

- Review: Cases of severe maternal morbidity should be reviewed so that lessons (both successes and failures) can be learned and applied to ongoing quality improvement. Review should be facility-based, but extension to regional referral systems has the potential to disseminate findings from reviews to a broader constituency.
- Research: Perhaps the most critical initial question concerns the validity of the indicators for severe maternal morbidity; are we measuring what we think we are and what we need for the purpose of improving quality of care? The questions are relatively simple but the answers are difficult to discern in that severe maternal morbidity does not have a consistent gold standard. There are large obstetric services with sophisticated databases that have the opportunity to collect all of the information to duplicate the scoring system proposed by Geller et al,³ the WHO,⁴ or both. Assessing the gain such systems might provide if they were used to replace a more parsimonious set of indicators could provide important information for improving identification of women with severe maternal morbidity. Quality improvement thus extends not just to care processes, but also identification, analysis, and review.

Severe maternal morbidity is not rare and to reduce severe maternal morbidity, we must be able to identify its occurrence, review these cases, and analyze findings to develop appropriate systems improvements. The indicators for identifying severe maternal morbidity proposed here have been validated and hence are based on more than expert opinion. Hence, we believe they will serve as a good starting point. Now it is time to start.

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