

# Maternal mortality: direct or indirect has become irrelevant



Application of the tenth revision of the International Classification of Diseases (ICD) to deaths during pregnancy, childbirth, and the puerperium (ICD-Maternal Mortality [MM]) divides maternal deaths into direct obstetric deaths (ie, deaths resulting from the obstetric complications of pregnancy, interventions, omissions, incorrect treatment, or a chain of events resulting from any of the above) and indirect obstetric deaths (ie, deaths resulting from a previous existing disease, or disease that developed during pregnancy that was not due to direct obstetric causes, but was aggravated by physiological effects of pregnancy).<sup>1</sup>

Classification into direct and indirect deaths was first included in the ninth revision of the ICD in 1975, the main justification being to target focused interventions.<sup>2</sup> The classification enabled a focus on quality of obstetric care for pregnancy-related conditions in previously healthy women, as well as insight into the contribution of non-obstetric conditions, serving as an incentive for obstetric professionals to liaise with those in other fields of medicine.

However, more than four decades on, many maternal deaths are still either not identified or misclassified. Instead of ascertainment of the primary cause, countries became fixated on grouping deaths as direct and indirect. Over the years, this classification somehow led many to believe that direct maternal deaths should receive greater attention than indirect maternal deaths. We argue that the division between direct and indirect has become less meaningful and, in some cases, misleading.

The obesity pandemic has shown the increasingly intricate association between underlying medical and pregnancy-related pathology. Obese women have increased risks of both classically indirect (most notably cardiac) and direct (eg, major obstetric haemorrhage, eclampsia, and uterine rupture) causes of maternal death.<sup>3,4</sup> In some cases, rather than being merely a contributing condition, morbid obesity has become the main underlying cause of maternal death, with the understanding that, had obesity not been present, haemorrhage, eclampsia, or cardiac death might not have occurred.

Differences in classification, compounded by a low number of autopsies in many settings, render comparisons between and within countries virtually

impossible (panel).<sup>3,5</sup> Anaemia-related deaths are one example. In countries where malaria is endemic, women in labour often have haemoglobin concentrations below 50 g/L, and a fairly minor obstetric haemorrhage can be rapidly lethal, whereas onset of bleeding in women with normal haemoglobin concentrations could be managed. A death of this nature would be classified as a direct maternal death caused by obstetric haemorrhage in the UK or the Netherlands. By contrast, in India the death would be classified as indirect due to anaemia.

In ICD-MM, maternal deaths related to psychiatric illness are classified as direct rather than indirect or fortuitous.<sup>1</sup> This step was taken because psychiatric illness in general, and suicides in particular, remain taboo in many countries and are likely to have been grossly under-reported. Although postpartum psychosis can be grouped as a direct cause, many suicides and other psychiatric deaths occur in women with underlying psychiatric conditions, and are therefore indirectly related to the pregnancy.<sup>6</sup> In this way, ICD-MM deviates from the initial pathophysiological basis for classifying deaths as direct or indirect, and causes confusion.

We agree that classification of psychiatric deaths into a separate group is important to raise their visibility.

## Panel: Comparison between the UK and the Netherlands

Members of the British and Dutch maternal mortality audit committees met to harmonise their methodologies.<sup>1</sup> Both committees have been responsible for conducting confidential enquiries into maternal deaths in the UK and the Netherlands. Combined with systematic mortality classification, the enquiries have become a highly valued tool to identify areas in which care could be improved. Both committees have used the International Classification of Diseases-Maternal Mortality as its most recent application in pregnancy.<sup>2,4</sup>

The perceived difference in incidence of direct and indirect maternal mortality between the UK and the Netherlands is striking. In the UK between 2012 and 2014, 59% of all maternal deaths were due to indirect causes,<sup>3</sup> compared with 37% in the Netherlands. The maternal mortality committees from both countries suggest that the difference in maternal deaths due to indirect causes is because of differences in classification, rather than representing a genuine difference in risk profile or obstetric performance.

For example, sudden arrhythmic cardiac death with a morphologically normal heart, the commonest cause of cardiac death in the UK,<sup>3</sup> has not been diagnosed as a cause of maternal death in the Netherlands. This type of cardiac death is a diagnosis of exclusion in the Netherlands, and, in the absence of a post-mortem report, women who die of cardiac death are most likely to be classified as having died from an unascertained direct cause. Additionally, the chain of morbid events leading to death is often traced back further in the Netherlands compared with the UK.<sup>5</sup> For example, women who had a pregnancy-related hypertensive disorder and who died from a peripartum cardiomyopathy would be classified as having had cardiac deaths in the UK, but as direct obstetric deaths in the Netherlands.

However, we contest the need to classify psychiatric death as a direct cause of maternal death. Similarly, classification of thromboembolic events as direct is arbitrary since pregnancy will often be another risk factor in women with several other factors, such as obesity or hereditary thrombophilia.

Globally, maternal deaths from indirect causes have continuously increased.<sup>7</sup> The risk of maintaining the divide between direct and indirect is that indirect maternal mortality might be regarded as less important or less urgent to tackle, since many countries have focused their efforts on a reduction of death from direct obstetric causes within the immediate realm of maternity care. Therefore, the division becomes increasingly counterproductive and arbitrary. Since the focus is to reduce all preventable deaths, we suggest that a theme-based approach would be more appropriate, grouping maternal deaths according to cause.

A theme-based approach regarding primary and underlying causes would provide more valuable insight into preventable risk factors for maternal mortality, and enable more detailed comparisons between and within regions. An added advantage of this more refined approach will be increased pressure on policy makers to invest in death reviews, and on researchers and assessors to look in more depth at the actual causes of death, and improve coding accordingly. Such an approach could also enable a more critical review of care, and do justice to the complexity of the interaction of pregnancy and pre-existing medical conditions, in addition to promoting continued involvement of other fields of medicine to further reduce maternal mortality.

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- 1 WHO. The WHO application of ICD-10 to deaths during pregnancy, childbirth and puerperium: ICD-MM. Geneva: World Health Organization, 2012.
- 2 Cross S, Bell JS, Graham WJ. What you count is what you target: the implications of maternal death classification for tracking progress towards reducing maternal mortality in developing countries. *Bull World Health Organ* 2010; **88**: 147–53.
- 3 MBRRACE-UK. Saving lives, improving mothers' care: surveillance of maternal deaths in the UK 2012–14 and lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2009–14. Oxford: Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK, 2016.
- 4 Witteveen T, Zwart JJ, Gast KB, Bloemenkamp KW, van Roosmalen J. Overweight and severe acute maternal morbidity in a low-risk pregnant population in the Netherlands. *PLoS One* 2013; **8**: e74494.
- 5 van den Akker T, Bloemenkamp KWM, Van Roosmalen J, Knight M. How to classify maternal deaths: where does the chain of events start? *Lancet* 2017; **390**: 922–23.
- 6 Howard LM, Piot P, Stein A. No health without perinatal mental health. *Lancet* 2014; **384**: 1723–24.
- 7 Nair M, Nelson-Piercy C, Knight M. Indirect maternal deaths: UK and global perspectives. *Obstet Med* 2017; **10**: 10–5.