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## Research Article

# Facility Based Maternal Death Review: Learning from Maternal Deaths in a Teaching Hospital of Eastern India

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## Abstract

**Background** Maternal mortality reflects the women's basic health status and the magnitude of care by the society towards its women. India being a country with a high burden of maternal deaths, there is an urgent need to reduce such deaths many of which are avoidable. The study aims to find out the specific reasons and circumstances of maternal deaths in hospital through facility based maternal death review which will help in improving maternal outcome.

**Methods** All maternal deaths during one year period were reviewed. Data was collected by interview with health care providers associated with maternal deaths. Structured schedules were used for collecting information from relevant documents. Analysis of data was done to arrive at the results.

**Results** Maternal deaths were most common in poor, illiterate rural women; in young women giving birth to first child; most of the maternal deaths were among referred cases and first 24 hours of hospital admission was the most crucial period. Majority of the deaths were avoidable and multiple contributory factors were associated with the death of the women.

**Conclusion** A sizeable portion of maternal deaths in a tertiary hospital setting are preventable. Regular facility based maternal deaths review is essential to know about the avoidable deaths and their contributory factors. This will help in improving the facility settings and current practices, thereby decreasing maternal morbidity and in improving future outcomes.

**Keywords:**Maternal mortality, avoidable, contributory factors

## 1. Introduction

Maternal mortality is one of the important public health challenges faced by India today. Being a country with highest number of maternal deaths worldwide, i.e. 63, 000 per year and having a Maternal Mortality Ratio of 230/1, 00,000 live births, it is a matter of grave concern and high priority[1]. Maternal mortality reflects women's basic health status, access to health care and the quality of care that has been provided. Although India has achieved a 59 % reduction in maternal mortality in 2008 as regards to 1990 levels, still it is behind the World Health Organization's (WHO) fifth Millennium

Development Goal (MDG 5) of 75 % reduction of 1990 levels by 2015 which comes out to be approximately 5.5 % reduction per year[1]. If we have to expedite this process and catch up with the WHO target, then we have to count beyond the numbers and review each and every maternal death for its possible cause and contributing factors, many of which are avoidable[2].

Maternal Death Review (MDR) is an approach advocated by the WHO to scrutinize practices and outcomes of delivery at health facilities and in community. It analyses deaths and its factors at all levels and is divided into Facility based and Community based maternal death review. A facility-based maternal death review (FBMDR) is a "qualitative, in-depth investigation of the causes of, and circumstances surrounding maternal deaths which occur in health care facilities"[2]. MDR as a strategy has been spelt out clearly in the Reproductive and Child Health – II (RCH –II) National Programme Implementation Plan document, the flagship Maternal and Child Health (MCH) programme of the country. Out of 25 Indian states and 7 Union Territories only a few like Tamil Nadu, Kerala and West Bengal have started MDR as an established intervention for the last few years; steps are being taken to extend it to others areas of the country[3]. It is an important strategy to improve the quality of obstetric care and reduce maternal mortality and morbidity.

Odisha is one of the 18 high focus states under National Rural Health Mission (NRHM)[3] situated in the eastern part of India. It is one of the states among a handful where two-thirds of all maternal deaths occur. It has a high maternal mortality ratio of 258/1, 00,000 live births[4] and institutional delivery rate of 35.6%[5]. This Medical College & Hospital in Odisha has a heavy case load and lot of referrals from adjoining areas. In-spite of being a tertiary level health care facility, maternal deaths do occur. It is always good practice to review the management of any complication that led to a maternal death. Moreover case notes and inputs from the health professionals may contain valuable information about such deaths that can help improve quality of care. FMBDR in resource poor settings is one of the oldest and the most documented methods that can be effective in improving emergency obstetric care and maternal outcomes[6]. Therefore FBMDR was thought to be the most appropriate to study the causes and factors of maternal mortality with an intention to find out why deaths occur in women during childbirth even after hospital admission.

## 2. Material and Methods

This is a facility based observational study conducted for a period of one year wherein all maternal deaths occurring at the health facility between April 2006 to March 2007 were included for the study. Maternal death has been defined by the ninth and tenth revisions of the International Statistical Classification of Diseases and Related Health Problems (ICD) as "the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and 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"[2, 7]. This definition has been used throughout the study. The study population does not include those women who had died as a result of non-maternal causes or on their way to this hospital.

Data collection was done through in-depth interviews of Health Care Providers (HCPs) associated with maternal deaths by means of semi-structured questionnaires known as Facility Staff Interview Record. The HCPs were consultants, post-graduates and nurses of Obstetrics and Gynaecology (O&G) department who were present with the woman in the treatment process through her time to death. A structured schedule was prepared for gathering socio-demographic and other information from Birth & Death Registers, Bed Head Tickets and Investigation Reports – known as Medical Record Extraction Form. Appropriate questionnaires and schedules for FMBDR by WHO[2] were adopted and modified for preparing the questionnaire and data extraction form. Permission was sought from the Medical Superintendent and from the Department Heads for carrying out the study.

The collected data were compiled, cleaned and analysed using SPSS 15.0 software. Different socio-demographic characteristics and medical causes of death of the women were analyzed using proportions to describe the results. Analysis of each and every maternal death was done by consultants to establish the underlying, immediate and contributory cause of death, type of maternal deaths – direct or indirect, whether the maternal deaths were avoidable and the contributory factors for such deaths.

According to available literature, there are four areas possible areas of substandard care which may lead to maternal death[8, 9, 10,11]. The factors responsible for maternal deaths in a health facility were broadly divided into health facility factors and health personnel problems. The health facility factors include lack of accessibility to the hospital, lack of adequate health care facilities, lack of equipments & consumables and unavailability of blood. Health personnel problems

include lack of personnel or lack of adequately trained staff, failure or delay in problem recognition, emergency response and intervention. These factors were taken into consideration to label maternal deaths as avoidable. Those factors which contributed to the death of the women or those administrative pitfalls had they been corrected could have saved the lives of the women were considered as contributory factors of maternal death. All such factors were analyzed to find out their individual contribution as well as how many of such factors operated together at the time of a woman's death.

## 3. Results

The analysis of data obtained from the Medical Record Extraction Form revealed that there were a total of 50 maternal deaths during the year. An overwhelming majority of deceased women were from rural areas (92%) and were Hindus (96%). A higher incidence of maternal deaths was observed during the first two quarters of the year with 19 deaths in April-June period and 21 deaths in July-September period. Most of the maternal deaths were in 20-30 years age group (62%) with a maximum 34% of deaths occurring in women of 25-29 years of age. The mean age of the women was 27.4±5.4 years. Almost half of the deceased women (48%) were illiterate while only 24% women had education of secondary level and above. The median duration of marriage at the time of death was four years; 60% of maternal deaths occurred within first five years of marriage. Majority of the cases (88%) were referred from other health facilities. Among the referrals 59% of the cases were referred from secondary level and 41% from primary level health facilities; most of the deceased women (96%) were from seven adjoining districts including the district where the medical college and hospital was situated.

**Table 1 Socio-demographic characteristics of the deceased women (n=50)**

| Characteristic | | No. of Women | Percentage |
|---|---|---|---|
| Residence | Rural | 46 | 92 |
| | Urban | 4 | 8 |
| Religion | Hindu | 47 | 94 |
| | Muslim | 3 | 6 |
| Distribution of maternal deaths | Apr-Jun | 19 | 38 |
| | Jul-Sep | 21 | 42 |
| | Oct-Dec | 5 | 10 |
| | Jan-Mar | 5 | 10 |
| Age | <20 years | 1 | 2 |
| | 20-25 years | 14 | 28 |
| | 25-30 years | 17 | 34 |
| | >30 years | 18 | 36 |
| Literacy | Illiterate | 24 | 48 |
| | Below Secondary | 14 | 28 |
| | Secondary and above | 12 | 24 |
| Duration of marriage | <5years | 30 | 60 |
| | 5-10 years | 13 | 26 |
| | >10years | 7 | 14 |
| Referral case | Yes | 44 | 88 |
| | No | 6 | 12 |

Among the maternal deaths 66% were among booked cases. The mean gravidity was 2.1±1.4, with 48% of women being primigravida and 38% being second or third gravida. The mean gestation period of the women at the time of death was 30.7±11.1 weeks, with 54% of maternal deaths associate with preterm pregnancies. Regarding the outcome of pregnancy, 8% women aborted, 36% died without delivering the baby and the rest (56%) died after delivery.

**Table 2 Reproductive and Obstetric Status of the Deceased Women**

| Characteristic | | No. of Women | Percentage |
|---|---|---|---|
| Booked case | Yes | 33 | 66 |
| | No | 17 | 34 |
| Gravidity | Primi | 24 | 48 |
| | 2nd – 3rd Gravida | 19 | 38 |
| | >4th Gravida | 7 | 14 |
| Gestation at the time of death | <37 weeks | 27 | 54 |
| | 37-42 weeks | 23 | 46 |
| Outcome of pregnancy | Delivered | 28 | 56 |
| | Undelivered | 18 | 36 |
| | Abortion | 4 | 8 |

The median duration of stay in the hospital from admission to death was 14 hours. Majority of the deaths (66%) occurred within 24 hours of admission to the hospital. Haemorrhage and shock was the commonest (32%) immediate cause of death. Anaemia was the commonest contributory cause of death among the deceased women (48%). Among the underlying causes of death, direct or obstetric causes were responsible for 76% of maternal deaths. Prominent among them were hypertensive disorders of pregnancy (30%), haemorrhage (14%), sepsis (14%), obstructed labour (8%) and septic abortion (8%). Among the indirect underlying causes of maternal death, malaria (10%) and anaemia (8%) were prominent causes.

Establishing the avoidability of maternal deaths, it was observed that 60% of all the maternal deaths were avoidable. Deaths were avoidable in 57.9% of women with direct causes and in 66.7% with indirect causes. 71.4% deaths in women due to haemorrhage were avoidable, so were 57.1% due to sepsis, 53.3% due to hypertensive disorders of pregnancy, 60% due to malaria and 100% of deaths due to anaemia were avoidable.

**Table 3 Timing, Cause and Preventability of Maternal Deaths**

| Characteristic | | No. of Women | Percentage |
|---|---|---|---|
| Time interval between admission and death | <24 hours | 33 | 66 |
| | 24-72 hours | 9 | 18 |
| | >72 hours | 8 | 16 |
| Immediate cause of death | Haemorrhage & Shock | 16 | 32 |
| | Ecclampsia | 6 | 12 |
| | Septicaemia | 5 | 10 |
| | Acute Respiratory Distress Syndrome | 5 | 10 |
| | Others | 18 | 36 |
| Contributory Cause of Death | Anaemia | 24 | 48 |
| | Intra-uterine death | 3 | 6 |
| | Others | 4 | 8 |
| Underlying Cause of Death | Absent | 19 | 38 |
| | Direct causes | 38 | 76 |
| | Indirect causes | 12 | 24 |

| Avoidability of Maternal Deaths | | | |
|---|---|---|---|
| Direct causes | Yes | 22 | 57.9 |
| | No | 16 | 42.1 |
| Indirect causes | Yes | 8 | 66.7 |
| | No | 4 | 33.3 |
| Total | Yes | 30 | 60 |
| | No | 20 | 40 |

The factors which contributed to the death of the women in the health facility were critical condition of the patient (80%) at the time of admission, inadequacy in health facility factors (78%), contributory cause of death (62%), health personnel problems (48%), lack of standard protocols and guidelines (26%) and unavailability of timely consultation from other departments (22%). The mean number of contributory factors present at the time of maternal deaths was 3.16±1.17 and in many cases more than one factor applied. Majority of the women (42%) had three contributory factors at the time of death.

**Table 4 Contributory factors of maternal deaths in the health facility (n=50)**

| Factors identified | No. of Women | Percentage |
|---|---|---|
| (Multiple factors may apply) | | |
| 1. Condition of the patient on admission | | |
| Critical | 40 | 80 |
| 2. Health Facility Factors | 39 | 78 |
| Lack of facilities, equipment or consumables | 24 | 48 |
| Unavailability of Blood | 15 | 30 |
| 3. Contributory cause of death | | |
| Present | 31 | 62 |
| 4. Health Personnel Problems | 24 | 48 |
| Delay in emergency response/inappropriate management | 12 | 24 |
| Lack of Health Personnel | 8 | 16 |
| Delay in Intervention | 4 | 8 |
| 5. Standard protocols and guidelines | | |
| Absent | 13 | 26 |
| 6. Timely Consultation from other Departments | | |
| Unavailable | 11 | 22 |
| Number of contributory factors present | | |
| One | 5 | 10 |
| Two | 7 | 14 |
| Three | 21 | 42 |
| Four | 9 | 18 |
| Five | 8 | 16 |

## 3. Discussion

Maternal mortality is a matter of global concern, more so in the resource poor settings of underdeveloped and developing countries where most of the deaths occur[12, 13]. A vast majority of the maternal deaths (96%) in the hospital were in women residing in rural areas although the hospital is situated in a city. The burden of maternal mortality is much higher in rural areas than in urban areas because of factors like poor socio-economic status[13, 14], inaccessibility to health system and delay in referral[15]. About half of the deceased women were illiterate or of low educational level (28%). Poor, illiterate rural women not only have resource constraint but also not self empowered to take their own decisions or to understand the seriousness of the situation. All these factors often prove critical to their pregnancy outcome. These are the major social risk factors of maternal mortality[13, 16].

Most of the maternal deaths were seen in women between 20-30 years age group (62%) and within first five years of marriage (60%). The distribution of maternal deaths in different age groups is similar to the pattern of maternal deaths reported in our country[4]. Maternal deaths occurring most commonly in 20-30 years age group also been observed in several other studies from India[17, 18, 19] and Africa[8, 20]. This may be attributed to the Indian tradition of early marriages and early pregnancy[16]. An overwhelming majority of the deaths (88%) had been among referral cases; most of such referrals had been from rural areas and were in critical condition at the time of admission. Many women in resource poor settings could not access the health system and even if they access, the health facilities were not well equipped to handle the cases probably because of lack of management protocols besides unavailability of equipment and personnel. All this leads to multiple referrals and vital time is lost in decision making and transit[13, 21, 22, 23]. Previous studies in India[16, 24, 25] and abroad[8, 26] have reported that maternal deaths among referral cases range from 31.2% to 76.4%.

One third of all maternal deaths were among un-booked cases. This shows that many women do not at all come in contact with the health system or have ante natal care (ANC) during pregnancy. Early registration and regular ANC are the key elements of "Risk Approach" in pregnancy and one of the accepted measures of reducing maternal mortality and morbidity[27]. Almost half of the maternal deaths (48%) were in primigravida. Higher proportion of maternal deaths among primigravida had been reported by Tayade et al[16], Chhabra S. et al[28] and Olufemi T Oladapo et al[29]. Relatively higher risk of maternal mortality is associated with the first child birth[16, 30].

More than half of the women (56%) have died following delivery. Between 11% and 17% of maternal deaths happen during childbirth itself and between 50% and 71% in the postpartum period[31, 32, 33, 34]. Two-thirds of all maternal deaths have occurred within first 24 hours of hospital admission. Ashi R. Sarin et al[35] and Majhi A. K. et al[36] reported that 63.6% and 48.95% of maternal deaths respectively had occurred within first 24 hours of hospital admission. About 45% of postpartum maternal deaths occur during the first 24 hours[33]. The first 24 hours of admission is the most critical time period for intervention to avert maternal deaths. The health facility needs to be geared up for this challenge and the health personnel should be aware of their crucial role during this period.

According to ICD-10 classification of WHO[7], cause of death is divided into underlying, immediate and contributory cause. The Hypertensive Disorders of Pregnancy (Ecclampsia and Pre-ecclampsia) was the most common underlying cause of death (30%), haemorrhae and shock – the most common immediate cause of death (32%) and anaemia – the most common contributory cause of death (48%) among deceased women. It is necessary to identify the primary (underlying) obstetric cause, because this will indicate areas where programmes based on preventing maternal deaths can be concentrated; the "Risk Approach" to pregnancy advocated by WHO being an example. The immediate cause and contributory causes indicate the resources that the health system requires in terms of saving lives. They also indicate where management protocols and resources may be lacking[11].

FMBDR has the ability to review deaths both as aggregated data and individually. From the aggregated data come broader themes and trends that can be identified and monitored and with appropriate policy changes and interventions might lead to improvements in outcomes[37]. From the single examination of cases by experts comes information that might otherwise have been overlooked[38]. The study revealed that majority of the maternal deaths was potentially avoidable (60%). Of these 57.9% of direct maternal deaths and two-thirds of indirect maternal deaths were avoidable. The avoidable maternal deaths in hospital setting vary from 28.4% to 69.4% in different studies[39, 40, 41, 42, 43]. It has been suggested that even in the developed world 50% of all maternal deaths are potentially avoidable[38, 44]. Review of individual maternal deaths by

consultants and opinion from HCPs helped to find out the different aspects of these avoidable deaths. The main reasons cited for these deaths were absence of separate Intensive Care Unit (ICU) in the department, unavailability of bed in central ICU, inadequate / non-functional ventilator and dialysis facilities at the bed side, critical state of the patient at admission, delay in diagnosis / decision making and prompt action like hysterectomy for PPH in the absence of senior faculty.

Multiple contributory factors were present, the absence of which may help avoid maternal deaths. Contributory cause of death (62%) and absence of standard protocol to deal with a patient in emergency (26%) were accountable in some cases. Timely interdepartmental consultation (22%) was not always possible, sometimes the moribund condition of the patients made shifting difficult. 30% of the maternal deaths were due to inability to arrange blood in time by the patient's relative; reasons being distance and lengthy procedural norms of central blood bank. Absence of any attached blood storage unit to the obstetrics department worsened the situation. There were also certain factors like condition of the patient on admission, which were beyond the control of health facility but it does that mean that it is not preventable. This requires a health care system with adequate infrastructure, facilities and awareness among the health personnel regarding the problem, at all levels of healthcare, besides a protocol based referral system to avert delay in referrals. Delay in referral and inadequacy of transport facilities lead to poor condition of the patient at the time of admission[15, 16, 45].

## 4. Conclusion

Maternal mortality do have some social determinants like poverty, illiteracy, early marriage and pregnancy, predominantly in a rural setting in a developing country like India; all these facts have been again reinforced through the present study. However there are some more serious points to consider, i.e. women have been able to reach a referral hospital, but have still died. The leading causes of maternal deaths in the health facility have been highlighted as well as the various factors and conditions contributing to such deaths. Hospitals have to be geared up to have adequate facilities like ICU, ventilator, dialysis facility, 24 hour blood bank and medicine availability attached to obstetric department in tertiary level hospitals where case load is high and referred cases are serious in nature. More importantly, appointing adequate number of health personnel, keeping them well informed through periodic training, development of protocols and guidelines for case management and interdepartmental coordination will help in improving outcomes. A regular unbiased FMBDR will help in picking up the loopholes and learning from the mistakes. Thus the study tries to underline the fact that bringing down maternal mortality is not only related to improving the social determinants but also needs a change in approach at the health facility where the death ultimately occurs. The approach of facility based maternal death review in resource poor settings, as advocated by WHO has to be institutionalized and made a continuous process. Lessons have to be learnt and changes should be implemented keeping the best interest of the patient in view.

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