REVIEW ARTICLE

Maternal mortality in the developing world: why do mothers really die?

Gwyneth Lewis MBBS MSc MRCGP FFPHM FRCOG

Director Confidential Enquiries into Maternal Deaths in the United Kingdom, International Maternal Health Consultant, National Clinical Leader for Maternal Health and Maternity Services, Department of Health, UK

Summary: Every year some eight million women suffer preventable or remediable pregnancy-related complications and over half a million will die unnecessarily. Most of these deaths could be averted at little or no extra cost, even where resources are limited, but in order to take action, and develop and implement changes to maternity services to save mothers and newborns lives, a change in cultural attitudes and political will, as well as improvements in the provision of health and social care, is required.

Further, to aid programme planners, more in-depth information than that which may already be available through national statistics on maternal mortality rates or death certificate data is urgently needed. What is required is an in-depth understanding of the clinical, social, cultural or any other underlying factors which lead to mothers' deaths. Such information can be obtained by using any of the five methodologies outlined in the World Health Organizations programme and philosophy for maternal death or disability reviews, 'Beyond the Numbers', briefly described here and which are now being introduced in a number of countries around the world.

Keywords: maternal mortality, maternal death review, Millennium Development Goals, saving mothers' lives

'In many parts of the world, what ought to be a wondrous event in a woman's life can be equivalent to a death sentence.'[1]

A PERILOUS JOURNEY

Across the developed world, as pregnant mothers leave for hospital when its time to give birth, they may hug their families and say a short farewell as they ready themselves for the journey of childbirth and the happiness of a new baby. While in countries with high quality maternity services these quick good-byes may mean little more than 'good luck' and 'see you soon'; elsewhere the picture is very different. Instead of anticipating a joyous event, mothers in other parts of the world have good reason to fear they may not return at all. For them the heartfelt 'good-bye' as the family is ushered out of their simple home so they can deliver on the floor, or they try to travel by donkey or by foot to a poorly equipped health clinic means what it says, a real farewell. A proper good-bye to acknowledge the significant chance they may not return from the dangerous journey upon which they have embarked. A common saying in parts of Africa is 'a pregnant women has one foot in the grave' and euphemisms are frequently used for leave taking prior to childbirth, such as 'I am going to the river to fetch some water; it is so very treacherous I may not come back'.

These mothers' fears are real. For every minute of every day, every day of every year, year in and year out, somewhere in the world a woman dies of complications arising from pregnancy or childbirth.[2] More than 600,000 women die needlessly each year.[3] The majority of these mothers die without skilled care, perhaps lying on a dirt-ridden floor attended only by the women of their families or untrained birth attendants using traditional, harmful practices. They die in pain, in fear and in vain. It is estimated that at least 80% of the daily toll of 1600 maternal and 5000 newborn deaths due to complications of pregnancy are largely preventable or treatable at little or no extra cost, even in resource poor settings.[3]

Death is not the only potential disaster these mothers face. The World Health Organization (WHO) estimates, globally, that over 300 million women live with disabling long-term complications as a consequence of complications arising from pregnancy or childbirth, with around 20 million new cases arising every year.[3,4] These conditions include chronic anaemia, obstetric fistulae with urinary and/or faecal incontinence, foot drop or palsy, uterine prolapse or pelvic inflammatory disease. More than two million young women are living with the consequences of untreated obstetric fistulae. Most of them are isolated and rejected by their husbands, families and communities.[5,6] It is impossible to estimate the impact of the psychological consequences of these problems on so many of the world's mothers.

Babies suffer too. Maternal mortality and morbidity have a direct impact on the health and wellbeing of the newborn. Around 98% of the nearly six million stillbirths or deaths of babies in the first week of life occur in developing countries. Most will die because of maternal complications, a third being due to intrapartum complications leading to birth asphyxia.[7] Babies who survive their mother's death seldom reach their first birthday and millions of older, motherless, children face uncertain futures. They may be orphaned, especially in countries where HIV has taken its toll, or they are taken in by relatives who

Correspondence to: Dr Gwyneth Lewis
Email: gwyneth.lewis@dh.gsi.gov.uk

already have trouble providing for their own families and who put them at the end of the already inadequate food queue. Overall, the risk of death for children under five is doubled if their mother dies in childbirth and is especially high for girls.[8]

Globally, about 63% of women receive support and care during birth from a skilled health worker. While such coverage is almost universal in developed countries, in those with less resources the picture is bleak. In Africa and Asia only 47% and 61% of mothers, respectively, give birth with a skilled carer to hand and in some African countries the proportion is as low as 34%.[9] This means 600 million mothers across the globe give birth without access to skilled care every year.

Each mother's death or long-term complication is not just an individual tragedy for the woman, her partner and her surviving children, but also an economic loss to her family, community and society. Apart from caring for their family and raising the next generation, who are the future for their county, women are often the backbone of the economy. In Nigeria alone, it is estimated that each year about US$ 102 million productivity losses are incurred due to maternal and newborn death and disability.[10] And, as the hard hitting 2005 World Health Report 'Make Every Mother and Child Count' states, 'children are the future of society, and their mothers are the guardians of that future. Mothers are much more than caregivers and homemakers, undervalued as these roles often are.'[3]

Women are not dying during pregnancy and childbirth of complicated conditions that are hard to manage. Women are dying because they do not receive the health care that they need, such as access to basic or emergency maternity care and a skilled attendant during childbirth. On a more fundamental level they are dying because their lives are already worthless. They die because they are poor, malnourished, lack contraception, have little or no education, have no control over their lives and have to defer to the male or elderly women decision makers in their families and communities, have no voice and live in societies which, to date, have not invested in maternal health. In many cases, the failure of support for pregnant women by their families, partners or government reflects the lack of societal value placed on women's lives.

A LACK OF DECLINE IN THE NUMBERS

In 2000, the 194 governments who are member states of the United Nations (UN), endorsed a set of far-ranging Millennium Development Goals (MDGs).[11] In recognition of the huge disparities in maternal outcomes, a goal was set for maternal health, known as MDG five, which set a target of a 75% reduction in each country's maternal mortality ratio (MMR) between 1990 and 2015. However, the position today, in 2008 which is halfway through the timescale, is described as 'a patchwork of progress, stagnation and reversal'.[3] This view is also born out by the latest estimates of global maternal mortality which show that the overall trend has been for maternal mortality to decrease at an average of less than 1% a year since 1990, far lower than the 5.5% annual decline required to meet the fifth MDG.[2] In Africa it has hardly changed at all, and in some countries the MMR may even have gone backwards as health systems fail due to lack of prioritization, planning, civil disruption or the effect of conflict.

Table 1 **Maternal mortality estimates by World Health Organization/United Nation Regions: 2005**[2]

Region	Maternal mortality ratio (MMR)	Numbers of maternal deaths	Lifetime risk of maternal death, one in:
World total	400	536,000	92
Developing regions*	9	960	7300
CIS (central Asian states)†	51	1800	1200
Developing regions		533,000	75
Africa	820	276,000	26
Northern Africa	160	5700	210
Sub-Saharan Africa	900	270,000	22
Asia	330	241,000	120
Eastern Asia	50	9200	1200
South Asia	490	188,000	61
South-Eastern Asia	300	35,000	130
Western Asia	160	35,000	130
Latin America & the Caribbean	130	15,000	290
Oceania	430	890	62

*Includes Canada, USA, Japan, Australia and New Zealand and most countries of the European region; †Commonwealth of Independent States (CIS) countries that previously constituted the Soviet Union

WHERE ARE MOTHERS DYING?

Over 99% of mothers die in developing countries. To better understand the true burden of maternal deaths worldwide, the WHO and its UN partners developed statistical estimates of the true number of maternal deaths and each country's own MMR.[a] The latest estimates, for the year 2005, are shown in Table 1.[2]

Although the table gives broad estimates for the regions of the world, it does not show the huge intra-regional discrepancies which exist. On a risk per birth basis, with the exception of Afghanistan, the countries with the highest mortality ratios are in Sub-Saharan Africa. Countries with rates of 1000 or greater are, in rank order: Sierra Leone (2100), Niger (1800), Afghanistan (1800), Chad (1500), Somalia (1400), Angola (1400), Rwanda (1300), Liberia (1200), Burundi (1100), the Democratic Republic of the Congo (1100), Nigeria (1100), Malawi (1100) and Cameroon (1000).[2] By comparison, the latest internationally comparable figure for the UK is seven per 100,000 live births.[12]

As Table 1 also shows, there are large regional variations between the lifetime risk of maternal death. Lifetime risk is defined as the probability that a 15-year-old girl will eventually die from a maternal cause. This risk is highest in Sub-Saharan Africa, where the regional overall risk is one in 22 and lowest in the developed regions with an average risk of one in 7300. Using individual country data, the latest estimates show that a girl living in Niger or Afghanistan today currently faces a one in seven or one in eight chance of dying from maternal causes, compared with one in 8000 in the UK.[2] In addition, the younger the mother the higher her risk. Fifteen million adolescent girls give birth each year at an age when the risks they face are particularly high. Girls under the age of 15 are five times more likely to die of a pregnancy related cause than women in their twenties.[13]

[a]Maternal mortality ratio (MMR) = number of maternal deaths from direct and indirect maternal causes per 100,000 live births (ICD 10)

Table 2 **Leading percentage causes of maternal deaths in Africa, Asia and the UK**[12,14]

Cause of death	UK Percentage (%)	Africa Percentage (%)	Asia Percentage (%)
Direct causes			
Haemorrhage	4.7	33.9	30.8
Sepsis	6.1	9.7	11.6
Eclampsia	6.1	9.1	9.1
Obstructed labour	0.0	4.1	9.4
Abortion	1.0	3.9	5.7
Other direct (includes anaesthesia)	4.4	4.9	1.6
Amniotic fluid embolism	5.8	0.0	0.0
Thromboembolism	13.8	2.0	0.4
Ectopic pregnancy	3.4	0.5	0.1
Indirect causes			
Anaemia	0.0	3.7	12.8
HIV/AIDS	1.0	6.2	0.0
Indirect other	53.7	16.7	12.5
Unclassified	0.0	5.4	6.1
Total %	100	100	100

WHY ARE MOTHERS DYING?

Clinical causes

Table 2 gives a breakdown of the major clinical causes of maternal deaths for Africa and Asia, in comparison with the UK. Around 80% of maternal deaths in developing countries are due to direct[b] obstetric causes and 20% due to indirect[c] causes.

Direct causes

Direct deaths are those due to complications that can only arise because of pregnancy, such as haemorrhage, obstructed labour, eclampsia or sepsis. They include deaths in early pregnancy, including unsafe abortion, from which about 70,000 women die each year.[15]

The WHO estimates of numbers of deaths, mortality and morbidity, and case fatality rates related to the five leading direct causes of maternal death are shown in Table 3. Overall deaths from these five causes comprise around 80% of direct maternal deaths. The other 20% are deaths from conditions, such as ectopic pregnancies, anaesthetic complications and thrombosis.

Abortion

Some 46 million women face an unwanted pregnancy every year[16] and 20 million women may risk an unsafe abortion as a result.[17,18] Of these, more than 69,000 women a year will die and many more are left with psychological and physical scars including infertility, chronic pelvic pain or infections and genital tract trauma. Unsafe abortion is an issue particularly for younger women, as two-thirds occur among women between 25 and 30 years of age. Around 2.5 million abortions in developing countries are among adolescent girls or young women of less than 20 years of age.[3]

It has been estimated that up to 100,000 maternal deaths a year could be prevented each year if women who do not wish to become pregnant had access to, and used, effective contraception.[19] Furthermore, the UK Department for International Development estimates that delaying the age of marriage and first birth, preventing unwanted pregnancy and eliminating unsafe abortion will avert one-third of maternal deaths, and birth spacing and prevention of pregnancy in very young women may reduce neonatal mortality by one quarter.[18,20]

Indirect causes

Although deaths from medical conditions aggravated by pregnancy, indirect causes, account for some 20% of the maternal deaths worldwide, in developed countries they generally outnumber deaths from direct causes. In developing countries, at least, the most common indirect conditions leading to death or long-term complications are related to infectious or transmissible diseases such as HIV/AIDS, malaria, hepatitis and tuberculosis.

HIV/AIDS is now the leading cause of maternal death in most African countries. An estimated two million women living with HIV become pregnant each year and evidence from some African countries indicates that the HIV epidemic is reversing past gains in reducing maternal morbidity and mortality.[21] In addition, more than 30 million women in Africa who become pregnant in malaria-endemic areas are at risk of malaria infection,[22] which increases the risk of dying directly from severe malaria but also indirectly from malaria-related severe anaemia, the presence of which contributes to death from haemorrhage. In most resource-poor countries the rise in deaths from infectious disease is now reversing the very small gains that were beginning to have been made in reducing maternal mortality over the past few years.

In more developed countries, however, chronic medial conditions dominate the list of causes of indirect deaths. This shows how the huge strides in obstetric care have not been matched by recognition of the need for specialist care for women with pre-existing medical conditions, such as cardiac disease, diabetes, epilepsy or autoimmune diseases. The same pattern of an increasing proportion of deaths due to indirect causes is seen in those few resource poor countries who have made major gains in reducing maternal mortality through the introduction of national safe motherhood programmes.

BEYOND THE NUMBERS: WHY MOTHERS ARE REALLY DYING

Even though figures for the MMR and life time risk are helpful, particularly in terms of advocacy and international level planning, they do not reveal which particular mothers in each country are at greatest risk of death or why. Vast discrepancies exist within each country between different communities and tribal groups, rural and urban women, rich and poor, the educated or illiterate, the healthy and those already weakened by malnutrition, malaria and/or HIV infection. Even in the UK the latest report of the *Confidential Enquiries into Maternal Deaths 'Saving Mothers Lives 2003–05'* shows excluded and

[b]ICD 10 defines direct deaths as those deaths resulting from obstetric complications of the pregnant state (pregnancy, labour and puerperium), from interventions, omissions, incorrect treatment or from a chain of events resulting from any of the above

[c]ICD 10 defines indirect deaths as those resulting from previous existing disease or disease that developed during pregnancy and which was not due to direct obstetric causes, but which was aggravated by the physiologic effects of pregnancy

Table 3 **Estimated incidence of major global causes of direct maternal deaths:[15] 2000**

Cause	Incidence of complication (% of live births)	Number of cases	Case fatality rate	Maternal deaths	Percentage of all direct deaths
Haemorrhage	10.5	13,795,000	1.0	132,000	28%
Sepsis	4.4	5,768,00	1.3	79,000	16%
Preeclampsia, eclampsia	3.2	4,152,000	1.7	63,000	13%
Obstructed labour	4.6	6,038,000	0.7	42,000	9%
Abortion	14.8	19,340,000	0.3	69,000	15%

vulnerable women face a 10 times greater risk of maternal death than professional women,[12] a figure hidden in an overall internationally comparable UK maternal mortality rate of seven deaths from direct or indirect maternal causes per 100,000 live births.

So, as many governments and organizations are now actively working to try to improve their mothers' health most are finding they need far better information about exactly why, where and which of their mothers are dying. Such information enables them to plan and target services more effectively within areas, and to those, who need them the most. As previously discussed, MMRs do not provide a country's health planners or health professionals with any information about which of their mothers are dying or from which underlying causes. Death certificates are little better. Even if the coding of cause of death is correct, and data entry mistakes are common, death certificates provide little or no information on the real reasons why the woman died.

The limitations of death certificates relate to not being able to identify the precipitating factors that led to the terminal event or any barriers that prevented the women from obtaining appropriate care. For example, a woman stated to have died from haemorrhage may have not understood the need to seek care, may not have had money or access to transport, may have been deterred from seeking help by inappropriate traditional practices, may have received inadequate clinical care or may have been treated in a facility without access to blood products. Knowing the precise reasons why such women die will enable a start to be made in addressing the issues to be overcome. The specific problems that will require remediable action will vary not just between countries or areas, but also between local hospitals or communities. These may include community and personal awareness, the provision of transport, updating health care worker training or improving the supply of blood and blood products.

In order to provide practical assistance to help address these issues, the WHO's 'Making Pregnancy Safer' programme developed a handbook on how to implement maternal death reviews to identify the underlying causes of maternal deaths in order to take remediable action. The programme and book is entitled *Beyond the Numbers; reviewing maternal deaths and disabilities to make pregnancy safer*[23] (BTN). It is a highly practical guide which describes a number of strategies and approaches to review cases of maternal death or disability to help understand why mothers really die. The lessons to be learnt from them enable health-care planners to take the necessary action on the results. The methodologies described in detail in BTN range from community (verbal autopsy) and facility-based reviews, confidential enquiries into maternal deaths, near miss reviews and clinical audit. These approaches, now introduced in over 50 countries globally as part of the BTN programme, are summarized in Table 4.

Table 4 **The five methodologies for maternal death or disability reviews as described in 'Beyond the Numbers'**

Approach	Definition
Community-based maternal death reviews (verbal autopsies)	A method of finding out the medical causes of death and ascertaining the personal, family or community factors that may have contributed to the deaths in women who died outside of a medical facility
Facility-based maternal death review	A qualitative, in-depth investigation of the causes of and circumstances surrounding maternal deaths occurring at health facilities. Deaths are initially identified at the facility level, but such reviews are also concerned with identifying the combination of factors at the facility and in the community that contributed to the death, and which ones were avoidable
Confidential enquiries into maternal deaths	A systematic multidisciplinary anonymous investigation of all or a representative sample of maternal deaths occurring at an area, regional (state) or national level. It identifies the numbers, causes and avoidable or remediable factors associated with them
Surveys of severe morbidity (near misses)	The identification and assessment of cases in which pregnant women survive obstetric complications. There is no universally applicable definition for such cases and it is important that the definition used in any survey be appropriate to local circumstances to enable local improvements in maternal care
Clinical audit	Clinical audit is a quality improvement process that seeks to improve patient care and outcomes through systematic review of aspects of the structure, processes, and outcomes of care against explicit criteria and the subsequent implementation of change. Where indicated, changes are implemented at an individual, team or service level and further monitoring is used to confirm improvement in health-care delivery

Maternal death reviews can save mothers' and newborns' lives, and also help reduce the burden of severe maternal and neonatal morbidity. Through the implementation of their recommendations they can improve access to, and the quality of, maternity care for all pregnant or recently delivered women and their infants. They review, assess and identify the underlying factors that led to mothers' deaths, and learn lessons from these in order to develop and promulgate recommendations to overcome the barriers and impediments to safe maternity care in future. They can take a number of forms depending on the circumstances, the scope and scale of the proposed study and the size of the population to be reviewed. They are not exercises in just counting numbers of

deaths for statistical purposes. Instead, they provide evidence of where the main problems in overcoming maternal mortality lie, an analysis of what can be done in practical terms and highlight the key areas requiring recommendations for health sector and community action as well as guidelines for improving clinical outcomes. A summary of the key points is shown in Box 1.

Box 1 Maternal death reviews: key points

The aims and objectives of maternal death reviews are:

- To save more women's and newborns' lives, to reduce deaths and complications, and to improve the quality of maternity services for the benefit of all pregnant women and their babies;
- Through the use of guidelines and recommendations, to help ensure that all pregnant and recently delivered women receive the best possible care, delivered in appropriate settings in ways that take account of, and meet, their individual needs;
- To identify the wider non-health system barriers to maternity care and to take action or advocate for beneficial changes such as improved status of women, health education programmes and improved community transport;
- The approaches can be used at community, health care facility or at regional or national level;
- Different approaches are appropriate for different circumstances, different levels of health service provision and can review a number of different outcomes, not just death.

REFERENCES

1 Oxfam calls for action on maternal mortality as over half a million women die each year. Oxfam press release March 2008. See: www.oxfam.org
2 Maternal Mortality in 2005. *Estimates Developed by WHO, UNICEF, UNFPA and The World Bank*. Geneva: WHO, 2007. See: www.who.int/reproductivehealth
3 The World Health Organisation Annual Report for 2005. *Make Every Mother and Child Count.* Geneva: WHO, 2005. See: www.who.int
4 Pittrof R, Cambell O, Filippi VGA. What is quality maternity care? An international perspective. *Acta Obstet Gynecol Scan* 2002;**81**:277–83
5 Lewis G, de Bernis L. *Obstetric Fistula: Guiding Principles for Clinical Management and Programme Development*. Geneva: WHO Organization, 2007. See: www.who.int (ISBN 92 4 159367 9)
6 WHO, UNFPA, FIGO, Columbia University Sponsored Second Meeting of the Working Group for the Prevention and Treatment of Obstetric Fistula. Addis Ababa, 2002
7 *Making a Difference in Countries. A Strategic Approach to Improving Maternal and Newborn Survival and Health*. Geneva: WHO, 2006
8 UNICEF. *The Progress of the Nations 2001*. New York: United Nations Children's Fund, 2001
9 *Proportion of Births Attended By a Skilled Attendant – 2007 Updates*. Geneva: WHO, 2007. See: www.who.int/reproductivehealth
10 Islam K, Gurdtham UG. *A Systematic Review of the Estimates of Costs-illness Associated with Maternal and Newborn Ill health. Part of the World Health Organisation Maternal – Newborn Health and Poverty series*. Geneva: WHO, March 2005
11 *United Nations Millennium Declaration*. New York: United Nations, 2000 (United Nations General Assembly Resolution 55/2). See: http://www.un.org/millenium/declaration
12 Lewis G (ed) 2007. *The Confidential Enquiries into Maternal and Child Health (CEMACH). Saving Mothers Lives; Reviewing Maternal Deaths to Make Motherhood Safer, 2003–05. The Seventh Report into the United Kingdom Confidential Enquiries into Maternal Deaths*. London: CEMACH, 2007. See: www.cemach.org.uk
13 United Nations. *The World's Women. Trend and Statistics 1970–90*. New York: United Nations, 1991
14 Causes of maternal death: a systematic review. *Lancet* 2006;**367**: 1066–74
15 AbouZahr C. Global burden of maternal death. In: *British Medical Bulletin. Pregnancy: Reducing Maternal Death and Disability*. British Council, Oxford University Press, 2003:1–13. See: www.bmb.oupjournals.org
16 *World Contraceptive Use 2001*. New York: United Nations Department of Economic and Social Affairs, 2002
17 *UNFPA State of the World's Population 1997*. New York: UNFPA, 1997
18 World Health Organisation. *Unsafe Abortion; Global and Regional Estimates of the Incidence of Unsafe Abortion and Associated Mortality in 2000*. 4th edn. Geneva: WHO, 2004. See: www.who.int/reproductive-health
19 Marston C, Cleland JC. Do unintended pregnancies carried to term lead to adverse outcomes for mother and child? An assessment in five developing countries. *Popul Stud* 2003;**57**:77–93
20 Department for International Development. *Reducing Maternal Deaths; Evidence and action. A Strategy for DFID*. London: Department for International Development, September 2004. See: www.dfid.gov.uk
21 Bicego G, Boerma JT, Ronsman C. The effects of AIDS on maternal mortality in Malawi and Zimbabwe. *AIDS* 2002;**16**:1078–81
22 WHO Strategic Framework for Malaria Control During Pregnancy in the WHO Africa Region. November 2002
23 Lewis G (ed) World Health Organisation. *Beyond the Numbers; Reviewing Maternal Deaths and Disabilities to Make Pregnancy Safer*. Geneva: WHO, 2004 ISBN 92 4 159183 8. See: www.who.int/reproductive-health

(Accepted 30 May 2008)