

EXTENDED ABSTRACT

Introduction

Under-five mortality rate (U5MR) has declined rapidly over the past 25 years in India. It reduced from 109 to 50 per 1,000 live births in NFHS -4. However, concern remains with India's geographical adverse child sex ratio (Census of India; 2011). Historically, a distorted child sex ratio constitutes the two-primary factor behind prenatal and postnatal discrimination against girls. It is therefore not surprising that the United Nation's sustainable development goals (SDG) declaration (2015) to ending all discrimination against women and girls is not only a fundamental human right, but it is also crucial for a sustainable future which was earlier laid out by the millennium development goals (MDG) to promote gender equality and empower women (UNDP; 2015). The excess female U5MR is continue observed in low -middle-income countries. ((et. El Arifeen, 2014), (Costa, Da Silva, & Victora, 2017), (Guilmoto, Saikia, Tamrakar, & Bora, 2018), (Bongaarts & Guilmoto, 2015)(Ram et al., 2013)). The ample scope to examine whether a reduction in U5MR is equal to reducing excess female deaths in India.

Since Amartya Sen's paper on missing women (1990), we can measure the extent of the resulting gap across studies (United Nations (1979, 1991), Coale (1991), Sen (1989), Klasen (1994b), and Bos et al. (1994)). United Nations Population Division (2012; Table-1) estimates are found missing women (0.2 million) in India. This figure significantly reflects the rise in not only sex-selective abortion but also the cumulative excess female mortality in the past. We find one confined research in this context compared to two approaches (prescriptive and descriptive) based on 60 Demography Health Survey in low -middle-income countries. The study suggested that the prescriptive approach more significant compared to the descriptive approach. There is two research study based in India. First is based on a descriptive approach using relative birth and mortality rate, about 74000 excess female deaths (Usha ram et al. 2013). Another one based on the prescriptive approach shows that 2.4 million girls die every year in India (Christophe et al., 2017). So, there here is ample scope to investigate the socio-economic pattern of excess female mortality in India.

India is vast in diverse cultural and geographical. The set of the study explained that Mother education have a significant association with reduced gender bias in under-five mortality in developing countries ((Monden & Smits, 2013), (Das, 2015),(Bourne, Walker, & Bournet, 1991),(Tulasidhar, 1993)). Evidence from literature younger women may have more exposure to child deaths. However, decrease birth order is the effect on excess female child deaths ((Helova, Hearld, & Budhwani, 2017),(Singh, Pathak, Chauhan, &

Pan, 2011)(Rose, 1999)(Kishor & Parasuraman, 1998)(Das Gupta, Bhat, & Das, 1997)). The household income and regional difference also exist in gender bias in U5MR((Costa et al., 2017)(Jain, Singh, & Pathak, 2013)(Lamichhane, Zhao, Paudel, & Adewuyi, 2017)(Houweling, Kunst, Huisman, & Mackenbach, 2007)(Kishor, 2006),(Dettrick, Jimenez-Soto, & Hodge, 2014)(Jose, 2003)).

Research in context

Evidence before this study

Existing literature suggests that developing countries like India still experience excess female under-5 mortality. Earlier, we have estimated the excess female under-5 mortality at the district level evidence from census 2011. However, the estimate does not show that the socio-economic pattern of excess female deaths under-age of five. We searched PubMed and Elsevier for published literature on excess female under-5 mortality rates in India. Google for reports in the public domain and references in these papers and reports, using the search terms, “missing women,” “excess female deaths,” “gender difference,” “under-five mortality,” “Millennium Development Goal,” “Sustainable Development Goal,” “gender equity” and “India” on July 2019, without language and or publication date restriction. We found two studies that state and However, a comprehensive understanding of the variation between the excess female deaths and socio-economic indicators.

Added-value of this study

This study builds on previous research by examining excess female under-five mortality association with socio-economic characteristics. Under-5 mortality by relying on Nationally representative data, using the past five years reference period, and examining excess female under-5 mortality trends in these associations over time. No study has an estimation of excess female under-five deaths with socio-economic characteristics in India. The uniqueness of this study is that the excess female under-5 mortality rate has an association of mother education, place of residence, wealth index, and birth order across the period in India.

The implication of all the available evidence

Our study finds that the excess female under-5 mortality is decreasing over the period in India. However, the socio-economic pattern distinguishes with low education of mothers, low wealth index, and rural areas with more excess female deaths under age five. Further, these findings appear to be birth order more than three associated with more excess female deaths under age five. Implications of these findings are that existing efforts to eliminate the sex ratio of under-five mortality and excess female mortality remain inadequate. Generally, social norm change focus on eliminating son preference is needed, as greater focus and effort for higher birth order in India.

Methods

Data Source

The data used in this study was taken from DHS, which is popularly known in India as the National Family Health Survey” (NFHS). The series from NFHS -1 (1992-93) and includes the recent round conducted in India in 2015-16 (NFHS-4), and like All the surveys, use a standard set of questions and similar indicators for comparison purposes. This study has used in the last five years of retrospective birth history information (112812, 100514, and 447592, respectively) to estimate the mortality rates. The NFHS -2 was purposely removed from the analysis as a change in policy and implication during this period. Noted that we had merged the sample for union territories into their nearby states, such as Andaman and Nicobar Islands and Puducherry merged into Tamil Nadu; Dadra and Nagar Haveli into Maharashtra; Daman and Diu into Gujarat; Lakshadweep into Kerala; and Chandigarh into Punjab. Chhattisgarh, Jharkhand, and Uttarakhand were merged with corresponding states Madhya Pradesh, Bihar, Uttar Pradesh in NFHS-1. It was comparable with NFHS-3 and NFHS-4. However, it was not possible to separate the state of Telangana from NFHS-3. Therefore, we merged with parent states Andhra Pradesh.

Estimation of under-five mortality rate

Synchrates approach used to estimate child mortality rates for five-year preceding surveys (Rutstein & Rojas, 2006). This synthetic cohort probability method introduced by Rojas applied in Demography Health Surveys (DHS) using all births in the last five years. This method low replicating mortality rates, which reported by Demography Health Surveys. The method changes the time interval over the 5, 10, or 15 years and allowed child mortality estimates at subgroups. In additional features provided by the STATA module

to calculated standard errors and 95% confidence interval bootstrap method and allowed test or difference between the social groups (gender, education, wealth, place of residence, and birth order).

Estimation of excess female mortality

In estimating the excess female under -5 mortality, we defined the excess female U5MR as the difference between observed and expected female U5MRs in India. The expected U5MR is calculated based on the existing relation between male and female U5MRs observed in countries without known gender discrimination in the same periods. The expected female U5MR calculated from a quadratic model on the relation between male U5MR (independent variable) female U5MR (dependent variable) in countries where observed no gender bias in under-5 mortality suggested by Prof. Christophe (2018).

3. Results

3.1 Trend in Excess Female under-5 mortality (EFU5MR) in India, NFHS (1992-2016)

The average level of excess female under-5 mortality was 20.6 per 1,000 live births (95% CI 19.9-21.3) in NFHS-1 (1992-93). The absolute number of excess female deaths 8.8 million (95 % CI 850448 - 913888) to the five-year reference period (1988-1992). Similarly, the rate of excess female deaths in NFHS -III (2005-06) is 20.8 per 1,000 live births (95% CI 19.6-22.0), and almost one-third of 2.4 million excess female deaths in absolute number. Substantial reduction observed after one decade shows that excess female deaths 5.8 per 1,000 live births (95 % CI 5.4-5.3) and more girls die 62126 (62975-61139) in NFHS -IV due to gender discrimination in India.

Table 2 Trend in excess female under-5 mortality rate (per 1000 live births) in India

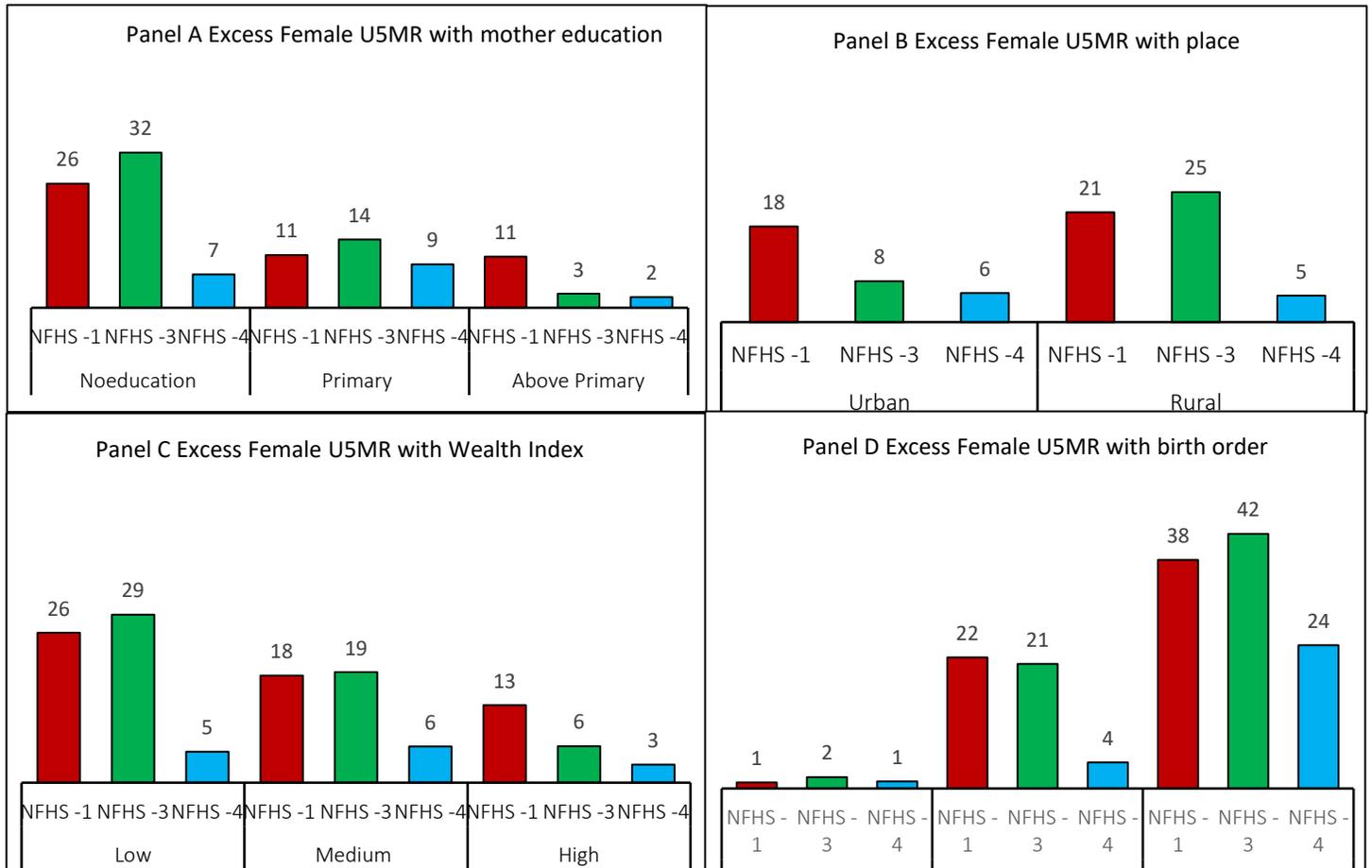
Survey	Reference Year	Excess female under-5 mortality per 1,000 live births (95% CI)	Annual number of female births per year	Excess female under-5 deaths per year (95 % CI)
NFHS 1	1988-1992	20.6 (19.9 - 21.3)	42818170	882482 (850448 - 913888)
NFHS 3	2001-2005	20.8 (19.6 - 22.0)	11832767	245344 (231248- 259349)
NFHS 4	2011-2015	5.8 (5.4 - 5.3)	11569120	62126 (62975 -61139)

3.2 Trend in Excess female under-5 mortality rate by socio-economic characteristics in India

Figure 1 presents the trend in the socio-economic and demographic pattern of excess female U5MR in the past 25 years in India. Female excess U5MR is the lowest in 2010-2016 across population subgroups. Irrespective of NFHS rounds, females belonging to mothers with higher primary education, living in an urban area, belonging to households with high wealth quintile, and with first birth order experienced the lowest excess deaths under age five. Another intriguing finding in figure 4 is that females belonging to more impoverished socio-economic strata have higher excess deaths in 2000-2006 compared to 1987-1993.

Females belonging to mothers without education usually suffer the highest excess deaths. However, a substantial reduction had been observed from 25.9 (24.7- 26.9) in 1987-1993 to 7.0 (6.5 -7.4) per 1000 live births in 2010-2016. While the minimal reduction in female excess U5MR has been seen among females belonging to mothers with primary education (11 vs. 9 per thousand live births), there has been more than five times reduction (11 vs. 2 per thousand live births) in excess female deaths among mothers having above primary education in the study period. Panel B in figure 4 shows three and four times reduction in excess U5MR in urban and rural India, respectively, between NFHS-1 and NFHS-4 results. Panel C further indicates that the reduction of excess females was the highest among females belonging to the low wealth quintile. Panel D also shows that there has been the least reduction in excess female deaths in the study period among the births of a higher order. The third or higher-order births experienced higher excess female deaths than the rest. Figure 5 presents a socio-economic and demographic pattern of excess female U5MR in high prevalent states in the most recent 2010-2016. Despite similar socioeconomic differences, the magnitude of the gap between social groups is higher among these states than at the national level.

Figure 1 Excess female U5MR by socio-economic and demographic characteristics in India



3.3 State disparity in excess female under-5 mortality in India

Figure 2 presents state variations in excess female U5MR in India, 1987-1993—2010-2016. In 1987-1993, 13 out of 19 states have experienced excess female deaths, more than 5 per 1000 live births. By 2010-2016, there has been a remarkable reduction in excess female U5MR in each state. There has been complete elimination of excess female under-five deaths in Andhra Pradesh, Gujarat, Himachal Pradesh, Karnataka, Kerala, Maharashtra, and Tamil Nadu. Nevertheless, the most populous north-central regions, including economically more affluent states (Haryana and Punjab), continue to experience excess deaths among young girls. In all rounds, we observe stark inter-state variation in excess female mortality rate. In general, excess female death rates are relatively higher in north-central and eastern states compared to the southern states.

Figure 2 state-level variation in excess female U5MR in India, 1987-2016

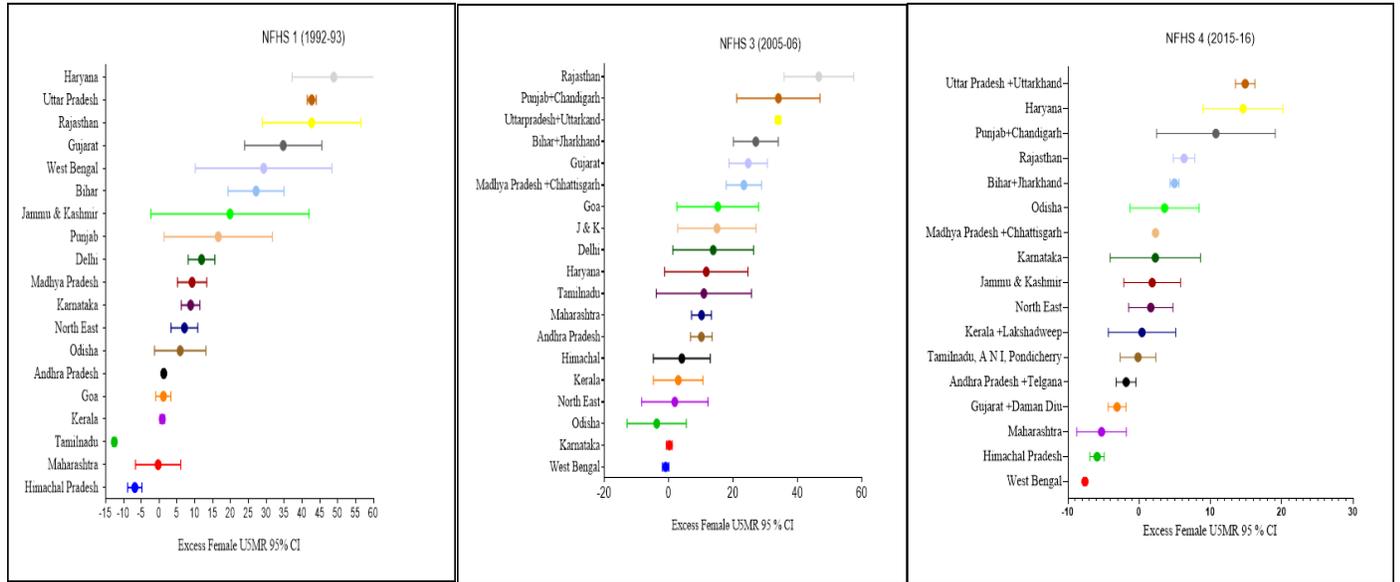


Figure 3 Relative share of the states to excess female deaths in India, 2000-2006 & 2010-2016

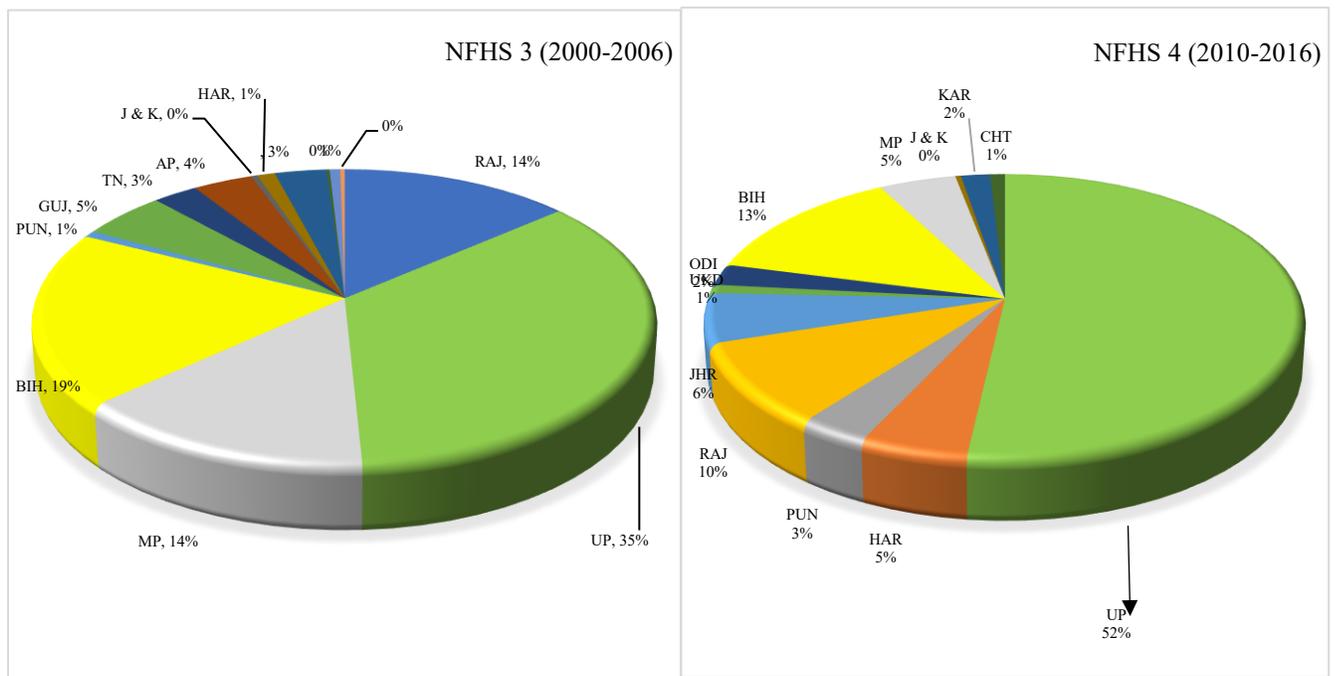


Figure 3 shows that the relative contribution of the states to excess female deaths in India. State with a high proportion of births and having a higher excess female mortality rate contribute more to the total excess female deaths. NFHS-3 data shows that the proportion contributed by Uttar Pradesh is the highest (37%), followed by Bihar (20%), Rajasthan (14%), Madhya Pradesh (15%), and Gujarat (5%). The remaining states contributed less than ten percent of excess female deaths. NFHS-4 results show that 75 percent of excess deaths are contributed by the three states alone, viz. Uttar Pradesh (52%), Bihar (13%), and Rajasthan (10%). The relative share of excess deaths by the states of Uttar Pradesh, Haryana, and Punjab has been increased between NFHS-3 and NFHS-4. In all remaining states, shares of excess female deaths have been reduced in this period.

Summary and Discussion

Our study provides trends and patterns of excess female U5MR in the last 25 years of NFHS across states in India. Northern states excess female U5MR ranging from 50 to 16 per 1,000 live births. However, the absolute number of excess female deaths contribute highest in Uttar Pradesh in NFHS -4 (2015-16). Contribution of excess female mortality decrease in India but still continuous contribution from Empowered Action Group states. However, the absolute number of excess female deaths still high in some of the parts of India. Despite the usefulness of birth histories, DHS surveys are subject to few data quality problems. One of the most commonly mentioned problems of DHS birth histories is the displacement of births. The omission of births is another constraint for birth histories and under-reporting of births. Therefore, examining the excess female deaths shows that improvement in the states that have begun with higher mortality rates shows signs of positive change; it may be possible to encourage more reversals of girls' survival in the future.