

Maternal mortality in India: A 20-year study from a large referral medical college hospital, West Bengal

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Abstract

Aim: The present study was carried out to analyze the maternal death rate and its changing trends over a 20-year period in a large referral/teaching institution in Eastern India.

Methods: A retrospective analysis of maternal deaths was carried out from January 1986 to December 2005 at the Department of Obstetrics and Gynaecology, R. G. Kar Medical College and Hospital, Kolkata, India. Records were divided into four 5-yearly periods: 1986–1990; 1991–1995; 1996–2000; and 2001–2005, for comparison of the trends. The initial interval from 1986 to 1990 was chosen as the reference period.

Results: The cumulative maternal mortality ratio (MMR) was 599.3 per 100 000 live births. Comparison between the first 5-year period (1986–1991) and the last (2001–2005) showed a statistical significant downward trend in MMR (683.6 vs 474.3; $P < 0.001$). Deaths due to direct causes are still the leading cause, accounting for 82.09% of total deaths. Hypertensive disorders (36.14%), hemorrhage (21.91%) and sepsis (19.54%) were still the major causes of direct obstetric deaths throughout the study period. Hypertensive disorders alone showed a substantial decline after the introduction of magnesium sulphate.

Conclusion: The fall in maternal mortality has been very slow.

Key words: maternal mortality, safe motherhood, trends.

Introduction

Every year, globally, an estimated 529 000 maternal deaths occur.¹ This means that every minute, a woman loses her life due to a pregnancy related cause. Maternal mortality has a serious impact, not only on the family, but the community and the nation. Surviving children are at a 17-fold increased risk of death during the first 6 months.² The risk of a women dying as a result of pregnancy or childbirth during her lifetime is about one in six in the poorest part of the world, compared with approximately one in 30 000 in Northern Europe.¹ The majority of these deaths are preventable. In spite of several initiatives, there has been no substantial reduction in maternal mortality in the developing countries, which contribute to approximately 98%

of all maternal deaths. One of the Millennium Development Goals (MDG-5) is to improve maternal health. Maternal death was chosen as the outcome measure with which to judge progress. The target is to reduce maternal mortality by 75% between 1990 and 2015. Periodical study and analysis of maternal mortality are therefore important to monitor progress. The present study was carried out to analyze the maternal deaths and its changing trends over a 20-year period in a large referral/teaching institution in Eastern India.

Methods

A retrospective analysis of maternal deaths was carried out over a period of 20 years from January 1986 to December 2005 at the Department of Obstetrics and

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Table 1 Maternal mortality ratio (MMR) and distribution of direct and indirect causes of maternal deaths, 1986–2005

	1986–1990†	1991–1995	1996–2000	2001–2005	Total
No. live births	41 837	47 275	54 237	60 726	204 075
Deaths					
Direct	237 (82.87)	255 (84.72)*	284 (81.61)*	228 (79.17)**	1 004 (82.09)
Indirect	49 (17.13)	46 (15.28)	64 (18.39)	60 (20.83)	219 (17.91)
Direct : Indirect	4.84	5.54	4.44	3.8	4.58
Total	286	301b	348b	288c	1 223
MMR/100 000 live births	683.6	636.7	641.6	474.3	599.3

* $P > 0.05$; ** $P < 0.001$; †reference period.

Gynaecology, R. G. Kar Medical College and Hospital, Kolkata, India. R. G. Kar Medical College and Hospital is a city based large teaching/referral hospital catering to both urban and rural areas, for mostly low and middle socioeconomic status women of adjacent four to five districts with annual deliveries ranging from 12 216 to 13 420 and abortions ranging from 3000 to 4000 annually. We included all maternal deaths that occurred during pregnancy or within 42 days of its termination, irrespective of the duration or site of implantation. Maternal mortality ratio (MMR) is considered as the number of maternal deaths during a given year per 100 000 live births. Deaths were classified as direct or indirect obstetric deaths. Direct causes are the causes which are due to pregnancy itself like pregnancy induced hypertension, hemorrhage, sepsis, obstetric shock and obstructed labor. Indirect causes are not directly related to pregnancy, but their presence or occurrence results in death during pregnancy from conditions such as severe anemia, hepatitis, heart disease, diabetes, pulmonary embolism and anaesthetics complications. Late maternal deaths (more than 42 days but less than 1 year after the termination of pregnancy) were not included in the present study. We collected data from the records section of our institution and from previous studies conducted at the same institution. Records were divided into four 5-yearly periods: 1986–1990; 1991–1995; 1996–2000; and 2001–2005, for comparison of the trends. The initial interval from 1986 to 1990 was chosen as the reference period. We analyzed the causes of maternal deaths during the last 5-year period on a yearly basis. The data was analyzed using Graph Pad InStat 3, for Macintosh (GraphPad software, San Diego, CA, USA).

Results and Analysis

During the study period the total number of live births was 204 075. There were 1223 maternal deaths. The cumulative MMR was 599.3 per 100 000 live births

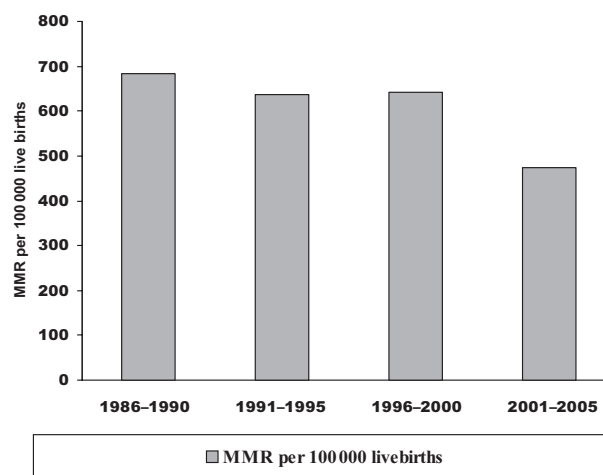


Figure 1 Maternal mortality ratio (MMR) per 100 000 live births in 5-yearly periods.

(Table 1). Comparison between the first 5-year period (1986–1991) versus the last (2001–2005) showed a statistically significant downward trend in MMR (683.6 vs 474.3; $P < 0.001$) (Fig. 1). Direct causes are still the chief culprit, accounting for 82.09% of total deaths. There was no significant change in deaths due to direct causes during the first three 5-yearly periods; however, there was significant reduction of direct obstetric deaths in the last 5-year period ($P < 0.001$). The proportion of direct : indirect deaths were slightly decreased from 4.84 (1986–1991) to 3.8 (2001–2005) (Table 1).

Hypertensive disorders, hemorrhage and sepsis continued to be the major causes of direct obstetric deaths throughout the study period (Table 2; Fig. 2). A particularly high MMR was found for hypertensive disorders accounting for 36.14% of total deaths. A statistically significant increase in deaths from hypertensive disorders was observed during second ($P < 0.01$) and third ($P < 0.001$) 5-year periods when compared to the first 5-year period. During the last 5-year period, a declining trend was observed in comparison to the

Table 2 Distribution according to important causes of maternal deaths

	1986–1990† No. (%)	1991–1995 No. (%)	1996–2000 No. (%)	2001–2005 No. (%)	Total No. (%)
Hypertensive disorders	87 (30.23)	121 (40.2)**	157 (41.09)***	77 (25.66)****	442 (36.14)
Hemorrhage	77 (22.31)	55 (18.49)*	66 (21.11)*	70 (24.84)****	268 (21.91)
Sepsis	70 (24.64)	52 (18.3)*	61 (16.84)*	56 (19.97)**	239 (19.54)
Hepatitis	13 (4.54)	10 (3.86)****	9 (2.17)****	15 (5.69)****	47 (3.84)
Anemia	13 (4.61)	16 (4.79)****	37 (10.93)***	22 (7.53)****	88 (7.2)

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$; **** $P > 0.05$; †reference period.

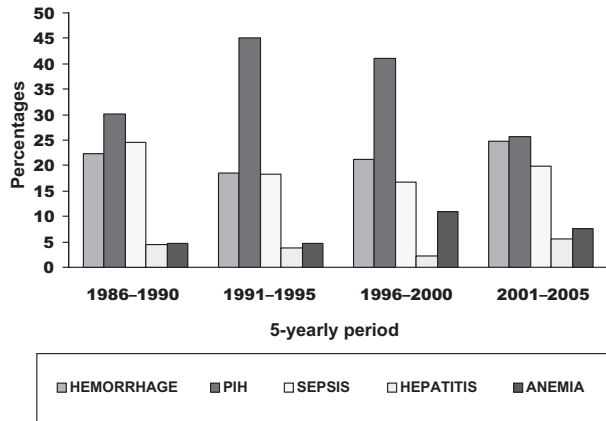


Figure 2 Contribution of hemorrhage, pregnancy induced hypertension (PIH), sepsis, hepatitis and anemia in maternal deaths (5-yearly periods).

second and third 5-year periods (25.66% for 2001–2005 vs 40.2% and 41.09% for 1991–1995 and 1996–2000, respectively).

A statistically significant decline of maternal deaths due to hemorrhage was observed during the second ($P < 0.05$) and third ($P < 0.05$) 5-year periods in comparison to the first 5-year period. But in the last 5-year period reduction of deaths from hemorrhage was not statistically significant ($P = 0.5334$) in comparison to the first 5-year period.

Approximately 19.54% of women died due to sepsis, which included both puerperal and post-abortion deaths. Among deaths from sepsis, there was significant reduction of deaths during the second, third and last 5-year period in comparison to the first 5-year period.

Anemia is the leading indirect cause of maternal death. Deaths from anemia are still high throughout our study period accounting for 7.2% of deaths and there was a statistically significant rise observed during the third 5-year period in comparison to the first 5-year period (10.93 for 1996–2000 vs 4.61 for 1986–1990;

$P < 0.001$ [Table 2]). Deaths from hepatitis remained the same and accounted for 3.84% of total obstetric deaths (Table 2).

Table 3 shows maternal deaths in the last 5-year period. There was a significant reduction ($P = 0.0125$) of maternal deaths from 77 (2001) to 50 (2005) and the MMR was decreased from 617.2 (2001) to 388.4 (2005) (Fig. 3). Deaths due to hypertensive disorders showed a statistically significant downward trend from 2001 to 2005 ($P < 0.05$), but deaths due to hemorrhage showed an increasing trend, though it was not statistically significant. Deaths from sepsis, hepatitis and anemia remained almost unchanged.

Discussion

Two-hundred and eighty-eight women die every day in India due to pregnancy related causes. Reduction of maternal mortality is an important Millennium Development Goal of special concern in low income countries where one in 16 women may die of pregnancy related complications, compared to one in 2800 in high income countries.³ Maternal deaths are not uniformly distributed throughout the world. In 2000, the MMR for sub-Saharan Africa was estimated to be nearly 1000 per 100 000 live births; almost twice that of south Asia, four times as high as in Latin America and the Caribbean, and nearly 50 times higher than in industrialized countries.¹ The true status of maternal mortality in India is not known.⁴ The National Health Policy (1982) aimed at reducing the maternal mortality in India from 400 per 100 000 live births to less than 200 per 100 000 live births by the end of year 2000.⁵ India is still lagging far behind in achieving this goal and the present MMR in India is 453/100 000 live births.⁶ According to Register General of India (RGI) estimates for the year 2000, the MMR for India was 407 per 100 000 live births. This means that more than 100 000 women die each year in India due to pregnancy related causes.⁷ In our present study, we have seen that the

Table 3 Yearwise maternal deaths in the last 5-year period

Year	2001†	2002	2003	2004	2005
No. deliveries	12 987	12 545	12 216	12 240	13 420
No. live births	12 476	11 985	11 688	11 705	12 872
No. maternal deaths	77	54****	46*	61****	50*
MMR/100 000 live births	617.2	450.6	393.56	521.1	388.4
Causes of death					
Hypertensive disorders	32 (41.56)	13 (24.07)*	13 (28.26)****	10 (16.39)**	9 (18)**
Hemorrhage	13 (16.88)	13 (24.07)****	10 (21.74)****	18 (29.51)****	16 (32)****
Sepsis	11 (14.29)	10 (18.52)****	10 (21.74)****	13 (21.31)****	12 (24)****
Hepatitis	2 (2.6)	1 (1.85)****	4 (8.7)****	2 (3.28)****	6 (12)****
Anemia	6 (7.78)	7 (12.96)****	2 (4.35)****	4 (6.56)****	3 (6)****

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$; **** $P > 0.05$; †reference period.

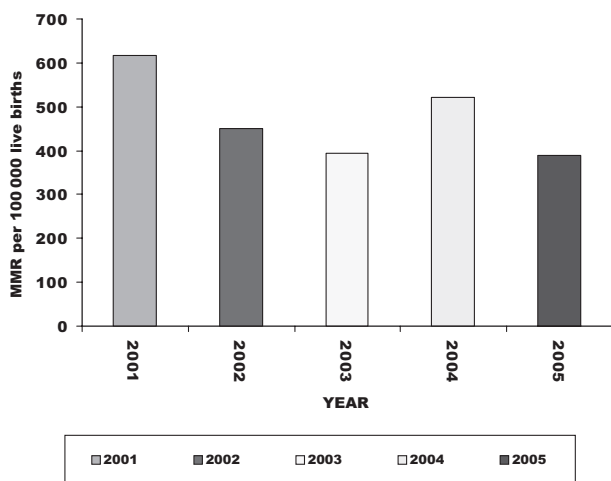


Figure 3 Yearwise contribution of maternal deaths in the last 5-year period. MMR, maternal mortality ratio.

MMR was 599.3 per 100 000 live births, which is high by international standards, but much less than from many referral institute in India, with figures from Central India of 2642.8 between 1986 and 2000, and from Eastern India of 1692.2 between 1990 and 1998 (Khare *et al.*, 2002; Roy *et al.*, 2002).^{8,9} Maternal mortality at this institute has been critically analyzed in previous two studies.^{10,11} The MMR at this institution has decreased significantly during the following years: 683.6 between 1986–1990 to 474.3 between 2001–2005 ($P < 0.001$), although the live births at our institution have increased from 41 837 between 1986–1990 to 60 726 between 2001–2005. This is due to the fact this institution deals with good number of high risk patients and often the women are only referred to hospital when they develop life threatening complications, which is too late and swells the number of hospital deaths.

In the present analysis, hypertensive disorders were responsible for 36.14% of deaths, followed by hemorrhage (21.91%) and sepsis (19.54%). Evidence suggests that direct consequences of pregnancy and childbirth continue to account for most maternal deaths in developing countries.¹ In a systematic review of studies of maternal mortality by the World Health Organization, severe bleeding, hypertensive diseases, and infections were the dominant causes.¹ From Western India, Chhabra has reported hypertensive disorders in 27.4%, hemorrhage in 12.9% and sepsis in 9.5% of cases of mortality.⁴ From Eastern India, Goswami has reported hypertensive disorders in 29.8%, hemorrhage in 16.8% and sepsis in 28.2% of cases of mortality.¹² From Eastern India, Pal *et al.* have reported hypertensive disorders in 50.56%, hemorrhage in 9.72% and sepsis in 18.17% of cases of mortality.¹³ Although a statistically significant rise of deaths for hypertensive disorders was observed during the second ($P < 0.01$) and third ($P < 0.001$) 5-year periods in comparison to the first 5-year period, a declining trend was observed during the last 5-year period in comparison to the second and third 5-year period (25.66% for 2001–2005 *vs* 40.2% & 41.09% for 1991–1995 and 1996–2000 respectively). Deaths due to hypertensive disorders showed a statistically significant downward trend from 2001 to 2005 ($P < 0.05$). One recent study on eclampsia has clearly demonstrated this reduction of deaths from eclampsia on comparing the previously reported study.¹⁵ The dramatically decreased rate of deaths from eclampsia over the last 5-year period has been due to exclusive use of magnesium sulphate for the control of convulsions.

Among hemorrhage, statistically significant decline of maternal deaths were observed during the second ($P < 0.05$) and third ($P < 0.05$) 5-year period in comparison to first 5-year period. But in the last 5-year period, reduction of deaths were not statistically significant

($P = 0.5334$) in comparison to the first 5-year period. Of an estimated 166 000 deaths from hemorrhage globally each year, an estimated half occur in sub-Saharan Africa and more than a third in south Asia. Whether or not a woman dies from bleeding during or after childbirth depends largely on access to timely and competent obstetric care.¹ Intranatal care by skilled attendant, timely management and replacement of lost blood volume will reduce deaths from hemorrhage.

Sepsis was still one of the most important causes (19.54%) of death in spite of legalization of medical termination of pregnancy (MTP) and advent of antibiotics. Ignorance and lack of awareness of the patients regarding MTP and contraceptive devices, untrained personnel performing illegal and unsafe abortion, deliveries under unsafe conditions and referring the patients late in tertiary care centre are still the root causes of deaths due to sepsis.

Deaths from anemia are still high throughout our study period accounting for 7.2% of deaths and a statistically significant rise of deaths from anemia was observed during the third 5-year period in comparison to the first 5-year period (10.93 for 1996–2000 *vs* 4.61 for 1986–1990; $P < 0.001$). This rise is partly relative, which is due to the reduction of deaths from direct causes and partly due to the fact that prevalence of anemia is still high in developing countries. Persistence of anemia is a matter of great concern as it reveals the failure of anemia prevention programs. Almost a fifth of all maternal deaths have been reported to be related to anemia in India. A significant number of mothers die due to infective hepatitis, which indicates the lack of proper sanitation and that of universal precaution in poor resource countries.

Conclusion

The present study indicates that there has been a decline of maternal mortality, but at a very slow pace. The dramatic reduction of maternal deaths in eclampsia after introduction of magnesium sulphate clearly shows the need for evidence based interventions. Deaths from other causes have not shown a similar decline. Medical causes of maternal deaths are largely dependent on the various social factors, such as socio-economic status, literacy, high parity and health status of women, which should be properly addressed. Maternal mortality still remains very high in tertiary referral care centers, mainly due to high percentage of referred cases from periphery. Though institutional deliveries are safer, it is not possible for all cases. A

health centre focused intrapartum care strategy can be justified as the best way to bring down high rates of maternal mortality. Ensuring appropriate provision of emergency obstetric care at peripheral first referral level hospitals can reduce the number of moribund patients crowding the tertiary teaching hospital.

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