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Levels and Differentials in Maternal Mortality in Rural India: New Evidence from Sisterhood Data

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Abstract

The paper presents estimates of maternal mortality derived from the NCAER-HDI survey (1994) for rural areas of India by broad geographical regions and by some selected background characteristics of respondents. According to these estimates, maternal mortality was 544 deaths per one lakh births roughly 12 years before the survey. The maternal mortality ratio was more than 600 in eastern and north-central India, while it was between 300 and 400 in north-western and southern India. The survey data suggest that maternal mortality levels were higher among the scheduled tribes and scheduled castes and low among Muslims. The level of maternal mortality was strongly related to amenities and infrastructure available in the village. However, its relationship with poverty and educational levels of respondents was found to be weak perhaps because the characteristics of respondents were not the ideal surrogates for sisters' attributes.

JEL Classification

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Keywords

Maternal mortality; sisterhood data

1. INTRODUCTION

In spite of the growing concern about reproductive health, information on levels, trends and differentials in maternal mortality remains fragmentary in India. Policy initiatives often rest on judgements made on the basis of a small, selective cross-section of the population. The National Family Health Survey (NFHS) of 1992–93 was the first to provide an estimate of 437 maternal deaths per one lakh births for the two-year period at the national level, preceding the survey (IIPS, 1995). But in spite of surveying nearly 90,000 households, it could not produce estimates at regional or state-levels owing to the smallness of the sample. Even at the national level, the sample inadequacies of the NFHS came into sharp focus when the second round of the survey in 1998–99 produced a maternal mortality estimate of 520, but failed to confirm statistically the possible rise in the level of maternal mortality (IIPS and ORC-Macro, 2000).

To fill the data gap, the potential of the Sample Registration System for collecting the data on maternal mortality has also been explored. The source has recorded a maternal mortality rate of 408 and 407 for 1997 and 1998 respectively (India, Registrar General, 1999 and 2000). While the suggested level seems plausible at the all-India level, the state-level pattern indicated by this source appears to be severely distorted by both sampling and non-sampling errors (such as low estimates for Gujarat and Tamil Nadu and relatively high estimates for Kerala).

2. THE SISTERHOOD METHOD

As direct investigations require a huge sample, several indirect methods have been proposed for the estimation of maternal mortality. One of these is the 'sisterhood method' developed by Graham and others (Graham et al., 1989). This method makes use of the data collected from female respondents in a sample survey on the number of ever-married sisters they had, the number who were not currently alive and the number who died while pregnant, during childbirth or within six weeks after delivery. This procedure cuts down the required sample size drastically because women generally have several sisters who could have been exposed to the risk of maternal mortality each time they were pregnant.

The method has been quite successful in estimating maternal mortality in African populations. In India, opportunities for using this method have been limited. The Human Development Profile Survey (HDPS) conducted by the National Council of Applied Economic Research in 1994 was the first national survey in India to experiment with these questions (Shariff, 1999). This survey covered about 33,000 rural households spread over 1,765 villages and 195 districts in 16 major states of India. As the relevant data have been collected from about 37,000 ever-married women, it is possible to derive (from the survey data) reasonably stable estimates of maternal morality for geographical regions and by socio-economic characteristics. This paper presents such estimates derived from sisterhood data of the HDPS.

2.1 Estimate for Rural India

Table 1 shows the application of the sisterhood method to the all-India data for rural areas. Nearly 37,000 women in the age group of 15–49 years, at the time of the survey have reported on an average 1.9 married sisters. Among them 2,671 sisters were not alive at the time of the survey (i.e. 4.3 per cent). The data available for 2,102 dead sisters indicate that 32 per cent died around the time of childbirth. Based on this information and following the procedure developed by Graham et al., the lifetime probability of dying from maternal causes for a female baby has been calculated as 2.5 per cent (see Table 1). This estimate of lifetime probability refers to, on an average, 11.8 years before the survey or roughly to 1982. For computing the more conventional measure of maternal mortality ratio, an estimate of average number of children born to women in their lifetime (i.e. total fertility rate) is required. The most convenient approximation to this is the average number of live births reported by the surveyed women in the age group of 40–49 years. According to HDPS, the

average number of children ever born to women of the age group 40–49 years was 4.4. But the reported sex ratio of 118 males for 100 female births suggests that women had underreported the number of daughters born to them. If a correction is made by assuming a sex ratio at birth as 105, the total lifetime births to an average woman rises to 4.7. This figure is close to the total fertility rate of 4.9 reported by the Sample Registration System for rural areas of India in 1982. With 4.7 as the estimate of lifetime births, the sisterhood data from the HDPS imply a maternal mortality ratio (MMR) of 544 per one lakh live births in rural areas of India in 1982. With 4.9 as the estimate of total fertility rate (TFR), the data imply a maternal mortality ratio of 518. As only the survey can provide estimates of lifetime births for various population groups, for the sake of comparability, the former could be adopted as the estimate of MMR for rural India from HDPS.

Using a completely different approach, the maternal mortality ratio was estimated as 638 per one lakh live births in rural areas of India during 1982–86 (Bhat et al., 1995). This estimate was derived from the SRS data on sex differentials in mortality in reproductive ages. Clearly, the sisterhood data from the HDPS implies lower levels of maternal mortality than the indirect procedure developed earlier. A state or zone-wise comparison could probably explain the source of this discrepancy.

2.2 Estimates for Geographical Zones

As one runs into problems of sample size in making state-specific estimates from the HDPS, estimates of maternal morality were derived for six geographical zones (Table 2). Maternal mortality levels were lowest (289) in the North-western zone comprising states of Punjab, Haryana and Himachal Pradesh and in South India (383). On the other hand, maternal mortality was over 600 in the Eastern zone (Assam, West Bengal and North-eastern states) and North-central zone (Uttar Pradesh and Bihar). The accuracy of this geographical variation in maternal mortality can be checked by comparing it with the estimates derived indirectly from sex-differentials in mortality by age. As the latter estimates were derived for major states, they were pooled to produce the zonal estimates (Table 2). While making the comparison, it should also be noted that the indirect estimates derived from the SRS data are for all areas while the estimates from the HDPS are for only rural areas of the respective zones. Nonetheless, but for one zone, there is a reasonably good correspondence between the estimates from the two sources on the regional variations in maternal mortality in India. Both sources suggest that maternal mortality is lowest in the North-western zone and

relatively high in the Eastern zone. The discrepancy between the two sources is mainly in the North-central zone where the sisterhood data from HDPS (612) is lower than the indirect estimate based on sex-differentials in mortality (879) by as much as 30 per cent. As this region is known to be one of the most backward regions in India, the estimate from the HDPS seems to be a bit too low.

2.3 Estimates by Background Characteristics of Respondents

An advantage of the sisterhood data is that it can be used to study variation in maternal mortality among population subgroups. However, one should be cautions in interpreting the results because the personal characteristics used for the classification are not of the women who were exposed to the risk of maternal deaths, but that of their sisters. Nonetheless, this information could be valuable because it is unlikely that the sisters would have come from very different socio-economic background.

Table 3 shows the estimates of maternal mortality by caste and religious background of the respondents. Not surprisingly, the maternal mortality ratio is estimated to be quite high among the Scheduled Tribe (652) and Scheduled Caste (584) women compared to the women of other castes (516). Among the religious groups, Hindu women have higher maternal mortality (573) than Muslim (384) or women of other religions (428). The unusually low maternal mortality among Muslim women is a puzzle; it could be partly due to the fact that they generally live in larger villages having better access to emergency obstetric care.

Estimates of maternal mortality by educational level of respondents are shown in Table 4. As one would expect, maternal mortality is higher among illiterates (574) as compared to those who had gone to primary school (492) or passed middle school (484). The educational differential in maternal mortality appears somewhat muted because some of the sisters of illiterate respondents could have gone to school or vice-versa.

Table 5 shows the estimates of maternal mortality by poverty level of respondents. Using the 'head-count' method, the survey respondents have been classified as belonging to the following groups.

- lower segment below the poverty line
- upper segment below the poverty line

- lower segment above the poverty line
- upper segment above the poverty line (see Shariff, 1999).

Surprisingly, the data do not disclose a strong relationship between poverty level of respondents and maternal mortality of their sisters. Those who are at the bottom most segment do have marginally higher maternal mortality (555) than those at the top most segment (484). But it is the two intermediary classes that show the lowest (439) and the highest (611) maternal mortality ratios. This could happen if the respondents and their sisters do not belong to the same poverty class.

It is interesting to explore whether access to health care has an influence on the level of maternal mortality. The sample villages of the HDPS have been classified as less developed, moderately developed and well-developed based on an index measuring the infrastructure and amenities in the village (Shariff, 1999). Table 6 shows the estimates of maternal mortality for these types of villages. It can be seen that the less developed villages have significantly higher maternal mortality (646) than either moderately or well-developed villages (501 and 488, respectively). Thus access to health care appears to have a significant effect on levels of maternal mortality.

3. CONCLUSION

The application of sisterhood method to the data from the HDPS (1994) yields an estimate of maternal mortality of 544 deaths per one lakh births in rural India for a period roughly 12 years before the survey. It also shows that maternal mortality ratio was more than 600 in East and North-central India, while it was between 300 to 400 in North-western and Southern India. The survey results also show that maternal mortality levels were high among Scheduled Tribes and Scheduled Castes and surprisingly low among Muslims. Maternal mortality was also found to be strongly related to amenities and infrastructure available in the village. However its relationship with poverty and educational levels of respondents were found to be weak perhaps because the characteristics of respondents were not ideal surrogates for their sisters' attributes.

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TABLES

TABLE 1
Estimation of Maternal Mortality Ratio from Sisterhood Method, All India (Rural)

Age Group	No. of Respond-Ents	No. of ever-married sisters	No. of married sisters (dead)	Per cent Died of Maternal Causes *	No. of maternal deaths	Mean no. of ever-married sisters	Adjusted ever-married sisters **	Adjust-ment factor	Sister units of exposure to risk	Lifetime probabi-lity of dying	Refer-ence time
15-19	2537	2975	58	40.2	23	1.17	4746	0.107	508	0.046	5.7
20-24	6763	9455	246	34.0	84	1.40	12653	0.206	2606	0.032	6.8
25-29	7684	12738	408	37.8	154	1.66	14376	0.343	4931	0.031	8.1
30-34	6429	11832	458	36.5	167	1.84	11832	0.503	5951	0.028	9.7
35-39	6110	11720	594	28.1	167	1.92	11720	0.664	7782	0.021	11.7
40-44	4181	7695	479	29.0	139	1.84	7695	0.802	6172	0.023	14.3
45-49	3289	6187	428	25.5	109	1.88	6187	0.900	5568	0.020	17.5
Total	**36993**	**62602**	**2671**	**31.5**	**843**	**1.87**	**69209**		**33519**	**0.025**	**11.8**

Notes:

TFR = 4.7 MMR = 544

* As per data available for 2,102 dead sisters.

** Figures for ages 15-29 are adjusted on the assumption that the average number of sisters reaching the reproductive period would be the same as in the age groups 30+, that is 1.87.

Source: Human Development Profile Survey (HDPS), 1994.

TABLE 2
Estimates of Maternal Mortality for Geographical Zones

Zones **	Estimates for rural areas from HDPS, 1994						Indirect estimates of MMR by Bhat et al. for 1982–86 *
	Number of Respondents aged 15–49	Lifetime Births for Women aged 40–49	Percentage of maternal Deaths	Lifetime risk of maternal death	Time reference	Maternal mortality ratio	
North-west	4708	4.8	27.5	0.014	11.7	289	346
North-central	7007	5.2	29.5	0.031	11.8	612	879
South-central	9298	5.0	35.1	0.029	11.6	588	614
East	3034	5.0	36.7	0.032	11.4	636	709
West	4752	4.1	23.8	0.019	11.9	471	414
South	8193	4.0	29.5	0.015	12.1	383	379
All India	**36993**	**4.7**	**31.5**	**0.025**	**11.8**	**544**	**580** (638) @

Notes:
* Pooled, state-specific estimates for the total area.
@ Estimate for rural India.
** North-west: Punjab, Haryana, Himachal Pradesh; North-central: Uttar Pradesh and Bihar; South-central: Rajasthan, Madhya Pradesh and Orissa; East: Assam, West Bengal and North-eastern states; West: Maharashtra and Gujarat; South: Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

TABLE 3
Estimates of Maternal Mortality by Caste and Religion, Rural India, 1994

Caste / Religion	Number of Respondents aged 15–49	Lifetime births for women aged 40–49	Percentage of maternal Deaths	Lifetime risk of maternal death	Time reference	Maternal mortality ratio
Scheduled Castes	8368	4.9	32.1	0.029	11.8	584
Schedule Tribes	4545	4.6	28.2	0.030	11.6	652
Others	24079	4.6	32.0	0.024	11.8	516
Hindus	31088	4.6	31.7	0.026	11.8	573
Muslims	3654	5.8	32.0	0.022	11.7	384
Others	2250	3.9	25.9	0.017	12.0	428
All India	**36993**	**4.7**	**31.5**	**0.025**	**11.8**	**544**

TABLE 4
Estimates of Maternal Mortality by Respondents Educational Level, Rural India, 1994

Educational Level	Number of respondents aged 15-49	Lifetime Births for Women aged 40-49	Percentage of maternal deaths	Lifetime risk of maternal death	Time reference	Maternal mortality ratio
Illiterate	24580	4.8	31.8	0.027	12.1	574
Primary or less	6694	4.3	30.4	0.021	11.6	492
Middle or more	5718	3.8	30.4	0.018	10.5	484
All India	**36993**	**4.7**	**31.5**	**0.025**	**11.8**	**544**

TABLE 5
Estimates of Maternal Mortality by Poverty Level of Respondents, Rural India, 1994

Poverty group	Number of respondents aged 15-49	Lifetime births for women aged 40-49	Percentage of maternal deaths	Lifetime risk of maternal death	Time reference	Maternal mortality ratio
Poor:						
Lower Segment	7334	5.3	31.3	0.029	11.6	555
Upper Segment	7823	5.1	31.2	0.022	11.5	439
Non-poor:						
Lower Segment	15688	4.5	32.7	0.027	11.8	611
Upper Segment	6147	4.2	28.9	0.020	12.3	484
All India	**36993**	**4.7**	**31.5**	**0.025**	**11.8**	**544**

TABLE 6
Estimates of Maternal Mortality by Development of Village, 1994

Development index of village	Number of respondents aged 15-49	Lifetime births for women aged 40-49	Percentage of maternal deaths	Lifetime risk of maternal death	Time reference	Maternal mortality ratio
Low	10904	5.1	31.3	0.032	11.7	646
Medium	14640	4.7	30.4	0.023	11.8	501
High	11448	4.3	31.4	0.021	11.8	488
All India	**36993**	**4.7**	**31.5**	**0.025**	**11.8**	**544**