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Maternal mortality estimates

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Acknowledging uncertainty about maternal mortality estimates

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Differences between estimates of maternal mortality from different research groups have been much debated.^{1–3} The data that are included or omitted and the choice of models have been discussed, but the uncertainty of the estimates has not received much attention. Attempts to estimate the maternal mortality ratio (MMR) for South Africa published in the past five years illustrate the large variability of estimates and the tendency to underestimate uncertainty, particularly when MMR is low.

Fig. 1 and Fig. 2 show the three most recent estimates of MMR published by the Institute for Health Metrics and Evaluation (IHME)^{4–6} and the two most recent estimates published by the World Health Organization (WHO).^{7,8} In addition, two sets of estimates derived from local data are shown: (i) the confidential enquiry based on maternal deaths recorded in health facilities and births at those facilities⁹; and (ii) the indicator used by the Health Data Advisory and Co-ordination Committee (HDACC) of the Department of Health.¹⁰ The latter is based on registered maternal deaths from vital registration, corrected for general incompleteness of reporting of death plus 50% to allow for maternal deaths incorrectly attributed to other causes.¹¹ Neither of the estimates based on local data purports to produce an accurate estimate of maternal mortality, but both attempt to track changes over time on a reasonably consistent basis.

Fig. 1 includes the 95% uncertainty intervals about the WHO estimates and Fig. 2 the 95% uncertainty intervals about the IHME estimates. These intervals supposedly indicate the uncertainty about the estimates. The most recent estimates from IHME and WHO lie outside the respective 95% uncertainty intervals about their previous estimates. In the case of IHME,

even though the most recent estimates acknowledge a much greater degree of uncertainty, the uncertainty intervals don't overlap those about the immediately preceding estimates. The most striking feature of these estimates is the wide range spanned by the WHO and IHME estimates. The second feature is the difference between the most recent and second most recent published estimates. The third is that where the IHME estimates now lie above the other estimates, the WHO estimates lie below the others, in contrast to their previous estimates.

Unless a country has a nationally representative system to track maternal deaths, there is likely to be a great deal of uncertainty about maternal mortality. Currently this uncertainty is not being fully acknowledged by those attempting to estimate MMR indirectly, particularly as part of efforts to track maternal mortality globally. This, together with the fact that estimates of MMR time series produced by those producing global estimates can change significantly from one set of estimates to the next, make them useless for informing countries about what is or is not working to combat maternal mortality.

Countries should monitor the effectiveness of policy and interventions using an index for tracking changes over time, such as the institutional MMR, even if this does not necessarily produce an accurate estimate of the absolute level of the maternal mortality in the country. The global initiatives that produce country-specific estimates should allow for greater model uncertainty and balance in-depth evaluation of country-specific data against finding one model that fits all.

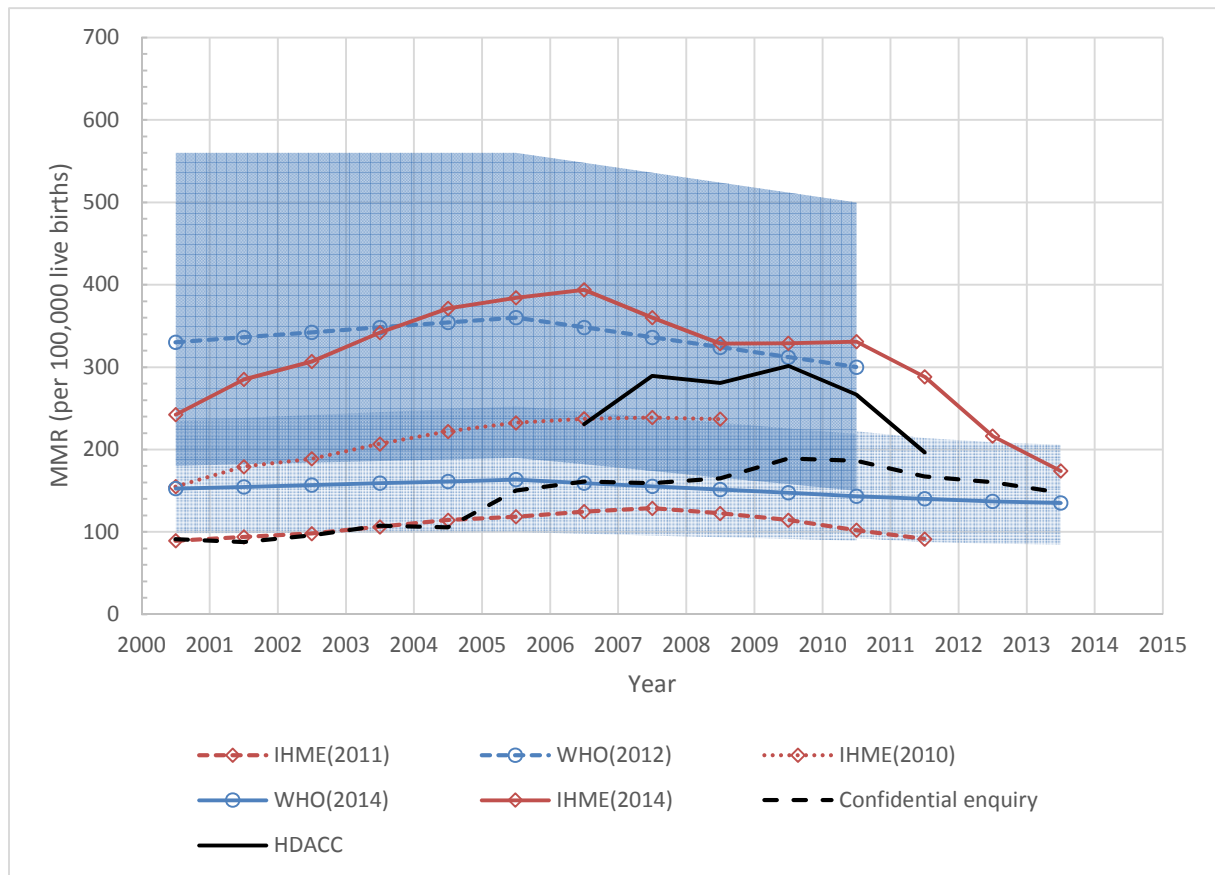
Given that the target 3.1 of the Sustainable Development Goals is to reduce the global maternal mortality ratio to less than 70 per 100 000 live births by 2030,¹² maternal mortality will be a key indicator to measure target progress. Therefore, investment is needed in civil registration and vital statistics for improved measurement of maternal mortality by low and middle income countries.¹³

References

1. AbouZahr C. New estimates of maternal mortality and how to interpret them: choice or confusion? *Reprod Health Matters*. 2011 May;19(37):117–28. [http://dx.doi.org/10.1016/S0968-8080\(11\)37550-7](http://dx.doi.org/10.1016/S0968-8080(11)37550-7) PMID:21555092
2. Horton R. Maternal mortality: surprise, hope, and urgent action. *Lancet*. 2010 May 8;375(9726):1581–2. [http://dx.doi.org/10.1016/S0140-6736\(10\)60547-8](http://dx.doi.org/10.1016/S0140-6736(10)60547-8) PMID:20382418
3. Kassebaum NJ, Lopez AD, Murray CJL, Lozano R. A comparison of maternal mortality estimates from GBD 2013 and WHO. *Lancet*. 2014 Dec 20;384(9961):2209–10. [http://dx.doi.org/10.1016/S0140-6736\(14\)62421-1](http://dx.doi.org/10.1016/S0140-6736(14)62421-1) PMID:25625393
4. Kassebaum NJ, Bertozzi-Villa A, Coggeshall MS, Shackelford KA, Steiner C, Heuton KR, et al. Global, regional, and national levels and causes of maternal mortality during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2014 Sep 13;384(9947):980–1004. [http://dx.doi.org/10.1016/S0140-6736\(14\)60696-6](http://dx.doi.org/10.1016/S0140-6736(14)60696-6) PMID:24797575
5. Lozano R, Wang H, Foreman KJ, Rajaratnam JK, Naghavi M, Marcus JR, et al. Progress towards Millennium Development Goals 4 and 5 on maternal and child mortality: an updated systematic analysis. *Lancet*. 2011 Sep 24;378(9797):1139–65. [http://dx.doi.org/10.1016/S0140-6736\(11\)61337-8](http://dx.doi.org/10.1016/S0140-6736(11)61337-8) PMID:21937100
6. Hogan MC, Foreman KJ, Naghavi M, Ahn SY, Wang M, Makela SM, et al. Maternal mortality for 181 countries, 1980–2008: a systematic analysis of progress towards Millennium Development Goal 5. *Lancet*. 2010 May 8;375(9726):1609–23. [http://dx.doi.org/10.1016/S0140-6736\(10\)60518-1](http://dx.doi.org/10.1016/S0140-6736(10)60518-1) PMID:20382417
7. Trends in Maternal Mortality. 1990 to 2010: WHO, UNICEF, UNFPA and the World Bank Estimates. Geneva: World Health Organization; 2012. Available from: <http://www.who.int/reproductivehealth/publications/monitoring/9789241503631/en/> [cited 2015 Nov 17].
8. Trends in Maternal Mortality: 1990 to 2013. WHO, UNICEF, UNFPA, The World Bank and the United Nations Population Division. Geneva: World Health Organization; 2014. Available from: <http://www.who.int/reproductivehealth/publications/monitoring/maternal-mortality-2013/en/> [cited 2014 Jun 7].
9. Pattinson R, Fawcus S, Moodley J. Tenth interim report on the confidential enquiries into maternal deaths in South Africa 2011–12. Pretoria: National Committee for Confidential Enquiries into Maternal Deaths, Department of Health; 2013.
10. Dorrington RE, Bradshaw D, Laubscher R, Nannan N. Rapid mortality surveillance report 2013. Cape Town: South African Medical Research Council; 2014. Available from: <http://www.mrc.ac.za/bod/RapidMortalitySurveillanceReport2013.pdf> [cited 2015 Jan 12].

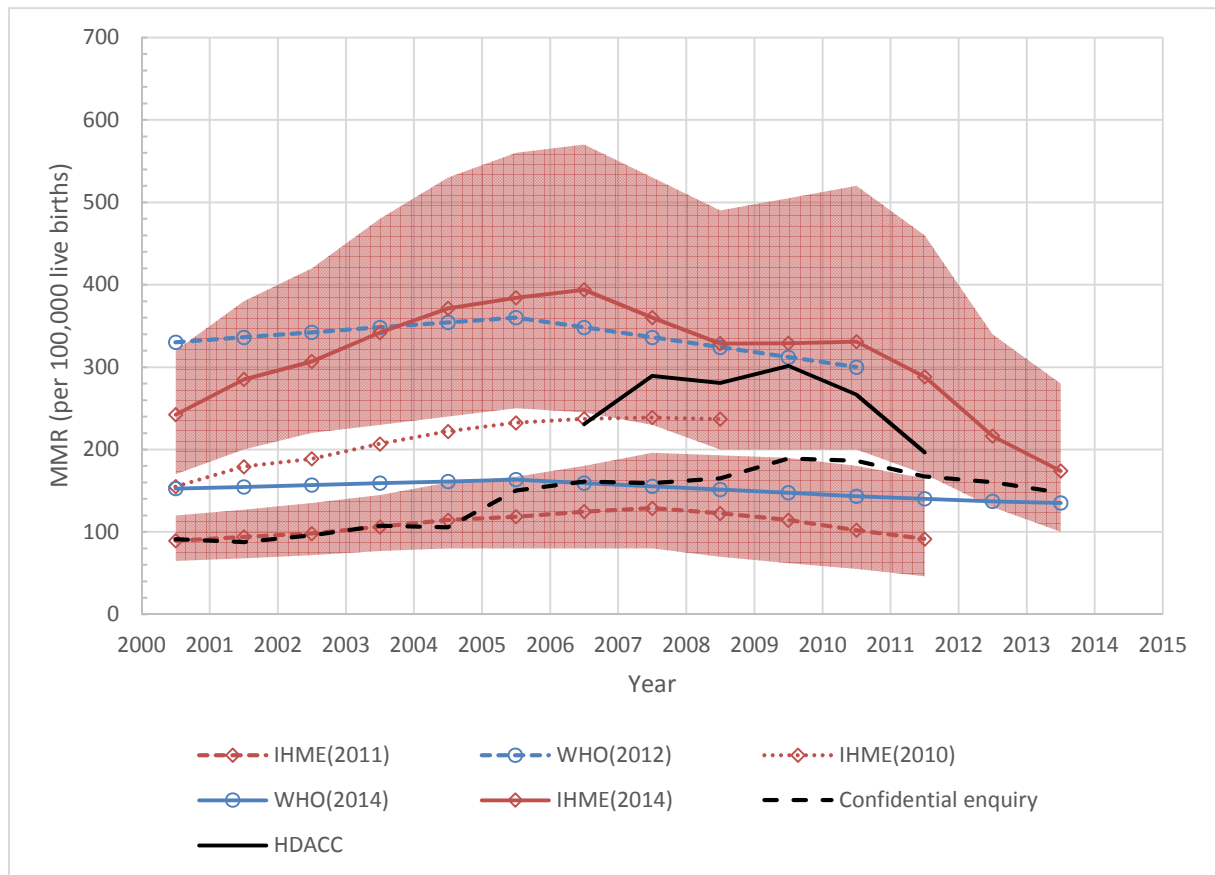
11. Trends in Maternal Mortality: 1990 to 2008: Estimates Developed by WHO, UNICEF, UNFPA, and the World Bank. Geneva: World Health Organization; 2010. Available from: http://whqlibdoc.who.int/publications/2010/9789241500265_eng.pdf [cited 2012 Mar 31].
12. Sustainable Development Goals. New York: United Nations; 2015. Available from: <https://sustainabledevelopment.un.org/topics> [cited 2015 Nov 13].
13. AbouZahr C, de Savigny D, Mikkelsen L, Setel PW, Lozano R, Lopez AD. Towards universal civil registration and vital statistics systems: the time is now. *Lancet*. 2015 Oct 3;386(10001):1407–18. [http://dx.doi.org/10.1016/S0140-6736\(15\)60170-2](http://dx.doi.org/10.1016/S0140-6736(15)60170-2) PMID:25971217

Fig. 1. Estimates of the maternal mortality ratio for South Africa from several data sources, 2000 to 2013 (with uncertainty intervals around the WHO estimates)



Note: 95% uncertainty intervals are indicated by shaded areas. MMR: maternal mortality ratio; IHME: Institute for Health Metrics and Evaluation; WHO: World Health Organization; HDACC: Health Data Advisory and Co-ordination Committee of the Department of Health

Fig. 2. Estimates of the maternal mortality ratio for South Africa from several data sources, 2000 to 2013 (with uncertainty intervals around the IHME estimates)



Note: 95% uncertainty intervals are indicated by shaded areas. MMR: maternal mortality ratio; IHME: Institute for Health Metrics and Evaluation; WHO: World Health Organization; HDACC: Health Data Advisory and Co-ordination Committee of the Department of Health