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Maternal Mortality: Editorial for AJOBGYN

Robert L Goldenberg¹ and Elizabeth M McClure²

¹Drexel University, Philadelphia, PA

²Research Triangle Institute, Durham, NC

The reduction in maternal mortality over the last 100 years in high income countries is one of the greatest achievements of modern medicine, but one that in recent years seems to have been nearly forgotten. In a walk through nearly any old cemetery, one finds the grave markers of large numbers of young women, many who died in childbirth. The statistics confirm these observations. Around 1900, depending on the country, between 300 and 1000 women per 100,000 of those giving birth – or 0.3% to nearly 1% - died as a result of the pregnancy.(1–3) In 1900, the maternal mortality rate in the US was approximately 850 per 100,000 births. In contrast, today in most high income countries, approximately 10–20 per 100,000 women die in conjunction with childbirth, almost a 99% reduction.(4) Based on data from high income countries where historical data are available and reliable, it appears that while slow improvements in maternal mortality occurred in some areas prior to 1930, the decline in nearly all countries became precipitous beginning around 1935 and continued in a linear fashion until about 1970. (1–3) (Figure 1) The declines then slowed, with little or no improvements since that time. Interestingly, despite large differences in maternal mortality rates between countries in 1935, by 1960 nearly all high income country maternal mortality rates converged to a rate of about 60 per 100,000, and continued to decline until the 1970s and 1980's, when the rates were all in the range of 10 to 20 deaths per 100,000 births.

There are several potential explanations for the large differences in maternal mortality prior to 1935 between the US and some of the European countries. These explanations include differences in the definition of a pregnancy-related maternal death, the underlying strength of the public health system and the extensive use of trained midwives in several European countries. Probably more important, was the adoption of a number of obstetric practices in the US including the use chloroform and other anesthetics for delivery, the elective use of internal podalic version, elective manual dilatation of the cervix, elective manual removal of the placenta, and the common use of prophylactic mid forceps and even high forceps for delivery. Cessation of these and other dangerous practices likely contributed to a portion of the decline in the US maternal mortality.(2)

One can better understand the reduction in maternal mortality in all locations if one focuses on the major causes of maternal death and the interventions used to reduce mortality from those causes. (5) Deaths from sepsis, for example, could have been reduced by prevention of infection through the increased use of sterile fields for delivery, hand washing, and the use of sterile gloves. However, the timing of the steep decline in infection-related maternal mortality is consistent with a major role for antibiotics in the treatment of those women who became infected. In most countries, sulfonamides were introduced into clinical practice

Corresponding Author: Robert L. Goldenberg, MD, Drexel University College of Medicine, 245 N. 15th Street, 16th Floor, Mail Stop 495, Room 16312, Philadelphia, PA 19102, rgoldenb@drexelmed.edu, Office: 215-762-2014.

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around 1939 and penicillin in the 1940s, and much of the initial rapid decline in maternal mortality is attributed to their use. Thus, together with aseptic techniques, the use of antibiotics appears to be the most important contributor to the dramatic decrease in maternal mortality.

Hemorrhage, often complicated by preexisting anemia, is a major killer of pregnant women. (4) The hemorrhage can occur in the antepartum period secondary to a placental abruption or a placenta previa, from uterine rupture during labor, or post partum from uterine atony, retained placenta, laceration of the cervix or vagina, and following an ectopic pregnancy or incomplete spontaneous or therapeutic abortion. In the 1930s and 1940s, cesarean section for abruption and placenta previa became standard practice following a study demonstrating that cases treated with cesarean section had a maternal mortality rate of less than 2%. For the treatment of a uterine atony, ergometrine became available between 1935 and 1940 and oxytocin around 1960. Probably more important, for all causes of bleeding, blood transfusion first became widely available in the 1940s and 1950s.(6)

Until the last half century, eclampsia was a major killer of pregnant women in the US and in every other country that has historical data on causes of maternal mortality. However, since the 1940s, in all high income countries, there have been substantial reductions in both the incidence of eclampsia and its case fatality rate. (7) Widespread introduction of prenatal care in many countries beginning in the 1930s and 1940s with an emphasis on preeclampsia detection (blood pressure and proteinuria testing), especially late in pregnancy, and hospital care that included timely induction of labor and cesarean section for women with severe preeclampsia or eclampsia, were the crucial elements both in the reduction of the progression of preeclampsia to eclampsia and from eclampsia to death. (7) In most countries, widespread use of magnesium sulfate for prevention or treatment of seizures was not common until the 1960s or later, after the major reductions in eclampsia-related maternal mortality were achieved.

Prolonged and obstructed labor, often complicated by intrauterine infection and maternal sepsis, and at times uterine rupture, was another important cause of maternal mortality. As more women had access to hospital care and surgical delivery, again beginning in the 1930's and 1940's, mortality from this condition virtually disappeared. With the availability of antibiotics and blood transfusion, the most important complications of surgical procedures aimed at reducing maternal mortality (cesarean section, tubal excision for ectopic pregnancy, hysterectomy, and repairs of uterine, cervical and vaginal lacerations) could be effectively treated. Thus, between 1935 and 1960, many of the interventions that could prevent or treat each of the most important causes of maternal mortality were introduced and increasingly became available. Widespread use of prenatal care with repetitive testing for preeclampsia, increasing use of hospitals for delivery, the availability of inductions of labor, cesarean sections, antibiotics, and blood transfusions were the crucial elements that resulted in the decrease in maternal mortality.

Beginning in the 1930's and 1940's, and coincident with the reductions seen in maternal mortality in the US and elsewhere, maternal mortality audits were performed at hospitals, by medical societies, and by various official groups evaluating maternal deaths within specific geographic boundaries.(8,9) Feedback from these audits is thought by many to have resulted in substantial reductions of inappropriate obstetric practices such as those mentioned above, and the adoption of effective prevention and treatment practices for the conditions that kill mothers. However, by the 1980's and 1990's, likely because of the relative scarcity of maternal deaths and perhaps because of malpractice concerns, in the US, many of the committees that reviewed maternal deaths were disbanded. Related or not, since that time, the US maternal death rates appear to have increased.(10)

In this issue of the journal, Farquhar et al (11) present a system that classifies maternal deaths by cause, by contributing circumstances, and by potential avoidability. Thirty-five percent of the deaths in New Zealand occurring over a 4 year period were found to be potentially avoidable, results that are similar to other published studies originating from high income countries. Knowledge regarding the proportion of deaths that are avoidable provides a target for improvement; knowledge regarding the cause and contributing conditions allows providers and health system administrators to take appropriate actions to reduce maternal deaths. Farquhar's study supports the case made by others for a return in the US to having universal formalized maternal mortality audits, confidential in nature, performed locally, with feedback aimed at improving care. Review of all maternal deaths with feedback is an important step if we are to eliminate all avoidable maternal deaths.

We should add that worldwide, 99% of maternal deaths occur in low and middle income countries with numbers 10 to 100 fold greater than those seen in counties like the US and New Zealand.(4) Despite these very large differences, the principles set forth in the paper by Farquhar et al remain the same. To effectively reduce maternal mortality in any location, the circumstances under which pregnant women are dying and the proportion of those deaths that are avoidable should be known. Only with such data can programs be instituted that effectively reduce maternal mortality.

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Figure 1.
Maternal mortality rates from the US, UK and Sweden, 1900–2000
Data from references (1–4)