

V11.1 NPIC/QAS

Special Quarterly Report: Maternal Mortality Review

I. Background

Monitoring maternal deaths is an essential element in improving maternal outcomes and identifying preventable factors. The fifth United Nations Millennium Goal (*Millennium Goal 5*) is to reduce maternal mortality by 75% between 1990 and 2015. Definitions of maternal deaths as defined by the International Classification of Diseases -10 Revision (ICD-10) code include:

“Maternal deaths are defined by the World Health Organization (WHO) as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of pregnancy, from any cause related or aggravated by the pregnancy or its management, but not from accidental or incidental deaths.” Late maternal deaths are defined as the “death of a woman from direct or indirect obstetric causes more than 42 days but less than one year after termination of the pregnancy”. Direct obstetric deaths are defined as “those resulting from obstetric complications of the pregnancy state (pregnancy, labor and delivery and puerperium), from interventions, omissions, incorrect treatment or from a chain of events resulting from any of the above”. Indirect obstetric deaths are defined as “those resulting from previous existing disease or disease that developed during pregnancy and which was not due to direct obstetric cause, but which was aggravated by physiologic effects of pregnancy.”¹

In 1986 the American College of Obstetrics and Gynecologists (ACOG) and the CDC Maternal Mortality Study Group sought to expand the ICD codes by adding two new terms.² These terms are:

Pregnancy-associated deaths defined as “the death of a woman while pregnant or within 1 year of termination of pregnancy, irrespective of cause”. *Pregnancy-related deaths* defined as “the death of a woman while pregnant or within 1 year of termination of pregnancy, irrespective of the duration and site of pregnancy, from any cause related to or aggravated by her pregnancy or its management, but not from accidental or incidental causes”. ICD terms are used by many nations and require strict coding consistencies in order to establish comparisons and trends. The ACOG/CDC terms are used by many states and cities and use a variety of data to identify maternal deaths.

It is important to understand how the terms are defined when analyzing data. Cross, Bell and Graham³ cite that “when maternal mortality is measured, the majority of aggregated information sources tend to group all maternal deaths together and there is a failure to differentiate between categories of maternal death” (pg 147). They stress the importance of differentiating *direct and indirect causes of death* in order to determine the most effective strategies for health care management. Knowledge gaps in relation to maternal mortality were discussed in a 2006 WHO Public Health Review.⁴ Following a 2000-2004 systematic review of literature on maternal mortality as defined by the WHO, gaps in published information about cultural and political determinants of maternal mortality were identified. The reviewers stated that “study design should be improved to allow causality between macrostructural determinants and maternal mortality” (pg 903). In an article entitled “Tailoring systematic reviews to meet critical priorities in maternal health

in the intrapartum period”, the author Viswanathan calls for a larger variety of study designs and closer attention to health disparities.⁵

The 2010 report *Trends in maternal mortality*⁶, released by WHO, the United Nations Children’s Fund (UNICEF), the United Nations Population Fund (UNFPA), and the World Bank, cite that deaths from pregnancy and childbirth have decreased by 34% from 1990 to 2008. The major causes of death revealed in the report are related to hemorrhage after childbirth, infections, hypertensive disorders and unsafe abortions. Ninety-nine percent of all maternal deaths occur in developing countries. Ten out of 87 countries with maternal mortality ratios equal to or over 100 in 1990 are on track with an annual decline of 5.5% between 1990 and 2008. Sub-Saharan African and South Asia account for 57% and 30% of all deaths respectively. The HIV epidemic contributed to substantial increases in maternal mortality in eastern and southern Africa. The estimates of maternal mortality rates (MMR) 1990-2008 for the United States indicate a 3.7 increase in maternal deaths. The rates for many other developed countries showed improvement in MMR. For example, France has a 2.4% decrease, Germany 3% decrease, Greece 5.2% decrease and United Kingdom 1% decrease. A report summary in *The Lancet*⁷ states:

“One of the most surprising results is the apparent rise in the MMR in the USA, Canada and Norway. This finding is likely to be partly explained by the introduction of late maternal deaths in the ICD 10, and the inclusion of a separate pregnancy status question on the US death certificate. This addition to the US death certificate was intended to improve ascertainment of pregnancy-related deaths, which our results suggest it has done” (pg 7).

On-going improvement in data collection continues toward clarification of terminology, improvement in sampling errors and greater consistency in data sets. The Global Burden of Disease study is working on improvement of classifications while methodological advancements are improving estimates of MMR.⁸

Improvements in MMR rates have been attributed to a stable global birth cohort, improved income per head, particularly in Asia and Latin America, increased maternal education and rise in skilled birth attendance.⁸ Continued efforts in providing education, access to care, and infection control and documentation of maternal outcomes is critical in achieving Millennium Development Goal 5.

II. NPIC/QAS CY 2010 Maternal Deaths

The NPIC/QAS CY 2010 Perinatal Center Data Base of 298,097 deliveries reports 9 maternal deaths (.003%). Four of the deaths involved patients with diagnoses of severe preeclampsia while one patient had a diagnosis of essential hypertension. Two other patients were HIV positive and had developed acute respiratory failure. One patient experienced an amniotic embolism and one experienced a cardiovascular disorder with a sickle cell crisis. The majority of patients 7 (78%) had complicating factors prior to delivery such as infection, anemia, drug dependency, and mental disorders. These indirect causes compromised the health of the women well before the pregnancy. It supports the importance of differentiating between direct and indirect causes, as stated by Cross, Bell and Graham, to establish the complex interventions needed to manage the care of patient with multiple causes related to maternal mortality.

However small the number of maternal deaths for this particular year, it is essential to continue to monitor maternal mortality in order to identify patients at risk and implement interventions that will further reduce the incidence.

III. Maternal Deaths: Trend Analysis CY 2006-Q1 2011

A review of the data related to maternal deaths from 2006 through first quarter 2011 for the 50 hospitals in the NPIC/QAS Trend Data Base identified a number of pre-existing conditions prior to pregnancy that could be classified as indirect causes impacting maternal mortality. Table 1 lists the specific conditions and the percentage of patients per year that presented with pre-existing conditions.

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n = 50 hospitals

	2006	2007	2008	2009	2010	2011 (Q1) *	Percent Change 2006-2010
Total deliveries	234,394	237,468	232,122	223,507	216,129	50,797	-7.8%
Total Maternal deaths**	19	18	13	17	7	3	—
Mortality Rate	0.008%	0.008%	0.006%	0.008%	0.003%	0.006%	-60.0%
Total Patients with Chronic Conditions	8	11	7	8	3	1	—
Percent of maternal deaths per year	42.1%	61.1%	53.8%	47.1%	42.9%	33.3%	1.8%

* One quarter of data only

** Only deaths during the admission for delivery were included in this count

List of frequently seen chronic conditions:

Diabetes	Infection- Hepatitis, HIV	Tobacco use
Obesity/morbid obesity	Malignancy/cancer	Drug use/dependence
Cardiovascular disease	Sickle cell disease	Insufficient prenatal care

Consideration of pre-existing conditions needs to be critically analyzed in the review of maternal mortality. In an analytical observational study reviewing maternal mortality and cesarean delivery ⁹, the researchers noted that “only a minority of publications account for medical and obstetrical comorbidities that may predispose patients to cesarean deliveries. Thus, mortality attributed to cesarean delivery may be a result of preexisting disease rather than the surgery itself” (pg 248). In this analysis, diabetes appeared frequently as a preexisting condition along with obesity, cardiovascular disease and infection. A study of maternal obesity and pregnancy outcomes ¹⁰ demonstrated that gestational diabetes mellitus, proteinuric preeclampsia, genital and urinary tract infections were more common in obese pregnant women. Antepartum complications also were noted for many patients in the maternal mortality analysis. Hypertensive pregnancy disorders were identified in 18 (23.3%) of all maternal deaths for 2006 through first quarter 2011. Hypertensive disorders complicate 10% of all pregnancies and remain a leading cause of maternal morbidity and mortality worldwide. Recent studies have linked hypertensive disorders in pregnancy as a risk factor for cardiovascular disease in later life.¹¹ “These two conditions share several common risk factors of obesity, diabetes mellitus and renal disease” (pg 562). Many of these risk factors were seen in the

preexisting conditions for this maternal mortality analysis. In addition, severe sepsis and septicemia were identified in 18 (23.3%) of patients, but due to the limitations of coded data it is difficult to determine when these conditions occurred.

Delivery complications were identified as amniotic embolism 4 (.05%), pulmonary embolism 6 (.07%), obstetric shock 6 (.07%), pulmonary complication 1(.01%), obstetric complication 3 (.03%) and surgical complication 1(.01%). “Amniotic fluid embolism (AFE) criteria consist of the presence of factors that include acute hypotension or cardiac arrest, acute hypoxia, coagulopathy or severe critical hemorrhage in the absence of other explanations”.¹² “Despite technological advances in critical care life support, the maternal mortality rate for AFE remains around 61%; a large percentage of survivors have permanent hypoxia-induced neurological damage” (pg109).¹³

IV. NPIC/QAS Continuing Education Program

On October 5, 2011 NPIC/QAS offered a CME/CEU program: *Maternal Mortality Review in the 21st Century*. This program provided healthcare professionals with an overview of current maternal mortality data and a review of perinatal quality improvement initiatives.

The program was presented by **Michael Varner, MD**, Principal Investigator for the University of Utah's NICHD Maternal-Fetal Medicine Units Network site. Dr. Varner is also the Director of Perinatal Research for Intermountain Healthcare, the Co-Chair of the Publications Committee for the National Children's Study, the Associate Director for Women's Health Research of the University of Utah's Center for Clinical and Translational Sciences (CTSA award), the Co-Director of the University of Utah's Institute for Women's and Children's Health Research, and the Interim Director of the University of Utah's Personalized Healthcare Program.

A recording of this program will be available in Archived Continuing Education Programs at www.npic.org approximately one week after the live event.

V. References

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