Maternal mortality

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Summary Worldwide maternal mortality is the health index that shows greatest disparity between developing and affluent countries. Many of the deaths in developing countries could be avoided by improving the availability of simple clinical interventions. In the UK, maternal deaths are infrequent, but many are associated with sub-standard care and avoidable deaths still occur. The Confidential Enquiry into Maternal Deaths (CEMD) had been instrumental in highlighting causes and possible solutions for more than 50 years. Recent reports have highlighted the importance of suicide and high-risk social and personal features.

Introduction

The Millennium Developmental Goals include three health-related goals, one of which is the reduction of maternal mortality by three-quarters by the year 2015. Current trends suggest that, in the region with the highest risk of death, Africa, this will not be achieved by some distance. Around 600,000 women per year die from pregnancy-related causes worldwide, the huge majority in low-income countries. Progress will be not be meaningful without a massive improvement in infrastructure, which requires funding and political support and in some areas, a radical re-think about the status of women. One dimension of this tragedy is that very many of the causes of death can be treated fairly simply, given basic facilities to permit treatment of pregnancy complications: notably ventouse delivery and Caesarean section for obstructed labour; evacuation of the uterus for incomplete miscarriage; treatment for postpartum haemorrhage, including retained placenta; blood transfusion; anti-hypertensives and magnesium sulphate for pre-eclampsia/eclampsia; antibiotics for sepsis; and availability of safe abortion.

In the affluent West, maternal deaths are much rarer, but many are avoidable and review of the causes of deaths, and the underlying clinical and social risk factors, are important to decrease the number of these tragedies still further. The irreducible minimum has certainly not been reached in the UK.

A confidential enquiry into maternal deaths

In the middle of the 19th century, Florence Nightingale, after her return from the Crimean War, made enquiries about maternal deaths in a number
of institutions in England, including what was then the Liverpool Workhouse. Some information about maternal mortality was collected by public health physicians throughout the late 19th and the early 20th centuries. This was formalised into the first Confidential Enquiry into Maternal deaths (CEMD) in England and Wales, which covered the years 1952–1954. The Enquiry is now, therefore, more than 50 years old. Separate enquiries for Scotland and for Northern Ireland were subsequently incorporated into a UK-wide enquiry.

Confidentiality has been critical to the success of the Enquiry. Regional assessors (in obstetrics, midwifery, anaesthesia, pathology) are aware of which hospitals are involved in maternal deaths, and can obtain additional information from clinicians and others. However, the central assessors (and authors of the reports) do not know the names of the deceased or their clinicians or their hospitals.

The central assessors have seen large changes in the quality of documentation produced by hospitals in the wake of a maternal death. In the past, some hospitals were very reluctant to produce detailed information, perhaps in the hope of avoiding litigation. Now the norm is to produce a critical incident report documenting the facts of the case and reflecting on ways in which care could, if possible, have been better. What is also clearer from documentation is the terrible impact on staff, as well as family members of these rare, and usually unexpected, events. Midwives have left their profession. An anaesthetist, involved in the care of a Jehovah’s Witness who refused blood transfusion and bled to death, was unsure whether s/he could continue to do obstetric on-call.

Sometimes, a hospital will have an unusual cluster of deaths, and there are separate mechanisms to assess whether these have resulted from organisational dysfunction or represent a chance effect.

One of many strengths of the Enquiry is that information emerges about rare but serious complications of pregnancy. Insights from the experience of others can help us if we encounter a similar problem. The ‘vignettes’—short summaries of cases with important messages—have always been very popular with clinicians, and these have survived despite the efforts of the National Institute for Clinical Excellence to abolish them.

Potential problems with the Reports are extrapolation from a single case to a conclusion that conflicts with high-quality evidence from research studies. The authors go to some lengths to avoid this and the Report represents collective views of the writing panel, and other advisors, rather than individuals. Also, the numbers of deaths are small each triennium, and it is important to avoid overinterpretation of small fluctuations in numbers from Report to Report.

Table 1  Types of maternal death.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct deaths</td>
<td>Deaths resulting from complications that are unique to pregnancy, e.g., eclampsia, postpartum haemorrhage, or from clinical interventions, e.g., anaesthesia, Caesarean section</td>
</tr>
<tr>
<td>Indirect deaths</td>
<td>Deaths that resulted from pre-existing disease, or disease that developed during pregnancy, which was not due to direct obstetric complications. Diseases aggravated by physiological changes of pregnancy, e.g., cardiac disease, epilepsy. Deaths by suicide are included, on the assumption of underlying depression, or propensity to depression</td>
</tr>
<tr>
<td>Co-incidental deaths</td>
<td>Deaths from unrelated causes, although deaths from, e.g., homicide (domestic violence) and road traffic accidents (seat belt use) may carry important messages</td>
</tr>
<tr>
<td>Late deaths</td>
<td>Direct and Indirect deaths occurring between 42 days and 1 year after the end of a pregnancy</td>
</tr>
</tbody>
</table>

Maternal deaths in the Confidential Enquiry are classified into Direct, Indirect, Co-incidental, and Late groups (Table 1). The international definition includes only deaths during and up to 6 weeks after pregnancy, and does not therefore include Late deaths. However, these are important and if they had not been included in UK Reports, we would not have had the insight into deaths from suicide that we now have.

The number of deaths between 1985 and 2002 are shown in Table 2. Some of the key issues that have emerged in recent Reports about the major causes of death will be highlighted.

Direct deaths

Thromboembolism
Thromboembolism is consistently the leading direct cause of maternal deaths in the UK. Deaths were more frequent in the 1950s, when women were
frequently restricted to bed rest for days after delivery. Early ambulation is to be encouraged. Although pulmonary embolism is the predominant cause of death, it is important to remember that cerebral vein thrombosis does occur and often is mis-diagnosed as psychiatric disorder. The physiological changes of pregnancy that carry a propensity to venous thrombosis are well recognised. Less well appreciated is the fact that life-threatening thromboembolic disease can occur early in pregnancy.

Risk factors include previous thromboembolic disease, thrombophilia (congenital or acquired), obesity [body mass index (BMI) \(> 30\)], hyperemesis, immobility, and pre-eclampsia. A comprehensive list of risk factors is available in the 2004 Royal College of Obstetrics and Gynaecology Guideline on Thromboprophylaxis, as are new recommendations about dose regimens of low molecular weight heparin. Formal assessment of risk should precede Caesarean section with appropriate preventative measures taken. A low threshold of clinical suspicion of thromboembolic disease is essential in women presenting with symptoms and signs compatible with this diagnosis.

Hypertensive disease
The number of pulmonary deaths in women with pre-eclampsia has steadily decreased, presumably from better fluid management. All maternity units should have clear guidelines for the management of severe pre-eclampsia, and there are some excellent regional guidelines. Women with pre-eclampsia are at risk of pulmonary oedema and, subsequent adult respiratory distress syndrome.

The overwhelming cause of deaths in women with pre-eclampsia/eclampsia is intracranial haemorrhage which, in contrast, has not seen a decrease in recent years. Intracranial haemorrhage reflects a failure of effective treatment of systolic hypertension—sometimes because of the explosive nature of fulminating pre-eclampsia, sometimes because of an inappropriate reluctance to initiate effective and timely anti-hypertensive treatment. It has been recommended that women should be treated if their systolic blood pressure is greater than 160 mm Hg. Some automated blood pressure monitoring devices systematically underestimate systolic pressure in pre-eclampsia, and though useful for monitoring trends, the blood pressure values should be checked initially against those obtained with a mercury sphygmomanometer. Magnesium sulphate is the treatment of choice for eclampsia, and for women with pre-eclampsia requiring anticonvulsant prophylaxis. It is now uncommon to see alternative drugs being used.

There have been anxieties that new packages of antenatal care with less frequent visits might delay recognition of pre-eclampsia. Such a phenomenon has not been obvious from inspection of recent maternal deaths reports but cannot be excluded. What is clear is that women with life-threatening disease often have an explosive pattern over a short time frame. However, the pattern of antenatal care should be shaped by recognition of risk of development of pre-eclampsia. It is important to ask about a family history.

Early pregnancy deaths
Deaths from ectopic pregnancy consistently dominate this group. Some women are found dead at home and it is not known whether they had preceding symptoms or not. In other cases, women had sought medical advice. A recurring problem is a failure to consider the diagnosis in women with atypical symptoms—notably diarrhoea and vomiting. A low threshold for human chorionic gonadotrophin testing is important in women of reproductive age. The latest Report described an unusual cluster of four deaths from ruptured cornal pregnancies. These, though rare, carry a higher risk than extrauterine tubal pregnancies and can be difficult to diagnose, clinically and ultrasonically.

In the early years of the Confidential Enquiries, deaths from unsafe, illegal abortions were numerically important. These declined after the 1967 Abortion Act, but did not disappear completely until a few years later. In the interim, deaths from legal abortion were prominent, but these too decreased. Current priorities are to ensure that services meet national guidelines that women seeking termination of pregnancy should wait no more than 3 weeks between referral and abortion.
Unnecessarily late terminations should be avoided for many reasons, including safety. Globally, unsafe abortion remains a major killer of pregnant women. The Millennium Development Goal will not be achieved unless this problem is tackled effectively through access to contraception and availability of safe abortion.

**Haemorrhage**

All women who died from haemorrhage associated with placenta praevia in the most recent Report, had had a previous Caesarean section. A consultant should be present for all Caesarean sections for placenta praevia (a recurring message in CEMD Reports) but placenta praevia accreta in a previous scar is a particular challenge.

In cases of postpartum haemorrhage, in addition to pharmacological interventions, early consideration should be given to such procedures as the B-Lynch suture and interventional radiology.

Drills to deal with massive haemorrhage are valuable. Jehovah’s Witness patients with haemorrhage are very challenging; cell savers may help.

**Other direct deaths**

Deaths from uterine rupture are less common now than previously. Acute fatty liver is classed in this group. Four deaths from bowel perforation after Caesarean section were described in the last Report: three from Ogilvie’s syndrome—a pseudo-obstruction of the large bowel. Not all abdominal distension after Caesarean section is due to paralytic ileus.

**Genital tract sepsis**

Figure 1 shows maternal mortalities from the 1850s. There was a dramatic drop in the 1940s, which coincided with the development and production of early antibiotic drugs. As the graph shows, much of the decrease can be attributed to a decrease in deaths from puerperal sepsis. Many improvements in the health of the nation arise from public health improvements. This is an example of the dramatic impact of pharmacological developments.

It is now uncommon for trainees in obstetrics and gynaecology in the UK to see patients with serious infection, and therefore, there may be delays in appreciating the significance of signs and symptoms in women developing life-threatening sepsis. Recognition of the classical signs of pyrexia, tachycardia and tachypnoea is important. Clinicians should also be aware that septic women may not have an elevated temperature, or a raised white cell count.

*Streptococcus* species were first recognised as a cause of puerperal sepsis in 1865 and this bacterium remains the most common cause of fatal genital tract infection today.

**Amniotic fluid embolism**

Amniotic fluid embolism is rare but carries a high mortality risk. Of cases reported to the Amniotic Fluid Embolism Register in Bradford, there is approximately a 25% risk of death. Collapse is usually rapid and unexpected and the best chances for survival rely on recognition and staff having appropriate skills in resuscitation and life support.

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![Maternal mortality from puerperal sepsis and all causes, England and Wales, 1847-2002](image)

*Figure 1* Maternal mortality from puerperal sepsis and all causes, England and Wales, 1847–2002. *Source*: General Register Office, OPCS and ONS mortality statistics Birth counts, Tables A10.1.1–A10.1.4. Graph by Alison Macfarlane.
Anaesthesia
This has been an undoubted success story. In the early years of the Confidential Enquiry there were between 30 and 50 deaths each triennium directly caused by anaesthesia. During the 1950s, a number of deaths were due to general anaesthesia administered by single-handed obstetricians. Recognition of the risk of gastric aspiration and the need for good airway management, together with the development of obstetric anaesthesia as subspeciality and the increasing use of regional anaesthesia, have greatly reduced the number of deaths against a background of much increased operative delivery. The latest CEMD Report calculates that the risk of direct death from anaesthesia per 100,000 Caesarean sections has fallen from 36 during 1964–1966 to 1 during 2000–2002.

Deaths associated with sub-standard care do still occur. It is important to consult with anaesthetic colleagues about high-risk patients in advance of planned procedures. Obesity, medical disorders and previous anaesthetic difficulties are among high-risk features.

Indirect deaths
There are now, in the UK, more Indirect than Direct deaths.

Cardiac deaths
Among women with congenital heart disease, Eisenmenger’s syndrome and primary pulmonary hypertension carry particularly high risks in pregnancy—a 40% risk of death with the former. Expert pre-pregnancy advice is essential and termination must be considered if pregnancy does occur. However, advice should not result in alienation should the woman decide to continue with a pregnancy.

Deaths from ischaemic heart disease are not common, but the majority in pregnancy result from coronary artery dissection rather than athero-sclerotic occlusion.

Deaths from aortic dissection are as common as ischaemic heart disease, and should be considered if a woman presents with crushing chest pain. If a woman is found to have Marfan’s syndrome, family members should be screened.

Peripartum cardiomyopathy is more common in older, more obese women and should be suspected if pulmonary oedema develops after delivery.

Other indirect deaths
Major non-cardiac, non-malignancy, Indirect deaths are summarised in Table 3. Epilepsy merits highlighting. There is sometimes a difficult balance to be achieved between the teratogenic risks to the fetus from anti-epilepsy drugs and the risks to mother of less than optimal seizure control. Management is best provided in a joint obstetric/neurology clinic—similar to the well-established joint clinics for pregnant women with diabetes.

Deaths from human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS) are still uncommon in the UK. In parts of Africa, they are now very common. South Africa has adopted the Confidential Enquiry model and Table 4 shows a comparison in percentage causes between South Africa and the UK. The differing contributions of HIV/AIDS are very striking.

Women with cancer may have their malignancies diagnosed late because of a reluctance to undertake appropriate diagnostic imaging during pregnancies. Persisting, unexplained symptoms may represent serious underlying disease and should be investigated.

Psychiatric deaths
After better systems of linkage of death and birth reports by CEMD, it has recently been recognised by the CEMD that deaths from suicide are numerically very important—more common than thromboembolism or cardiac deaths. Unlike most other causes of maternal death, there is no social class gradient with suicide. The deaths are typically violent—hanging, jumping from heights, cutting throat—unlike suicides of women unrelated to pregnancy, where drug overdose is the usual method.

It is important to identify past history of psychiatric illness and making appropriate management plans in association with the psychiatric services. The acronym ‘PND’ (postnatal depression) is unhelpful as it can be used to include anything from previous mild upset to a full-blown psychotic episode. A narrative description of the previous history should be noted.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Non-cardiac indirect deaths, CEMD 2000–2, excluding malignancy.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central nervous system</td>
<td>40</td>
</tr>
<tr>
<td>Sub-arachnoid haemorrhage</td>
<td>17</td>
</tr>
<tr>
<td>Epilepsy</td>
<td>13</td>
</tr>
<tr>
<td>Infectious diseases</td>
<td>14</td>
</tr>
<tr>
<td>Human immunodeficiency virus</td>
<td>4</td>
</tr>
<tr>
<td>Respiratory system</td>
<td>10</td>
</tr>
<tr>
<td>Asthma</td>
<td>5</td>
</tr>
<tr>
<td>Endocrine disorders</td>
<td>7</td>
</tr>
<tr>
<td>Diabetes</td>
<td>3</td>
</tr>
<tr>
<td>Others</td>
<td>19</td>
</tr>
</tbody>
</table>
Twelve women who were murdered by a partner or ex-partner were included in the last CEMD Report. All had a history of domestic violence, most were poor attenders for antenatal care, many had overbearing partners who insisted on being present and dominating clinic interactions. Creative methods of communication may be required such as use of mobile telephones, but suspicion of domestic violence is first required together with a willingness by clinical staff to raise the topic.

There remains a need to reinforce advice about appropriate seat belt use during pregnancy—‘above and below the bump, not over it’.

Vulnerable groups

Certain groups have an increased risk of maternal death, including the socially excluded (× 20 risk), those living in poor communities, some minority ethnic groups—notably Black African women, refugees and asylum seekers, late bookers for antenatal care, the obese, substance mis-users, and women experiencing domestic violence. There is a need for the maternity services to reach women who are sometimes difficult to reach.

Morbidity

The umbrella organisation that oversees the CEMD (CEMACH—Confidential Enquiries into Maternal and Child Health) aims to develop methods of confidential enquiry into major morbidities during pregnancy, building on previous such projects in South Africa, London and Scotland. Identification of ‘near-misses’ should add additional information to improve the maternity and related services with the ultimate aim of driving down still further the risks to pregnant women in the way that the CEMD has done for maternal deaths over the past 50 years.

Practice points

- Thromboembolism is the major cause of Direct deaths. Better definition of risk factors and appropriate prophylaxis are required.
- Effective treatment of high systolic blood pressure in pre-eclampsia is required to prevent intracranial haemorrhage.
- Women with ectopic pregnancies may have atypical symptoms, suggestive of gastrointestinal disorder.
- Eisenmenger’s syndrome carries a high risk of death in pregnancy.
- Pregnant women with epilepsy need combined care by obstetrician and neurologist.
- Suicide is the leading cause of maternal mortality. High-risk women should be identified and engaged with the psychiatric services.
- Women at increased risk of maternal death include the socially excluded, some ethnic groups, overweight women, and those experiencing domestic violence.

Further reading


