A single death is a tragedy; a million deaths is a statistic (Kurt Tucholsky: Französischer Witz, 1932).

The individual stories of maternal death, documented in Confidential Enquiries into Maternal Deaths, are tragic and compelling, and have informed many recommendations in the past half-century that have improved maternal and neonatal outcomes in the UK and probably, around the world. The individual stories continue with the recent publication of the Eighth Report of the Confidential Enquiries into Maternal Deaths in the UK, ‘Saving Mothers’ Lives: Reviewing Maternal Deaths to Make Motherhood Safer—2006–08’ (hereafter referred to as the Report). In this month’s issue of the British Journal of Anaesthesia, Drs McClure, Cooper, and Clutton-Brock, on behalf of the Centre for Maternal and Child Enquiries, have summarized the findings of the Eighth Report. In the past, the chapters summarizing deaths attributed directly to anaesthesia and critical care were republished in the British Journal of Anaesthesia, but due to copyright issues, the authors have written a review of the current Report.

Between 2006 and 2008, 261 maternal deaths were reported; 331 existing children and 147 live-born newborns lost their mothers. The good news is that the overall maternal risk ratio (MMR) decreased compared with the 2003–5 report. Since 1985, there is a significant downward trend in the MMR due to direct causes (deaths resulting from obstetric complications). The decrease from the previous triennium is primarily due to a decrease in deaths from pulmonary embolus, and to a lesser extent, obstetric haemorrhage. In all likelihood, this decrease is attributable to the development of protocols to prevent embolism and treat haemorrhage that were developed and implemented after previous reports. A worrying change is the increase in deaths from genital tract infection.

According to the latest World Health Organization (WHO) data, the MMR has decreased worldwide by 34% since 1990. Still, an estimated 358 000 women died of pregnancy-related disease in 2008. This rate equates to more than 1000 deaths per day or 42 deaths per hour. The vast majority of these deaths occur in developing countries. The WHO 2000 Millennium Development Goal Five (MDG5) is to reduce MMR by 75% between 1990 and 2015. Unfortunately, at the current rate of decline (2.5% per year), we are making insufficient progress towards this goal. In fact, the MMR is increasing in some countries, including the USA.

Better data collection may explain some, but not all of this increase.

Despite the improved MMR observed in the UK, there is no room for complacency. The MMR trend for indirect deaths (deaths resulting from pre-existing disease, or disease that developed during or was aggravated by pregnancy) is increasing. Of equal concern is the number of cases in which substandard care was judged to be present. For direct deaths, the proportion has hovered between 60% and 70% for the past decade. For the first time, the proportion of indirect deaths in which care was substandard was 50%.

The UK is not alone in this regard. The French National Expert Committee on Maternal Mortality (CNEMM) recently published a report summarizing maternal mortality in France from 2001 to 2006, using techniques similar to the Confidential Enquiries. Almost half (46%) of deaths were judged avoidable. In the Netherlands between 1993
and 2005, care in 55% of women who died was identified as substandard.6 In the State of California, USA, the Pregnancy-Associated Mortality Review Committee judged that more than one-third of deaths had a ‘good to strong chance’ of being prevented.7 In South Africa, 304 of 482 (63%) maternal deaths in women with hypertension were ‘clearly avoidable’.8 In the developing world, the vast majority of maternal deaths are preventable.9

Fortunately, direct deaths attributed to anaesthesia care are rare. In the UK between 2006 and 2008, there were seven direct deaths; the MMR was 0.31 per 100 000 maternities (95% confidence interval 0.15–0.64).1 Anaesthesia deaths constituted 3% of maternal deaths, ranking behind sepsis, pre-eclampsia and eclampsia, thrombosis or thromboembolism, amniotic fluid embolism, early pregnancy deaths, and haemorrhage. In France (2001–6), the MMR attributed to anaesthesia was 0.14/100 000 live births (seven deaths).5 In the Netherlands (1993–2005) the rate was 0.1.6 and in the USA (1991–2002) it was 0.1.9 It is reassuring that the rates are roughly the same, although not directly comparable because the denominator used for calculating the MMR in the UK is per 100 000 maternities, whereas it is per 100 000 live births in other countries. Additionally, data acquisition differs among countries, for example, the Confidential Enquiries use active surveillance to identify cases, whereas most countries rely on civil records, resulting in significant under-identification of cases. Although the absolute number of deaths attributed to anaesthesia is low compared with other causes, in the UK and elsewhere, the majority of anaesthesia deaths continue to involve substandard care. Six of seven deaths in the 2006–8 Report were judged to involve substandard care, three major (contributed significantly to death) and three minor (relevant factor in death).1 All five of the anaesthesia-related deaths described in the recent French report were classified as ‘avoidable’.5 In the most recent summary of obstetric cases from the American Society of Anesthesiologists Closed Claims Database, 53% of cases in which payment was made for anaesthesia care were judged to have substandard care.10

Over the past several decades, the anaesthesia MMR has not decreased.1 The number of deaths directly attributed to anaesthesia has ranged from 1 to 8, averaging ~5 per triennium. The data regarding substandard care imply that anaesthesia-related maternal mortality can and should be lower. In their review, McClure and colleagues argue that anaesthesia is an intervention, not a disease.2 Therefore, all deaths could be considered iatrogenic and potentially preventable. Of note, the aetiology of anaesthesia deaths has changed over the past two to three decades. Deaths in the 1980s and early 1990s were primarily related to securing the airway.11 12 Only one of seven deaths in the current report involved failure to ventilate during induction of anaesthesia.1 Indirect evidence from the USA also suggests that airway disasters are becoming less common. The case fatality risk ratio for general compared with neuraxial anaesthesia between 1985 and 1990 was 16.7.12 The majority of general anaesthesia deaths were related to airway management and respiratory events. Between 1997 and 2002, the risk ratio decreased to 1.7 and there was no difference between the two anaesthetic techniques (P = 0.2).5 Given that the incidence of failed intubation does not appear to have changed during this time interval,13 14 these findings suggest that the emphasis on failed intubation algorithms, new airway devices, and simulation and practice have improved airway rescue techniques and skills in maternity units. However, airway events are still being reported, suggesting that we must continue to practise the management of a difficult airway in this high-risk population.15

Indeed, this is a specific anaesthesia recommendation of the current Report.1

Given that we have shown that we can improve outcomes by developing and implementing new protocols, it is imperative that we use the current mortality data to develop and implement protocols to address the preventable causes of death identified in the current Report. Respiratory deaths in the postoperative period have been reported in several recent case series. The current Report describes a woman who aspirated on emergence from general anaesthesia and a second death was likely to have resulted from an overdose of opioid analgesia;1 three of six deaths in the previous triennial report involved respiratory events in the immediate post-partum period.16 In the State of Michigan in the USA, five of eight anaesthesia-related deaths between 1985 and 2004 were due to postoperative hypoventilation and airway obstruction.17 These cases suggest that better post-partum monitoring and management are necessary. A 2009 survey of obstetric post-operative care practices in the USA confirmed that post-operative care in most US maternity units was provided solely by perinatal nurses, not perianesthesia [post-anaesthesia care unit (PACU)] nurses.18 Almost half of respondents indicated that their institutions had no specific post-anaesthesia recovery training for perinatal nurses. In many institutions, including my own, perinatal nurses are currently not required to have Advanced Cardiac Life Support (ACLS) training. This will soon change.

Other problem areas may benefit from implementing new protocols. In the current Report, one woman who underwent uneventful spinal anaesthesia died from acute haemorrhagic disseminated leucoencephalitis, a rare disease that may be triggered by vaccination or infection. The autopsy revealed thoracolumbar spinal canal empyema. Last year, the US Centers for Disease Control (CDC) reported a series of five women (two from one institution/one anaesthetist and three from another institution/one anaesthetist) who developed meningitis within 13–22 h after the initiation of neuraxial labour analgesia (spinal or combined spinal-epidural).15 One woman died. In four of five cases, Streptococcus salivarius was identified in the cerebrospinal fluid of the patient. The anaesthetist was thought to be the source of the
infection in all cases. The AAGBI\textsuperscript{20} and the American Society of Anesthesiologists\textsuperscript{21} have both recently published guidelines stating the masks should be worn during neuraxial procedures. Alcoholic chlorhexidine solution\textsuperscript{10, 21} or alcoholic povidone iodine solution\textsuperscript{20} should be used for skin asepsis.

In the current Report, one woman died from acute anaphylaxis from an antibiotic administered during labour,\textsuperscript{7} and in the French report, two women died from anaphylaxis from succinylcholine.\textsuperscript{2} The Report ‘learning point’ is that anaphylaxis charts should be available in all clinical areas.\textsuperscript{1} It may also be helpful to simulate (‘fire drills’) response to anaphylactic reactions along with other obstetric emergencies.

Developing interventions to decrease the MMR directly attributed to anaesthesia, although important to our speciality, will play a small role in decreasing the overall MMR because the absolute number of these deaths is low. However, in the current Report, anaesthesia management was found to contribute to adverse outcome in 18 women; in a further 12 cases, failure to consult the anaesthesia service in a timely fashion was thought to have contributed to death.\textsuperscript{3} Anaesthesia services were involved in 127 of 261 women who died in the current triennium. Although anaesthesia care was not thought to be contributory to death for most of these women, anaesthetists were members of the care team. Presumably, they could positively affect outcome by participating in the early recognition and care of high-risk women with pre-eclampsia and eclampsia, sepsis, haemorrhage, and chronic co-morbidities such as cardiac and respiratory disease. Anaesthetists and intensivists are trained to care for high-risk patients. It is our responsibility, as members of the obstetric care team, to positively contribute to their care.

There are a number of specific ways in which anaesthetists might contribute to improving obstetric care. Top Ten Recommendation No. 5 from the current Report suggests that clinical skills and training, including basic, intermediate, and advanced life support skills, should be updated regularly.\textsuperscript{1} In the USA, closed-claims analysis of data from a large insurance company suggests that we need to improve knowledge and management of cardiac arrest in obstetric patients.\textsuperscript{22} In a survey study, a large proportion of anaesthetists, obstetricians, and emergency medicine physicians lacked knowledge of basic concepts of resuscitation of obstetric patients.\textsuperscript{23} Multiple deficits in resuscitation procedures by multidisciplinary teams were noted in simulated maternal cardiac arrest.\textsuperscript{24} These findings suggest that simulation drills of maternal cardiac arrest, with participation of all members of the team, might improve care.

The current Report continues to emphasize the need for specialist input in the management of high-risk women. This includes the early request for help from senior medical staff. Although not specifically stated, this recommendation should apply to both the anaesthesia and obstetric services. Sick women, day or night, will benefit from the collective wisdom and skill set of senior staff. The immediate availability of skilled senior personnel is not a problem unique to the UK. However, currently in the UK, the standards for obstetric consultant presence on maternity units\textsuperscript{25} exceed those for anaesthesia consultant presence.\textsuperscript{3} If we are to argue that our knowledge and skill set are important to the safe provision of care on maternity units, then we must work to optimize our availability and presence on these units.

On a global level, anaesthetists can also influence outcome. Volunteer anaesthetists from North American and Europe have enthusiastically participated in multiple missions to multiple countries. Kybele (http://www.kybeleworldwide.org) is a humanitarian organization dedicated to improving childbirth conditions worldwide by establishing medical education partnerships in host countries. Although the teams are multidisciplinary, the organization’s founder and most volunteers are anaesthetists, including many from the UK. Over the past decade, the Kybele team has made remarkable progress at both the local and the national level, particularly in Ghana, and data are now accumulating showing improved neonatal and maternal outcomes.\textsuperscript{27}

How do we measure whether what we are doing has an effect? Fortunately, in the UK and other developed countries, maternal death is unusual. Therefore, it is difficult to measure whether interventions (e.g. simulation) positively affect outcome. The last two Confidential Enquiries have proposed measurement of baseline and auditable standards for each of the Top Ten recommendations. However, these standards are of necessity intermediate outcomes. The development of obstetric surveillance systems which track ‘near-miss’ events, which occur much more frequently than death, is one method of assessing whether interventions affect outcome. Results of two UK systems, the UK Obstetric Surveillance System (UKOSS) and the Scottish Confidential Audit of Severe Maternal Morbidity, are summarized in the Eighth Report. Anaesthetists should work to ensure that these or similar systems include data important to anaesthesia care.

At the risk of being presumptuous, because I do not practice in the UK, I believe that anaesthetists should actively participate in implementation of many, if not most of the recommendations from the current Report, both in the UK and abroad.\textsuperscript{2} We are vital members of the safety net of care on maternity units. These recommendations, outlined in the review,\textsuperscript{2} include using professional interpretation services when communicating with non-English-speaking patients, being available for antenatal referrals for women with anticipated complicated anaesthesia care, participation in multidisciplinary care teams, routine training and maintenance of clinical skills, supporting the routine use of early obstetric warning scores, aggressive treatment of severe hypotension, and recognition and early treatment of genital tract infection or sepsis. Finally, anaesthetists should be
active participants in high-quality serious incident reviews. They can even help improve maternal autopsies (another goal) by directing the pathologist to the relevant organ systems.

The Safe Motherhood Initiative of the World Health Organization is founded on the premise that we already know what needs to be done to save the lives of mothers and newborns. The challenge is to put these solutions into operation in many different environments at home and around the world, in the presence to varying degrees, of limited resources. Anaesthetists should, and do, have an essential role to play in this important endeavour.

Conflict of interest
C.A.W. is a member of the State of Illinois Maternal Mortality Review Committee.

References
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