Current challenges in pregnancy-related mortality

Charlotte Oyston

Christian F Rueda-Clausen

Philip N Baker

Abstract

Pregnancy is a normal, healthy state that most women are desirous for at some point in their lives. Sadly, this life-affirming process carries serious risks of death and disability for both mother and offspring. It is estimated that about 830 women die from pregnancy or pregnancy related complications each year. Almost all of these deaths occur in resource-poor countries, and most of them are preventable. Reducing maternal mortality is an ongoing challenge, and care providers, researchers and policy makers must not only identify the key barriers to accessing quality health care, but commit to making maternal health a priority.

Keywords death; haemorrhage; maternal; mortality; obstructed labour; preeclampsia; resource-poor countries; sepsis; unsafe abortion

Introduction

The death of a mother is a catastrophic tragedy which will impact significantly on her children, partner, families and communities left behind. Maternal mortality is highly related to maternal morbidity and long-term disability and complications. It has been calculated that for every woman who dies from a pregnancy-related cause there are an average of 16.5 cases of significant maternal illness or disability related to pregnancy. Despite advances in healthcare technologies in some parts of the world, globally around 80% of maternal deaths are from preventable causes. This review will outline the terminology used to describe maternal mortality, the aetiologies of maternal mortality and summarise some barriers to reducing maternal mortality.

Charlotte Oyston MB ChB BMedSci(Hons) DipOMG *is a Registrar in Women's Health at Middlemore Hospital, Auckland, New Zealand. Conflicts of interest: none declared.*

Christian F Rueda-Clausen MD PhD FTOS *is a Postgraduate Clinical Trainee, Department of Medicine, University of Alberta, Alberta, Canada. Conflicts of interest: none declared.*

Philip N Baker BMedSci BM BS DM FRCOG FRANZCOG FMedSci *is Pro-Vice-Chancellor and Head of the College of Medicine, Biological Sciences and Psychology, Dean of Medicine College of Medicine, Biological Sciences and Psychology, University of Leicester. Distinguished National Professor, Chongqing Medical University, China & Professor of Maternal and Fetal Health, University of Auckland, New Zealand. Conflicts of interest: none declared.*

Definitions

Measurement of maternal mortality is a well-accepted vital statistic that provides a broad diagnostic of the maternal health condition of any given region, as well as the overall effectiveness of health systems. Consistency in the terminology used is crucial when discussing the global burden of and trends in maternal mortality. In the International Statistical Classification of Diseases and Related Health Problems 10th edition (ICD-10), the World Health Organization defines maternal mortality as:

> *The death of a woman while pregnant or within 42 days of the end of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes.*

Deaths are further classified as either direct or indirect. Direct maternal deaths are those resulting from obstetric complications (e.g. postpartum haemorrhage), interventions (e.g. anaesthetic complications), maternal suicide, omissions or incorrect treatment. Indirect maternal deaths are deaths not caused by obstetric complications, but by pre-existing conditions which are exacerbated by pregnancy (e.g. heart failure precipitated by pregnancy in the presence of pre-existing aortic stenosis). Other definitions in the ICD-10 include pregnancy-related death (maternal death during pregnancy or within 42 days of the end of pregnancy), and later maternal death (death resulting from direct or indirect causes occurring between day 42 and 1 year after the end of pregnancy). Collecting data on *pregnancy related death* may be important in resource-poor countries where accurate information regarding cause of death is not available. Conversely, information on *later maternal deaths* may be more important in resource-rich countries, where life-sustaining technologies can allow very sick women to live longer than 6 weeks post-delivery (e.g. a woman suffering acute fatty liver of pregnancy who dies following liver transplantation 3 months following pregnancy).

Measures of maternal mortality

Estimates of maternal mortality are influenced by both the chance of a woman being pregnant (i.e. the fertility rate) and the chance of death in a pregnancy. The maternal mortality ratio (MMR) takes into consideration both of these attributes and is calculated as

$$MMR = \frac{number\ of\ (direct\ or\ indirect)maternal\ deaths}{100,000\ live\ births\ in\ the\ same\ population\ over\ the\ same\ time\ period}$$

This definition is important, as it is the calculation used for international comparison. In contrast, the maternal mortality rate (MMRate) does not consider the fertility rate, and is calculated as:

$$MMRate = \frac{maternal\ deaths\ in\ a\ population\ over\ a\ given\ period}{100,000\ women\ aged\ 15-49\ years\ in\ that\ population,\ over\ the\ same\ time\ period}$$

Women living in resource-poor countries not only have a higher risk of death in pregnancy, but have (on average) many more

pregnancies than women in resource-rich countries. Consequently, their lifetime risk of death due to pregnancy related complications is higher. This is accounted for by the lifetime risk (LR) of maternal death, which describes the probability that a 15-year-old woman will eventually die from a pregnancy related cause.

Limitations in calculating maternal mortality rates and cause of death

Data used to estimate maternal mortality can be derived from civil registration of births and deaths, household surveys, census data, reproductive-age mortality studies and verbal autopsy (lay respondents are interviewed on the signs and symptoms of the deceased before death). Obtaining high-quality data on maternal mortality may be challenging, especially in poorly resourced settings. In 2015, the United Nations Maternal Mortality Estimation Inter-Agency Group reported that there was no recent, good quality data on maternal mortality for 55 of 171 countries considered. Inconsistent or mis-classification of maternal deaths also impedes the ability to accurately describe and compare statistics on maternal mortality amongst regions. While some civil registration systems use the ICD-10 to classify causes of death, the use of this system is not consistent between all countries. Obtaining data where civil registration is incomplete, pregnancy status or cause of death is unknown is especially challenging, and likely to obscure true rates of maternal mortality or causes of maternal mortality especially in resource-poor settings. Even in well-resourced countries, relying on civil registration data alone is likely to result in an underestimate of true maternal mortality: in the 2011. In report of the Centre for Maternal and Child Enquiries (CMACE), 60% more deaths were ascertained by the enquiry compared civil registration alone.

Current estimates and trends of maternal mortality

In 2015, the global maternal mortality ratio was estimated to be 216 maternal deaths per 100,000 live births, and the global lifetime risk of maternal death estimated to be 1:180. The burden of maternal mortality, however, is not disturbed evenly worldwide: 99% of maternal deaths occur in resource-poor countries, with 88% of maternal deaths occurring in Sub-Saharan Africa and Southern Asia. The MMR is substantially higher in resource-poor, compared to resource-rich countries: 239 vs. 12 deaths per 100,000 live births (in comparison, the most recent estimate of the UK MMR is 4.65 deaths per 100,000 live births). The lifetime risk of maternal mortality is one in 36 for women in sub-Saharan Africa compared to one in 4900 for women in resource-rich countries. As well as global disparities, there are disparities between women of differing demographics living in the same country. The most susceptible populations are those with low income or socioeconomic status, women living in rural areas and those who are younger than 15 years old; complications in pregnancy and childbirth are the leading cause of death among adolescent girls in most resource-poor countries.

The aetiologies of maternal mortality

A recent WHO systematic analysis has shown that globally, almost three-quarters of maternal death are attributable to a direct cause. Overall, haemorrhage, hypertensive disorders and sepsis account for more than 50% of maternal deaths. The most prevalent individual aetiologies of maternal mortality are:

- haemorrhage — 27%
- hypertensive disorders — 14%
- sepsis — 11%
- unsafe abortion — 8%
- embolism — 3%

In comparison, in resource-rich countries, most maternal deaths are due to indirect causes. In the UK, for the triennium of 2012−2014, 60% of maternal deaths were due to indirect causes and the leading causes of maternal death were:

- cardiac disease — 26%
- indirect neurologic conditions — 11%
- thrombosis and thromboembolism — 10%
- amniotic fluid embolism — 8%
- maternal suicide — 7%

The more common aetiologies are discussed below, however a detailed discussion of all aetiologies is beyond the scope of this review. Further information can be found in the suggested readings.

Postpartum haemorrhage

Postpartum haemorrhage (PPH) causes more deaths than any other aetiology and disproportionately affects women giving birth in resource-poor countries. It is likely that the prevalence of PPH is underestimated, as visual estimates of blood loss are notoriously inaccurate and constitute a major obstacle in both the diagnosis and study of PPH. The most common cause of PPH is uterine atony. The use of uterotonic medications to increase myometrial tone, compress blood vessels and stop haemorrhage is key to treating PPH. It is a WHO and RCOG recommendation that all women giving birth have access to uterotonic administered by a health worker trained in its use for the prevention of PPH. This recommendation is not met in many cases, especially in sub-Saharan Africa; where more than half of the women give birth do so without access to a skilled birth attendant. Over a 10-year period, if all women giving birth had access to uterotonics (such as misoprostol and oxytocin), an estimated 41 million cases of PPH would be prevented and 1.4 million lives saved.

PPH also contributes to maternal mortality in the resource-rich countries. Between 2012 and 2014, PPH was the fourth most common direct cause of maternal death in the UK (5.6 deaths/million maternities). Despite maternal death being a relatively rare outcome in the UK, there is a need to remain vigilant, adhere to management guidelines, and undergo regular drills and skill updates to ensure that their care for women is optimal. This is especially important due to the rising incidence of PPH, perhaps due to changing maternal demographic (older and more obese), trends toward increasing interventions (induction of labour, caesarean delivery and consequently increased rates of abnormal placentation), and increased rates of multiple pregnancy.

Pre-eclampsia/eclampsia

Pre-eclampsia is estimated to affect up to 10% of pregnancies, and contributes significantly to maternal mortality worldwide, as well as being a significant cause of perinatal morbidity and mortality. The majority of maternal deaths due to pre-eclampsia occur in resource-