Is gender gap in childhood mortality disappeared in India? Trends over past 25 years

The effect of strong son preference and pervasive gender discrimination between boys & girl, on poor health and high mortality among girls than boys are widely researched in India. The recent good news is the decreasing gender gap in childhood mortality and even lower mortality among female and male children. Using data of four rounds of the National Family Health Survey conducted in India during 1992–2016, this paper examines the trends, socioeconomic, and north-south pattern of gender gap in childhood mortality (neonatal, postnatal, infant, child, and under-five mortality) rate. Adjusted mortality rates (per 1000 live births) are estimated using multivariate analyses. Gelbach's decomposition analysis is used to understand the factors contributing decreased gender gap in childhood mortality over time. Findings indicate that, the trend of excessive mortality among female than male children is first time turned around in 2015-16 – indicating lower under-five mortality rate among female (49) than male (54). This pattern is even evidenced among poor, rural, children of illiterate mothers, and even in north Indian patriarchal society. Increased educational level among mother, improved use of maternal and child health services, and promotional schemes are prime contributors to the decreased gender gap in the childhood mortality in India.

Background

The persistent and pervasive son preference in India results in discrimination against daughters and further disfavors the girl child from receiving proper nutrition, preventive care, treatment for illnesses and disease, the consequence of which is excess female mortality and poor health of girl children (Pande, 2003). Girls born in India have a 40% higher risk of ill-health as compared to boys and are less likely to access healthcare services including immunization (Fikree and Pasha, 2004; Filmer et al., 1998). Boys, however, are more likely than girls to die in the first month of life from perinatal conditions, such as birth asphyxia and birth trauma. Beyond these causes and contrary to the trends observed in most of the world; more girls than boys in India die due to acute respiratory, infectious & parasitic diseases, and viral infections (WHO, 2006; Kuntla et al., 2014).

In past one and half decades, Government of India (GOI) along with its state governments, implemented several programs, in order to bridge the gender gap in education, health, and wellbeing. These programs include *Balika Samridhi Yojana*, 1997; *Samagra Shiksha Abhiyan* (universal education mission), 2002; *Dhanalakshmi Yojana* (Cash Transfer Scheme for Girl Child) 2008, etc. All these programs meant to welcome newborn girl babies, promote their care and health, universal school enrollment, and providing schooling to certain level. Further, India's Prohibition of Child Marriage Act was revised in 2006 with stricter enforcement, with a fine of 100,000 Indian rupees ($1975 approx.) and two years in prison for parents caught trying to marry off their underage children. In nutshell, all these programs meant to eliminate prevalent gender discrimination in the society which had ill-impact on girls and women health and life-course.

While, previous data showed an excessive childhood mortality among female than male children, little is known about recent trends. One could expect that all these programmatic efforts might have translated into reducing childhood mortality among female children and hence narrowing down the gender gap in the mortality. The present paper attempts to provide evidence on gender gap in the childhood mortality with the most recent data available. Furthermore, this paper also generates such evidence across socioeconomic and regional layers as the average scenario may mask the pervasive differences across the sub-groups of population. Therefore, the present study, examines the trends in gender gap in childhood mortality at average level, across household wealth, mother's education, place of residence and regions of India for past 25 years.

Data and Methods

Data

This study used multi-waves cross sectional data of four successive rounds of the National Family Health Survey (NFHS) conducted in India during 1992–93, 1998–99, 2005–06, and 2015–16. The NFHS is similar to the Demographic and Health Survey (DHS) of other developing countries. The NFHS is a large scale and multi-round survey conducted in representative sample of households spanning across the states and union territories of India. The NFHS covered more than 99% of the India's population in each of the survey rounds. The main purpose of the NFHS is to provide reliable estimates on childhood mortality, fertility, family planning, utilization of maternal and child healthcare services, and childhood nutritional status in the country and state levels. The NFHS also provides these estimates by urban-rural residence.

The NFHS adopted similar sampling design in each of the four survey rounds. A two-stage sampling design was adopted in most of the rural areas – villages were selected at the first stage using probability proportional to size (PPS) sampling scheme followed by selection of households at the second stage using systematic sampling scheme. The sample in urban areas was selected in three stages. The first stage comprised of selection of urban wards using PPS sampling scheme. Census enumeration blocks (CEB) containing approximately 150-200 households were selected at the second stage. Households were selected at the third stage using systematic sampling scheme. The details of sampling design are given in the reports of the various rounds of NFHS (IIPS and ORC Macro, 1995, 2000; 2007; IIPS & ICF, 2017).

2.2 Measures

The outcome variable in this study is different childhood mortality rates, defined as follows:

(i) ***Neonatal mortality*** **–** The probability of dying within the first month of life.

(ii) ***Postneonatal mortality*** **–** The probability of dying between the first month of life and the first birthday (computed as the difference between infant and neonatal mortality).

(iii) ***Infant mortality*** **–** The probability of dying between birth and the first birthday.

(iv) ***Child mortality*** **–** The probability of dying between the first and fifth birthdays.

(v) ***Under-five mortality*** **–** The probability of dying between birth and the fifth birthday.

A unique feature of NFHS is that the survey collected detailed information on all births to women (in the age-group 15–49) interviewed in the respective samples. This detailed birth history provided us an opportunity to conduct the statistical analysis presented in the results section. We first collected information on births that took place in 10 years preceding the respective survey round. Then we excluded the births taken place in the last 1 year preceding the respective survey dates to remove the censored cases. All the outcome variables are binary variable (1 if died during infancy; 0 if survived during infancy).

2.3 Exposure variables

Several socio-economic and demographic variables which are empirically associated with childhood mortality rates are considered in the analysis while estimating mortality rates. These variables are birth order & preceding birth interval (first birth order; higher birth order and birth interval ≤ 24months; higher birth order and birth interval > 24 months), size of the new-born at birth (smaller than average; average; larger than average), mother's age at birth of the new-born (≤19 years, 20-29 years, and ≥30 years), maternal schooling (no schooling; 1-5 years of schooling; 6-12 years of schooling; >12 years of schooling), household wealth quintile (poorest; poorer; middle; rich; richest), medical assistance at delivery (yes; no), mother's exposure to media (yes; no), current working status of mother (yes; no) and geographic region of residence (north; east; central; northeast; west; south). The geographic regions were based on the regional classification of NFHS (IIPS and ORC Macro, 2007).

2.4 Statistical analysis

Different mortality rates were estimated among male and female children (0-6 years) for each round of the NFHS using the *syncmrates* command available in STATA 13.0. The mortality rates were estimated simply to give the levels and trends of childhood mortality over the survey periods.

Multivariate analysis is used to estimate the gender gap in adjusted childhood mortality rates by poorest and richest wealth quintiles, illiterates and highly educated mother (12+ years of schooling), rural and urban residence, and by selected north and south Indian states. The adjustment is made for the selected socio-economic and demographic characteristic. Since, all the outcome variables are binary, we used binary logistic regression analysis.

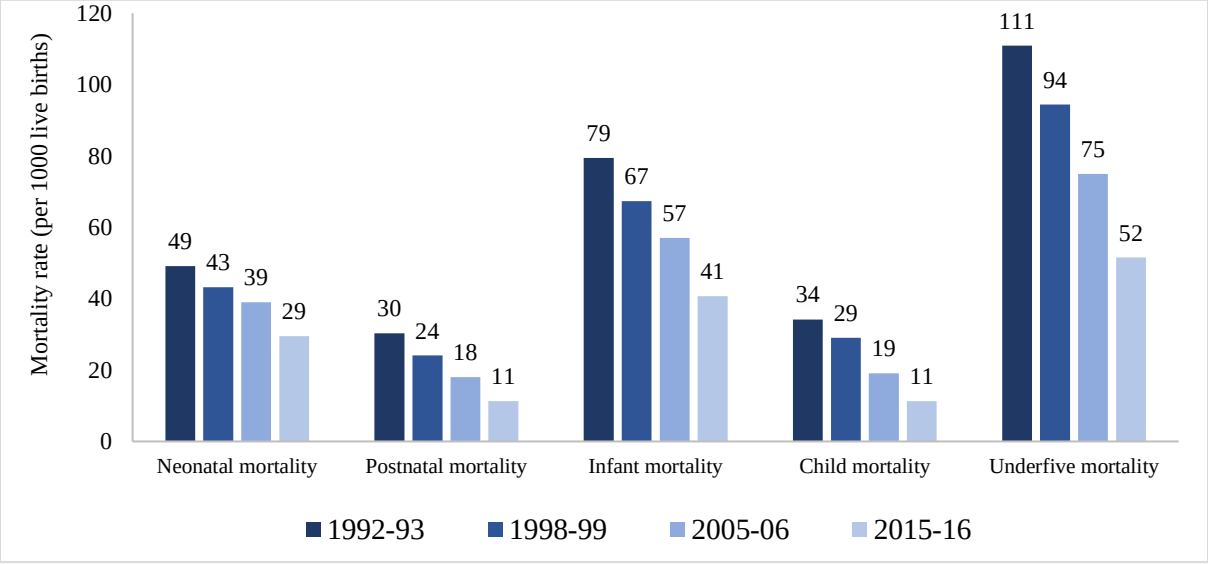
Decomposition analysis is used to understand that what contributed to the decreased gender gap in the mortality rates in past one decade i.e. between NFHS 2005–06 to NFHS 2015–16. Generally, Blinder–Oaxaca decomposition technique is used for the purpose. It is a commonly used approach to identify and quantify the factors associated with inter-group differences in mean level of an outcome (Blinder, 1973; Oaxaca, 1973). However, this technique is not appropriate if the outcome is binary in nature (Fairlie, 2005) – like in our case where the outcome is whether a child died or not. Hence, we used the Blinder–Oaxaca decomposition technique modified for binary outcomes to decompose the inter-group or temporal differences in the mean level of an outcome due to different observable characteristics or endowments across groups (Fairlie, 2005). Following the same logic, we decomposed the decline in the gender gap in childhood mortality rates between NFHS 2005–06 to NFHS 2015–16. All analyses were done using statistical software STATA 13.0.

Preliminary findings

Trends in childhood mortality in India

At aggregate level, India witnessed a decreasing trend in all the childhood mortality rates over past 25 years (Figure 1). For instance, infant mortality rate has decreased from 79 per 1000 live births in 1992-93 to 41 per 1000 live births in 2015-16. Similarly, under-five mortality rate has declined from 111 per 1000 live births in 1992-93 to 52 per 1000 live births in 2015-16.

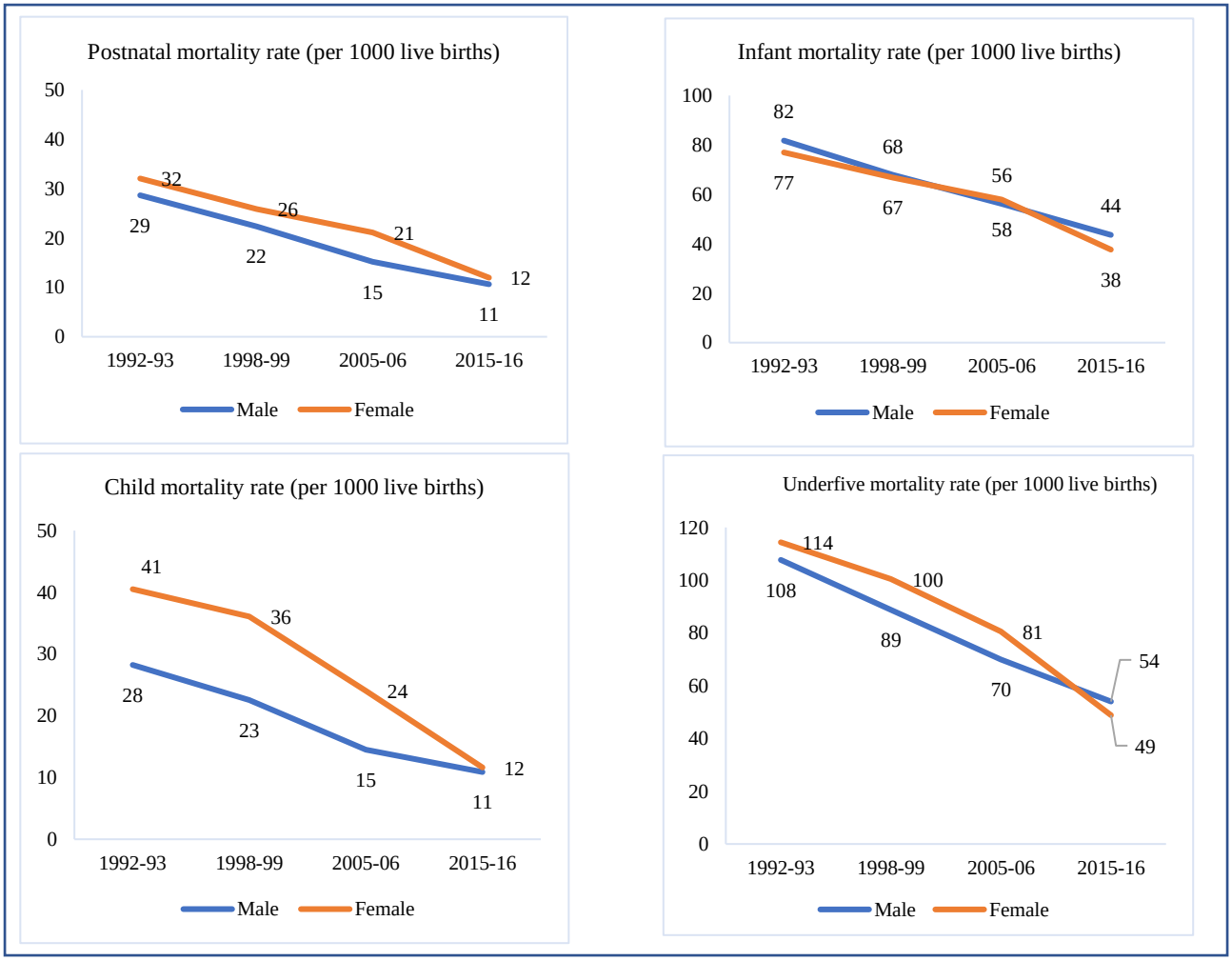
Figure 1. Trends in childhood mortality (per 1000 live births) rate in India, 1992-2016



Trends in gender gap in mortality rates

Results presented in Figure 2 clearly suggest a decreasing gap in childhood mortality rates mortality rates between male and female children (Figure 2). For instance, child mortality rate among female vs. male children was 41 vs. 28 per 1000 live births respectively in 1992-93, with an excessive mortality of 13 per 1000 live births among female children. This rate has decreased to 12 per 1000 live births among female and 11 per 1000 live births among male children in 2015-16 with an excessive mortality of 1 per 1000 live births among female children. While looking the gender gap in under-five mortality rates, it was 81 per 1000 live births among female vs. 108 per 1000 live births among male children in 2005-06 with an excessive mortality rate of 11 per 1000 live births among female children. This has decreased to 49 per 1000 live births among female and 54 per 1000 live births among male in 2015-16, with a remarkable and first time lower mortality rate of 5 per 1000 live births among female than male children.

Figure 2. Trends in childhood mortality rates among male and female children in India, 1992-2016



Gender gap also declined among least affluent population

The decreased gender gap is also witnessed across socioeconomically poor population as well (Figure 3, 4, 5). For instance, among children of poorest quintiles, the under-five mortality rate was 151 per 1000 live births among female and 36 per 1000 live births among male children in 1992-93, leading to an excessive mortality rate of 15 per 1000 live births among female children. This has declined to 72 per 1000 live births among female children and 76 per 1000 live births among male children in 2015-16, with an excessive mortality among male children. A similar trend is observed among children of illiterate mother and belonging to rural area. For instance, in rural area, under-five mortality rate was 90 per 1000 live births among female and 76 per 1000 live births among male children in 2005-06, which is decreased to 54 per 1000 live births among female children and 60 per 1000 live births among male children in 2015-16. Among affluent population i.e. among children of richest wealth quintiles, urban areas, and belonged to mothers with more than 12 years of schooling, the gender gap in mortality rates either remained minimal over time, or the mortality rate was lower among female than male children.

Figure 3. Trends in gender gap in underfive mortality rate (per 1000 live births) among poorest and richest quintile children in India, 1992-2016

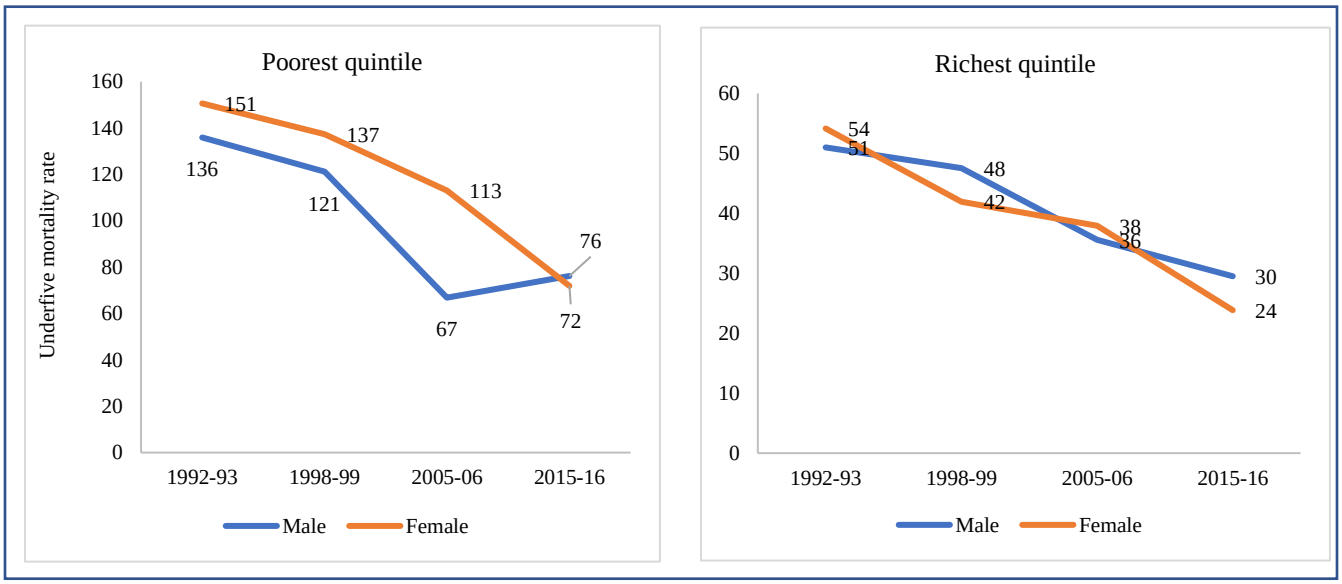


Figure 4. Trends in gender gap in underfive mortality rate (per 1000 live births) among children of illiterate and highly educated (12+ years of schooling) mothers in India, 1992-2016

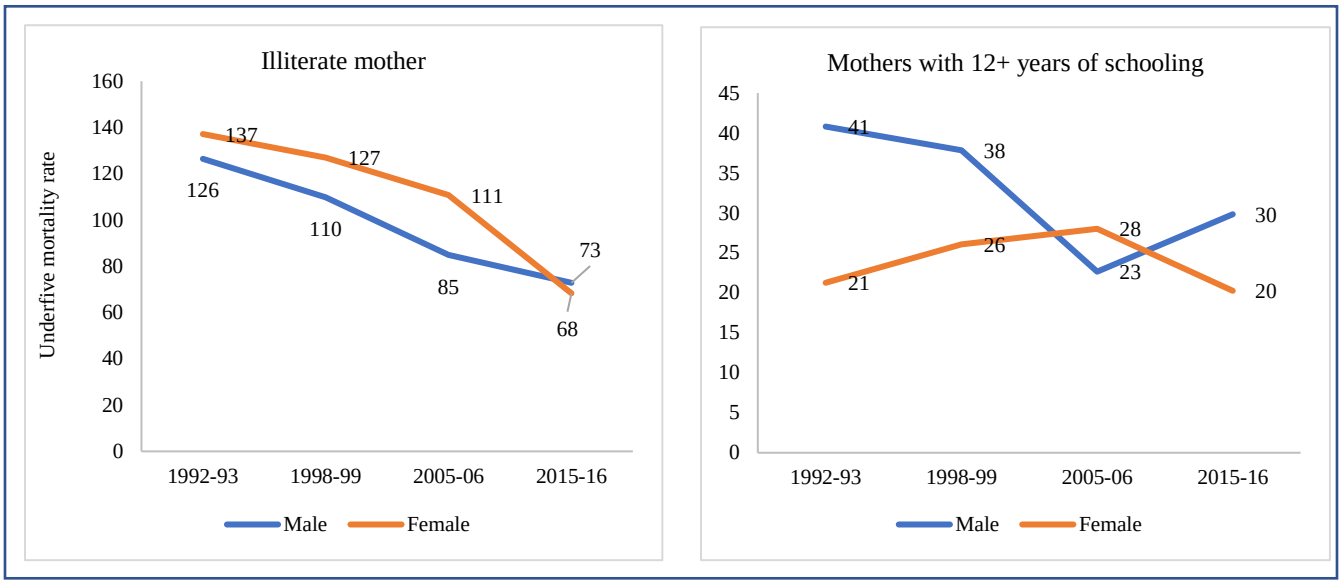
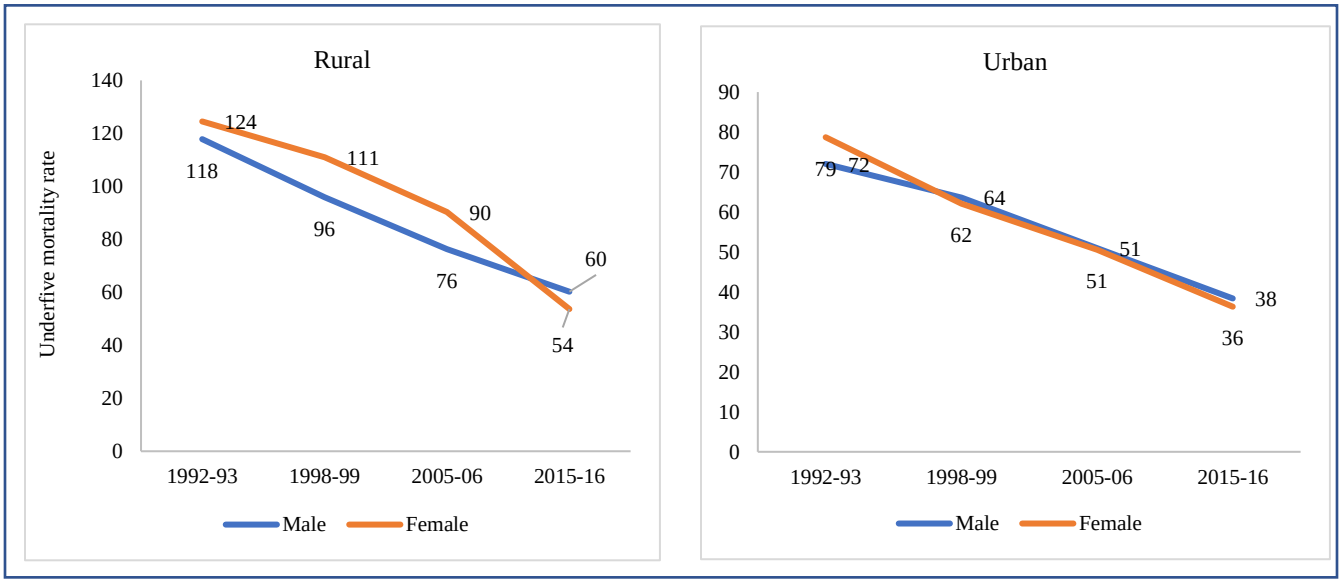


Figure 5. Trends in gender gap in underfive mortality rate (per 1000 live births) among rural and urban children in India, 1992-2016



Gender gap also reduced across patriarchal society of north India

The decreased gender gap in the childhood mortality rate is not only evidenced India as a whole, but also across the regions of the country as well (Table 1). For instance, in a north Indian state i.e. Uttar Pradesh – which is most populous state of the country – where societies are historically

patriarchal, recent evidence suggests a sharp decline in excessive child and under-five mortality rate among female than male children. For instance, in 2005-06, the excessive child mortality rate among female children was 33 per 1000 live births, which has reduced to 6 per 1000 live births in 2015-16. Similarly, the excessive female under-five mortality rate has reduced from 25 per 1000 live births in 2005-06 to 3 per 1000 live births in 2015-16. A southern Indian state, which has matriarchal society, witnesses minimum gender gap in childhood mortality rate since beginning. Moreover, at some point of time, the mortality rate was even much higher among male than female children.

Table 1. Trends in childhood mortality (per 1000 live births) rate – among male and female children across selected states of India, 1992-2016

	Uttar Pradesh			Tamil Nadu		
	Male	**Female**	**(Female-Male)**	**Male**	**Female**	**(Female-Male)**
Neonatal mortality						
1992-93	61.5	59.4	–2.1	56.6	36.1	–20.5
1998-99	57.8	52.1	–5.7	30.9	38.9	8.0
2005-06	49.6	45.5	–4.1	18.9	19.6	0.7
2015-16	49.3	40.8	–8.5	15.0	13.4	–1.7
Postnatal mortality						
1992-93	39.7	42.1	2.5	23.3	20.7	–2.7
1998-99	29.8	38.7	8.9	12.4	14.3	1.9
2005-06	21.1	29.6	8.5	8.5	16.7	8.2
2015-16	15.5	21.8	6.3	6.5	4.9	–1.6
Infant mortality						
1992-93	101.1	101.5	0.4	79.9	56.7	–23.1
1998-99	87.7	90.8	3.2	43.3	53.2	9.9
2005-06	70.7	75.1	4.4	27.4	36.3	8.9
2015-16	64.8	62.6	–2.3	21.6	18.3	–3.2
Child mortality						
1992-93	34.6	60.6	26.0	26.7	13.3	–13.4
1998-99	24.9	56.5	31.5	14.9	17.0	2.1
2005-06	13.7	47.2	33.5	14.5	13.7	–0.8
2015-16	13.9	19.4	5.6	32.2	17.7	–14.5
Underfive mortality						
1992-93	132.2	155.9	23.7	104.5	69.3	–35.2
1998-99	110.4	142.2	31.8	57.5	69.3	11.8
2005-06	83.4	118.7	35.3	31.8	49.5	17.7
2015-16	77.8	80.8	3.0	53.1	35.7	–17.4

What contributed to the decreased gender gap in childhood mortality rates in India

Findings reported above, clearly suggest a decreasing gap in childhood mortality rates between male and female children. There may be several factors that might have contributed to such

decline, including increased use of child healthcare services, diminishing son preference, a wider exposure to media, and increased education level among women etc. To quantify the contribution of factors explaining the decreased gender gap in the childhood mortality rates in the past decade, we conducted Fairlie's regression decomposition analysis. The analysis is restricted for India only. In India, increased education among mothers/women (12+ years of schooling) has contributed more than 60 percent of the decreased gender gap in childhood mortality over the past decade, followed by improved household wealth, and greater utilization of child healthcare services such as vaccination and increased treatment of diarrhea, pneumonia, vaccination etc. (result not shown).

Discussion

While India is notoriously known for gender discrimination and hence resulting poor health and excessive childhood mortality among female than male children since decades, the recent evidence comes with the good news of decreased gender gap in the childhood mortality. Using all four rounds of the National Family Health Survey conducted during 1992-2016, this paper attempts to examine the trends, socioeconomic & regional pattern of gender gap in childhood mortality. Using the decomposition analysis, this paper further examined the factors contributed in the decreased gender gap in childhood mortality in the past decade.

Our findings indeed indicate that the first time, the trend of excessive mortality among female than male children is turned around in 2015-16, with lower under-five mortality rate among female than male children. This pattern is even evidenced among poor and rural children, and children of illiterate mothers. Even among these less affluent population sub-groups, currently the mortality rate among female children is lower than the male children. While there may be chance that the average phenomena can mask the regional variations. Therefore, we also examined the trend across two Indian states – Uttar Pradesh and Tamil Nadu. While Uttar Pradesh – least developed and most populous state – represents typical patriarchal society of north India where gender discrimination and son preference is pervasive; the other hand Tamil Nadu is characterized with a contrary situation and represents the typical southern Indian society. Our finding clearly indicates that even in Uttar Pradesh, the gender gap in childhood mortality has reduced sharply and almost negligible currently.

There may be several factors associated with the decline in gender gap in childhood mortality ranging from decreased urged of prevailing son preference, increased awareness among women, better child healthcare, and several governmental programs for promoting girls' health, education etc. However, due to restricted information available in the data sets, our decomposition analysis clearly shows that the sharp decline in the gender gap over past 10 years is result of increased women's education (12+ more years of schooling), increased childhood vaccination, child healthcare etc. Apart from that, the several central and state governments programs such as *Balika Samridhi Yojana*, 1997; *Samagra Shiksha Abhiyan* (universal education mission), 2002; *Dhanalakshmi Yojana* (Cash Transfer Scheme for Girl Child) 2008, etc. might have contributed in this decline. These programs were meant to promoting birth of baby girl, their schooling, hence breaking the stereotype son preference in the country.

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Appendix 1. Trends in childhood mortality rate (per 1000 live births) between male and female across selected socioeconomic characteristics in India, 1992-2016

	Poorest wealth quintile			Richest wealth quintile			Illiterate mother			Highly educated® mother			Rural residence			Urban residence		
	M	**F**	**(F-M)**	**M**	**F**	**(F-M)**	**M**	**F**	**(F-M)**	**M**	**F**	**(F-M)**	**M**	**F**	**(F-M)**	**M**	**F**	**(F-M)**
Neonatal mortality																		
1992-93	58	52	–6	31	22	–9	60	52	–9	35	13	–22	57	49	–8	38	30	–8
1998-99	55	46	–9	30	22	–8	52	50	–2	27	17	–10	49	44	–4	34	28	–6
2005-06	41	44	2	24	23	–2	47	44	–3	15	16	1	44	41	–3	33	23	–10
2015-16	47	36	–11	17	15	–2	43	31	–12	17	15	–2	37	29	–8	22	18	–4
Postnatal mortality																		
1992-93	36	46	9	13	18	5	34	38	5	5	6	0	31	34	3	21	24	3
1998-99	33	38	5	10	9	–1	29	33	4	6	5	–1	24	29	5	17	14	–3
2005-06	14	28	14	7	10	3	20	29	10	6	5	–1	17	23	6	10	16	5
2015-16	15	17	2	5	6	0	16	17	2	6	4	–2	12	13	1	7	9	2
Infant mortality																		
1992-93	94	97	3	44	40	–4	94	90	–4	40	18	–22	88	84	–5	58	54	–4
1998-99	88	84	–4	40	31	–9	81	83	2	33	22	–11	73	74	1	51	42	–9
2005-06	55	71	16	31	33	2	67	73	7	21	20	0	61	64	3	43	39	–4
2015-16	62	53	-9	22	20	–2	59	48	–10	23	18	–4	49	42	–7	30	27	–2
Child mortality																		
1992-93	46	59	13	8	15	7	35	52	16	1	3	2	32	45	12	15	26	11
1998-99	37	58	22	8	11	4	31	48	17	5	4	–1	25	40	15	13	21	8
2005-06	13	45	33	4	5	1	20	41	21	2	8	6	17	28	11	8	12	4
2015-16	15	20	5	7	3	–4	15	21	6	7	2	–6	12	13	1	9	9	0
Underfive mortality																		
1992-93	136	151	15	51	54	3	126	137	11	41	21	–20	118	124	7	72	79	7
1998-99	121	137	16	48	42	–6	110	127	17	38	26	–12	96	111	15	64	62	–1
2005-06	67	113	46	36	38	2	85	111	26	23	28	5	76	90	14	51	51	0
2015-16	76	72	–4	30	24	–6	73	68	–5	30	20	–10	60	54	–7	38	36	–2

M – Male; F – Female; ®highly educated represents mothers received 12+ years of schooling