

Improvements in maternal mortality in South Africa

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South Africa introduced confidential enquiries into maternal deaths in 1997, and the first report was published in 1998. Subsequently, six triennial reports have been published, and the seventh was being prepared at the time of submission of this manuscript. This paper is focused on data from the last 5 years and documents the reduction in maternal deaths since 2009. The main reason for this decline in maternal deaths has been the success of the antiretroviral treatment programme for HIV-positive women. There has also been a decline in deaths owing to obstetric haemorrhage, but deaths owing to complications of hypertension remain stubbornly high. There has been a continuous reduction in potentially preventable maternal deaths since 2008. However, there is still much to do, and efforts need to concentrate on improving the health system to reduce the deaths owing to haemorrhage and hypertension.

S Afr Med J 2018;108(3 Suppl 1):S4-S8. DOI:10.7196/SAMJ.2018.v108i3.12770

Deaths of women during pregnancy, childbirth and the puerperium remain a major public health issue, particularly in low- and middle-income countries, such as South Africa (SA). Clinical audits have contributed considerably to the reduction of maternal deaths in high-income countries such as the United Kingdom.^[1] As far as the authors are aware, SA is the only country in Africa to have a sustained and functional National Confidential Enquiry into Maternal Deaths Committee (NCCEMD).

The NCCEMD is a ministerial committee of experts representing obstetrics, midwifery, anaesthesia and representatives from each of the 9 provinces with the Department of Health's support. It was mandated to analyse reported maternal deaths and to make recommendations that would result in a reduction in the Maternal Mortality Ratio (MMR).^[2]

The NCCEMD process was modelled on the UK CEMD process, which has been operational since 1952, and advisors from the UK committee assisted SA to develop its enquiry process. This process has evolved over the years and the current enquiry process is illustrated in Fig. 1, which shows that there are essentially two recommended audit loops in the process. Firstly, there is discussion at the facility where the death occurred, so that avoidable factors can be identified immediately and remedied locally. The

second audit loop is the CEMD process, which is as follows: The maternal death is reported to the provincial maternal, child and women's health (MCWH) coordinator, who allocates a unique number to the case. A Maternal Death Notification Form (MDNF) that was designed to capture information is completed and is sent

to the co-ordinator together with a photocopy of all clinical records, after which it is assessed by independent provincial assessors that are teams that include obstetricians, medical officers and midwives, and anaesthetists.

Assessors work as a pair (usually a midwife and an obstetrician or an experienced

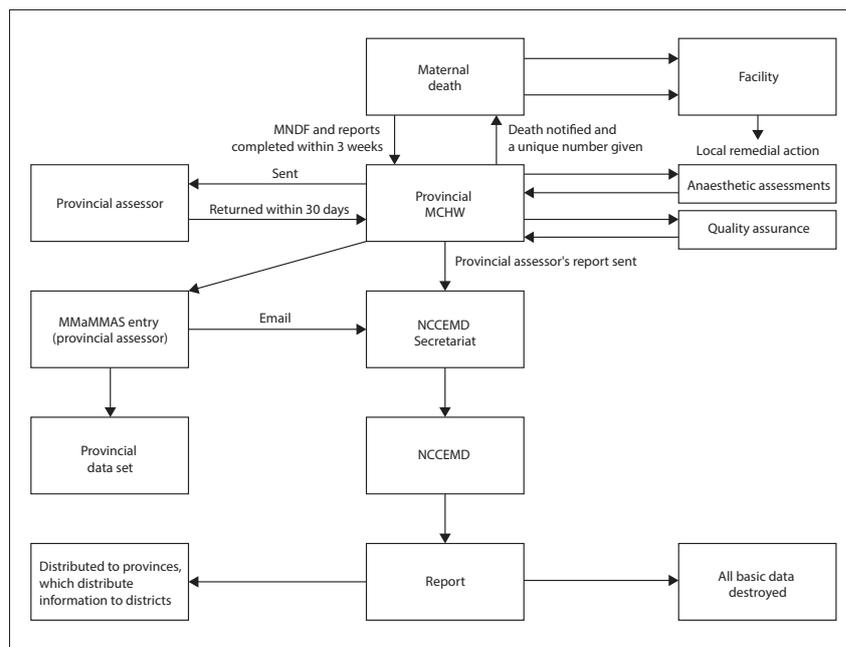


Fig. 1. The process of CEMD in South Africa. (MDNF = maternal death notification form; MCWH = maternal, child and women's health; MaMMAS = maternal morbidity and mortality audit system; NCCEMD = National Committee for the Confidential Enquiries into Maternal Deaths.)

medical officer) in order to overcome inherent biases. All deaths where the woman received an anaesthetic are also assessed by an anaesthetist. Assessors are appointed by the provincial departments based on their knowledge of the subject and respect within the maternal, newborn and child healthcare fraternity.

Assessors identify causes and avoidable factors using a structured form, and the data are entered into an electronic data-collection system, the Maternal Morbidity and Mortality Audit System (MAMMAS), which then collates information from all the provinces. There is a quality-control component at the provincial level to ensure that assessments are as accurate as possible. At the national level, the MAMMAS data are used to generate tables and the information is collated into reports. These reports, called Saving Mothers reports (SMRs), are produced as annual interim reports and more comprehensive triennial reports, which include chapters on each of the major conditions that cause death. Prior to publication of the reports, there are national and provincial stakeholder discussion meetings to identify the key recommendations that arise from the data. These recommendations must be implemented to reduce the maternal mortality ratio (MMR) in SA. The key recommendations to the provinces, districts and academic institutions are discussed at educational sessions, where the SMRs are distributed.

The CEMD process, which is detailed in the Saving Mothers comprehensive reports, is confidential, and all copies of case notes are destroyed after publication of the reports. The data collected by the enquiry and the specific notification forms are for use by the CEMD process only, and cannot be used for medico-legal or disciplinary processes that, when they occur, are completely separate and parallel. This has been ratified by relevant judicial bodies. The NCCEMD also produces guidelines for completion of the MDNF.

Trends over time

Fig. 2 illustrates the number of maternal deaths reported to the NCCEMD since its inception. Since 2009 there has been a fall in the number of maternal deaths compared with the 2003/4 era. The slight declines at the end of 2001, 2004, 2007, 2010 and 2013 were due to the closure of the database at the end of each triennium for data analysis. Fig. 3 illustrates that the institutional MMR (iMMR) declined substantially from 2009 and appeared to level off in 2016, when 64 fewer deaths were reported and there was a decline in the number of live births. This decrease in the iMMR has also been demonstrated in all ways of measuring maternal deaths by different organisations.^[3]

Causes

Fig. 4 illustrates the change in the iMMR of the underlying conditions causing maternal deaths. Since 2011 there has been a major reduction in deaths owing to non-pregnancy-related infections (NPRI) and this has been the main reason for the overall reduction in the iMMR (risk ratio (RR) 0.52; 95% confidence interval (CI) 0.41 - 0.61; $p < 0.00001$). The NPRI category includes deaths owing to tuberculosis, pneumonia, meningitis and malaria. Approximately 95% of these women were HIV-infected. The reduction reflects the major success the PMTCT and ARV programmes have had on maternal deaths. There has also been a small drop in the number of deaths owing to obstetric haemorrhage (OH) (RR 0.85; 95% CI 0.71 - 1.04; $p = 0.12$). Deaths due to the complications of hypertension in pregnancy have shown a slight increase (RR 1.12; 95% CI 0.93 - 1.36; $p = 0.21$).

Data from the recent triennial and interim SMRs demonstrate a concerning increase in the numbers of and case fatality rates (CFRs) for excessive bleeding associated with caesarean delivery (BLDACD),

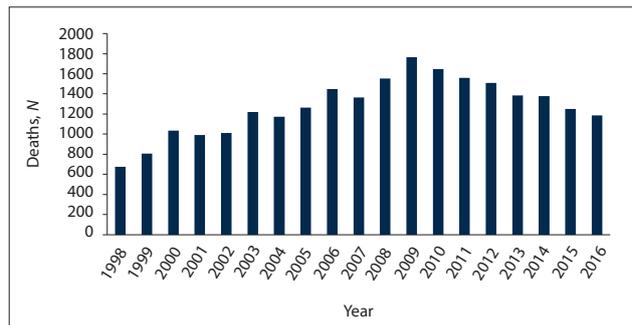


Fig. 2. Maternal deaths reported to the NCCEMD between 1998 and 2016.

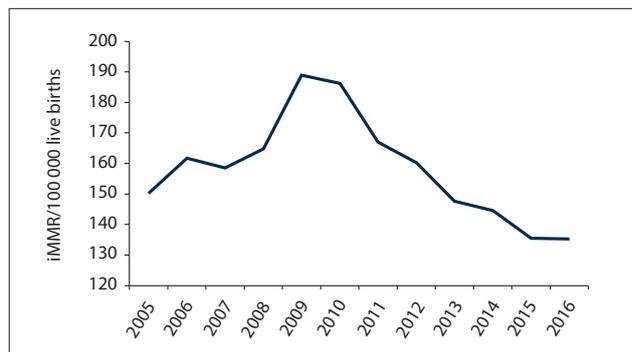


Fig. 3. iMMR per year for South Africa: 2005 - 2016. (iMMR = institutional maternal mortality rate; HT = complication of hypertension in pregnancy; OH = obstetric haemorrhage; EC = ectopic pregnancies; Miscar. = miscarriage; PRS = pregnancy-related sepsis; AR = anaesthetic-related deaths; Emb = embolism; AC = acute collapse, cause unknown; NPRI = non-pregnancy-related infections; M&S = pre-existing medical and surgical conditions, Unk. = unknown.)

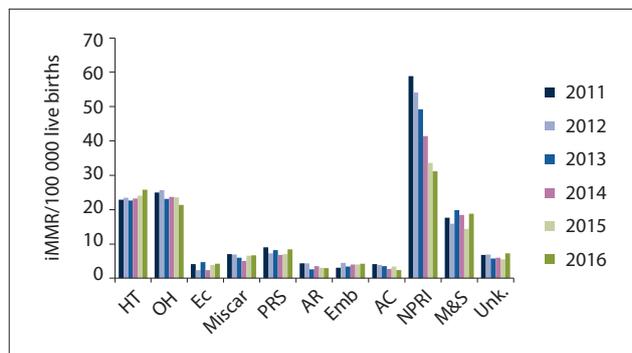


Fig. 4. Trend in iMMR per underlying cause: 2011 - 2016. (iMMR = institutional maternal mortality rate; HT = complication of hypertension in pregnancy; OH = obstetric haemorrhage; EC = ectopic pregnancies; Miscar. = miscarriage; PRS = pregnancy-related sepsis; AR = anaesthetic-related deaths; Emb = embolism; AC = acute collapse, cause unknown; NPRI = non-pregnancy related infections; M&S = pre-existing medical and surgical conditions, Unk. = unknown.)

which increased from 78 cases in 2002 - 2004 to 221 during 2011 - 2013. This number reduced slightly to 217 in 2014 - 2016. The CFR from BLDACD has dropped from 33.1 deaths per 100 000 CDs (2011 - 2013) to 31 (2014 - 2016). Annual reviews indicate that the BLDACD CFR was highest in 2012 at 40 cases and has since declined to 30 cases in 2016.^[4] The majority of these deaths (98%) occurred at district hospitals (DHs) in the public sector, where the majority of the CDs were performed. A significant number of

deaths occurred at provincial tertiary hospitals, probably due to the fact that women were referred to tertiary centres from DHs after CD with unresolved bleeding. There were also large inequities between provinces in BLDACD CFRs, ranging from 76.05 in Mpumalanga to 15.6/100 000 CD in the Western Cape during the 2014 - 2016 period.

Trends in preventable maternal deaths

At the end of the assessment of every maternal death, the assessors (a doctor and professional nurse) are asked to classify the deaths as follows: unavoidable; unavoidable but there was some substandard care; possibly avoidable, and there was some substandard care that may have impacted on the death of the woman; and probably avoidable, where there was some substandard care that probably contributed significantly to the death of the woman. The cases were assessed for factors within the control of the healthcare system, and factors related to the behaviour of the woman and/or her family were excluded. Potentially preventable maternal deaths are defined as possible and probably avoidable deaths. Although subjective, there are over 100 assessors in the country and this assessment is probably fairly robust. Fig. 5 illustrates the potentially preventable deaths in the last triennium for the underlying causes of maternal deaths. Overall, ~60% of all maternal deaths were thought to be potentially preventable by the assessors, and this has been the case since the inception of this method of assessment in 2008, which indicates poor quality of care.

It is possible to calculate the iMMR of the potentially preventable maternal deaths, and Fig. 6 illustrates the trend for the three triennia. There has been a consistent decline (17%) in the iMMR of preventable deaths since 2008, which suggests continued improvement in the quality of care (Fig. 6).

There has been a noteworthy decline (33%) in non-preventable maternal deaths, which likely reflects a decline in patient/community-related modifiable factors. Owing to its predominantly facility-based nature, the NCCEMD can assess health system modifiable factors related to the healthcare provider's management and administrative factors. Thus, potentially preventable deaths refer to preventable factors within the healthcare system. Less well explored by the NCCEMD process are, however, patient/community-related factors that are influenced by a multitude of factors, such as access to social grants, improved knowledge of health needs and rights and the influence of the MomConnect initiative, which are less well explored by the NCCEMD. These factors may have changed over the years but have not been adequately explored owing to limitations in the NCCEMD methodology. According to NCCEMD assessors, 'delay in accessing medical help' by women accounted for about one-third of assessable deaths in previous reports, but this figure is not included in the sum of the total preventable deaths illustrated in Figs 6 - 8.

The distribution of the major causes of potentially preventable maternal deaths over the three triennia indicated that the contribution of NPRI to the iMMR was declining, with a concomitant increase in the importance of HT and OH (Fig. 7). Originally, NPRI deaths were the most common causes of potentially preventable maternal deaths and are currently the third most common cause.

An analysis of the iMMR of potentially preventable deaths for the underlying causes of maternal deaths during the three triennia (Fig. 8) revealed a marked reduction in iMMR due to NPRI, and a small reduction in OH, PRS and anaesthetic-related iMMR, with no changes for hypertension-related deaths.

The reduction in potentially preventable deaths is mainly attributed to the introduction of an improved HIV testing and ARV treatment

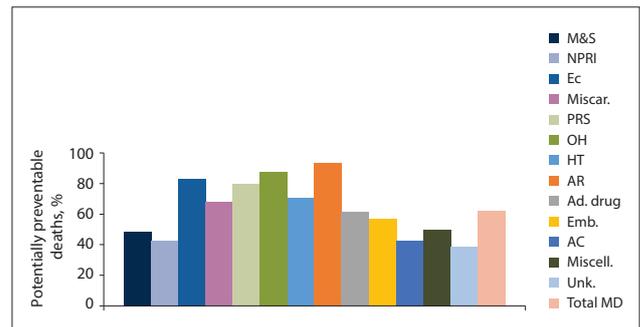


Fig. 5. Potentially preventable deaths per underlying cause: 2014 - 2016. (M&S = pre-existing medical and surgical conditions; NPRI = non-pregnancy-related infections; EC = ectopic pregnancies; Miscar. = miscarriage; PRS = pregnancy-related sepsis; OH = obstetric haemorrhage; HT = complication of hypertension in pregnancy; AR = anaesthetic-related deaths; Ad. drug = adverse drug effects; Emb. = embolism; AC = acute collapse, cause unknown; Miscell. = miscellaneous; Unk. = unknown; MDs = maternal deaths.)



Fig. 6. Potentially preventable and non-preventable maternal deaths per triennium. (iMMR = institutional mortality rate; PP= potentially preventable; NP = non-preventable.)

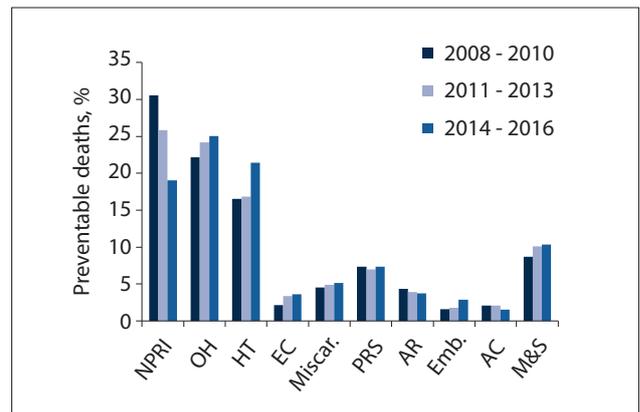


Fig. 7. Distribution of potentially preventable deaths: 2008 - 2016. (NPRI = non-pregnancy-related infections; OH = obstetric haemorrhage; HT = complication of hypertension in pregnancy; EC = ectopic pregnancies; Miscar. = miscarriage; PRS = pregnancy-related sepsis; AR = anaesthetic-related deaths; Emb. = embolism; AC = acute collapse, cause unknown; M&S = pre-existing medical and surgical conditions.)

strategy in 2010. The less-marked reduction in the direct cause of maternal deaths reflects some improvement in the quality of care, but this is inadequate and it remains disappointing that there have not been greater reductions in deaths owing to haemorrhage and hypertension in pregnancy. The management of these two conditions requires adequate functioning of the maternity healthcare

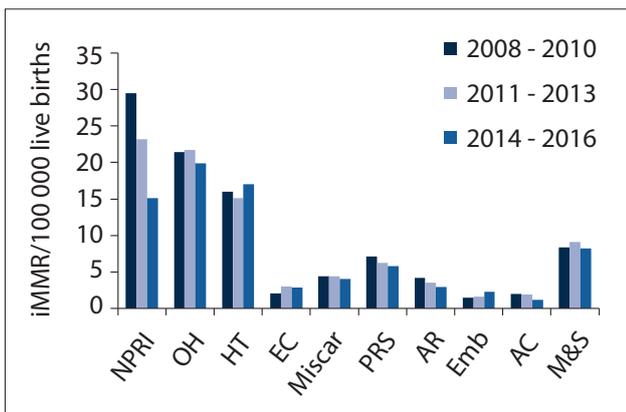


Fig. 8. iMMR of potentially preventable deaths over the three triennia: 2008 - 2016. (iMMR = institutional maternal mortality rate; NPRI = non-pregnancy related infections; OH = obstetric haemorrhage; HT = complication of hypertension in pregnancy; EC = ectopic pregnancies; Miscar. = miscarriage; PRS = pregnancy-related sepsis; AR = anaesthetic-related deaths; Emb. = embolism; AC = acute collapse, cause unknown; M&S = pre-existing medical and surgical conditions.)

system in terms of treatment, referral systems and personnel. In particular, deaths due to haemorrhage occur very quickly after the onset of bleeding, and the patients do not survive referral. This necessitates definitive care at the place where the bleeding occurs, which is frequently level one. All of the above-mentioned aspects of care have not improved sufficiently. Despite the overall reduction in maternal deaths the iMMR is still too high, and there are a number of unaddressed challenges.

Challenges for further reduction in MMR in South Africa

Safe CD

Bleeding associated with CD has been identified as a problem that still requires attention, despite the small observed decrease in CFR during the 2014 - 2016 period. In addition, CD is an underlying factor in other causes of maternal deaths such as puerperal sepsis, thromboembolism and eclampsia. The NCCEMD has addressed the problem of safety of CD by implementing the following measures:

- Clinical protocols: NCCEMD algorithms in SMRs; postpartum haemorrhage (PPH) and caesarean-section monographs; and a PPH training programme, including a lecture, accompanied dissemination of the PPH monograph throughout the country in 2011.
- Practical training: Since 2008, the Essential Steps in Managing Obstetric Emergencies (ESMOE) training programme has taught practical modules on managing bleeding at CD. The programme was recently updated to include training videos on the surgical management of PPH and a DVD training lecture on PPH. The videos and lecture were developed by the Health System Trust in 2014 and the material was circulated to district clinical specialist teams (DCSTs) to use for teaching in the districts.
- The requirements for a facility to be able to provide safe CD were stipulated in a consensus document by the NCCEMD. The document is titled 'Setting minimum standards for safe CD' and is directed at facility and healthcare managers.
- An action plan has been detailed for the implementation of safe CD. The plan has clearly allocated responsibilities for healthcare personnel.
- The developments of accreditation tools to assess: (a) the competency of the surgeon performing the CD; (b) the competency

of the doctor providing the anaesthetic; and (c) the compliance of the facility with the minimum standards. This may involve consolidation of services performing CD together with improved availability of onsite interfacility transport for referrals.

The recent declines in the number of deaths associated with obstetric haemorrhage and BLDACD have followed on the implementation of some of the abovementioned initiatives, for which all the material has been expanded and compiled into a Safe CD package of care – the programme is currently being implemented and requires scale-up to all appropriate facilities. Greater reductions in the iMMR are anticipated with the implementation of the Safe CD package of care

Improve antenatal care

An assessment of maternal and perinatal deaths owing to complications of hypertension involve two major factors, i.e. the failure to refer women with hypertension, mostly from the primary healthcare clinics, and infrequent antenatal visits. The first factor was addressed by concentrating training on hypertension and creating mechanisms for women to be easily referred.^[5] The second factor was not directly related to the women, rather, it was a function of the attendance schedule for women who were classified as having low-risk pregnancies, which initially stipulated 6-weekly visits from 20 weeks' gestation. This was too infrequent to detect sudden changes in a woman's condition. Pre-eclampsia can occur rapidly and, therefore, the National Department of Health (NDoH), through the National Health Council, has decided to increase the antenatal visits in the third trimester to fortnightly. This should have a major impact on efforts to identify women with hypertension in pregnancy and ensure that they are referred to the appropriate place.

Continuously improve the knowledge and skills of all healthcare professionals

The NDoH has conducted an intensive outreach in training healthcare professionals in managing obstetric emergencies. This was done using the ESMOE and ensuring that emergency obstetric simulation training exercises were performed. In areas where these programmes have been implemented, the maternal deaths have decreased by 29.3% overall and the direct causes of maternal death decreased by 17.5%.^[6] The expansion of these programmes to all districts is an ongoing process.

Development of strategies to improve the identification of patient/community-related factors in maternal deaths

Here, there are two major components: (a) gaining a greater understanding of patient/community-level preventable factors; and (b) identifying non-facility deaths.

Patient/community-level preventable factors

These factors are poorly evaluated in the NCCEMD process, but delays in seeking medical care remains the most common community-related problem. Strategies to circumvent this problem include improving knowledge of and access to care, with initiatives such as expanding the role of community health workers (CHWs) in ward-based outreach teams (WBOTS) to identify and monitor pregnant women, use of the MomConnect antenatal messaging service and providing maternity waiting areas for women who live far from delivery facilities.

Maternal deaths outside of institutions

The discrepancy between NCCEMD maternal mortality rates and World Health Organization global estimates is probably due to the

occurrence of maternal deaths at home/outside facilities, which are not counted or analysed in the NCCEMD process. These deaths may be classified as any of the following: women who never accessed maternity care; women who were booked but were unable to reach a facility at the time of an emergency; or women who died postpartum at home after delivery at a facility. At the time of submission of this manuscript, the NCCEMD was exploring three mechanisms for improving identification and analysis of these deaths:

Working with groups conducting ongoing demographic health surveillance (DHS) such as those in Agincourt, Mpumalanga and the Africa Centre for Health and Population Studies in KwaZulu-Natal – both provide population estimates of maternal mortality.

Working with the Burden of Disease Unit at the Medical Research Council of SA, which receives Statistics SA data derived from death certificates (DHA-1663 forms) to enable identification of maternal deaths from the recent pregnancy question on the death certificate or the codes used to classify the cause of death. In addition, deaths are categorised by location (i.e. facility or outside).

Working with traditional leaders/chiefs who are informed of deaths in their communities, and who are able to notify authorities of deaths using the DHA-1680 forms, has been investigated in KwaZulu-Natal and Limpopo as a means to improve the reporting of home deaths.

A preliminary review of these three mechanisms indicates that at least a quarter of maternal deaths occur outside facilities, but the pattern of causes is similar to that revealed by the NCCEMD data. The NCCEMD needs to develop a system based on the WHO verbal autopsy technique for exploring both the circumstances around deaths outside of facilities and the community/patient-level avoidable factors in deaths outside institutions. The verbal autopsy approach and narrative summaries for each death in the DHS sites can provide insight into these issues. This needs to be replicated across the country, possibly by CHWs and WBOTS. This remains a challenge for the NCCEMD but would provide very useful information on the many reasons that delay or obstruct women in accessing care timeously.

Conclusion

The SA NCCEMD recognises that confidential enquiries offer a good opportunity to link clinical practice with health policy to impact maternal mortality. This has been achieved by overcoming resistance to confidential enquiries, such as a lack of time, poor documentation, lack of interest or accountability, poor organisation, fear of litigation and deaths outside of the healthcare facilities. The last is still a problem in SA, but the NCCEMD intends to work with governmental organisations to conduct interviews with key informants. This has been shown to produce useful information in other countries.^[7] Such enquiries may be a catalyst to improve documentation and practice in information gathering about events that occur at the community level in rural health districts.

The NCCEMD has shown that setting targets for the reduction of deaths due to specific causes, and focusing on the provision of information and training in these areas, results in significant reductions in the number of maternal deaths. The strategies to reduce deaths related to BLDACD have had some positive effects and it is anticipated that implementing the Safe CD package of care will enable further improvements in the quality of care of women having CDs, thereby reducing maternal mortality.

Future interventions are more difficult to implement as they involve improving the healthcare system. Managing complex conditions such as obstetric haemorrhage and hypertension, which often involve many role-players in different healthcare facilities and emergency care services, can only be effective if each aspect of the system works efficiently and in harmony. Improving knowledge, skills and resources is not sufficient; the system must function efficiently.

Acknowledgements. We would like to thank the members of the NCCEMD and all the provincial assessors for their continued contributions to reducing maternal deaths – their unstinting work is paramount to the success of the work of the NCCEMD. We would also like to thank the Minister of Health, Dr Aaron Motsoaledi, for permission to publish the article and Dr Peter Barron for reviewing it.

Author contributions. All authors contributed equally to the conceptualisation and writing of the manuscript. RCP extracted the relevant data from the NCCEMD reports.

Funding. None.

Conflicts of interest. None.

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Accepted 26 September 2017.