

**Severe maternal morbidity and maternal mortality:
A need for consensus on concepts and prevention efforts**

Marian Knight,¹ K.S. Joseph²

Author affiliations

1. National Perinatal Epidemiology Unit, Nuffield Department of Population Health, University of Oxford, Oxford, UK.
2. Department of Obstetrics and Gynaecology and the School of Population and Public Health, University of British Columbia and the Children's and women's Hospital and Health Centre of British Columbia, Vancouver, BC, Canada

ORCID

Marian Knight <https://orcid.org/0000-0002-1984-4575>

K.S. Joseph <https://orcid.org/0000-0003-2317-5607>

Correspondence

Marian Knight, National Perinatal Epidemiology Unit, Nuffield Department of Population Health, University of Oxford, Old Rd Campus, Oxford, OX3 7LF, UK.

Email: marian.knight@npeu.ox.ac.uk

Defining both maternal mortality and severe morbidity has become controversial over recent years, leading to debate in the literature about the utility and comparability of alternate definitions and classifications. In some instances this debate seems to be leading to confusion and/or inertia and a failure to act to prevent both maternal mortality and severe morbidity. This special issue of *Paediatric and Perinatal Epidemiology* brings together a collection of articles which we hope will further ignite debate and perhaps lead to international initiatives to identify solutions.

Since the introduction of the International Classification of Diseases (ICD) to classify maternal deaths (ICD-Maternal Mortality [MM]), a number of discussions have arisen over the classification, focussing particularly on the inclusion of maternal suicides as a direct cause of death,¹ and exclusion of deaths due to homicide, particularly those as a result of domestic violence. The relevance of classifying underlying causes of maternal death into direct and indirect obstetric causes has also been challenged.² Disagreement over these issues has led to individual country by country, or even state by state, decisions about how to classify maternal deaths, limiting comparability of findings.

Less well recognised, perhaps, are the limitations in comparability introduced by different methodological approaches to identifying deaths. Maternal, pregnancy-related and pregnancy-associated deaths can only be robustly identified with enhanced methods of case ascertainment. Reliance on death certification or vital statistics data alone, even with pregnancy check-boxes, is known to be unreliable, resulting in false positive and false negative identification of deaths, particularly late deaths occurring six weeks to a year after the end of pregnancy.^{3, 4} The Europeristat group recognises that data on maternal mortality

which do not use enhanced case ascertainment cannot be compared, and reports figures from countries with enhanced case ascertainment separately.⁵ Recent reports on maternal mortality in the United States have also presented mortality rates estimated with and without information from the pregnancy checkbox which was introduced on the 2003 death certificate.⁶

Unfortunately many of these methodological differences remain unrecognised, possibly because data from maternal mortality surveillance and review processes are largely unreported in Medline listed journals. Disappointingly, researchers still fail to undertake systematic searches of the grey literature when reviewing processes and outcomes of maternal mortality surveillance. For example, the eighth report of the UK Confidential Enquiries into Maternal Deaths, published in a Medline-listed journal in 2011, is still cited 150-200 times each year, despite the fact that a further six reports have been published more recently in the grey literature.

The ultimate goal of any maternal mortality surveillance process, is to drive change to improve outcomes for women. The World Health Organisation's Maternal Deaths Surveillance and Response (MDSR) process is now widely implemented, but it is increasingly recognised that simply reporting on the outcome of surveillance and death reviews will not drive change. Mechanisms need to be established to implement and monitor recommendations. Articles in this issue suggest that implementation planning and evaluation of progress towards achieving impact on the basis of MDSR recommendations in existing programmes is limited, however, and is a clear area to strengthen. A starting point, in countries with inadequately developed systems for preventing maternal death, would be

detailed local facility reviews that could eventually build into a more comprehensive regional system for surveillance and prevention (as recommended in a Commentary in this issue).

When considering definitions of severe maternal morbidity, the debate is even more wide-ranging with concerns raised over complex systems involving assessment of detailed criteria for organ dysfunction which are impossible to ascertain through routine data. Despite a proposed unified approach from the WHO, new definitions continue to be developed, including, for example, adaptations for Sub-Saharan Africa,⁷ condition-specific definitions from the International Network of Obstetric Survey Systems,⁸ country-specific definitions using primary data collection,⁹ and country-specific definitions developed for use with routine sources of data.¹⁰ In this issue of the *Journal* further refinements are proposed to a US definition and a new definition is proposed for use in Canada.

This multitude of definitions and continuing efforts to establish new systems indicates an urgent need for an international consensus about definitions, criteria and surveillance methods which can be used consistently across settings both with high and low resources. The challenge here is both conceptual and operational: it is necessary to first define severe maternal morbidity, to identify the specific conditions that satisfy the definition, and to propose methods that enable surveillance without placing an undue cost or other resource burden on health systems. The complexity of this task notwithstanding, it should be recognised that consistent surveillance and review of severe maternal morbidity is essential to continuing progress to improve maternal health in all regions, irrespective of whether maternal deaths are more or less common.

In the area of assessment of maternal co-morbidity, work is considerably less well developed, particularly when using routine data sources. Articles in this issue highlight some of the pitfalls which need to be considered when assessing the prevalence and impact of maternal co-morbidity on pregnancy outcomes. Selective under-reporting of co-morbidity in records of delivery hospitalisations may be significant; as described in an article in this issue of the *Journal*, linking individual data for different admissions substantially reduces this under-reporting and minimises risk of underestimating the impact of specific types of co-morbidity. As the obstetric transition continues, the likelihood of co-morbidity will increase, and with several high-income countries now reporting cardiovascular disease as the leading cause of maternal death, the need for specific indicators for cardiac morbidity becomes more imperative. A study in this issue shows, however, that indicators using coded data have limited sensitivity.

All researchers in maternal and child health are motivated by the need to improve outcomes for women during and after pregnancy. For this issue, we specifically sought articles addressing, and proposing solutions for, some of the challenges in monitoring and preventing severe maternal morbidity and maternal mortality. There remain clear questions with which we challenge the research community. Should we now be focussing on defining and assessing maternal co-morbidity robustly and consistently as the pregnancy population ages and becomes more complex? Maternal mortality reporting is still very variable, and monitoring the implementation of MDSR recommendations is underdeveloped - does this lack of monitoring hide an inequitable impact of recommendations, accounting for widening disparities? As we publish yet more studies (re)defining severe maternal morbidity, should

we be questioning whether it is time to draw a line on this research waste and instead initiate a truly international consensus process?

About the authors

Marian Knight is Professor of Maternal and Child Population Health in the National Perinatal Epidemiology Unit, Nuffield Department of Population Health, University of Oxford, UK and Honorary Consultant in Public Health, Public Health England. Her research focuses on the prevention and treatment of severe complications of pregnancy and early life using national observational studies and clinical trials. She also leads the UK Confidential Enquiry into Maternal Deaths and Morbidity.

K.S. Joseph is a Professor in the Department of Obstetrics and Gynaecology and the School of Population and Public Health at the University of British Columbia, Canada. His research interests include pregnancy complications, preterm birth, fetal growth, perinatal mortality, severe neonatal morbidity, and maternal mortality and severe morbidity.

Both authors serve on the Editorial Board of *Paediatric and Perinatal Epidemiology*.

References

1. Knight M, Nair M, Brocklehurst P, Kenyon S, Neilson J, Shakespeare J, et al. Examining the impact of introducing ICD-MM on observed trends in maternal mortality rates in the UK 2003-13. *BMC Pregnancy Childbirth*. 2016; 16:178.
2. van den Akker T, Nair M, Goedhart M, Schutte J, Schaap T, Knight M, et al. Maternal mortality: direct or indirect has become irrelevant. *Lancet Glob Health*. 2017; 5:e1181-e1182.
3. Horon IL, Cheng D. Effectiveness of pregnancy check boxes on death certificates in identifying pregnancy-associated mortality. *Public Health Rep*. 2011; 126:195-200.
4. Knight M, Bunch K, Tuffnell D, Shakespeare J, Kotnis R, Kenyon S, et al., editors. Saving Lives, Improving Mothers' Care - Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2015-17. Oxford: National Perinatal Epidemiology Unit, University of Oxford; 2019.
5. Euro-Peristat Project. European Perinatal Health Report. Core indicators of the health and care of pregnant women and babies in Europe in 2015. Paris: Inserm; 2018.
6. Hoyert D, Uddin S, Miniño A. Evaluation of the pregnancy status checkbox on the identification of maternal deaths. Hyattsville, MD: National Center for Health Statistics. 2020 Contract No.: 1.
7. Tura AK, Stekelenburg J, Scherjon SA, Zwart J, van den Akker T, van Roosmalen J, et al. Adaptation of the WHO maternal near miss tool for use in sub-Saharan Africa: an International Delphi study. *BMC Pregnancy Childbirth*. 2017; 17:445.
8. Schaap T, Bloemenkamp K, Deneux-Tharaux C, Knight M, Langhoff-Roos J, Sullivan E, et al. Defining definitions: a Delphi study to develop a core outcome set for conditions of severe maternal morbidity. *BJOG*. 2019; 126:394-401.
9. Siddiqui A, Azria E, Howell EA, Deneux-Tharaux C, Group ES. Associations between maternal obesity and severe maternal morbidity: Findings from the French EPIMOMS population-based study. *Paediatr Perinat Epidemiol*. 2019; 33:7-16.
10. Roberts CL, Cameron CA, Bell JC, Algert CS, Morris JM. Measuring maternal morbidity in routinely collected health data: development and validation of a maternal morbidity outcome indicator. *Med Care*. 2008; 46:786-794.