CHAPTER 9 MATERNAL MORTALITY IN INDIA

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9.1 Introduction:

In India, the proportion of institutional deliveries is low (less than 41 percent as per the National Family Health Survey III [NFHS-III]). Every seven minutes a maternal death occurs, leading to more than 77,000 Indian women dying each year. Most maternal deaths can be prevented if deliveries are attended by skilled Birth Attended (SBA) and proper Antenatal Care (ANC) and Post-natal Care (PNC) is received. Further more, institutional deliveries are encouraged for women with potential complications since home deliveries lack the time of emergency obstetric care (EmOC) that trained health professional in an institution can provide. As part of an effort to reduce the nation’s MMR, the Government of India (GOI) has developed programmes promoting safe and healthy deliveries for pregnant women.

In the present study an attempts is to provide the levels and trends in maternal mortality ratio (MMR) by State and the national level for India. The estimates are obtained from India’s Sample Registration System and the National Family Health Surveys. The method is built on the close association between MMR and IMR as evidenced by developed and developing countries. Nevertheless, the adequate sample base and the regularity of the surveys under the SRS, makes it a valuable source to monitor maternal health in the country, provided certain gaps in data are addressed. However, the estimates from varied sources do
reveal a decline in MMR, particularly since in the early 1970s, but the present level is still high, particularly in certain under developed states.

The continuing high levels of morbidity associated with pregnancy and child birth present a grim scenario of maternal health in India. The Maternal Mortality Ratio (MMR) is defined as the number of maternal deaths during pregnancy or within 42 days after the termination of pregnancy per 100,000 live births during a year. The MMR at 400-570 per 100,000 live births in the country is fifty times higher than several developed countries (IIPS & ORC Macro 2000; Mari Bhat et al., 1995). According to estimates by the United Nations, at current levels of fertility and mortality, 1 in 55 women in India face the risk of maternal mortality compared with 1 in 80 in Pakistan and 1 in 610 in Sri Lanka (Biswas, 2003).

Wide regional disparities with regard to maternal mortality ratio (MMR) for the period 1982-86 have been noted by Mari Bhat and his colleagues, (1995). Despite a decline in maternal mortality over time, these differentials persisted even during 1987-96 (Bhat, 2002). For example, among the major states Assam had the highest maternal mortality ratio (984), followed by Uttar Pradesh (737) and Madhya Pradesh (700). Tamil Nadu had the lowest level of MMR lower (195). Kerala and Punjab are expected to have a level of MMR lower than Tamil Nadu, but due to problem in data, estimates for the later period (1987-96) for these two states are not available. At the all-India level, the level of MMR was about 479 during 1987-96 which declined from 580 during 1982-86 (Bhat, 2002).
Results from a community based study in Anantpur district of Andhra Pradesh during 1985-86 revealed a material mortality ratio of 830 and 545 in the rural and urban areas, respectively (Bhatia, 1993).

This study, which combined data from multiple sources (survey, clinical /hospital records and registration), further, noted the incompleteness of records on this important aspect of women’s health. It also revealed that more than three fourths of the maternal deaths could have been prevented by the provision of early antenatal care, treatment of ill-health during pregnancy and timely availability of medical care. Post abortion complication was yet another cause maternal death are similar to those in several developing countries and they include excessive bleeding, infections, pregnancy related hypertension, obstructed labour and unsafe abortion (Biswas, 2003).

Several hospital-based studies also provide wide ranging from as low as 80 for Bombay during 1980-83 (Pandit, 1987) to as high as 1152 during 1983-84 for Baroda (Bhatt, 1989). However, it is obvious that these estimates are not based on respective samples of the population, as an overwhelming proportion of deliveries in India are usually being conducted at home, attended by untrained birth attendants. Similarly, the rates obtained through the civil registration system cannot be relied on since these records are incomplete with regard to population coverage, medical certification of the causes of deaths and their classification procedures.
While death is the ultimate consequence of early and frequent childbearing, various non-fatal morbidities are the other obstetric outcomes that are even more devastating than maternal death. Between 4 and 5 million women suffer from ill-health associated with childbearing (Jejeebhoy, 2000). Evidence from developing countries shows that for each woman who dies as a result of pregnancy complication, many more women sustain severe debilitating injuries (Koblinsky, et al., 1993). Maternal morbidity can be defined as any injury or illness caused or aggravated by pregnancy or child birth. The disability can be acute affecting a woman during or immediately following child birth, or chronic, lasting four months, year or a lifetime. Disabilities can also be caused by illnesses that are aggravated by pregnancy such as anemia, malaria, cardiac disease, sexually transmitted infections and diabetes. Irrespective of the cause, pregnancy complications pose a serious health risk to the fetus or newborn as well as for the women’s subsequent pregnancies. They also affect women’s quality of life, fertility and productivity long after pregnancy and child birth (Ashford, 2003). It therefore becomes necessary to assess and understand the status of maternal health in the country. Section 9.2 is about maternal health status in India and objectives are discussed in section 9.3 of the chapter Estimation of maternal mortality rate is consider in section 9.4 which includes methodology and interpretation of the results.
9.2 Maternal Health Status in India:

Maternal health continues to be a matter of concern in the country. The NFHS-II data for all India reveal the various health problems experienced by women during their pregnancy. Among these, excessive fatigue heads the list (43 percent), followed by anemia (27 percent), swelling of legs, body or face (26 percent), night blindness (12 percent) and blurred vision (22 percent) (IIPS and ORC Macro, 2000). These problems point to the causative role of malnutrition and inadequate health care, which continue to impact women’s health during their most vulnerable stage of reproductive life. The poor nutritional status of women is borne out by the fact that one third of women had a body mass index below normal (i.e. less than 18.5) and as high as 58 percent of pregnant women (15-49) were found anemic (NFHS-III, 2005-06), while corresponding figures from NFHS-2 (1998-99) were 36 percent and 50 percent, Respectively. It is disturbing to note that the nutritional status of women has not improved to the desired level during the two survey periods. With regard to ante-natal care, the data reveal that 33 percent of the pregnant women had no ante-natal check-up while 24 percent had not received iron tetanus toxin injections and 22 percent had not received iron supplementation to combat anemia NFHS-2 & 3). The NFHS-II all India data further reveal that a large proportion of women suffer from postpartum complications at any time during the two months after delivery. For example, while enumerating these health problems, women reported massive vaginal bleeding for 11 percent of births that occurred in the three years preceding the
survey and very high fever in the postpartum period for 13 percent of births. Both these symptoms are indicative of possible postpartum complications, experienced by Indian women.

As we know, maternal health is largely influenced by poverty and socio cultural related factors on the one hand, and various programme interventions on the other. Socio-cultural factors that impinge on women’s health include adolescent marriage, large family size norms which encourage frequent and closely spaced pregnancies, nutrition and lack of awareness of other health care and long periods of physical activity. The consequences of these underlying factors on women’s health can best be judged by maternal mortality ratio (MMR). While the data on MMR are scanty and not reliable, estimates from the two rounds of NFHS for all India reveal that the level of MMR was 437-540 deaths per 100,000 live births during the 1990s, indicating that its current level is still very high. Aside from maternal mortality, high rate of abortion and still births as well as of perinatal and neonatal mortality, as revealed by the recent NFHS data, are a direct consequence of poor reproductive health and inadequate antenatal, natal and postnatal care. This tragic picture of maternal health is further compounded by the fact that women in the reproductive ages are repeatedly exposed to the risk of childbearing and are powerless to alleviate their suffering under the existing socio-economic and cultural setting and an inadequate medical and health system.
9.3 Objectives:

Maternal Mortality is a useful indicator, not only to capture the reproductive health status of women, but also to get an idea of the rich and adequacy of maternal health services provided to women under the national programme. The scanty data available reveal that the level of MMR is still high. The direct estimate of MMR for the recent period is available only at the country level from NFHS 1 and 2 data, as mentioned earlier. Reliable direct estimates at the state level are so far not available since maternal deaths are statistically infrequent events even in settings with high levels of mortality and fertility and therefore household surveys require a very large sample size to derive such reliable estimates of MMR. Nevertheless, a recent SRS report provides the estimates of MMR for major states of India, although the reliability of the same is not yet known. Since there are major caveats, apart from time and cost factors to using this direct approach, certain indirect methods were also developed during the last two to three decades to estimate maternal mortality, a review of which is presented later in this section. These indirect methods however, are based on certain assumptions and have their own limitations in application.

In order to understand the level and determinants of maternal mortality in the country for the recent period, the present study proposes to use a judicious mix of techniques and approaches. However, before describing the details of the data
and methods, a brief review of the available direct and indirect methods of estimation of MMR, along with their inherent problems, is presented here.

9.4 Estimation of MMR:

A number of indicators are usually used for the measurement of maternal mortality. The maternal mortality rate provides an indication of the risk of maternal deaths among women of reproductive ages and is defined as the number of maternal deaths per 100,000 women ages 15-49 years. On the other hand, the maternal mortality ratio, which is defined as the number maternal deaths per 100,000 live births, gives the obstetric risk of death. The latter index is the one that is conventionally used in the study of maternal mortality.

The vital registration system is an important source to estimate maternal mortality. However, in our country, the registration system is deficient in many respects such as under reporting of deaths, misclassification of maternal deaths as non maternal etc. which under estimate the MMR. Similarly, estimates of MMR from hospital are rarely acceptable because either the numerator (the number of maternal deaths) or the denominator (the number of births in the facility) or both are not representative of the general population and the ratio is biased in unpredictable ways. For example, very often emergency obstetric cases are brought to the hospital which is likely to inflate the ratio.
Other alternative methods for studying maternal mortality include a review of all
deaths to women of reproductive age, longitudinal studies of pregnant women
and repeated household surveys. All this methods rely on accurate reporting of
deaths and the correct cause of death. These methods suffer from
misclassification and under reporting since persons giving information on death
may not know the pregnancy status of the deceased or the cause of death.

Finally, one time household level sample surveys enable the estimation of MMR
but the major drawback of this method is the large sample required to capture all
maternal deaths (which is a rare event even where levels of maternal mortality
are high), to provide a precise estimate. Household sample survey may have a
wide margin of error if the required sample size is not covered. Furthermore, the
large sample coverage makes this approach of direct estimation, a costly and
time consuming one and it too can suffer from recall errors and errors of
misclassification. Although the NFHS-I and II have attempted to provide national
level estimates of MMR, the same are not consistent and have large sampling
errors, despite the large sample size of bath the surveys. The average maternal
mortality ratio (MMR) at the national level for the two years preceding the NFHS-2
(1998-99) is 540 maternal deaths (with MMR ranging from 428 to 653 at 93 %
confidence interval) per 100,000 live births. This however, is much higher than
that observed about six years ago during NFHS-1 (1992-93), which gave
estimates of 424 maternal deaths per 100,000 live births (with MMR ranging from
324 to 524 at 95% CI). This apparent discrepancy (increase in MMR) is attributed
to a large sampling error and the difference in the two estimates is not found to be statistically significant. In other words, these data once again seem to suggest that there is a lack of reliable estimates even at the national level.

As mentioned earlier, there are alternative methods to estimate maternal mortality indirectly. One of these is the so-called sisterhood-methods, wherein women are asked to recall the number of their sisters who died during pregnancy, delivery and puerperium among those who were ever married and not surviving at the time of the survey (Graham, Brass and Snow, 1989). In order to use this method, in settings with high levels of maternal mortality (over 500 maternal deaths per 100,000 live births), sample sizes needed can be of the order of approximate 4000 households. However, while this method cuts the sample size recruitment drastically, it relies heavily on the women accurately recalling events which occurred some time ago. The estimates derived from this procedure might not be for a period as recent as one might wish, and also could be sensitive to the assumed level of fertility. Moreover, this method is likely to underestimate maternal mortality because of omission of events in the survey due to recall lapse (Bhat, 2002). The method is suitable for populations where fertility and mortality levels have been relatively stationary in the recent past.

Another method is to estimate maternal mortality indirectly from age and sex specific death rates, without having data on cause of death. This approach does not necessarily cut down on the sample size requirement, but it makes use of
information routinely collected on a large scale censuses, surveys and registration system. In this regard, Blum and Fargues (1990) have proposed two methods of utilizing this information, one method giving a good approximation to maternal mortality from direct obstetric causes, and the other giving estimates closer to the overall maternal mortality, including indirect obstetric causes. But both these methods seem to underestimate the significance of adult mortality (among women in reproductive age) from causes other than obstetric (for example, from accidents, violence etc.)

Yet another indirect method of estimating the level of maternal mortality is by relating sex differentials in mortality in reproductive ages to the schedule of fertility (Bhat, Navaneetham and Rajan, 1995). The use of age-schedule of fertility, as an extra requirement in the methods helps to separate the influence of sex differential in mortality from external causes other than obstetric related causes, while estimating maternal mortality. The application of this method to SRS data for 1982-86 indicated a level of maternal mortality of 580 per 100,000 live births for India as a whole. Further, estimates using this method also suggest a substantial decline of maternal mortality in India since the 1970s. The level of MMR was estimated to be 853 per 100,000 live births during the 1970s which declined to 440 during the period 1992-96 (Bhat, 2002).

In view of the merits and demerits of various methods of estimation, the present study has reviewed the recent level and trend of maternal mortality across the
region/ states of the country as well as at the all India level, based on the estimates of maternal mortality derived using recent national level surveys.

9.4.1 Data and Method:

At the first place, the study has used the recent data from Sample Registration System (SRS) which is the largest demographic sample survey in the country. The SRS has recently initiated (since 1997) retrospective or continuous recording of maternal deaths, with generally consistent definitions, to provide direct estimates of maternal mortality for the major states as well as for the country as a whole (Registrar General, India, 2006). The SRS data available for the periods 1997-98, 1999-2001, 2001-2003 have been used to examine the level and trend of maternal mortality. The 2001-03 survey data have also been used to understand the causes of maternal deaths, inferences of which were made by the SRS, based on examination of household reports and their medical evaluation by two trained physicians, besides adopting other quality control methods. For the present study, the conventional definition of maternal death, as given in the international Classification of diseases, is used. Accordingly, “maternal death is 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” (WHO, 1977).
Estimate of MMR:

As mentioned earlier, an attempt has been made to provide an estimate of MMR by state to understand completeness of SRS estimates. It is well documented that the factors which give rise to maternal mortality are also those which give rise to infant mortality. Therefore, it is likely that in a country or region, where maternal health is poor, maternal mortality and infant mortality are likely to be high. In other words, it can be assumed that the IMR for a given country/region is largely dependent on the maternal health condition as reflected by the maternal mortality ratio of that region. This close association between IMR and MMR suggests that the index of IMR can be used to compute an estimate of MMR. Furthermore, the estimate of IMR can be computed on a relatively smaller sample size than that required for the estimation of MMR. It is of course acknowledged that maternal health condition is more likely to influence neonatal mortality than post neonatal mortality. However, in the absence of country level data on neonatal mortality, readily available estimates of IMR facilitate the use of this latter index at the country level. To understand the strength of association between IMR and MMR, the experience of maternal mortality and infant mortality for the developed and developing countries is examined. Such an examination, as expected, has revealed a clear pattern of association between these two variables. Assuming that IMR is dependent on maternal health condition, which can be measured through MMR by proxy, an appropriate non-linear model has been developed and is presented in the following section.
As a first step, when the observed country level data on IMR and MMR were plotted, it is noted that the trend is not linear, but upward and concave upward. Similarly, when IMR and logarithm of MMR are plotted the curve again shows an upward, smooth non-linear pattern but its shape reverses. Accordingly, an appropriate exponential curve was fitted to the recent observed data on IMR (Y) and MMR (X), Log based 10 MMR(X) and Log based e MMR(X) for 103 developed and developing countries and the results of the analysis are presented in the following tables.

Table 1:
<table>
<thead>
<tr>
<th>Dependent Variable (Y): IMR</th>
<th>Variable in the equation:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Regression Coefficient (b)</td>
</tr>
<tr>
<td>MMR X</td>
<td>0.104</td>
</tr>
<tr>
<td>Constant</td>
<td>15.320</td>
</tr>
<tr>
<td>N = 103</td>
<td></td>
</tr>
</tbody>
</table>

Table 2
<table>
<thead>
<tr>
<th>Dependent Variable (Y): IMR</th>
<th>Variable in the equation:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Regression Coefficient (b)</td>
</tr>
<tr>
<td>Log 10 MMR X (Loge MMR X)</td>
<td>36.408 (15.812)</td>
</tr>
<tr>
<td>Constant</td>
<td>-31.112</td>
</tr>
<tr>
<td>N = 103</td>
<td></td>
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As can be seen from these tables, the fit is extremely good as apparent from the value of F which is highly significant and the model explains about 75.5% percent of the variance. The regression coefficient of log based 10 MMR is more than 1 and highly significant indicating once again the strong association with IMR. The shape of the curve between these two variables is shown in Figures 1 and 2 which also indicate a good fit of this model. Therefore this model is appropriate to estimate the level of MMR in various states of India from the observed estimates of IMR available from the Sample Registration System.

Figure 1:
Observed Trend Between IMR and Log MMR Across the Countries and Trend Shown by an Exponential Curve Fitted to the Data.
Figure 2: Observed Trend Between IMR(Y) and log10MMR(X) Across the Countries and Trend Shown by the Exponential Curve.