Explaining gender differentials in child mortality in India: Trends and determinants

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Abstract

The study is aimed to investigate the progress in gender differentials in child mortality and factors explaining the differentials in India. Based on the analyses of three rounds of National Family Health Survey data, the findings suggest that there is a positive change in the scenario of child mortality from 1992 to 2006 where, though, largely female child is at higher risk of dying but there is a decline over the period. The decomposition analyses suggest that demographic variables such as breastfeeding, birth order, antenatal care and the mother's age emerged as critical contributors for excess female child mortality compared to socioeconomic variables. Overall, the results foster that the gender discrimination is mainly operating through the provision of breastfeeding and negligence of higher order female births. The study also fosters that discrimination of higher order female births mainly operates in terms of health care provisions and allocation of intra-household resources.

Keywords

child mortality, decomposition analyses, breastfeeding, birth order, antenatal care, gender discrimination

Introduction

In most populations, female mortality rates are lower than those for males consistently across at all ages[1]. Historically, India is known for its male skewed child sex ratio and researchers attributed sex differentials in child mortality being one of the primary factors contributing to it. India's Sample Registration System (SRS) has been indicating the presence of sex differentials in child mortality from as early as the 1970s. The recent SRS report also indicates a large gap (9 per 1000 live births) in terms of under-five mortality rate among males and females; such differences further increases in case of rural areas[2]. Among the states, except for four south Indian states, West Bengal and Odisha in East, Maharashtra in West and Himachal Pradesh in North, all other Indian states foster excessive female child mortality (Figure 1).

There are ample studies that have attempted to explain sex differentials in child mortality, particularly, in India [3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17]. In an attempt to analyze the factors explaining child mortality, the studies in India have been excessively focused upon the existence of gender disparity in nutrition and health care of children. According to Das Gupta[6], excess female child mortality is a part of family building strategy, where girls are considered as a burden and boys as resources. It has been found that the biggest contribution to striking female disadvantage in India comes from the gender disparity in nutrition and health care of children[17]. Among other studies, the evidence of an excess female mortality in childhood is typically understood as the consequence of parental discrimination against daughters in the provision of food and health care, even abusing the girl child within the household is also prevalent[6, 7, 8, 18, 19, 20]. It has also been contemplated that where behavior can be adequately commanding to influence outcome, there is consistent discrimination against female children in comparison with male children[19]. However, the persistent excess female child mortality, continue to speculate about authentication of existing factors and their volume of contribution. The lack of information on exact cause and contribution of factors contributing to excess female child mortality intricate development of strategies to bring balance in gender disparity in child mortality.

India has been making efforts explicitly oriented towards eliminating health inequalities but despite of these efforts, gender health inequalities still persist. The issue of gender differentials remains a great challenge for achieving gender equity and eliminating such differences will also substantially reduce the child mortality. It is important to examine whether existing efforts from Indian government have brought any changes towards traditionally skewed female child mortality and factors explaining it. However, there is scarcity of studies that have attempted to assess the change in the trends and determinants of sex differentials in child mortality. Few of the studies have tried to provide the insights on existing inequalities but there is a virtual vacuum of studies that have attempted to go beyond the factors to explore and understand the factors contributing and their relative proportional contribution to gender differentials in child mortality. The estimation of relative proportional contribution allows the policy makers to prioritize the factors and consequent interventions to bring balance in gender differences in child mortality. Therefore, the issue of gender differentials remains a daunting task for the policy makers, social scientists, and public health professionals in India. This paper attempts to assess the change and explain the factors leading to gender differentials in child mortality in India and progress made over time.

Methods

Data source

The three rounds of NFHS (1992-2006) data have been used to assess the trends in child mortality. The National Family Health Survey (NFHS) is an equivalent of worldwide

Demographic Health Survey (DHS), and a widely accepted source of data for estimating fertility, mortality and health trends in India. Three rounds of NFHS were conducted by the International Institute for Population Sciences and Macro International under the aegis of the Ministry of Health and Family Welfare, India. The NFHS collects information on fertility, mortality, morbidity, maternal and child health, with representative samples covering all the 29 states of India, which comprises more than 99 percent of the population. All the three rounds of NFHS hold adequate sample size for the estimation of child mortality (for details on sampling see IIPS and Macro-International, 1992-93, 1998-99, 2005-06)[21,22,23].

Life -Table approach

In the first stage, the study estimated child mortality (${}_4q_1$) based on Life -Table approach by using STATA 11.0. The Life-Table approach gives the probability of surviving. Further probability of dying is estimated by the following equation:

$$q = 1-p$$

Where *q*=probability of dying, *p*=Probability of surviving.

Pyatt's Gini decomposition model

Pyatt [24] has given the decomposition model of Gini coefficient. Gini index is used to calculate the change in inequality in child mortality among male-female population of Indian states during 1992-2006. Further, the Gini index is decomposed into between group inequality, within group inequality and inequality due to group overlapping in child mortality among male-female population across Indian states.

Let a population of n individuals, with mortality vector (y_1, y_2, y_3....... Yin) and means mortality$\bar{y}$, is disaggregated in k subgroups, with $n = \sum_{j=1}^{k} n_j$ and subgroup mean is$\overline{y_j}$.

The Gini index between subgroups j (male) and h (female) can be expressed as

$$G_{jh} = \frac{1}{n_j\, n_h(\overline{y_j} + \overline{y_h})} \sum_{i=1}^{n_j} \sum_{r=1}^{n_h} |y_{ji} - y_{hr}|$$

If F(y) be the cumulative distribution function of mortality, then expected mortality difference between group j and h can be defined as

$d_{jh}^{1} = \int_0^{\alpha} dF_j(y) \int_0^{y} (y-x)\, dF_h(x)$, for $y_{ji} > y_{hr}$ and $\overline{y_j} > \overline{y_h}$

$d_{jh}^2 = \int_0^{\alpha} dF_h(y) \int_0^{y} (y - x)\, dF_j(x)$, for $y_{ji} < y_{hr}$ and $\overline{y_j} > \overline{y_h}$

The relative mortality affluence is defined as

$$D_{jh} = \frac{d_{jh}^1 - d_{jh}^2}{d_{jh}^1 + d_{jh}^2}$$

If the population shares in subgroup j is $p_j = \frac{n_j}{n}$ and mortality share in subgroup j is $s_j = \frac{p_j \bar{y}_j}{\bar{y}}$, then the contribution to total inequality attributable to the difference between the k population subgroup is defined as:

$$G_b = \sum_{j=1}^{k} \sum_{h=1\, j\neq h}^{k} G_{jh}\, D_{jh} \left(p_j\, s_h + p_h\, s_j\right)$$

The Gini index for subgroup j is given by

$$G_{jj} = \frac{\sum_{i=1}^{n_j} \sum_{r=1}^{n_j} (y_{ij} - y_{rj})}{2 n_j^2 \bar{y}_j}$$

The within group inequality index is the sum of Gini indices for all subgroups weighted by the product of population shares and mortality shares of the subgroups:

$$G_w = \sum_{j=1}^{k} G_{jj}\, p_j s_j$$

If subgroups are not overlapping, total inequality can be expressed as the sum of within group and between group indices. But, if subgroups are overlapping, we can add another component which is a part of between-group disparities issued from the overlap between the two distributions which measures the contribution of the intensity of transvariation. The contribution of the transvariation between the subpopulations to G is

$$G_t = \sum_{j=1}^{k} \sum_{h=1\, j\neq k}^{k} G_{jh} \left(1 - D_{jh}\right)\left(p_j\, s_h + p_h\, s_j\right)$$

Thus Gini index can be decomposed into three components: within group inequality, between group inequality and inequality due to group overlapping:

$G = G_w + G_b + G_t$

Oaxaca Decomposition

Oaxaca`s decomposition analysis has been used to decompose the differences by quantifying the contribution attributable to different factors. Taking into account the utility of regression based decompositions, this study uses the Oaxaca's technique that is appropriate for binary models to decompose the gender differences in child survival in contribution attributable to different explanatory factors[25].

Mathematically, Oaxaca decomposition is expressed as

$$y^{Male} - y^{Female} = \Delta x \beta^{Female} + \Delta \beta x^{Male} \quad (1)$$

Where,

$$\Delta x = x^{Male} - x^{Female} \text{ and } \Delta\beta = \beta^{Male} - \beta^{Female}$$

$$y^{Male} - y^{Female} = \Delta x \beta^{Male} + \Delta \beta x^{Female} \quad (2)$$

The model shows that in the first part (unexplained part) the differences in X's are weighted by the coefficients of the female group and differences in the coefficients are weighted by the X's of the male group, whereas in the second, the difference in the X's are weighted by the coefficient of male group and the difference in coefficients are weighted by the X's of female group (Explained part).

The socioeconomic and demographic variables were dichotomized into disadvantageous and advantageous groups to perform the differential decomposition analyses: place of residence as rural/urban, caste SCs or STs / others, Hindu religion/ Non Hindu religion, mother's age risky (less than 19 years and above 30 years) age group / non risky (20-29 years) age group, education of mother as no education/ education, mass media exposure of mother as no /yes, mothers body mass index less than 18.5 kg/m^2/ more than 18.5 kg/m^2, economic status as poor/non poor, place of delivery as home/other, birth weight as low/high, birth order less than 3/ above 3, antenatal care received/ not received, breast feeding less than 5 months/ above 5 months.

Results

Trends in difference of male-female child mortality

The child mortality estimates ($_4q_1$) by sex of the child from 1992 to 2006 are given in table 1. The table depicts that in 1992, female child was at a higher risk of mortality in comparison to her male counterpart in all the states with Kerala and Tamil Nadu being exception where female child is at a better position. There is a positive change in the situation of sex differentials in child mortality during 1992 to 2006 where, though, largely female child is at higher risk but there is a decline in that risk. However, Kerala and Tamil Nadu became favorable for male child whereas Himachal Pradesh, Orissa and Karnataka emerged as states where female child mortality is lesser as compared to a male child mortality. Uttar Pradesh is consistently being the highly skewed state in terms of differentials in male-female child mortality; however over the time the differences have been reduced from 27 in 1992 to 21 in 2006. A similar trend is reflected in Haryana where male-female child mortality differentials are quite high but it has also reduced over time (7.6 in 1992 to 6.3 in 2006). The situation is alarming for two of the southern states i.e. Kerala and Tamil Nadu which were initially advantageous for female child but over time the situation turn reverse. It is clearly evident from the table that female child mortality was always higher in the north and central regions of India with Uttar Pradesh in 1992 and 2006 (65.6 per thousand females and 43.2 per thousand females respectively) and Madhya Pradesh in NFHS-2 (66.3 per thousand females) being the states with highest female child mortality. The differentials in male-female child mortality are decreasing in almost all the states. Although there is a slight increase in Assam (6.7 to 7.3), Gujarat (11.5 to 11.7), Kerala (-0.6 to 1) and Tamil Nadu (-5.8 to 5.6) from 1992 to 2006 respectively.

Pyatt's decomposition results

Table 2 reflects that a considerable gender differential (G=0. 23) persists in child mortality in India during 2005-06; however, this differential is lesser as compared to earlier periods, 1992-93 (G=0. 36). Decomposition of child mortality inequalities between male-female children reveal that the gender differences in child mortality are mainly due to within group inequalities rather than between groups. Results for all the three periods consistently show that within group inequalities contribute over 50% to gender inequalities in child mortality in India. This gives a strong message that the difference among female children belonging to different sections of the population contributes greater to the gender differential in child mortality rather than differences among male-female children. Thus, the entire female child population is not at a disadvantageous stage, rather certain section of this population are at disadvantageous end. And to identify those sections children, we have decomposed the gender differentials in child mortality by their socioeconomic and demographic characteristics in the following section.

Oaxaca decomposition results

Table 3 presents the results of decomposition analysis for proportional contributions of selected predictors. The socioeconomic and demographic predictors can explain up to 82% of the total mortality difference between male and female children in India. The remaining 18% constitutes the unexplained residual component. The results illustrate the relative contribution of selected predictors by taking the total explained components (i.e. 82%) equivalent to 100%. Out of all the predictors, breastfeeding up to less than five months contributes to 82% of the difference in male and female child mortality. Women of birth order of 3 and above, who do not receive antenatal care, each contribute 4% to the male and female child mortality differences between children in India. Rural place of residence and mother's age contributes to almost 2% of the male and female child mortality difference. The variables like mothers not having any education, do not have any mass media exposure, non Hindu religion, caste, body mass index (<18.5 kg/m^2) and low birth weight of baby contribute for lesser than 1% to the gender differential in child mortality. The negative contribution (-1.39%) of home delivery indicates that there is no contribution of it to the overall effect.

Conclusion

This study assessed the progress in gender differentials in child mortality in India during 1992-2006. The findings suggest that there is a positive change in the scenario of child mortality from 1992 to 2006 where, though, largely female child is at higher risk but there is a decline in the risk of mortality. Patty's decomposition results foster that discrimination within the same sex across different population contributes more to gender differentials in child mortality rather between sex discrimination. This clearly indicates that male children are treated with the same priority across all subgroups of the population but female children are treated differently across the population subgroups. Further, to find the factors responsible for gap in male-female childhood mortality, this study performed the Oaxaca decomposition analyses. The results of decomposition model suggest that demographic variables such as breastfeeding, birth order, antenatal care and the mother's age emerged as critical contributors for excess female child mortality compared to socioeconomic variables. This indicates that proximate determinants as discussed by Mosley and Chen[26] play a greater role in creating sex differentials in child mortality. However, many previous studies attributed such differences to girl child discrimination in accordance with the cultural context of social and religious values in Indian society[6, 11, 17, 18, 19, 20].

However, the present study brings out the pathways of girl child discrimination which are directly responsible for excess female child mortality in India. The female child is facing a greater discrimination during breastfeeding; consequently, may be at other food allocations as well. Thus, poor nutrition will lead to poor health which will further lay down the path for excess female child mortality. Moreover, women with higher birth order and younger age practice more discrimination against female children that again results into excess female child mortality in India. Overall, the results foster that the gender discrimination is mainly operating through the provision of breastfeeding and negligence of higher order female births. The study also fosters that discrimination against higher order female birth mainly takes place in terms of health care provisions and allocation of intra-household resources. At policy perspective, this study evidently suggests that any efforts to remove gender differences in child survival could achieve their targets if those efforts are more focused on the proximate determinants such as breast feeding, other nutritional and health care requirements and also equal provisions for male and female child.

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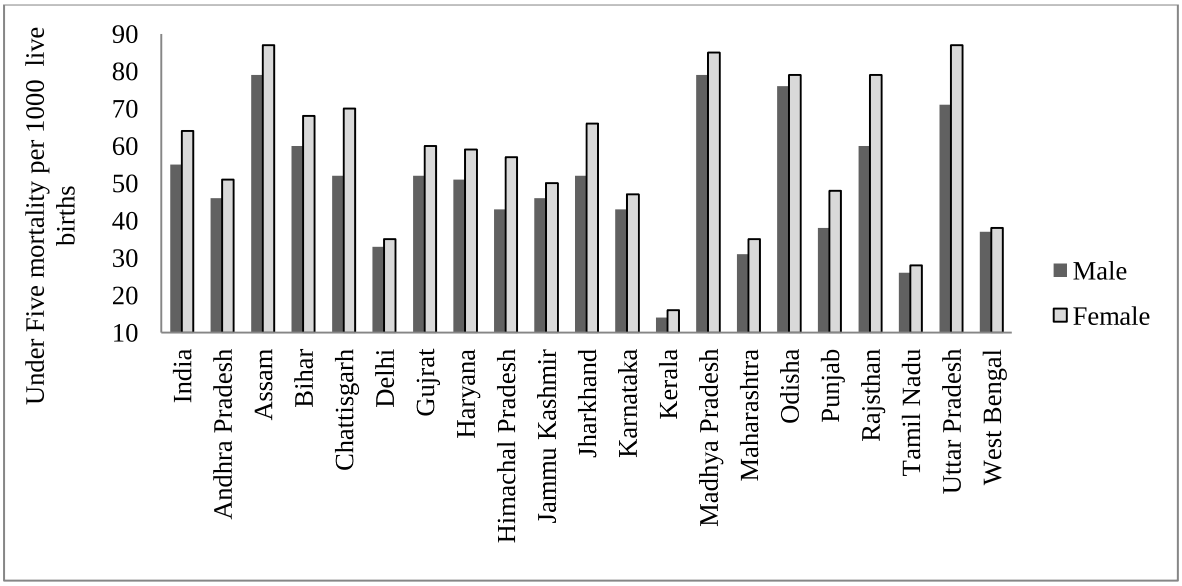

Figure 1. Under-five Mortality rates by sex of the children, India and states, 2010

Table 1. Trends in Child Mortality ($_4q_1$) by sex of the child in India and Major states, 1992-2006

States	NFHS-1 (1992-93)			NFHS-2 (1998-99)			NFHS-3 (2005-06)			D_1-D_3
	M	F	D_1 (F-M)	M	F	D_2 (F-M)	M	F	D_3 (F-M)	
Delhi	13.6	21.2	7.6	10.6	13.4	2.8	7.6	8.9	1.3	6.3
Haryana	18.4	43.2	24.8	13.8	30.2	16.4	10.4	21	10.6	14.2
Himachal Pradesh	17.6	25.3	7.7	9.0	9.3	0.3	5.0	4.2	-0.8	8.5
Punjab	12.7	23	10.3	5.9	23.8	17.9	6.0	15.5	9.5	0.8
Bihar	34.5	53.5	19	31.4	43.6	12.2	24.5	40.4	15.9	3.1
Madhya Pradesh	46.7	56.8	10.1	49.4	66.3	16.9	24.7	32.6	7.9	2.2
Rajasthan	26.5	42.2	15.7	29.4	52.3	22.9	18.5	26.2	7.7	8
Uttar Pradesh	38.5	65.6	27.1	28.8	53.4	24.6	21.7	43.2	21.5	5.6
Assam	52.9	59.6	6.7	21.4	16.9	-4.5	22.6	29.9	7.3	-0.6
Orissa	16.1	23.4	7.3	29.6	27.9	-1.7	31.1	26.5	-4.6	11.9
West Bengal	21.7	35.4	13.7	18.5	23.9	5.4	13.1	14.9	1.8	11.9
Gujarat	27.1	38.6	11.5	25.1	31.4	6.3	9.7	21.4	11.7	-0.2
Maharashtra	19.1	23.6	4.5	15.5	20	4.5	7.9	9.1	1.2	3.3
Andhra Pradesh	21.5	27.6	6.1	16.6	27.8	11.2	9.2	13.2	4	2.1
Karnataka	25.6	33.4	7.8	21.1	23.8	2.7	14.7	13.1	-1.6	9.4
Kerala	10	9.4	-0.6	6	4.5	-1.5	1.4	2.4	1	-1.6
Tamil Nadu	29	23.2	-5.8	12.7	15.8	3.1	4.9	10.5	5.6	-11.4
India	29.4	42	12.6	24.9	36.7	11.8	14.2	22.9	8.7	3.9

Table 2. Pyatt's Gini decomposition of Change In Male-Female Differential in Child Mortality in India during 1992-2006

Survival	**1992-93 (NFHS-1)**		**1998-99 (NFHS-2)**		**2005-06 (NFHS-3)**	
	Gini indices	**%**	**Gini indices**	**%**	**Gini indices**	**%**
Contribution from between inequality	0.004	0.99	0.004	1.02	0.001	.53
Contribution from Overlap	0.177	48.95	0.173	48.91	0.135	49.41
Contribution from within inequality	0.181	50.05	0.177	50.72	0.137	50.06
Total inequality	0.361	100	0.353	100	0.237	100

Note: figures might affected by rounding

Table 3. Oaxaca Decomposition: Contribution of Selected Predictors to Child Mortality Difference between Female and Male Children, India 2005-06.

Summary of Oaxaca decomposition		
	Coef.	Std.error
Female	0.14	0.0154
Male	0.09	0.0122
Difference	0.05	0.0196
Explained	0.04	0.0139
Unexplained	0.01	0.0141
% explained	81.95	-
% unexplained (residual)	18.05	-
Details of Explained part		
Predictors	% Contribution to total difference	Std.error
Mother's no education	0.73	0.0012
Mother's age (15 to 19 and 30+)	1.61	0.0008
Mother do not have mass media exposure	0.31	0.0014
Non Hindu Religion	0.22	0.0003
SCs/STs Caste	0.61	0.0006
Non institutional Place of delivery/ Home delivery	-1.39	0.0012
Poor household economic status	-0.07	0.0004
No ante natal care received	3.93	0.0013
>3 birth order	4.27	0.0017
<5 months breastfeeding	87.68	0.0036
Rural Place of residence	1.98	0.0010
<18.5 kg/m^2 Mother's body mass index	0.01	0.0001
Low birth weight	0.12	0.0003
Total explained part	100	