DISENTANGLING THE RISK OF MOTHERHOOD: AN EXPLORATORY STUDY OF MATERNAL MORTALITY IN INDIA

Background

During the International Conference on Population and Development (ICPD) held at Cairo in 1994, and a newer vision of reproductive health care came. Still, there is not even a single country in the world has not met the goals set in the conference, and the problems spotted continue to be worse in the developing countries. For developing nations, it is about 50 times higher than in developed countries (Radkar et al., 2007). The millennium development goals (MDG) have set to achieve 200 maternal deaths per lakh live births by 2007 and 109 by 2015. However, the global maternal mortality ratio found 216 per 100000 in 2015 (Alkema, L. et al., 2016). The latest study conducted by the registrar general of India found that the maternal mortality ratio (MMR) of India is 130 per lakh live births (SRS, 2018). The MMR has declined substantially from 1990 to 2015, but the pace of decline has been much slower than required to achieve the MDG target of reducing the MMR by 75% between 1990 and 2015 (Alkema, L. et al., 2016). The level of MMR in India went down 150 maternal deaths per lakh live births, whereas it was above 400 maternal deaths per lakh live births during the 1990s. The reasons behind this sharp decline are fertility decline, an increase in usage of birth control methods and rigorous implementation of safer motherhood programmes to reduce the burden of maternal mortality. When the National Rural Health Mission (NRHM) has been launched, the government started to increase its spending on family welfare and safe motherhood programmes. The large-scale growth in financial outlays under the Janani Suraksha Yojana (JSY) scheme, which is targeted in reducing the overall MMR and IMR by increasing institutional deliveries for 'below poverty line' families, is assumed to be the significant step towards maternal mortality reduction in India (Government of India, 2005; Srinivasan et al., 2007; Jain, 2010). Despite such unprecedented attention, the decline in MMR has been retarding in recent times; and most maternal deaths in India continue to be correlated with determinants such as nutrition, poverty, and socioeconomic marginalisation, over which health schemes have had minimal impact. The current problem is to recognise and highlight the role of governments, health, and other sectors, and households in population-wide strategies to ameliorate access, delivery, and health care services utilisation (Tanner et al., 2014; Jeffery and Jeffery, 2010).

The methods which are currently are in use to estimate maternal mortality from different data sources are ***Civil Registration (CR) and Vital Statistics Data, Census and population or household surveys, Sisterhood Methods, Reproductive Age Mortality Studies (RAMOS).*** Since there are different issues with the assumptions and estimations of these methods, this study uses a technique given by Stecklov in 1995 through which we can calculate separate mortality rates for women during and outside pregnancy period. By detaching pregnancy-related from non-pregnancy related mortality, will not only provide a measure of maternal mortality that is more coherent with the WHO definition of maternal mortality, but may also lead to new insights concerning the types of risks being measured (Stecklov, 1995). This study uses calendar data from the fourth round of the National Family Health Survey (2015-16), which is the Indian version of DHS to accomplish its objectives.

Research Questions

This study is based on two research questions which are as follows

1. What is the age pattern of mortality among women in reproductive ages during pregnancy period compared to non-pregnancy period?
2. Does this age pattern of mortality vary for different background characteristics?

Objective

To estimate mortality rates, and summary risk measures for India by different subpopulation during pregnancy and non-pregnancy period.

Data and Methods

The present study used secondary data from the fourth round of the National Family Health Survey (NFHS), which is the Indian version of the Demographic Health Survey. It is a large-scale, multi-round survey, which is conducted in a representative sample of households throughout India under the aegis of the Ministry of Health and Family Welfare, India. Fourth in the series, NFHS4, with some new additions was undertaken in 2015-16. Unlike its previous three rounds, the fourth round National Family Health Survey encompasses and provides the estimates in the field of population, health, and nutrition to all the 29 States, 7 Union Territories, and 640 districts. With the prime objective of providing much-needed data in the area of health and family welfare and newly arisen affair in the related field. A total of 628,892 households (almost seven times as large as the household sample size in the first two rounds of NFHS) were covered, and 699686 ever-married women in the age group 15-49) were interviewed The description of different methodologies with have been used for our analysis is discussed below.

The methodology used to estimate Pregnancy period mortality rate (PPMR), Non-pregnancy period mortality rates (NPPMR) and Summary Measures

The numerator for PPMR and NPPMR

In the fourth round of National Family Health Survey number of women (who was a usual resident of the household) died during *childbirth or within two months after the end of pregnancy or childbirth* or outside this period is enumerated and here referred as ***death during pregnancy and non-pregnancy period*** respectively. Death during pregnancy and the non-pregnancy period are used as the numerator for the estimation of pregnancy and non-pregnancy period mortality rates ***(PPMR)*** & ***(NPPMR)*** for total females and females from selected background characteristics. Enumerated deaths in pregnancy and non-pregnancy period outside the age range of (15-49) are not considered for the calculation of rates. ***Deaths due to accidents, violence, poisoning, homicide or suicide are not included in the numerator***.

Denominator for PPMR and NPPMR

Denominator for the mortality rates which are person-years lived in pregnancy and non-pregnancy period' for the living and dead women in the age range (15-49). For the living women, 'person-years' lived in pregnancy and non-pregnancy period' is extracted through the calendar data which gives the month-wise history of women's pregnancy, birth and contraceptive usage up to 80 months. It provides the total number of months lived by women in the reference period of the study or total exposure. In the calendar of individual woman episodes of pregnancy, births and particular contraceptive usage which is basically months lived in pregnancy, birth months and the total number of months a particular contraceptive respectively is given. Months lived in pregnancy, month in which woman gave birth and the month in which pregnancy is terminated is recorded as "P," "B" and "T" respectively. The total number of "P", "B" and "T" is termed as months lived in pregnancy period or pregnancy period exposure. Non-pregnancy period for women is calculated by subtracting pregnancy period exposure from total exposure. Finally, all three exposure months is converted into years. On the other hand, no information is given about pregnancy period exposure in the reference period for the women who died during pregnancy period. So the pregnancy period exposure is simulated by assuming that

Pregnancy period exposure of dead women is similar as living women (e.g., pregnancy period exposure of a dead woman from the rural region is similar as pregnancy period exposure of living women from the rural region). ⟶ **(Assumption 1)**

The method to estimate PPMR, NPPMR and their summary measures is given by (Stecklov 1995), and here it is used with some modifications

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$$PPMR = \frac{Number\ of\ deaths\ in\ pregancy\ period\ in\ the\ age\ group\ (x, x+n)}{Person\ years\ lived\ \ in\ pregancy\ in\ the\ age\ group\ (x, x+n)}$$

$$NPPMR = \frac{Number\ of\ deaths\ in\ non-pregancy\ period\ (x, x+n)}{Person\ years\ lived\ outside\ pregancy\ in\ the\ age\ group\ (x, x+n)}$$

Here non-pregnancy related mortality during the pregnancy period is assumed to equal non-pregnancy-related mortality during the non-pregnancy period. ⟶ **(Assumption 2)**
The assumption that the baseline (non-pregnancy-related) risks are constant regardless of whether a woman is in the pregnancy period appears to be a useful starting point.
Summary risk measures namely *pregnancy to non-pregnancy mortality ratio*, *pregnancy-related mortality rate* which gives attributable risk which can be attributed to pregnancy-related conditions, and *pregnancy-related pregnancy period mortality* which gives attributable risk% attributable to pregnancy-related conditions for an age interval *(x, x+n)* have been calculated with the help above two rates as follows,

$$Pregnancy\ to\ non\ pregancy\ mortality\ ratio\ = \frac{PPMR}{NPMR}$$

$$Pregnancy\ related\ mortality\ rate = (PPMR - NPPMR)$$

$$Pregnancy\ related\ pregnancy\ period\ mortality(\%) = \frac{(PPMR - NPPMR)}{(PPMR)}$$

Preliminary Findings-

In the age-group 30-49 mortality level during pregnancy period is approximately three times higher than the mortality levels in the non-pregnancy period. This age group also faces the highest proportionate risk from pregnancy-related mortality, with more than 75% mortality being pregnancy-related. These measures are lowest in the 15-19 age group. For all age groups combined, the data suggest that the mortality levels during pregnancy period are about two times higher than non-pregnancy pregnancy period, pregnancy to non-pregnancy mortality rate is 1.14 and 49% mortality in reproductive ages being pregnancy-related.

Age group	Pregnancy Period				Non-Pregnancy period				Summary risk measures		
	(A)	(B)	(C)[a]		(D)	(E)	(F)[b]		(G)[c]	(H)[d]	(I)[e]
	Deaths	Exposure	Mortality Rate	95% Confidence Limits	Deaths	Exposure	Mortality Rate	95% Confidence Limits	Pregnancy to non-pregnancy mortality ratio	Pregnancy-related mortality rate	Pregnancy-related pregnancy period mortality (%)
15-19	30	26,819	1.12	(0.72 , 1.52)	403	571,806	0.70	(0.64 , 0.77)	1.6	0.4	37.0
20-24	161	83,004	1.94	(1.64 , 2.24)	397	502,150	0.79	(0.71 , 0.87)	2.4	1.2	59.2
25-29	120	52,491	2.29	(1.88 , 2.70)	373	468,480	0.80	(0.72 , 0.88)	2.8	1.4	65.2
30-49	136	29,840	4.56	(3.79 , 5.32)	2263	1,355,191	1.67	(1.60 ,1.74)	2.7	2.9	63.4
Total	**447**	**192,154**	**2.33**	**(2.11 , 2.54)**	**3436**	**2,897,627**	**1.19**	**(1.15 ,1.23)**	**1.9**	**1.1**	**49.0**

[a]A/B*1,000. [b]D/E*1,000. [c]C/F. [d]C-F. [e]H/C*100

The sensitivity of the Estimated Pregnancy and Non-Pregnancy Mortality Rates

The results of the sensitivity analysis of the mortality rates for total females to assumption 1 discuss is presented in figure 3.1 and 3.2. Three separate measures of pregnancy mortality are shown in figure 3.1. The total height of each bar is showing the estimate of maternal mortality which can be similar to the estimates that we can have from applying direct sisterhood method. The method used here suggests that the total height of each bar which is pregnancy-period mortality rate can be divided into two parts. The first part is baseline mortality which is the bottom part of each bar and the second part is pregnancy-related mortality which upper part of each bar. In figure 3.1, the mortality rates that are shown are estimated with taking an exposure of dead women in the denominator which is extracted with the help of assumption 1. According to assumption 1, the pregnancy exposure of dead

women is same as living women. It means that the proportion of pregnancy exposure out of total exposure for the living women in the reference period is the same for the women who died in the reference period. However, in figure 3.2 denominator of the mortality rates shown do not contain the exposure of dead women. After comparative assessment of both figures, it is evident that the age pattern of mortality rates is similar and there is no such significant change occurred in the rates if the exposure of dead women is not considered. It seems that since the portion of exposure of dead women in the denominator is too smaller than living women, so its effect is getting diluted. In conclusion, we can say that assumption 1 will not hamper our process of estimating mortality rates and their summary measures, and we can rely on estimated mortality rates.

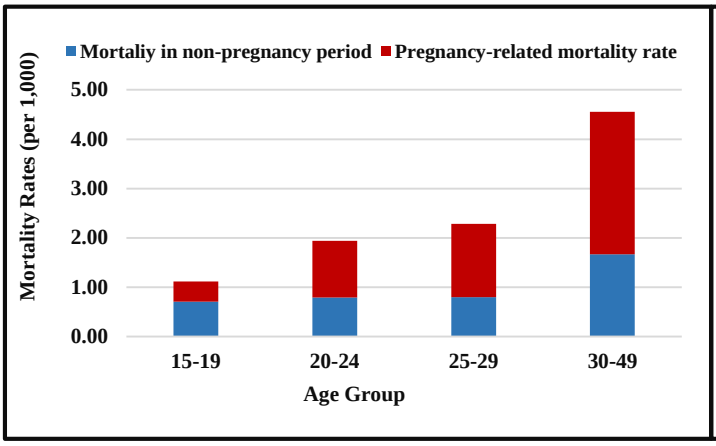

Figure 3.1: Pregnancy and Non-pregnancy related mortality rates with exposure of dead women in the denominator, by age-group, India, 2011-16

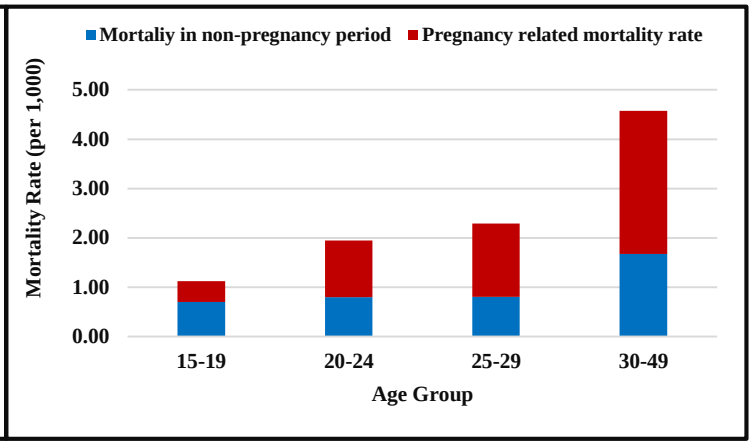

Figure 3.2: Pregnancy and Non-pregnancy related mortality rates without exposure of dead women in the denominator, by age-group, India, 2011-16

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