The Use of Audit to Identify Maternal Mortality in Different Settings: Is It Just a Difference Between the Rich and the Poor?

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Abstract

Objective: To illustrate how maternal mortality audit identifies different causes of and contributing factors to maternal deaths in different settings in low- and high-income countries and how this can lead to local solutions in reducing maternal deaths.

Design: Descriptive study of maternal mortality from different settings and review of data on the history of reducing maternal mortality in what are now high-income countries.

Settings: Kalabo district in Zambia, Farafenni division in The Gambia, Onandjokwe district in Namibia, and the Netherlands.

Population: Population of rural areas in Zambia and The Gambia, peri-urban population in Namibia and nationwide data from the Netherlands.
Methods: Data from facility-based maternal mortality audits from three African hospitals and data from the latest confidential enquiry in the Netherlands.
Main Outcome Measures: Maternal mortality ratio (MMR), causes (direct and indirect) and characteristics.
Results: MMR ranged from 10 per 100,000 (the Netherlands) to 1,540 per 100,000 (The Gambia). Differences in causes of deaths were characterized by HIV/AIDS in Namibia, sepsis and HIV/AIDS in Zambia, (pre-)eclampsia in the Netherlands and obstructed labour in The Gambia.
Conclusion: Differences in maternal mortality are more than just differences between the rich and poor. Acknowledging the magnitude of maternal mortality and harnessing a strong political will to tackle the issues are important factors. However, there is no single, general solution to reduce maternal mortality, and identification of problems needs to be promoted through audit, both national and local.

Introduction

Worldwide, a woman dies every minute as a result of complications arising during pregnancy, childbirth and puerperium. All these cases represent a personal, familial and social tragedy. According to the Millennium Development Goals (MDG) formulated by the United Nations in 2000, maternal mortality should be reduced by 75% by 2015 compared with 1990 (MDG5 – UN 2005). Maternal mortality, however, is notoriously difficult to measure. This is especially true since 99% of the estimated 529,000 annual maternal deaths occur in low-income countries where vital statistics are lacking (AbouZahr 2003). Without data on the dimensions, impact and significance of a health problem, it is not possible to create an advocacy case or establish strong programs to address it.

Especially in sub-Saharan Africa, often the only information available on maternal mortality is hospital-based data. In many low-income countries, only a small proportion of births and maternal deaths occur in health facilities. Low utilization of maternal health services, which is usually caused by a combination of different factors, can contribute to high maternal mortality (Stekelenburg et al 2004). On the other hand, hospital data tend to overestimate maternal mortality in the community (Walraven et al 2000). In fact, hospital maternal mortality is expected to exceed community rates, if the hospital functions well as an integral part of a primary healthcare network to which women with high-risk pregnancies and complications are referred.

Conducting a facility-based maternal death review is primarily an educational process for health professionals providing care to pregnant or recently delivered women (WHO 2004). Furthermore, a facility-based maternal death review is only complete if linked with proper, feasible recommendations to improve maternal care and services.

Auditing hospital data, although not useful for estimating maternal mortality in the community, provides detailed information about the underlying causes of death and substandard care factors and can be used in strategies to reduce maternal mortality. An important additional advantage is that the findings can be used by health managers at district, regional, national or international levels to help identify service needs, prioritize resources and raise funds for programs and/or projects to improve maternal health.

Objectives

The primary objective of this paper is to illustrate how maternal mortality audit can be used to identify causes of and contributing factors to maternal deaths in different settings. A second objective is to illustrate differences between low- and high-income countries by presenting data from three facility-based maternal death reviews in sub-Saharan Africa and from the confidential enquiry into maternal deaths in the Netherlands (Schutte et al. in review). Finally, using regional and international differences in relation to historical lessons learned, the paper elaborates on how to reduce maternal mortality as stated by MDG5.

Methodology

Study areas and population

Study sites were selected purposively based on the authors' working experiences (see initials in parentheses).

Zambia (JS). Kalabo District is one of seven districts in Western Province in Zambia, situated on the western side of the Zambezi River. Characteristics of the area are presented in Table 1. During the flood season, six rural health centres are completely cut off from the rest of the District. Adequate access to health services is not provided to all communities. Kalabo District Hospital is the main referral hospital in the district where comprehensive emergency obstetric care is available on most occasions. Maternal mortality in the hospital is high, as in most rural areas of Africa, with far more than 1,000 maternal deaths per 100,000 live births.

Table 1. Selected indicators for the four countries and characteristics of study areas/hospitals

Country indicators[a]	Zambia	The Gambia	Namibia	Netherlands
GDP per capita (USD)	877	1,115	4,934	28,983
Life expectancy at birth (years)	37	59	49	78
Literacy rate (%)	68	38	85	99
Health expenditure per capita (USD)	49	46	331	2,564
People living with HIV/AIDS (% age 15–49)	16.5	1.6	21.3	0.2
Skilled attendance at delivery (%)	43	55	76	100
Study area/hospital	**Kalabo**	**Farafenni**	**Onandjokwe**	**Netherlands**
Catchment area (km^2)	17,447	2,256	26,607	41,160
Number of inhabitants	116,003	213,700	152,000	16,000,000
Population density (km^2)	6.6	94.7	5.7	388.7
Study Period (months)	30	12	12	24
Institutional births (n)	1471	1169	3480	409,222[b]

[a]Sources: http://www.who.int/country
http://www.undp.org/hdr2003/indicator
[b]Total births in the Netherlands: institutional + home births.

The Gambia (GW). The North Bank Division is one of seven divisions in The Gambia, situated to the north of the Gambia River. Characteristics of the area are presented in Table 1. Over the last 20 years, there has been a marked change in health service availability in the division. Farafenni hospital, where comprehensive emergency obstetric care is available on most occasions, was established only recently, in 1999. Between 1982 and 1998, the proportion of women delivering in a health facility increased from 4.6% to 18.0%. Again, maternal mortality in hospital is high, with far more than 1,000 maternal deaths per 100,000 live births.

Namibia (JvD). Onandjokwe District is situated in Oshikoto region in the former North West Health Directorate. Characteristics of the area are presented in Table 1. In this semi-rural district, peri-urban areas (like Ondangwa town) are rapidly expanding, and many people settle here in search of work. Onandjokwe District has one hospital, Onandjokwe Lutheran Hospital, where comprehensive emergency obstetric care can be given at any time. According to official records, in-hospital maternal mortality was 21 per 100,000 in 2001, when only one case was reported. Nationally, however, maternal mortality stands at 271 per 100,000.

The Netherlands (JS and JvR). This western European country is bordered by the North Sea, Belgium and Germany. Characteristics are presented in Table 1. In the Netherlands, 409,222 deliveries occurred in 2000 and 2001. Approximately 70% of the births were in hospital; 30% were at home under the guidance of a trained midwife or a family practitioner. Maternal mortality is low, at 12.6 per 100,000 live births in 1993–2002 (Schutte et al. submitted).

Methods

We analyzed maternal deaths in Zambia (January 1999 to July 2001), in The Gambia and Namibia (January to December 2002) and in the Netherlands (January 2001 to December 2002). In the three African hospitals, hospital staff performed the local audit as an integral part of routine clinical work (Stekelenburg and Van Roosmalen 2002). In the confidential enquiry in the Netherlands, audit forms were reviewed by the maternal mortality committee of the Dutch Society of Obstetrics and Gynaecology. We searched for classification of death (direct or indirect deaths), causes of death, substandard care factors (in hospital) and delay factors in all cases of the four series.

Definitions

Maternal death – death of a woman while pregnant or within 42 days of termination of the pregnancy, irrespective of the duration or the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes (WHO 1992).

Maternal mortality ratio (MMR) – the number of maternal deaths per 100,000 live births.

Direct maternal deaths – those resulting from complications of the pregnant state, from interventions, omissions or incorrect treatment.

Indirect maternal deaths – those resulting from a disease (either previously existing or developed during pregnancy) aggravated by the physiological effects of pregnancy.

Substandard care – care was considered substandard when, according to the local audit team (African hospitals) or the national maternal mortality committee (the Netherlands), it deviated from existing local protocols or consensus.

Delay factor – delay factors included delay in the decision-making process (phase 1), delay in reaching a health facility (phase 2) and delay in receiving appropriate care (phase 3) (Thaddeus and Maine 1994).

Limitations

As previously mentioned, hospital-based mortality data does not necessarily reflect community maternal deaths. Furthermore, even deaths in hospital might have been misclassified as non-maternal, especially indirect deaths in medical wards. Data was recorded retrospectively from patient files, which in some cases were incomplete. On the other hand, audit sessions were done locally, and healthcare workers involved in patient management gave additional information if necessary. Finally,

the definition of substandard care differed between settings according to differences in local protocols and possibilities (e.g., the absence of an intensive care department in Zambia and The Gambia).

Results

Differences in socio-economic indicators between the four study areas and country data are presented in Table 1. A picture of poverty, short life expectancy and poor healthcare arises from the data for Zambia and The Gambia. Namibia is slightly better, with a gross domestic product (GDP) per capita about fivefold and health expenditure per capita about sevenfold compared with Zambia and The Gambia. The situation in the Netherlands can be characterized as wealthy, a long life expectancy and good healthcare.

The distribution in classification between direct and indirect obstetrical deaths does not show a difference between Zambia, The Gambia and the Netherlands (Table 2). In Namibia, however, indirect causes of maternal death were identified in 67% of the cases. As for cause of death, a high percentage of sepsis but no eclampsia cases exist in Kalabo, Zambia. In Farafenni there were no abortion-related cases, while obstructed labour, hemorrhage and sepsis were common direct causes of maternal mortality. Absence of obstructed labour and abortion-related cases and a very high percentage of (pre-)eclampsia-related deaths were the most striking findings in the Netherlands (Table 3). For Namibia and Zambia, HIV/AIDS is a major influence in maternal mortality. AIDS might have been the cause for the "chronic disease" case in The Gambia. Four cases in The Gambia were booked as "unknown," but considered indirect maternal deaths.

Table 2. Characteristics of maternal deaths (numbers, % or range in parentheses)

Characteristics of Deaths	Zambia Kalabo	The Gambia Farafenni	Namibia Onandjokwe	Netherlands
Maternal deaths - Direct - Indirect	15 10 (67) 5 (33)	18 12 (67) 6 (33)	21 7 (33) 14 (67)	48 35 (73) 13 (27)
Maternal mortality ratio	1359	1540	603	10
Mean age in years (range)	25.5 (15–42)	28.1 (17–45)	27.0 (16–40)	29.2 (16–40)
Substandard care	9 (60)	11 (61)	9 (43)	25 (52)
Delay factors	9 (60)	10 (56)	-	1 (2)

Substandard care is prevalent in all hospitals (Table 2). In the Netherlands, the confidential enquiry committee identified substandard care in 52% of cases. In Zambia and The Gambia, substandard care was found in about 60% of cases of maternal death. In Namibia, substandard care was identified in 42%, but this would increase to 67% if a missed family planning opportunity in a known or suspected HIV patient were classified as substandard care.

Discussion

Although the data presented in this paper are not intended for comparing causes of maternal deaths, results from three local African audits and the nationwide confidential enquiry into maternal deaths in the Netherlands illustrate clear differences.

First, they indicate an association between poverty (low gross national product [GNP]) and maternal death (high MMR). This relationship, however, is not straightforward. In countries where the GNP per capita was below USD 1,000 in 1993, estimates of maternal mortality ratios ranged

from 22 to 1,600 per 100,000 live births (Stanton et al. 1995; World Bank 1995). For example, at that time, maternal mortality ratios were estimated at 160, 1,200 and 1,300 in Vietnam, Uganda and Burundi, respectively, despite very similar GNPs per capita (USD 170–180). The main differences in maternal mortality between countries and world regions cannot simply be explained by variations in economic growth (De Brouwere et al. 1998). Also, national figures mask substantial internal variations – geographic, economic and social – which are not confined to low-income countries. Irrespective of the stage of development or the condition of the health system, inequalities in the risk of maternal death are found everywhere (Ronsmans et al. 2006).

Table 3. Causes of maternal deaths (numbers, % in parentheses)

	Zambia Kalabo	The Gambia Farafenni	Namibia Onandjokwe	Netherlands
Direct maternal deaths	10 (66,7)	12 (66,7)	7 (33,3)	35 (72,9)
Hemorrhage	1 (6,7)	3 (16,7)	1 (4,8)	1 (2,1)
(Pre-)eclampsia	0	1 (5,6)	2 (9,5)	12 (25,0)
Sepsis	5 (33,3)	3 (16,7)	1 (4,8)	3 (6,3)
Abortion	1 (6,7)	0	2 (9,5)	0
Obstructed labour	2 (13,3)	4 (22,2)	0	0
Other direct causes				
Thromboembolism	1 (6,7)	0	1 (4,8)	5 (10,4)
Amniotic fluid embolism	0	0	0	5 (10,4)
Other	0	1 (5,6)	0	8 (16,7)
Unknown				1 (2,1)
Indirect maternal death	5 (33,3)	6 (33,3)	14 (66,7)	13 (27,1)
HIV/AIDS	4 (26,7)	0	8 (38,1)	1 (2,1)
Other	1 (6,7)	2 (11,1)	6 (28,6)	12 (25,0)
Unknown[a]	0	4 (22,2)	0	0

[a]Four cases in Farafenni were audited as indirect maternal death with unknown cause. The maternal mortality committee of the Dutch Society of Obstetrics and Gynaecology classifies sudden death of unknown cause as direct maternal death.

Historically, the trend in maternal mortality in Sweden, England and Wales and the United States suggests two main phases (Loudon 1988; De Brouwere et al. 1998). The first phase, in the late 19th century, was characterized by recognition of the magnitude of the problem revealed by vital statistics. This led to professionalization of midwifery care and, together with the introduction of aseptic techniques, reduced maternal mortality in the early 20th century in countries like Sweden, the Netherlands and Denmark to the equivalent of the 25th centile of the poorest countries today. The second phase, which followed the plateau between 1900 and 1930, was made possible by the improvement of techniques such as use of antibiotics, caesarean section and blood transfusion. During this phase, the quality-of-care concept and a system of control was assisted by information from studies into maternal mortality. Vital statistics, although available in Sweden from as early as the 18th century, resulted in confidential enquiries into maternal deaths in England and Wales only from 1949. These enquiries and the medical audit introduced at the same time resulted in awareness among caregivers and largely contributed to further decline until the low rates found today were achieved.

As with the relationship between poverty and maternal mortality, the possible relationship between access to healthcare and maternal mortality is not straightforward. The case of Kalabo, Zambia, demonstrates what happens in a large district (in square kilometres almost half as big as the Netherlands) with only one hospital offering emergency obstetric care and no transport system at all (Stekelenburg et al. 2004). The decentralization of emergency obstetric care has not taken place and is not feasible. However, like Zambia, Sweden was a country with a very scattered (and

poor) population and a very high maternal mortality ratio in the first half of the 18th century. Early recognition of the magnitude of the problem and a strong political will to tackle it led to a decrease to below 100 per 100,000 live births by 1950 (Hogberg and Joelsson 1985). The striking difference in the presence of delay factors in reaching a health facility between the cases of maternal deaths in the Netherlands on one hand, and Zambia and The Gambia on the other, is as expected. Absence of delay factors in Namibia is surprising and can be explained by the quality of the referral system in Onandjokwe district. This plays a role in understanding the absence of obstructed labour as a cause of maternal death in both the Netherlands and Namibia.

Another striking difference concerns the HIV/AIDS epidemic, which plays a devastating role in healthcare in Africa. Halting the spread of HIV is an important goal, summarized in MDG6 (UN 2005). In the studies presented here, HIV prevalence ranged from 0.2% for the Netherlands to 21.3% for Namibia. In Kalabo, Zambia, HIV/AIDS was the cause in at least 4 of 15 (27%) cases of maternal death. Probably, some of the women who died from septicemia were also HIV-positive but were not tested. In Onandjokwe, Namibia, HIV/AIDS contributed to the cause of death in at least 8 of 21 (38%) cases. In the series from Farafenni, The Gambia, the single case of "chronic disease" might have been HIV/AIDS as well. An increase in maternal mortality in HIV-prevalent settings has been reported earlier, with levels up to 22 times as high in HIV-positive women compared with HIV-negative women (Ticconi et al. 2003). At present there appears to be consensus that pregnancy itself does not have a major adverse effect on survival of HIV-infected women (Minkoff et al. 2003). It is clear, however, that in sub-Saharan Africa the HIV/AIDS epidemic negatively affects maternal health through a cascade of interrelated factors such as anemia, susceptibility to infection, comorbidity with other STDs, malnutrition, poverty, shortage of health staff and lower immunity for malaria. Most (African) countries have introduced national and local programs on dealing with HIV in pregnancy. However, massive support is still needed to implement comprehensive reproductive health programs that include (costly) antiretroviral treatment. Finally, in addition to the medical consequences, the HIV/AIDS epidemic has also increased the community's unwillingness to donate blood and has led to a critical shortage of health workers of all cadres in many remote districts (Stekelenburg and Van Roosmalen 2002).

In the Netherlands, (pre-)eclampsia was identified as the largest single cause of maternal death, at 25%. Maternal mortality and morbidity audits have identified the incidence of pre-eclampsia as high in the Netherlands compared to its surrounding countries. This has led to recent changes in national guidelines.

Finally, it is important to note that in all four series the proportion of indirect maternal deaths is relatively high, with figures up to 67% in Onandjokwe (Van Dillen et al. 2006). Indirect maternal deaths are particularly prone to being reported as non-maternal and there are significant differences between countries in the classification of indirect deaths to the maternal category (Schuitemaker et al. 1997; Songane and Bergstrom 2002). The 2000–2002 confidential enquiry in the United Kingdom found for the first time that indirect deaths account for more maternal deaths than direct causes (Lewis and Drife 2004). There is reason to assume that, at least, attention to maternal mortality as a problem has led to increased registration, even of indirect causes. Most countries with confidential enquiries into maternal deaths see an initial increase in registered maternal deaths after the program is introduced, due to improved identification and classification (Schuitemaker et al. 1998).

Conclusion

To achieve MDG5 and reduce maternal mortality by 75%, many factors need to be addressed, among these socio-economic and organizational ones. But there is more than just a difference between rich and poor. The first step in reducing maternal mortality is to identify the problems. Identifying local, regional or national causes, assessing substandard care and recommending improvements can be achieved through the implementation of audit. Audit is a low-cost operational research tool that is not just relevant for monitoring local progress. It should also be used for advocacy and can inform policy makers and planners about effective interventions to reduce maternal deaths. This

paper illustrates that there is no single solution, since every country or region has different factors influencing maternal health.

Author's Contributions

Jeroen van Dillen: MD, resident specialist-in-training, Former MD Onandjokwe Lutheran Hospital, Namibia. Initiated Onandjokwe maternal mortality audit and analysis of Namibian data. Drafted/ revised manuscript for Journal of World Health and Population.

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Joke Schutte: MD, resident specialist-in-training, Analysis of maternal deaths from the Netherlands, member of the Netherlands Maternal Mortality Committee, assisted in drafting manuscript.

Gijs Walraven: MD, MPH, PhD, public health physician/epidemiologist, Former Head Reproductive Health Programme, Medical Research Council Laboratories, The Gambia. Initiated Farafenni maternal mortality audit and analysis of The Gambia data. Revised manuscript critically for substantial intellectual content.

Jos van Roosmalen: MD, PhD, consultant obstetrician, Chairperson of The Netherlands Maternal Mortality Committee, supervised audit of maternal deaths in the Netherlands, assisted in analyzing data from the Netherlands and revising the manuscript critically for substantial intellectual content.

References

AbouZahr C. 2003. "Global Burden of Maternal Death and Disability." *British Medical Bulletin* 67: 1–11.

De Brouwere V., R. Tonglet, W. Van Leberghe. 1998. "Strategies for Reducing Maternal Mortality in Developing Countries: What Can We Learn from the History of the Industrialized West?" *Tropical Medicine and International Health* 10: 771–82.

Hogberg U and I. Joelsson. 1985. "The Decline in Maternal Mortality in Sweden, 1931–1980. *Acta Obstetricia et Gynecologica Scandinavica* 64: 583–92.

Lewis G and J. Drife. 2002. *Why Mothers Die: The Sixth Report of the Confidential Enquiries into Maternal Deaths in the United Kingdom.* London: Royal College of Obstetricians and Gynaecologists.

Loudon I. 1988. "Maternal Mortality: 1880–1950. Some Regional and International Comparisons." *Social History of Medicine: The Journal of the Society for the Social History of Medicine* 1: 183–227.

Minkoff H., R. Hershow, D.H. Watts, M. Frederick, I. Cheng, R. Tuomala et al. 2003. "The Relationship of Pregnancy to Human Immunodeficiency Virus Disease Progression." *American Journal of Obstetrics and Gynecology* 189: 552–59.

Ronsmans C. and W.J. Graham. 2006. "Maternal Mortality: Who, When, Where, and Why." *The Lancet* 368: 1189–1200.

Schuitemaker N.E.W., J.J.M. van Roosmalen, G.A. Dekker, P. van Dongen, H.van Geijn and J.B. Gravenhorst. 1997. "Underreporting of Maternal Mortality in the Netherlands." *Obstetrics and Gynecology* 90: 78–82.

Schuitemaker N.E.W., J.J.M. van Roosmalen, G.A. Dekker, P. van Dongen, H. van Geijn and J.B. Gravenhorst. 1998. "Confidential Enquiry into Maternal Deaths in The Netherlands 1983–1992. *European Journal of Obstetrics, Gynaecology, and Reproductive Biology* 79: 57–62.

Schutte J.M., E.A.P. Steegers, N.W.E. Schuitemaker, J.G. Santema, K. de Boer, J.W. Briet et al. submitted. Confidential Enquiry into Maternal Deaths in the Netherlands 1993–2002.

Songane F.F. and S. Bergstrom. 2002. "Quality of Registration of Maternal Deaths in Mozambique: A Community Based Study in Rural and Urban Areas. *Social Science & Medicine* 54: 23–31.

Stanton C., K. Hill, C. AbouZahr and T. Wardlaw. 1995. *Modelling Maternal Mortality in the Developing World.* WHO & UNICEF: Geneva.

Stekelenburg J. and J. van Roosmalen. 2002. "The Maternal Mortality Meeting: Experiences from Kalabo District Hospital, Zambia." *Tropical Doctor* 32: 19–23.

Stekelenburg J., S. Kyanamina, M. Mukelabai, I. Wolffers and J. van Roosmalen. 2004 . "Waiting Too Long: Low Use of Maternal Health Services in Kalabo, Zambia." *Tropical Medicine and International* 9: 390–98.

Thaddeus S. and D. Maine. 1994. "Too Far to Walk: Maternal Mortality in Context. *Social Science & Medicine* 38:1091–110.

Ticconi C., M. Mapfumo, M. Dorrucci, N. Naha, E. Tarira, A. Pietropolli and G. Rezza. 2003. "Effect of Maternal HIV and Malaria Infection on Pregnancy and Perinatal Outcome in Zimbabwe." *Journal of Acquired Immune Deficiency Syndromes* 34: 289–94.

UN Millennium Development Goals. 2005. Retrieved July 4, 2006. <http://www.un.org/millenniumgoals>

Van Dillen J., T. Meguid and J. van Roosmalen. 2006. "Maternal Mortality Audit in a Hospital in Northern Namibia: the Impact of HIV/AIDS. *Acta Obstetricia et Gynecologica Scandinavica* 85: 499–500.

Walraven G., M. Telfer, J. Rowley and C. Ronsmans. 2000. "Maternal Mortality in Rural Gambia: Levels, Causes and Contributing Factors. *Bulletin of the World Health Organization* 78: 603–13.

World Bank. 1995. *World Development Report 1995. Workers in an Integrating World.* Oxford University Press: New York.

World Health Organization. 1992. *ICD-10: International Classification of Diseases and Health Related Problems.* WHO: Geneva.

World Health Organization. 2004. *Beyond the Numbers. Reviewing Maternal Deaths and Complications to Make Pregnancy Safer.* WHO: Geneva.