

EVALUATING COMPLETENESS OF MATERNAL MORTALITY REPORTING IN A RURAL HEALTH AND SOCIAL AFFAIRS UNIT IN VELLORE, INDIA, 2004

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Summary. Health systems in developing countries infrequently implement and evaluate maternal death surveillance. This study identified under-reported and misclassified maternal deaths among women of reproductive age between 1999 and 2004 in a rural service unit in Vellore, India. In-depth interviews, semi-structured interviews and structured questionnaires were used to identify maternal deaths known to health care providers and community leaders who regularly come in contact with pregnant women. Eighteen under-reported and misclassified cases – or 50% of maternal deaths – were reported. These included 29% of abortion-related and 7% of domestic violence-related deaths. Based on this study's fieldwork, the existing death surveillance system detected 100% of the maternal deaths reported by hospital staff; however, it missed most maternal deaths reported by community workers. The latter are more likely than deaths reported by hospital workers to result from abortion and family violence. The existing surveillance system should be augmented with a community-based death surveillance system. This comprehensive approach identified twice as many maternal deaths than previously recorded and could be applied in other settings. Appropriate public health interventions should be initiated to prevent maternal deaths in this community.

Introduction

The fifth Millennium Development Goal is to improve maternal health by reducing the maternal mortality ratio by three-quarters between 1990 and 2015. The UN states that it is difficult to measure improvements in maternal deaths due to unreliable data and wide margins of uncertainty in regions where most deaths occur, including Southern Asia (United Nations, 2006).

According to the 2005 maternal mortality working group, the maternal mortality ratio for 2001–2003 was about 450 per 100,000 women in India (Hill *et al.*, 2007).

Routine ongoing population-based community surveillance of maternal deaths has not been reported in India. Previous studies have used multiple sources, including informants such as health workers, newspapers and medical examiners, to gather information on maternal deaths to ascertain complete maternal deaths in resource-poor settings (Walker *et al.*, 1986; Fortney *et al.*, 1987; Rochat *et al.*, 1981; Bhatia, 1993). These studies found that even high-quality routine registration of maternal deaths will miss a small proportion of cases (Ronsmans *et al.*, 1998; Olsen *et al.*, 2002). In light of the fifth Millennium Development Goal, the Rural Unit Health and Social Affairs (RUHSA) near Vellore, India, decided to evaluate the completeness of maternal mortality reporting, to describe the types of maternal deaths, and to develop a simple and quick method of improving maternal mortality data.

Methods

Study site

RUHSA has been a department of the Christian Medical College of Vellore, South India, since 1985 and has been involved in comprehensive community-based health and development work since 1977; a detailed description of RUHSA is given elsewhere (Abel *et al.*, 2003). RUHSA operates in the K.V. Kuppam block, which consists of thirty-nine *panchayats* that are grouped into eighteen Peripheral Service Units (PSU). A mobile clinic visits each PSU weekly to provide antenatal care, child immunizations and primary care services. A Rural Community Officer (RCO) is responsible for two PSUs (approximately 10,000 people) and each PSU has one Health Aid (HA) and between two and seven Family Care Volunteers (FCVs), each in charge of approximately 200 families.

This project was conducted over a period of 13 weeks, with about 3 weeks devoted to data collection. It was initially developed in response to RUHSA's request for an Emory MPH student to evaluate the completeness of maternal mortality reporting during a summer practicum experience. The project had no external funding support.

The Management Information System (MIS) reporting system

Since 1983 RUHSA has had a Management Information System (MIS) to record registered marriages, deliveries and deaths. The FCVs report vital events when they occur to the HA because FCVs interact most closely with the community. Then the HA records the event and hands it to the RCO, who later gives it to a statistician to enter into the MIS. In recent years the number of voluntary FCVs has declined by 10% due to ageing and attrition (personal communication, 2nd February 2007, Abel Rajaratnam). While the MIS routinely provides data on many indicators, including deaths, it has limited data on causes of death, nor does it categorize deaths, including maternal deaths, into systematic categories.

Evaluating the completeness and accuracy of maternal deaths in the MIS system

Case definition. With the aid of local translators and the RUHSA study team, data were collected through key informant interviews, field interviews and structured

questionnaires. Multiple sources were used to identify maternal deaths for the five-year period 1999–2004. To ensure reporting of all maternal deaths in the past 5 years, the key informants were asked for reports of maternal deaths in the past 6 years and FCVs and Self-Help Group (SHG) members – middle-aged or elderly women with little or no education – were asked for reports of maternal deaths and their causes in the past 10 years. These interviewees described deaths of women aged 12–50 years who resided within the K.V. Kuppam block, and who died due to causes related to or aggravated by their pregnancy or its management, as described in the ICD-10 definition (WHO/UNICEF/UNFPA, 2000). This definition includes maternal deaths up to 42 days after pregnancy ends and late maternal deaths between 42 and 365 days after pregnancy ends. The case descriptions included name, address, husband's name, duration of pregnancy and year, cause and place of death and any other information associated with the death. After obtaining informed consent, the key informant and FCV interviews were recorded on tape and later transcribed. The SHG members completed a questionnaire written in Tamil, which was later translated into English.

Sources of information. A key informant was defined as any health worker who has regular contact with pregnant women or who works with the MIS. Male and female health care providers and community leaders aged 18 and older were recruited. All eighteen key informants were interviewed: two physicians, three nurses, nine RCOs and four administrative personnel. Four were female and fourteen were male. All had schooling beyond high school and most had graduate degrees. The average age was 42 years. The interviews were conducted in English.

Field interviews were conducted with FCVs and SHG members. Although the SHG members are women with little or no education, RUHSA has trained them in technical skills such as providing safe deliveries, money management and literacy. Of 92 FCVs, a total of 74 (80%) were interviewed with the help of a local translator. In each service unit more than one FCV was interviewed, but eighteen FCVs who did not show up to the mobile clinic visits were not interviewed. In addition, 200 SHG members were asked at a monthly SHG meeting to fill out and return a written questionnaire in Tamil if they had knowledge of a maternal death. Sixteen completed questionnaires with information on five unique deaths were received. None of the others was aware of any maternal deaths in their area. Last, the death reports were reviewed by ten staff at the government Primary Care Hospitals and a staff worker from the Christian Medical College Hospital. The Christian Medical College and the Emory University Institutional Review Board (IRB) approved the project.

Methods of analysis

Case descriptions of maternal deaths were compared with records from the RUHSA hospital, the government facilities and the Christian Medical College (CMC) hospital to identify a matching death of maternal causes within this time period. Within RUHSA, the case descriptions from key informant interviews, FCVs and SHG members were compared with a print-out of all the deaths of women of reproductive age (ages 12–50 years) between 1994 and June 2004 recorded in the MIS.

Any maternal death found in both the MIS and this study was coded as correct. A community-identified maternal death case that had a non-maternal cause of death in the MIS was coded as a discordant classification. Maternal death cases were looked for in the MIS that were not reported through key informant or community interviews. Lastly, if maternal death case descriptions were not found in the MIS, two physicians were consulted to validate and confirm that it was a maternal death.

To further verify each case description and to identify additional deaths, the reported maternal deaths from this study were cross-checked with four government Primary Healthcare Centres and one main private hospital (Christian Medical College Hospital). With the aid of two physicians the maternal deaths were characterized as direct or indirect (WHO/UNICEF/UNFPA, 2000). The final classifications are based upon the case descriptions provided by the respondents and available medical records.

The content of the open-ended interviews, questionnaires and field notes were examined, identifying common themes and phrases in the case descriptions for additional information about maternal deaths. Information was recorded and stratified by hand and also organized with EZ Text (CDC, 1998). The data were classified into seven major themes consistent with past reports (Ronsmans *et al.*, 1998; Liljestrand, 2000; Olsen *et al.*, 2002): maternal mortality, MIS, abortions, cultural practices, domestic violence, healthcare and other. To ensure consistency with the definitions of the phrases, the data were coded twice. They were compared across different groups and within the same group of respondents.

After classifying the maternal deaths by year of occurrence, the annual maternal mortality ratio (MMR) per 100,000 live births in the K.V. Kuppam block and confidence intervals were computed using Statistical Analysis Battery for Epidemiologic Research software (CDC, 2004).

Results

Overall, 91 reports of possible maternal deaths were identified. After a thorough verification process, only the 28 deaths (Fig. 1) that were verified as being due to maternal causes in the time period (1999–2004) were included. Five cases were eliminated because the case was either a duplicate death or wrong information was given (i.e. the woman was still alive or the woman could not be identified in the village). Of the remaining 86, fourteen were found in the MIS and included in the study; ten were classified as maternal deaths and four as unnatural or suicide. Of the 72 not in the MIS, fourteen were kept, 31 with incomplete information were excluded (i.e. could not be verified as pregnancy related, the residency of the woman could not be confirmed, or the actual cause of death was unknown) and 27 were excluded because the MIS reported that these deaths occurred before 1999.

Of the 28 maternal deaths, FCVs reported eleven (39.3%) and the SHG members reported five (17.9%). Of these sixteen (57.1%) deaths, four (25%) were in the MIS. The key informants reported ten (35.7%) maternal deaths, each of which was in the MIS. Finally the government health facilities reported two (7.1%) maternal deaths, neither of which was in the RUHSA MIS (Table 1).

Of the 28 deaths, fourteen (50%) were not reported in the registration system (Table 2). Of the fourteen deaths in the registration system, 29% had a discordant

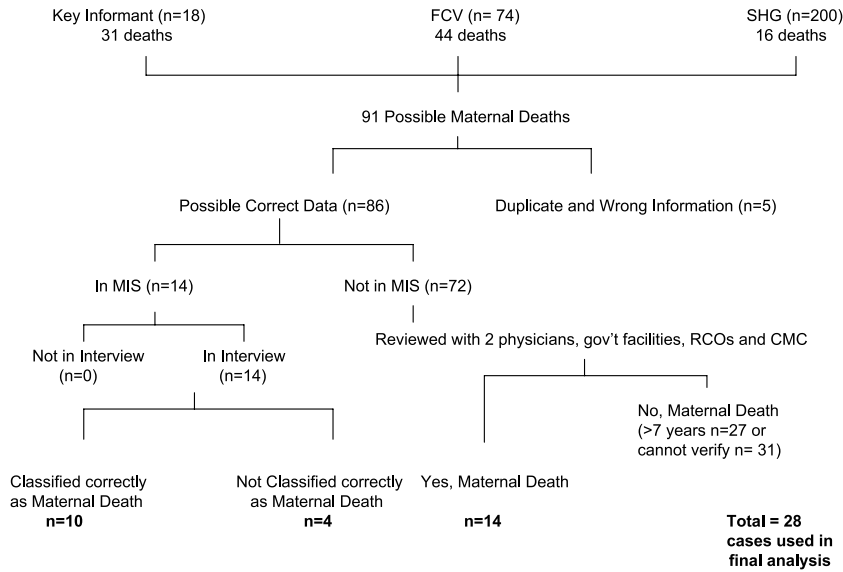


Fig. 1. Flow chart to identify maternal deaths.

Table 1. Total maternal deaths classified by sources of information, RUHSA 1999–2004

Source of information	Maternal deaths		
	Total	Direct	Indirect
Key informants	10	9	1
Also reported in MIS ^a	10	9	1
Field interviews and questions	16	12	4
FCV total	11	8	3
Only reported by FCV	9	9	0
Also reported in MIS ^a	2	1	1
SHG total	5	4	1
Only reported by SHG	3	2	0
Also reported in MIS ^a	2	1	1
Health facilities (PHC) total	2	0	2
Total deaths	28	21	7

^aNumbers are already reported in MIS total.

Numbers in bold add up to the total deaths.

PHC, Primary Health Care; MIS, Management Information System; FCV, Family Care Volunteer; SHG, Self-Help Group.

classification. Of the four deaths identified as maternal deaths by the community but labelled differently in the MIS, the community described two as ‘fits after delivery’ and the MIS reported one as a ‘fit’ and another as ‘unknown’. The MIS listed two

Table 2. Maternal deaths, MIS classification by year, RUHSA, 1999–2004

Year	Deaths recorded in MIS			Total maternal deaths
	Classified as maternal death in MIS	Not classified as maternal death in MIS	Reported only by community	
1999	6	1	3	10
2000	2	0	0	2
2001	0	0	3	3
2002	1	3	3	7
2003	1	0	2	3
2004	0	0	3	3
Total	10	4	14	28

deaths from suicide and the community provided additional information – each woman was pregnant when she committed suicide. Of the ten that were correctly classified in the MIS, all were hospital-based deaths. Comparing deaths not reported by the MIS for 1999–2000 vs 2001–2004, 69% of deaths were reported outside the MIS in 2001–2004 compared with 25% of deaths being reported outside the MIS in 1999–2000.

The estimate of the overall maternal mortality ratio for these years is 279 (95% CI: 185, 403) deaths per 100,000 live births. The annual maternal mortality ratios fluctuate greatly and the Poisson confidence intervals for each year's maternal mortality ratio are wide, making it difficult to examine trends (Table 3). Six (21.4%) deaths were attributed to abortion and five (17.9%) to suicide or domestic violence. Overall 21 (75.0%) were directly related to pregnancy and seven (25.0%) were indirectly related to pregnancy (Table 4).

Field interviews

Key informants and field interviews provided case descriptions that help explain causes of maternal death in the community. The most common phrases were 'antenatal clinics', 'abortion', 'family problems' and 'direct cause'.

Key informants. Different types of key informants reported different types of maternal deaths. Of the eighteen key informants, five of the physicians and nurses only provided maternal death descriptions due to a direct cause such as anaesthetic accidents and eclampsia. The deaths described by the physicians and the nurses were in the MIS and all occurred in the hospital, unless the mother was transferred to the CMC hospital or the death did not occur at RUHSA. The four administrative personnel did not know of any maternal deaths. The remaining nine key informants (Rural Community Officers) reported maternal deaths due to abortions, family problems, husband abuse, suicide and other socially proscribed behaviour. Three RCOs described a maternal death related to abortion, such as:

Table 3. Maternal mortality ratios and 95% confidence intervals by year, RUHSA, 1999–2004

Year	Total live births	MMR ^a	95% Poisson confidence interval	
			Lower limit ^b	Upper limit ^b
1999	1884	531	254	976
2000	2077	96	12	348
2001	1851	162	34	473
2002	1744	401	161	827
2003	1574	191	39	557
2004 ^c	913 ^d	329	68	961
Overall	10,043	279	185	403

^aMaternal mortality ratio per 100,000 live births.

^bThe lower and upper limits are per 100,000 live births.

^c2004 data only includes information from January to June.

^dTotal live births for 2004 is the mean value divided by two of the total live births from 1999–2003.

Table 4. Maternal deaths by cause of death, RUHSA, 1999–2004

Direct deaths		Indirect deaths	
Cause	<i>N</i>	Cause	<i>N</i>
Hypertensive diseases of pregnancy	2	Suicide	3
Haemorrhage	2	Domestic violence	2
Amniotic fluid embolus	1	Tumour	1
Pulmonary embolus	1	Tuberculosis	1
Abortion (including sepsis)	6		
Eclampsia	1		
Anaesthesia	1		
Anaemia	2		
Other ^a	5		
Total	21	Total	7

^aOther includes delivery complications (1), fits (2) and first child (2).

... she had an informal/induced abortion within the village and had sticks stuck inside of her vagina for the abortion ... she was about five months pregnant. The mother died at the PHC.

Another frequently mentioned theme was 'family problems', which meant that either the husband or the in-laws abused the wife, leading to her death, or that the wife committed suicide. For example:

... a woman who had completed about nine months [pregnancy], went to the hospital and died after she came back due to family problems. It was an unnatural death. It was her first pregnancy after 15 years.

FCV and SHG interviews. Family Care Volunteers often gave information that key informants did not provide. Seventy-four FCVs provided eleven stories of abortion-related deaths; six were verified to be in the correct time period and listed in the MIS. Most of the eleven stories referred to the use of 'sticks' and the outcome of 'sepsis':

A woman who was five months pregnant had an abortion using a local method of inserting sticks into the uterus. The sticks got stuck so she went to the hospital and she died there.

In P village 10 years back, a mother who was six months pregnant got an illegal abortion using Errukkan Sticks inside her vagina ... it was a septic abortion and after two or three days she got a fever and cold ... she eventually died within five days.

In addition, FCVs gave descriptions of an 'unnatural death':

A woman ... who was well-educated drank kerosene and burned herself when she was five months pregnant ... she had family problems.

Lady died after delivery due to fear of husband and problem in the family ...

Although the FCVs would not say that the death of the woman resulted from abuse in the home, they mentioned that women would obtain an abortion to avoid shame and embarrassment.

... she had an abortion because she did not want to face shame from her family, she was not married ...

The girl's family did not want her to face embarrassment because she was not able to have any sons ... she had sticks put into her vagina and died several hours later.

Descriptions of maternal deaths from the SHG ranged from maternal deaths due to tetanus to family problems, with the majority of the cases being death due to a weak heart.

Discussion

Overall, this study identified 28 maternal deaths in the period 1999–2004, a maternal mortality ratio of 279, which is 1.67 times higher than 167, the latest reported ratio (1999–2001) for Tamil Nadu, India (Registrar General, 2006). Baseline data are lacking for 1990 to estimate what the Millennium Development Goal should be for 2015, so we are unable to assess progress. This study's data show no decline in the MMR between 1999 and June 2004.

RUHSA has reported improvements in immunization, nutrition and infant mortality. For nearly 15 years, RUHSA has made efforts to improve maternal health, especially safe motherhood initiatives, but maternal mortality remains high. Therefore, if an effective health care delivery programme in a small geographical area cannot reduce maternal mortality adequately, how will larger geographical areas with much less health care provision reduce maternal mortality as anticipated by the Millennium Development Goals?

Reporting of maternal deaths

Community workers identified fourteen under-reported and four misclassified maternal deaths. It is hypothesized that the chief reason maternal deaths were not

reported is that they occurred in the community and RUHSA lacks resources to provide ongoing training for community workers. The existing death surveillance system appears more effective in detecting hospital- than community-based maternal deaths. The lack of reporting of community-based deaths may be due to the declining role of FCVs, urbanization of the communities, or because women with socially proscribed health problems, such as abortion and family abuse, do not seek medical care that would lead to the reporting of their deaths.

Most maternal deaths reported solely by community workers were attributed to abortions and 'family problems'. Some abortions were either due to out-of-wedlock pregnancies or an attempt to limit family size. 'Family problems' included out-of-wedlock pregnancies, female fetuses or domestic abuse; most of these cases were not reported to the MIS due to the shame the family might face in their community or the fear of legal ramifications from the local authorities.

Of the four discordant cases, two were due to suicide during pregnancy. The MIS listed women dying from suicide as being due to 'unnatural causes' or 'family problems'. In addition, two cases were due to violence during pregnancy; violence during pregnancy can lead to infections, unsafe abortions, miscarriages, low birth weight, suicide and homicide (Liljestrand, 2000). To promote the health of all pregnant women, deaths from causes such as suicide and domestic violence related to pregnancy should be reported as maternal deaths.

Correct ascertainment of all maternal deaths requires consistent and accurate reporting of the date of death, place of residence, place of death and cause of death. The existing surveillance system should be augmented with a community-based death surveillance system, since the current MIS system was not designed to systematically obtain all deaths. The key informant survey approach may be more appropriate for periodic evaluation of completeness and accuracy of routine surveillance systems, especially in areas where no maternal mortality data management systems exist. RUHSA should also use a clear and concise maternal death definition, such as WHO's ICD-10 definition, which includes maternal deaths up to one year after termination of the pregnancy. Here, an approach is presented that is quick, and does not require investment in a huge monitoring infrastructure. Monitoring maternal mortality has to be incorporated into the routine data management of the government. This method will work and be useful in places where there is no such system in place.

Abortion and violent deaths

In this study, community abortion was found to be a common cause of maternal death and exceeds WHO's global estimate of 13% of maternal deaths. Preventing maternal deaths from abortion can be achieved by preventing unwanted pregnancies, post-abortion care and the provision of safe abortions (Campbell & Graham, 2006). To eliminate abortion-related deaths, the community or government needs to make specific policy and care provisions (Liljestrand, 2000). Some low-income countries may not have the proper technology, training and licences to perform abortions at the proper gestational period (Jain *et al.*, 2004). Therefore, communities, families and individuals need adequate contraception information, contraceptive technologies and

pregnancy options. Community involvement is essential in sensitizing community members and policymakers to the idea that these services can save lives (Liljestrand, 2000).

Communities also need to address the problem of violence, especially when a woman is pregnant. Violence against women in India is common and widely accepted (Panchanadeswaran & Koverola, 2005). Studies report incidences of physical abuse of women during pregnancy in India ranging from 14% to 44% (Jain *et al.*, 2004; Khosla *et al.*, 2005; Varma *et al.*, 2007; Ahmed *et al.*, 2006). The risk of maternal mortality is three times higher for abused mothers (Boy & Salihu, 2004). Hence, violence against women is a potentially life-threatening event for both the fetus and the mother.

Study limitations

This study has two major limitations. First, the cases that were excluded or that could not be verified were primarily due to an incomplete recall of deaths. More complete surveillance of maternal deaths in this community would require multiple sources of reporting, including collaboration with community workers and government PHC facilities. In this study, maternal deaths may be underestimated because informants may not be aware of the deaths, the cause of death, or the temporal association with pregnancy or pregnancy outcome, and the uncertainty of dates of death and place of residence. Second, indirect causes of maternal death are often not reported in maternal death surveillance because they are not recognized as pregnancy related. The Tamil Nadu government reports that in 2001 the maternal mortality ratio was 1.4 per 1000 or about half the level identified in this study (Government of Tamil Nadu, 2005). The problems of incomplete and inaccurate assessment of maternal mortality are not limited to RUHSA and make it difficult to recognize when progress occurs.

Directions for the future

To improve the quality of maternal mortality data obtained, community representatives and health care providers should be used as appropriate sources of information on maternal deaths. In addition, appropriate public health interventions, with evaluation, should be initiated to prevent community-based maternal deaths; the two most common in this study are abortion and family violence. Last, the definition of maternal mortality needs clarification, including the time or duration of a maternal death.

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