

Reduction of Maternal Mortality in India (Using Census and NFHS Data)

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Abstract: Reducing maternal mortality has been a constant struggle globally. Although developed regions have shown a steep decline in maternal deaths, developing world continues to contribute inordinately to the total maternal deaths. The Millennium Development Goal (MDG) 'five' focused on reducing maternal mortality and achieving universal access to reproductive health care. In lieu of that, India has made extensive efforts to achieve the same, which are visible through the sharp increase in the rate of institutional births (NFHS 4), but the concurrent high incidences of maternal mortality present a contradictory picture of the nation's progress in improving maternal health. Despite of the boom in the medical and health sector that India has witnessed in the past decades, progress in reducing maternal mortality at the national level is disappointing. With new Sustainable Development Goal (SDG) to reduce maternal mortality ratio to 70 per 100,000 live births by the year 2030, India needs to move beyond the hospital-based approach in addressing the reproductive health issues. The determinants of maternal mortality need to be studied through the lens of social phenomenon to understand its multidimensional nature. The present review, thus, briefly explores the available evidences to determine the causes of maternal mortality operating from proximate to distant level.

Keywords: Maternal Mortality, Maternal and Reproductive Health, NFHS, SRS

1. Introduction

However, a doubt had been cast on the decline continuing in the 1990s by two relatively small demographic surveys which suggested that the MMR had not changed significantly from 424 (95% C.I: 324-524) in 1992-1993 (NFHS-1) to 540 (95% C.I: 428-653) in 1998-1999 (NFHS-2). The confidence intervals were large due to inclusion of only a few dozen maternal deaths in these surveys. Moreover, estimates by lower geographical level, could not be generated. Further, there has been little direct evidence from various regions of India on the possible causes of maternal mortality. The contribution of hemorrhage to maternal deaths has been a matter of incessant debate. A recent WHO review of 34 datasets² has found that the percentage of maternal deaths from hemorrhage was higher than that previously estimated by WHO. 1.4 In this backdrop, the present Report lends itself a unique position. Based on nearly 4500 maternal deaths for the periods 1997-1998, 1999-2001 and 2001-2003, the Report gives trends in maternal mortality in recent years, examines the major causes of maternal mortality, and provides estimates of current and future burden from maternal deaths. The analysis in the Report is the result of largest series of maternal deaths studied

in any single country over the seven-year period from 1997 to 2003. The Sample Registration System (SRS) estimates of maternal mortality for 1997 and 1998 varied widely at the state level, being based on a single year each and relatively small number of maternal deaths. The data has subsequently been pooled for three years each and the estimates of the overall levels of maternal mortality and trends have been presented for 1999-2001 and 2001-2003. The pooling of the data accounting for the overlapping years 1997 and 2001, have been done since the data are based on independent surveys though pertaining to the same sample.

Maternal mortality refers to the "death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the site and duration of pregnancy, from any cause related to or aggravated by the pregnancy or its management but not by accidental or incidental cause" (WHO 1994). It is used as a proxy indicator to assess the country's maternal and reproductive health status. Maternal mortality can have a serious health effects and psychological costs for the family members especially children. Recent studies have shown significant decline in the incidences of maternal deaths in the developed world, but the estimates from the developing countries are still highly disappointing. According to the WHO, UNICEF, UNFPA and the World Bank, of the total estimated maternal deaths that occurred globally, developing countries accounted for 99% of them (WHO, 2016). In the past decade, India has been able to reduce maternal mortality from 206 to 181 maternal deaths per 100000 live births, but with 17 % (50000 maternal deaths) of all maternal deaths occurring in India, it still is the highest contributor of maternal deaths in the world followed by Nigeria (14%, 40000). In fact, India and Nigeria together account for two third of the global maternal deaths (WHO, 2014). Despite of witnessing an excellent economic growth and a boom in the health sector, India couldn't percolate down this progress to the reproductive health indicators. Post-partum haemorrhage, hypertensive disorders and sepsis are the most common causes of maternal deaths in India followed by complications of delivery and obstructed labour (Say, 2014; Montgomery, 2014), and it is being emphasized that 80 % of these deaths can be prevented or avoided through institutional deliveries or by providing quality health care to the women (CRR, 2008; WHO, 2010; Hogan, 2010). However, the current high rates of institutional deliveries (table 1) with concurrent high maternal mortality rates in the country indicate that the maternal mortality cannot be addressed only through hospital-based approach and there is an urgent need to look beyond it. In this review, maternal health situation and maternal mortality issue has been looked as a social phenomenon.

Table-1
Survey and Details

Year	Name of the Surveys	No. Maternal Deaths netted	Causes	Retrospective/concurrent	Method of determination of Causes of Deaths
1997-98	SRS, Special Maternal Mortality, Special Fertility and Mortality survey	1589	Direct, Indirect and others	Continuous and Retrospective	Post Death Verbal Autopsy and recording causes of death for females age 15-49
1999-2001	Causes of Deaths through Verbal Autopsy in SRS	1512	Direct, Indirect and others	Continuous and Retrospective	Post death enquiry based on symptoms, conditions duration and anatomical site of the disease as reported by family members of the deceased and assignment of causes of death by SRS Supervisors
2001-2003	Special survey of Deaths	1383	Direct, Indirect and others	Continuous and Retrospective	Post death enquiry based on symptoms condition duration and anatomical site of the disease as reported by family members of the deceased. These were recorded in specifically designed forms along with brief narratives. Assignment of cause of death by two independent trained physicians

India accounts for a relatively large share of the world’s disease burden and is undergoing an epidemiological transition that the non-communicable diseases dominate over communicable in the total disease burden of the country. In a recent report of India Council of Medical Research (ICMR), titled India: Health of the Nation’s States: The India State-Level Disease Burden Initiative(2017), it is observed that the disease burden due to communicable, maternal, neonatal, and nutritional diseases, as measured using Disability-adjusted life years (DALYs), dropped from 61 per cent to 33 per cent between 1990 and 2016.

The Maternal Mortality Ratio has shown a decrease of 11 points during 2010-12 to 2011-13. According to the latest data available maternal mortality ratio is highest for Assam i.e. 300 per 1, 00,000 live births and lowest for Kerala i.e. 61 per 1, 00,000 live births in 2011-13. Infant mortality rate (IMR) has declined considerably i.e. 37 per 1000 live births in 2015; however, there is a huge gap between IMR of rural (41 per 1000 live births) and urban(25 per 1000 live births). There are noteworthy improvements in health indicators such as life expectancy, infant mortality rate (IMR) and maternal mortality rate (MMR) due to increasing penetration of healthcare services across the country, extensive health campaigns, sanitation drives, increase in the number of government and private hospitals in India, improved immunization, growing literacy etc. Fairly-developed states like Kerala, Maharashtra and Tamil Nadu have brought down their IMR, TFR and MMR rates and states like Assam, Jharkhand continue to grapple with these issues even today.

2. Data and Methodology

Maternal deaths are rare events. That is why wide fluctuations in the estimates of maternal mortality at state level were

estimated in the SRS for the years 1997 and 1998 suggesting that single year data would not be able to provide reliable estimates of maternal mortality due to small number of events. The methodology was changed and data was subsequently pooled for three years. The pooled estimates of maternal mortality and trends for 1999-2001 and 2001-2003 have been reasonably stable. All the pooled surveys were, however, conducted within the domain of SRS.

Maternal Mortality Ratio =

$$\frac{\text{Number of maternal deaths to women(15-49years)}}{\text{Number of live births to women(15-49 years)}} * 100000 \quad (1)$$

Maternal Mortality Rate =

$$\frac{\text{Number of maternal deaths to women(15-49years)}}{\text{Number of living women(15-49 years)}} * 100000 \quad (2)$$

Life time risk of Maternal Death =

$$1 - (1 - \text{Maternal MortalityRate}/100000)^{35} \quad (3)$$

3. Analysis of SRS and NFHS Data

In order to understand the maternal mortality situation in the country better and to map the changes that have taken place, specially, at the regional levels, States have been categorized into three groups namely, “Empowered Action Group” (EAG) States comprising Bihar, Jharkhand, Madhya Pradesh, Chhattisgarh, Odisha, Rajasthan, Uttar Pradesh & Uttarakhand and Assam; “Southern” States which include Andhra Pradesh, Telangana, Karnataka, Kerala and Tamil Nadu; and “Other” States covering the remaining States/UTs as was done in respect of Maternal Mortality Report (1997-2003) and also in the Maternal Mortality

Table-2

Maternal Mortality Ratio (MMR), Maternal Mortality Rate and Life Time Risk; India, EAG & Assam, South and Other States 2014-16

India & Major States	Sample Female Population	Live Births	Maternal Deaths	MMR	95% CI	Maternal Mortality Rate	Lifetime risk
INDIA TOTAL	6296101	426861	556	130	(119-141)	8.8	0.30%
Assam	180780	12334	29	237	(151-323)	16.2	0.60%
Bihar/Jharkhand	391838	37641	62	165	(124-206)	15.8	0.60%
Madhya Pradesh/Chhattisgarh	409030	37106	64	173	(131-215)	15.7	0.50%
Odisha	285319	19498	35	180	(121-240)	12.3	0.40%
Rajasthan	249729	23082	46	199	(141-256)	18.3	0.60%
Uttar Pradesh/Uttarakhand	621153	52843	106	201	(163-239)	17.1	0.60%
EAG AND ASSAM SUBTOTAL	2137849	182504	342	188	(168-207)	16	0.60%
Andhra Pradesh	323541	15995	12	74	(32-116)	3.6	0.10%
Telangana	208979	10840	9	81	(27-134)	4.2	0.10%
Karnataka	299276	23341	25	108	(66-150)	8.4	0.30%
Kerala	332361	15229	7	46	(12-79)	2.1	0.10%
Tamil Nadu	285844	22552	15	66	(32-99)	5.2	0.20%
SOUTH SUBTOTAL	1450001	87957	67	77	(58-95)	4.7	0.20%
Gujarat	357416	25241	23	91	(54-129)	6.4	0.20%
Haryana	182102	14707	15	101	(50-152)	8.2	0.30%
Maharashtra	384107	23172	14	61	(29-93)	3.7	0.10%
Punjab	160608	9097	11	122	(50-194)	6.9	0.20%
West Bengal	448410	24318	25	101	(61-141)	5.5	0.20%
Other States	1175608	59865	58	97	(72-122)	5	0.20%
Other Sub Total	2708251	156400	146	93	(78-109)	5.4	0.20%

Bulletin (2011-2013). It is heartening that the Maternal Mortality Ratio of India has declined from 167 in 2011-2013 to 130 in 2014-2016. The decline has been most significant in EAG States & Assam from 246 to 188. Among the Southern States, the decline has been from 93 to 77 and in the Other States from 115 to 93.

The key statistics presented in the Bulletin is the Maternal Mortality Ratio (MMR). This is derived as the proportion of maternal deaths per 1, 00,000 live births reported under the SRS. Besides, the 95% Confidence Intervals (95% CI) of the estimates based on the calculated Standard Error (SE) have also been presented. In addition, estimates of Maternal Mortality Rate viz. maternal deaths to women in the ages 15-49 per lakh of women in that age group, and the life time risk have been presented. The life time risk is defined as the probability that at least one women of reproductive age(15-49) will die due to child birth or puerperium assuming that chance of death is uniformly distributed across the entire reproductive span and has been worked out.

Table-3

Age Distribution of Maternal and Non-Maternal Deaths, India, 2014-16

Age Groups	Maternal Deaths		Non-Maternal Deaths	
	Proportion	95% CI	Proportion	95% CI
15-19	4%	(3-6)	9%	(9-10)
20-24	35%	(31-39)	10%	(9-11)
25-29	34%	(30-38)	12%	(11-12)
30-34	16%	(13-20)	12%	(12-13)
35-39	7%	(4-9)	15%	(14-16)
40-44	3%	(1-4)	19%	(18-20)
45-49	1%	(0-1)	22%	(21-23)
15-49	100%		100%	

Reduction of mortality of women is an area of concern for the Governments across the globe. The International Conference on

Population and Development in 1994 had recommended reduction in maternal mortality by at least 50 percent of the 1990 levels by the year 2000 and further one half by the year 2015. 2. The Office of the Registrar General, India under the Ministry of Home Affairs, apart from conducting Population Census and monitoring the implementation of Registration of Births and Deaths Act in the country, has been giving estimates on fertility and mortality using the Sample Registration System (SRS). SRS is the largest demographic sample survey in the country that among other indicators provide direct estimates of maternal mortality through a nationally representative sample. Verbal Autopsy instruments are administered for the deaths reported under the SRS on a regular basis to yield cause-specific mortality profile in the country. The First Report on maternal mortality in India (1997-2003) – Trends, Causes and Risk Factors was released in October, 2006. The present Bulletin, which provides only the levels of maternal mortality for the period 2014-16, is being brought out as a sequel to the previous Bulletin (2011-13). With this, the maternal mortality data from SRS is available for a period of 20 years.

The maternal deaths being a rare event require prohibitively large sample size to provide robust estimates. In order to enhance the SRS sample size, the results have been derived by following the practice of pooling the three years data to yield reliable estimates of maternal mortality. Further, in order to take care of the undercount mainly on account of out-migration as VA forms during the period was administered after the conduct of the Half Yearly Surveys, the actual number of maternal deaths for each state has been multiplied by a ‘Correction Factor’. This correction factor, which is the ratio of total female deaths in a particular age group in SRS to the counts for the corresponding

age group as yielded from VA forms, has been applied separately for different reproductive age groups as was done in the past.

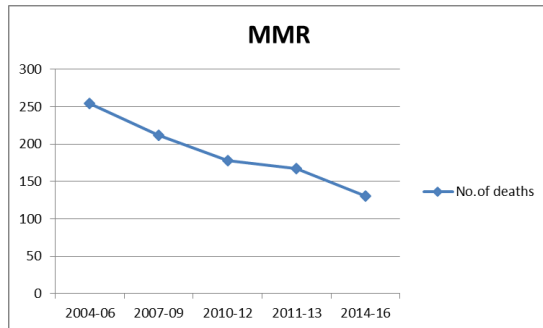


Fig. 1. MMR (No. of deaths)

Table-4

Maternal Mortality Ratio: India, EAG & Assam, Southern States and other States (per 100000 live births)

State/Nation	2004-06	2007-09	2010-12	2011-13	2014-16
India	254	212	178	167	130
Assam	480	390	328	300	237
Bihar/Jharkhand	312	261	219	208	165
MP/Chhattisgarh	335	269	230	221	173
Odisha	303	258	235	222	180
Rajasthan	388	318	255	244	199
UP/Uttarakhand	440	359	292	285	201
EAG & Assam Subtotal	375	308	257	246	188
Andhra Pradesh	154	134	110	92	74
Telangana					81
Karnataka	213	178	144	133	108
kerala	95	81	66	61	46
Tamil Nadu	111	97	90	79	66
South Subtotal	149	127	105	93	77
Gujrat	160	148	122	112	91

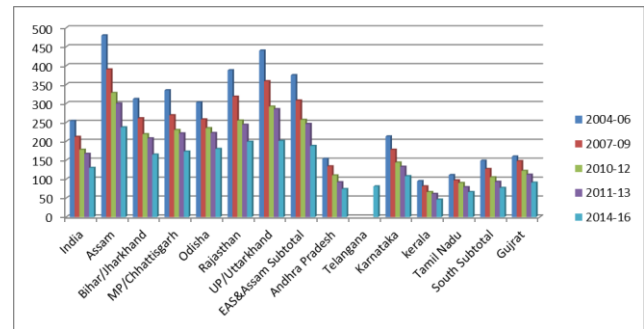


Fig. 2. Graph showing maternal mortality ratio

4. Overview of Social Factors of Maternal Mortality (NFHS)

Although, haemorrhage, hypertension and anemia, have been reported to be the primary causes of maternal deaths across the country, other underlying causes like socio-economic disparity, rural-urban differences, education level of women, caste and gender-based inequity etc. are a real hurdle to any attempt made to reduce maternal deaths in the country. Further, there is marked difference in the maternal mortality rates at the state levels, with some states heading towards achieving the set targets while some are still struggling at the initial stage. It is therefore the time to look at the maternal and reproductive health not just as a medical event but rather a social phenomenon, where contextual factors play an equally important role. There is a need to adapt the strategies and policies for maternal mortality reduction specific to the state while simultaneously taking lessons from the well performing states, Table-5.

Table-5
Indicators and NFHS

S. No.	Indicators	NFHS-3(2005-06)			NFHS-4(2015-16)		
		Urban	Rural	Total	Urban	Rural	Total
1	Antenatal care coverage	73.8	42.8	50.7	66.4	44.8	51.2
2	Antenatal care Coverage(Full)	NA	NA	NA	31.1	16.7	21
3	Births attended by skilled health personnel	75.3	39.9	48.8	90	78	81.4
4	Perinatal mortality rate	36.3	52.6	48.5	NA	NA	NA
5	Prevalence of low birth weight	19.3	23.3	21.5	NA	NA	NA
6	Prevalence of anemia women	51.5	58.2	56.2	NA	NA	NA
7	Mothers who consumed IFA for 90 days or more when they were pregnant with their last child (%)	34.5	18.1	22.3	40.8	25.9	30.3
8	Institutional births	69.4	31.1	40.8	88.7	75.1	78.9
9	Received PNC within 48 hours of discharge/delivery	60.8	28.5	36.8	71.7	58.5	62.4
10	Currently married women who usually participate in household decisions (%)	45	33	36.7	85.8	83	84

1. NFHS-3mothers who had at least 3 antenatal care visits for their last birth (%)
2. NFHS-4 Mothers who had at least 4 antenatal care visits (%)
3. Full antenatal care is at least four antenatal visits, at least tetanus toxoid (TT) injection and iron folic acid tablets
4. NFHS-4 Mothers who consumed IFA for 90 days or more when they were pregnant with their last child (%)

5. Overview of Social Factors of Maternal Mortality (NFHS)

1) Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA) (2016)

Pradhan Mantri Surakshit Matritva Abhiyan envisages to improve the quality and coverage of Antenatal Care(ANC) including diagnostics and counseling services as part of the Reproductive Maternal Neonatal Child and Adolescent Health (RMNCH+A) Strategy. Shri J P Nadda, Union Minister of Health and Family Welfare, launched PMSMA on 04-November-2016. PMSMA guarantees a minimum package of antenatal care services to women in their 2nd / 3rd trimesters of pregnancy at designated government health facilities. PMSMA is based on the promise that if every pregnant woman in India is examined by a physician and appropriately investigated at least once during the PMSMA and then appropriately followed up the process can result in reduction in the Number of maternal and neonatal deaths in our country.

2) National Health Mission

The National Health Mission (NHM) encompasses its two Sub-Missions, the National Rural Health Mission (NRHM) and the newly launched National Urban Health Mission (NUHM). The main programmatic components include Health System Strengthening in rural and urban areas- Reproductive -Maternal Neonatal Child and Adolescent Health (RMNCH+A), and Communicable and Non-Communicable Diseases. The NHM envisages achievement of universal access to equitable, affordable & quality health care services that are accountable and responsive to people needs.

3) Janani Suraksha Yojana was launched in April 2005 by modifying the National Maternity Benefit Scheme (NMBS)

The Janani Suraksha Yojana (JSY) is a centrally sponsored Scheme which is being implemented with the objective of reducing maternal and infant mortality by promoting institutional delivery among pregnant women. Under the JSY, eligible pregnant women are entitled for cash assistance irrespective of the age of mother and number of children for giving birth in a government or accredited private health facility. The scheme focuses on poor pregnant woman with a special dispensation for states that have low institutional delivery rates.

Maternal & Child Health: The term maternal & child health refers to the promotive, preventive, curative & rehabilitative health care for mother & children which includes the sub areas of maternal health, child health, family planning and health aspects of care of children.

Maternal Mortality Ratio (MMR): Annual number of maternal deaths per 100,000 live births. A maternal death is the death of a woman while pregnant or within 42 days of termination of pregnancy, from any cause related to aggravate by the pregnancy or its management, but not from accidental or incidental causes.

Mortality Rate from Communicable Diseases: The total number of deaths from communicable diseases in a population of a given

sex divided by the corresponding total number of this population, after removing the effect of differences in the age distribution, expressed per 100,000 population for a given year, in a given country, Territory or geographic area.

Mortality Rate from Non-communicable Diseases: The total number of deaths from non-communicable diseases in a population of a given sex divided by the corresponding total number of this population, after removing the effect of differences in the age distribution, expressed per 100,000 population for a given year, in a given country, territory, or geographic area.

Primary Health Care: Essential health care that is technically valid, economically feasible and socially acceptable. Primary health care includes eight essential elements: education concerning prevailing health problems and the methods of preventing and controlling them; promotion of food supply and proper nutrition; an adequate supply of safe water and basic sanitation; maternal and child health care, including family planning; immunization against the major infectious diseases; prevention and control of locally endemic diseases; appropriate treatment of common diseases and injuries; and provision of essential drugs.

6. Conclusion

The overall average rate of MMR decline during the period 1997-2003 has been, of 16 points per year. At this rate of decline, both the NRHM Goal of a MMR of 100 by 2012 and the MDG of 109 by 2015, 17

Under the prevailing conditions and the presumption of decline being log linear, the MMR would be around 231 by 2012. Using conservative estimates, the MMR would be 195 by then. Appropriate and strong governmental policies would then be required to meet the targets of NRHM and MDG.

The strategies to reduce maternal mortality are beyond the scope of this Report. The central message is, however, to rapidly expand institutional births with a skilled practitioner (well trained midwife or doctor) that can not only manage most "low-risk" routine deliveries, but can also quickly refer for major obstetrical complications. The death rate for obstetrical complications arising within such institutional births is only a fraction of that for home births, or births at facilities without trained staff. There has been a steady increase in institutional births in the various regions, but less so in the EAG states and Assam.

Further evidence of the importance of skilled attendance and institutional delivery is demonstrated by the causes. There are a substantial percentage of all deaths that arise from maternal hemorrhage. Some of this could reflect the easier recall of ante partum or post-partum hemorrhage versus other obstetrical causes (such as abortion). The WHO's previous estimates of maternal deaths is too high, and those that arise from maternal

hemorrhage is too low. The Global Burden of Disease estimates for South Asia also suggest that the major causes in order are: hemorrhage (31%), sepsis (14%), hypertension (14%), abortion (14%) and obstruction (10%). The higher hemorrhage percentage is also consistent with the high background rates of anemia reported among Indian women. Also, the data from urban, medically-certified deaths suggests that hemorrhage is a much less common cause of maternal death in these settings, reflecting better accesses to emergency obstetrical care.

The chief implications of this study for monitoring maternal deaths are several. Firstly, there is a need to do so periodically within the SRS, using at least 3 years of deaths to aggregate results. The new SRS sample since 2004 will, besides recording the type of institution where the birth took place and the attention received, be able to track the outcomes of individual pregnancies more efficiently. This will facilitate monitoring and recording of the maternal deaths much effectively.

To conclude, there is a substantial decline nearly 24 percent during the seven year period 1997-2003. However the pace of decline is insufficient to achieve the major development goals for maternal deaths. The patterns of causes of death reinforce the key finding that rapid expansion of institutional and skilled birth attendance, especially in the EAG states and Assam is needed to further reduce maternal mortality in India.

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