

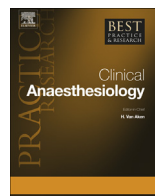


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Maternal mortality and the role of the obstetric anesthesiologist



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Maternal mortality is increasing in the United States and remains unacceptably high in many parts of the world. Pre-existing conditions and social determinants of health frequently contribute to maternal death. General solutions to enhance maternal safety focus on systems to identify women at high risk and to tailor the management before, during, and after pregnancy. This review highlights condition-specific solutions for the leading etiologies of maternal death, including cardiac disease, sepsis, hemorrhage, venous thromboembolism, hypertensive disorders of pregnancy, and amniotic fluid embolism. Although anesthesia is an exceedingly rare cause of maternal death, specific hazards remain, including airway management, high neuraxial block, and unintentional dural puncture. The review concludes with an overview of strategies to create an institutional culture of both safety and equity, including multidisciplinary team training, simulation, shared decision-making, family-centered care, and serious morbidity review.

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Introduction

Few women expect to suffer significant harm from pregnancy. Serious maternal harm can devastate not only the affected woman but also her family, her community, her care providers, and the institutions that fund and deliver her care. Prevention of maternal morbidity and mortality should be at

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the forefront of all healthcare providers in maternity services, whether in a small community hospital or tertiary referral center. It is the responsibility of all personnel to try and reduce the incidence of maternal morbidity and mortality. This article attempts to provide up-to-date information for anesthesiologists who provide care on labor and in delivery units to optimize patient management and safety.

Definition and statistics

The definition of maternal death needs to be clearly understood to interpret metrics such as the maternal mortality ratio (MMR) and compare mortality statistics among countries [1,2]. Table 1 presents the numerators and denominators used to define the pregnancy-related mortality ratio in the United States (US) and the MMR in the United Kingdom (UK). Over the last 25 years, maternal mortality increased by 75% in the US, whereas it continued to decrease in the UK and many other high-income countries [1–3]. The incidence of maternal mortality in the US was 16.0 per 100,00 live births in 2006–2010 [1] and 26.4 in 2015 [3]. Over a similar period in the UK, maternal mortality was 11.4 per 100,00 maternities in 2006–2008, 10.6 in 2009–2011 [2], and 9.2 in 2015 [3].

Global maternal mortality declined by 1.5% (95% uncertainty interval 2.0 to 0.9) per year between 1990 and 2015 [3]. The improvement accelerated after the year 2000 in response to the Millennium Development Goals (MDG) 5A, which aimed to reduce the MMR by at least 75% by 2015 worldwide. Although falling short of this goal, the World Health Organization estimated a cumulative decrease of 44% in global MMR (Table 2). Following the work of MDGs, the United Nations member states committed to pursue 17 Sustainable Development Goals (SDG). Target 3.1 of SDG 3 proposes to reduce the global MMR to <70 per 100,000 live births by 2030 [4].

Risk factors for maternal death

Low-income countries account for approximately 99% of global maternal deaths, where the lifetime risk of maternal mortality is 1:150, compared with the 1:4900 in high-income countries [4]. In sub-Saharan Africa, the lifetime risk of maternal mortality is estimated to be as high as 1:36 [4]. Nigeria and India were estimated to account for over one-third of all maternal deaths globally in 2015 (approximately 19% and 15%, respectively) [4]. The leading cause of maternal mortality worldwide is hemorrhage, and this along with hypertensive disorders of pregnancy accounts for nearly 50% of all deaths [3,5]. To achieve SDG 3.1, global efforts will need to concentrate on improved maternity services for low- and middle-income countries.

In resource-rich countries, maternal mortality appears to be concentrated in high-risk populations. For example, in the US, risk for maternal mortality is increased in individuals with serious medical disease, cesarean delivery, advanced maternal age (AMA), non-White race, unplanned pregnancy, unmarried status, and four or fewer prenatal visits [6–8]. In the UK, seven risk factors accounted for 85% of the population-level risk of mortality, including pre-existing medical problems (population attributable fraction [PAF] 66%, adjusted odds ratio [aOR] 8.7), age ≥ 30 years (PAF 29%; aOR 2.8), inadequate use of antenatal care (PAF 24%; aOR 46.9), problems in previous pregnancy (PAF 19%; aOR 1.9), substance misuse (PAF 7%; aOR 12.2), anemia during the current pregnancy (PAF 2%; aOR 3.6), and unemployment (PAF 1%; aOR 1.8) [9,10]. Black women face three-fold more risk for all (direct and

Table 1

Definitions used to calculate maternal mortality rates in the US and the UK.

US numerator	Death of a woman during <i>or within 1 year</i> of pregnancy that was caused by a pregnancy complication, a chain of events initiated by pregnancy, or the aggravation of an unrelated condition by the physiologic effects of pregnancy
US denominator	<i>Live births</i>
UK numerator	Death of a woman while pregnant <i>or within 42 days</i> of the end of pregnancy (includes giving birth, ectopic pregnancy, miscarriage or termination of pregnancy) from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes
UK denominator	<i>Maternities</i> (women giving birth at or beyond 24 weeks' gestation)

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