J R Coll Physicians Edinb 2005; **35**:332–336

Why mothers die

J Drife
Department of Obstetrics and Gynaecology, University of Leeds, Leeds, England

ABSTRACT The UK maternal mortality rate is now 13·4 per 100,000 maternities, which is much lower than in the developing world but still too high. For 50 years in England and Wales the CEMD has published triennial reports, and since 1985 the Enquiry has covered the whole of the UK. Its latest report, *Why Mothers Die 2000–2002*, published in November 2004, includes 106 Direct (due to complications of pregnancy) and 155 Indirect deaths (due to pre-existing conditions made worse by pregnancy).

Since 1997, Indirect deaths (which are rising) have outnumbered Direct deaths, which fell in the 1990s. The leading Direct cause is thromboembolism, which accounted for 30 deaths in 2000–2002, mainly in women with predisposing risk factors such as obesity or thrombophilia. The leading Indirect cause is cardiac disease, which led to 44 deaths, including eight from myocardial infarction and eight from cardiomyopathy. Obese women accounted for 35% of all maternal deaths. The increasing tendency to delay pregnancy means that 18% of births are now to women aged 35 or over. Maternal mortality in the UK is related to social class, with the rate among socially excluded women being 20 times higher than that in social class 1. Women from ethnic minorities have three times the rate of the overall population, and the risk among black African women is increased sevenfold.

When late deaths (up to one year after delivery) are included, the overall leading cause of pregnancy-related death is psychiatric disease, which accounted for 60 deaths in 2000–2002. Suicide due to puerperal psychosis is usually by violent means and shows no social class gradient. The Enquiry also records Coincidental deaths, among which the leading cause is murder. The 11 murders in 2000–2002, all perpetrated by the woman's partner, highlight the continuing problem of domestic violence.

KEYWORDS Confidential enquiries, ethnicity, maternal mortality, pregnancy, puerperium, social class

LIST OF ABBREVIATIONS Central nervous system (CNS), confidential enquiry into maternal and child health (CEMACH), confidential enquiry into maternal deaths (CEMD), intensive care unit (ICU)

DECLARATION OF INTERESTS J Drife is a member of the National Advisory Committee for Enquiries into Maternal Health and is on the editorial board of *Why Mothers Die*.

Published online ***May 2005***

Correspondence to ***J Drife, Department of Obstetrics and Gynaecology, University of Leeds, Leeds, England***

tel. ***+44(0)113 392 3888***

fax. ***+44 (0)113 392 6021***

e-mail ***J.O.Drife@leeds.ac.uk***

CME

INTRODUCTION

For women in the UK, pregnancy is relatively safe. Their risk of maternal death is around 1 in 10,000 pregnancies, while in parts of Africa the risk is 1 in 100 pregnancies. The common assumption that safety is a side-effect of a healthy, well-nourished population is incorrect; obstetric haemorrhage or pre-eclampsia, for example, cannot be prevented by a healthy lifestyle. The key to preventing maternal death is early diagnosis and effective treatment of obstetric complications or medical disease. Learning how to do this, however, is not easy. Life-threatening obstetric haemorrhage occurs once in 1,000 deliveries, i.e. only about five times a year in a large maternity unit. Most obstetricians will never see acute dissection of the aorta. Lessons must be learned by pooling experience across the country.

CONFIDENTIAL ENQUIRIES INTO MATERNAL DEATHS

This is why the CEMD was started in England and Wales in the late 1940s. Its first report covered the period 1952–1955, and an unbroken series of triennial reports has appeared since then. The Enquiry's general approach has not changed. When a maternal death occurs a form is sent to all the professionals involved to obtain detailed information and comments. Confidentiality is essential to allow honest and constructive comment from people who have often thought deeply about what might have been done differently. A regional obstetric assessor reviews the completed form and sends it to a named

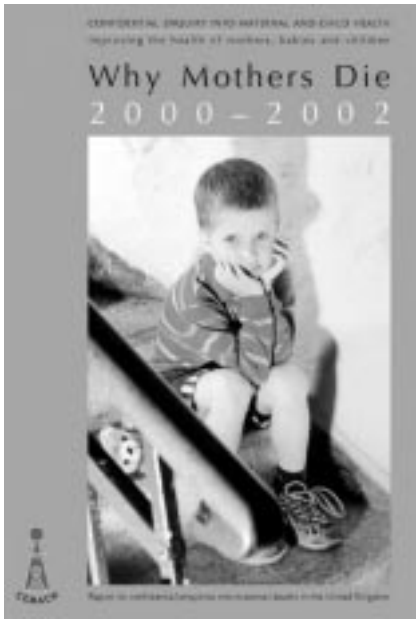

FIGURE 1 *Why Mothers Die*. Reproduced from Why Mothers Die Report, The Sixth Report of the Confidential Enquiries into Maternal Deaths in the UK, published in 2004. With the permission of the Confidential Enquiry into Maternal and Child Health.

doctor at the Department of Health, who keeps it under lock and key. All cases are reviewed by national assessors who are looking for emerging patterns. Once the triennial report is sent to the printers, all individual forms are destroyed.

Changes to the Enquiry since the 1950s have included the appointment of assessors in general medicine, anaesthesia, psychiatry, intensive care, and midwifery, as well as obstetrics and pathology. In 1985 the CEMD became UK-wide with the inclusion of Scottish deaths, which previously had been reported separately. The reports themselves have become bigger and, in an attempt to ensure that they are widely read, are now called *Why Mothers Die*, with a deliberately emotive cover picture (see Figure 1). As fashions in research changed the Enquiry underwent sceptical scrutiny, but its strengths have been recognised and the 'confidential enquiry' method has been extended to surgery, paediatrics, and psychiatry. Recently the CEMD combined with the Confidential Enquiry into Stillbirths and Deaths in Infancy to form the CEMACH, a major part of the National Patient Safety Agency of England and Wales.

DEFINITIONS

A maternal death, by international definition, is one occurring between conception and 42 days after delivery. Direct deaths are due to complications of pregnancy itself and Indirect deaths are due to pre-existing conditions made worse by pregnancy. Coincidental (formerly called Fortuitous) deaths are unrelated to pregnancy – for example, road traffic accidents and most cancers. Late deaths are those between 42 days and one year after delivery.

TABLE 1 Maternal deaths notified to the Confidential Enquiry.

	1991–93	1994–96 (+linkage)	1997–99 (+ linkage)	2000–02 CEMACH
Direct	129	134	106	106
Indirect	100	134	136	155
TOTAL	**229**	**268**	**242**	**261**

TABLE 2 Direct deaths reported to the Confidential Enquiry.

	1994–96	1997–99	2000–02
Thromboembolism	48	35	30
Hypertensive disease	20	15	14
Haemorrhage	12	7	17
Amniotic fluid embolism	17	8	5
Early pregnancy	15	17	15
Sepsis	14	14	11
Other Direct	7	7	8
Anaesthesia	1	3	6
TOTAL	134	106	106

Categorisation may vary between countries. For example, in the UK suicides are classed as Indirect rather than Coincidental deaths if they result from puerperal psychosis, and many suicides are classed as Late deaths, which would be missed by applying the international definition.

DIRECT DEATHS

Direct deaths have fallen dramatically over the last 50 years, and the fall has continued in the 1990s (Table 1 and Table 2). Puerperal sepsis, the leading cause of Direct death until 1935, had almost disappeared before the CEMD started. The fall in Direct deaths was due initially to better organisation of maternity care with improved selection of cases for hospital delivery, better access to blood transfusion, and better training of staff. Anaesthetic deaths were reduced by replacing general with regional anaesthesia and by ensuring that junior anaesthetists were properly supervised. As care improved, the role of the CEMD in identifying problems became more important. For example, in the mid-1990s the Enquiry found that many women with severe pre-eclampsia were dying from pulmonary oedema, and this led to improved fluid balance management.

Thromboembolism

The leading Direct cause is now thromboembolism. Some women still die after presenting to a GP, casualty officer, or physician with classic symptoms that are not taken

CME

TABLE 3 Indirect deaths reported to the Confidential Enquiry.

	1997–99	2000–02
Cardiac	35	44
Psychiatric	15	16
Malignancy	11	5
Other	75	90
TOTAL	136	155

seriously enough. In most cases of thromboembolism there are obvious risk factors such as obesity, a personal or family history of thromboembolism, or a recent long journey by air or by car. Recognising this, the Royal College of Obstetricians and Gynaecologists has extended its guidelines on thromboprophylaxis which have been successful in reducing deaths after caesarean section, and from now on all pregnant women will be assessed for risk factors (see also Adamson DL, Nelson-Piercy C. The diagnosis and treatment of thromboembolic disease in pregnancy *J R Coll Physicians Edinb* 2005; **35:**231–5).

Early pregnancy deaths

Disappointingly, deaths from ectopic pregnancy have not fallen in recent years. A concerted effort is needed to alert non-obstetricians to the dangers of this insidious condition. The Enquiry found deaths occurring after women presented to a GP or casualty officer with gastrointestinal symptoms which were erroneously diagnosed as food poisoning. Diarrhoea may be caused by free blood in the pelvis irritating the bowel. The main requirement for preventing death is to include ectopic pregnancy in the differential diagnosis in women of childbearing age.

Sepsis

In 2000–2002 five of the 11 deaths caused by sepsis occurred after vaginal delivery. Two of these were home births and two other women became ill at home after discharge from hospital. The onset of life-threatening sepsis can be insidious with rapid deterioration. Seventy years ago, when 'childbed fever' caused one maternal death in 500 births, midwives and GPs were alert to the early signs of infection. Nowadays a slight temperature and tachycardia may not cause appropriate concern.

Anaesthesia

After reaching an all-time low of one death in 1994–1996, anaesthetic deaths have increased again. In 2000–2002 there were six deaths, all associated with general anaesthesia, sometimes in isolated sites. Two were due to endotracheal tubes misplaced by SHOs and one woman aspirated gastric contents after failed intubation. The 1952–1954 report drew attention to the risks of general anaesthesia and inexperienced anaesthetists, and these risk factors are still relevant today.

TABLE 4 'Other' Indirect deaths reported to the Confidential Enquiry, 2000–2002.

Cause	Number
Diseases of the CNS	40 (Epilepsy 13)
Infectious	14 (HIV/AIDS 4)
Respiratory	10 (Asthma 5)
Gastrointestinal	7
Endocrine, metabolic, immune	7
Circulatory	3
Renal	3
Diseases of the blood	2
TOTAL	90

INDIRECT DEATHS

A disturbing finding has been the steady rise in Indirect deaths (see Table 3). This is partly due to improved ascertainment. The Office of National Statistics now links death certification with birth certification, identifying cases that might otherwise have gone unreported. Nevertheless, there seems to be a genuine increase also. Women with serious medical conditions such as congenital heart disease are now surviving and embarking on pregnancy in spite of risks of death which may be as high as 50% (for example with Eisenmenger's syndrome). It has been suggested that some patients have not had the risks spelled out to them, but it seems that maternal instinct or cultural expectations can override explicit warnings. Most of the Indirect deaths, however, relate to acquired, not congenital disease.

Cardiac disease

Cardiac disease is now the leading cause of maternal death (as internationally defined), with 44 cases in 2000–2002. The recent sharp rise in cardiac deaths is related to acquired disease such as myocardial infarction and cardiomyopathy, each of which caused eight deaths in the last report.

Psychiatric disease

The importance of psychiatric disease has only recently been recognised. Most deaths from this cause occur after pregnancy, and postpartum psychosis lasts longer than 42 days. Deaths from suicide may not be classified as such by coroners in order to spare the feelings of the family. For these reasons, the number of deaths from psychiatric disease has been hidden in the past and even now is underestimated. When Late deaths are included in the total, psychiatric disease becomes the leading cause of pregnancy-associated death. Unlike other conditions it shows no social class gradient, and

CME

TABLE 5 Maternal mortality rates by ethnic group, UK, 2000–2002.

Ethnic group	No.	Rate/100,000	RR
Black African	30	72.1	6.7
Black Caribbean	13	25.8	2.4
Pakistani	10	12.3	1.2
Indian	7	15.5	1.4
Bangladeshi	8	22.5	2.1
Asian and others	4	5.7	0.5
Total non-white	72	31.0	2.9
White	151	10.7	1.0

professional women are as much at risk of depressive psychosis as anyone else. Suicide attempts are not a 'cry for help' and are usually successful, being made by violent means such as hanging or jumping from a height. Awareness of the early signs of disease, and skilled help in mother and baby units, are the ways to save these lives.

Other Indirect deaths

Table 4 shows that although Indirect deaths are due to a wide variety of diseases, the leading single category is diseases of the CNS. Organic brain disease may be misdiagnosed as anxiety, particularly in women from ethnic minorities. This group also included 13 deaths from epilepsy (see also Pirie AM. Epilepsy in pregnancy *J R Coll Physicians Edin* 2005; **35:**236–8). Medical diseases in pregnancy may be inadequately supervised because responsibility falls between the obstetrician, midwife, GP, and physician. Good communication is essential to avoid such misunderstanding.

COINCIDENTAL DEATHS

Coincidental deaths may seem irrelevant, but there are important lessons here, too. The importance of wearing seatbelts in cars when pregnant ('over and under the bump') needs continuous emphasis, but the most common cause of Coincidental death is not road traffic accidents but murder. Eleven women died as a result of homicide, and each was killed by her male partner. This represents the tip of the iceberg of domestic violence, and the Enquiry is encouraging maternity hospitals to develop strategies to enable affected women to seek help.

SUBSTANDARD CARE

Standards are rising all the time, and so the proportion of cases judged by the Enquiry to have had substandard care tends to remain the same from year to year. In 2000–2002 care was substandard in 67% of Direct and 36% of Indirect deaths. Aspects highlighted were failure of some obstetric and midwifery staff to recognise and act on medical conditions outside their immediate experience, failure of accident and emergency staff to ask for obstetric or midwifery assessment, and failure of GPs and other medical specialists to pass relevant information to maternity staff. The underlying message is that communication between specialties needs to be improved.

RISK FACTORS

The Enquiry identifies risk factors, both medical and social. Maternal mortality is related to age, with a fivefold increase between the ages of 20 and 40. The average age at childbearing in the UK has risen sharply over the last decade and 18% of pregnant women are now aged 35 or over, compared with 8% in 1990. Obesity has also become a major factor, and 35% of the women in the 2000–2002 report were obese with a BMI of 30 or more.

Social class

One of the starkest messages of *Why Mothers Die* is the huge difference between social classes. In 1999 the maternal mortality rate among women from social class 1 in the UK was under 3 per 100,000 pregnancies. Among social class 9 (the unemployed and socially excluded) it was over 135 per 100,000, which is equivalent to that in a developing country. A major effort to focus attention on women who book late or are poor attendees for antenatal care is now being recommended. Maternity care for travellers and asylum seekers is generally very poor.

Ethnicity

Maternal mortality among black women is higher than among white women in all countries for which figures are available. Britain gathered no data on this until 1994, but CEMD assessors had the clear impression that ethnic minorities were over-represented among the deaths. Denominator data are still not readily available, but estimates are now made and Table 5 shows that overall, ethnic minority women have three times the risk of white women. In 2000–2002 it emerged that the risk among black African women is increased sevenfold.

This is not due to specific diseases peculiar to black women; achieving safety in pregnancy requires good communication between a woman and the team looking after her. She needs to book early so that risk factors can be identified, know how to access services when problems occur, know how to communicate her needs, and understand how to cooperate with treatment. All these may be difficult for socially excluded women, recent immigrants, or asylum seekers and, indeed, the system may not be geared to the needs of long-established minority groups.

CME

THE FUTURE

The Confidential Enquiry into Maternal and Child Health plans to extend its remit beyond maternal deaths to investigate severe morbidity or 'near misses'. The systems for doing this have been developed. For example, the Scottish Confidential Audit of Severe Maternal Morbidity includes criteria such as eclampsia, pulmonary oedema, and ICU admission. By including severe haemorrhage (which is generally treated well, with a non-fatal outcome) many more cases will be scrutinised than in a mortality enquiry. The Confidential Enquiry into Maternal and Child Health will also undertake controlled studies – for example, to investigate whether death rates from epilepsy are higher in pregnant than in non-pregnant women. This could produce startling lessons which are not limited to pregnancy.

KEYPOINTS

- Direct maternal deaths have fallen during the last decade but Indirect deaths are rising.
- Low social class and black African ethnicity are major risk factors for maternal death.
- Most women who die of thromboembolism have obvious risk factors which should have led to prophylaxis or prompt diagnosis.
- When Late deaths are included, psychiatric disease is the leading cause of maternal death.
- Eleven women were murdered, and in each case the perpetrator was the woman's partner.

FURTHER READING

- Lewis G (editor). *Why Mothers Die 2000–2002.* London: RCOG Press; 2004.
- Loudon I. *The Tragedy of Childbed Fever.* Oxford: Oxford University Press; 2000.
- Rodeck C (editor). *Pregnancy: Reducing Maternal Death and Disability. British Medical Bulletin 67(1).* Oxford: Oxford University Press; 2003.
- Royal College of Obstetricians and Gynaecologists. *Thromboprophylaxis during pregnancy, labour and after vaginal delivery. Guideline no. 37.* London: RCOG; 2004.
- World Health Organisation. *Beyond the Numbers: Reviewing Maternal Deaths and Complications to Make Pregnancy Safer.* Geneva: WHO; 2004.

CME

J R Coll Physicians Edinb 2005; **35**:332–336