State-wise pattern of gender bias in child health in India

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STATE-WISE PATTERN OF GENDER BIAS IN CHILD HEALTH IN INDIA

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Abstract: Health being one of the most basic capabilities, the removal of gender bias in child health can go a long way in achieving gender parity in various dimensions of human development. The present study examines the state-wise pattern of gender bias in child health in India. It uses 21 selected indicators of health outcome (e.g., post-neonatal death, child death and prevalence of malnutrition) and health-seeking behaviour (e.g., full immunisation, oral rehydration therapy, fever/ cough treatment and breast-feeding). Three rounds of unit level National Family Health Survey data are analysed using Borda Rule and Principal Component Analysis techniques. Children under age three years are the unit of the analysis. The study found that any consistently robust state-wise pattern of gender bias against girl children in child health is not present among all the 29 Indian states over the three rounds of NFHS. Among the major 19 states, there is high gender bias in three Empowered Action Group of states (namely, Uttar Pradesh, Madhya Pradesh, and Bihar) and in Andhra Pradesh, Punjab, and Gujarat as well. However, there is a consistent state-wise pattern in girl children's health achievement. With Rawlsian theory of justice, to reduce gender bias in child health we need to focus on the states with low health achievement by girls.

[Keywords: Gender Bias; Child Health; National Family Health Survey; India]

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1. INTRODUCTION:

Advancement of health care services is of utmost importance for its *intrinsic* value. The provision of public health is a basic human right and a crucial *merit* good. With the inception of the *Human Development Index* (HDI), the *Human Poverty Index* (HPI), and the *Gender-related Development Index* (GDI) by the *United Nations Development Programme* (UNDP), governments are required to redefine development. Universal access to health together with safe drinking water, sanitation, nutrition, basic education, information and employment are essential to balanced development. If India, like China, is to glean the gains of a demographic dividend and become an economic superpower by 2030, it will have to guarantee that her people are healthy, live long, generate wealth and, dodge the tag of a 'high risk country'.

Since the *Bhore Committee Report* (GoI 1946) and the *Constitution of India*, the Government of India (GoI) has corroborated many times its aim of advancing the average health of its citizens, reducing inequalities in health and, fostering financial access to health care, particularly for the most destitute. In the *Directive Principles of State Policy* of the Constitution of India, Articles 38 (2) and 41 stress the need for equitable access and assistance to the sick and the underserved, right to employment and education, while Article 47 stresses on improving nutrition, the standard of living and, public health. Article 39 and Article 45 directs for gender equality and protection of children rights including education (Bakshi 2006: 84-91). A World Bank report on gender and development begins with the statement: 'Large gender disparities in basic human rights, in resources and economic opportunity…are pervasive around the world… these disparities are inextricably linked to poverty' (World Bank 2001).

The dual causality between health and wealth is well documented. Health and mortality status of infants and gender bias in health are 'synoptic indicators' of a society's present condition. A study of gender bias with reference to child health is relevant as an area of research in its own right since children are helpless and solely depend on the social setting in which they are born. Health being one of the most basic capabilities, removal of gender bias in child health can go a long way in achieving gender parity in many other dimensions of human development. Gender-specific health policies would make women more independent and empowered and, thus achieve some of the goals laid by *Millennium Development Declaration* (declared in September 2000 by 189 countries).

2. BACKGROUND AND HYPOTHESES

Let us start with a theoretical background of gender bias. Biologically women tend to have a lower mortality rate than men at nearly all age groups, *ceteris paribus* (Sen 1998: 11). But, owing to the gender bias against women in many parts of the world, women receive less attention and care than men do, and particularly girls often receive far lesser support as compared to boys. As a consequence, mortality rates of females often exceed those of males (Bairagi 1986; Caldwell and Caldwell 1990; D'Souza and Chen 1980; Faisel, Ahmed and Kundi 1993; Koenig and D'Souza 1986; IIPS 1995; Pande 2003; Sen 1998). Gender discrimination prevails regardless of the realisation that prejudice in morbidity, nutritional status, or use of health care will probably contribute to greater gender bias in mortality (Arnold et al 1998; Bardhan 1974, 1982; Doyal 2005: 10; Kishor 1993, 1995; Kurz and Johnson-Welch 1997; Makinson 1994; Miller 1981; Obermeyer and Cardenas 1997; Waldron 1987).

Gender bias, even when it is not disastrous, may still generate greater debility among surviving girls and its effect may be perpetuated over generations (Merchant and Kurz 1992; Mosley and Becker 1991; Mosley and Chen 1984; Pande 2003; Sen 1998). If the 'Barker thesis' (i.e., fetal origin of adult diseases hypothesis) (Barker 1993, 1995) is true, there is a possibility of a causal connection 'that goes from nutritional neglect of women to maternal undernourishment, and from there to fetal growth retardation and underweight babies, thence to greater child undernourishment' and to a higher incidence of permanent disadvantages in health much later in adult life (Sen 2005: 248; Osmani and Sen 2003). 'What begins as a neglect of the interests of women ends up causing adversities in the health and survival of all—even at advanced ages' (Sen 2005: 248). Thus, gender bias not only hurts women, but inflicts a heavy economic cost on the society by harming the health of all, including that of men (Osmani and Sen 2003). Gender bias can be a blend of 'active' bias (*e.g.*, 'intentional choice to provide health care to a sick boy but not to a sick girl'), 'passive' neglect (*e.g.*, 'discovering that a girl is sick later than that would be the case for a boy, simply because girls may be more neglected in day-to-day interactions than are boys'), and 'selective favouritism' ('choices made by resource-constrained families that favour those children that the family can ill afford to lose') (Pande 2003).

Women in India face discrimination in terms of social, economic and political opportunities because of their inferior status. Gender bias prevails in terms of allocation of food, preventive and curative health care, education, work and wages and, fertility choice (Arokiasamy 2004: 835; Miller 1997; Pande et al 2003; Pandey et al 2002). A large body of literature suggests preference to son and low status of women are the two important factors contributing to the gender bias against women. The patriarchal intra-familial economic structure coupled with the perceived cultural, religious and economic utility of boys over girls based on cultural norms have been suggested as the original determining factors behind the degree of son preference and the inferior status of women across the regions of India (Arokiasamy 2004: 836; Pande 2003). Daughters are considered as a net drain on parental resources in patrilineal and patrilocal communities (Dasgupta 2000). Intra-household gender discrimination has primary origins not in parental preference for boys but in higher returns to parents from investment in sons (Hazarika 2000).

On an empirical note, preference to sons in India has endured for centuries. The 1901 census noted 'there is no doubt that, as a rule, she (a girl) receives less attention than would be bestowed upon a son. She is less warmly clad, … she is probably not so well fed as a boy would be, and when ill, her parents are not likely to make the same strenuous efforts to ensure her recovery' (1901 census, quoted in Miller 1981: 67). Population sex ratios from censuses almost steadily stepped up, from 1030 males per 1000 females in 1901 to 1072 males per 1000 females in 2001 (Census 2001; Desai 1994; Visaria 1967, 1969; Visaria and Visaria 1983, 1995). Due to unequal treatment of women, India now has the largest share of 'missing women' in the world (Klasen et al 2001). 'A strong preference for sons has been found to be pervasive in Indian society, affecting both attitudes and behaviour with respect to children and the choice regarding number and sex composition of children (Arnold et al 1998, 2002; Arokiasamy 2002; Bhat et al 2003; Clark 2000; Das Gupta et al 2003; Mishra et al 2004; Pande et al 2007)' (IIPS 2007: 103). Son preference is an obstructing factor for maternal and child health care utilisation (Choi et al 2006; Li 2004).

Existing empirical literature on inter-state (or regional) pattern of gender bias suggests that boys are much more likely than girls to be taken to a health facility when sick in both north and south India (Caldwell, Reddy and Caldwell 1982; Caldwell and Caldwell 1990; Das Gupta 1987; Ganatra and Hirve 1994; Govindaswamy and Ramesh 1996; Kishor 1995; Murthi *et al* 1995; Ravindran 1986; Visaria 1988). Girls are more likely to be malnourished than boys in both northern and southern states (Arnold et al 1998; Basu 1989; Caldwell and Caldwell 1990; Das Gupta 1987; Osmani and Sen 2003; Pebley and Amin 1991; Sen and

Sengupta 1983; Wadley 1993). 'The states with strong anti-female bias include rich ones (Punjab and Haryana) as well as poor (Madhya Pradesh and Uttar Pradesh), and fast-growing states (Gujarat and Maharashtra) as well as growth-failures (Bihar and Uttar Pradesh)' (Sen 2005: 230).

Gender bias in child health prevails even today when India is *shining* or *Bharat Nirman* is going on. 'For India the infant mortality rate is marginally higher for females (58) than for males (56). However, in the neonatal period, like elsewhere, mortality in India is lower for females (37) than for males (41). As children get older, females are exposed to higher mortality than males. Females have a 36 percent higher mortality than males in the post-neonatal period, and a 61 percent higher mortality than males at age 1-4 years.' (IIPS 2007: 183). 'Boys (45 percent) are slightly more likely than girls (42 percent) to be fully vaccinated. Boys are also somewhat more likely than girls to receive each of the individual vaccinations.' (IIPS 2007: 230). Among the children under age 5 years with symptoms of acute respiratory infection (ARI), treatment was sought from a health facility or provider for 72 percent of the boys but 66 percent of the girls (IIPS 2007: 235). Among the children under age 5 years with fever, treatment was sought from a health facility or provider for 73 percent of the boys but 68 percent of the girls (IIPS 2007: 237). Boys are also (seven percent) more likely than girls to be taken to a health facility for treatment in case of diarrhoea (IIPS 2007: 242). Among children under five years, girls are three percent more likely to be underweight than boys (IIPS 2007: 270). Among the last-born children, boys are 11 percent more exclusively breastfed than girls (IIPS 2007: 281). For the children age 6-59 months, girls are more anaemic than boys (IIPS 2007: 289).

The above discussion provides ample evidence of gender bias in child health indicators that ultimately transforms to gender imbalance in many other dimensions of human development. Thus, this paper attempts to answer the following questions. First, is there evidence of gender bias in the selected indicators of health outcome and health seeking behaviour of children? Second, if gender bias is there, what is the state-wise pattern of gender bias in child health in India? Third, has this state-wise pattern of gender bias remained unchanged over the study period of almost one-and-a-half decades? If we can identify the pattern of gender bias, it is possible to focus on those particular states to reduce and remove gender bias.

3. DATA AND METHODOLOGY:

The present study uses data from *National Family Health Survey* (NFHS)-III (2005-06), NFHS-II (1998-99), and NFHS-I (1992-93). 'NFHS-III collected information from a nationally representative sample of 109,041 households, 124,385 women age 15-49, and 74,369 men age 15-54. The NFHS-III sample covered 99 percent of India's population living in all 29 states' (IIPS 2007: xxix). 'The NFHS-II survey covered a representative sample of more than 90,000 eligible women age 15-49 from 26 states that comprise more than 99 percent of India's population' (IIPS 2000: xiii). The NFHS-I survey covered a representative sample of 89,777 ever-married women age 13-49 from 24 states and the National Capital Territory of Delhi, which comprise 99 percent of the total population of India (IIPS 1995: xix). It is worth to noting that NFHS-II (1998-99), the second round of the series, is regarded as 'storehouse of demographic and health data in India' (Rajan et al 2004).

Children under age three years are the unit of the present analysis, which uses the children's recoded data-files. The selected 21 indicators of health-seeking behaviour and health outcome are: for childhood immunisation—A: childhood full vaccination; for diarrhea—B: childhood diarrhea with 'no treatment', C: childhood diarrhea with 'medical treatment', D: childhood diarrhea with 'given ORS'; for breastfeeding—E: childhood breastfeeding with 'never breastfed', F: childhood breastfeeding with 'less than six months breastfed', G: childhood breastfeeding with 'at least six months breastfed', H: childhood breastfeeding with 'currently breastfeeding', I: childhood breastfeeding with 'exclusively breastfed for first six months'; for malnutrition—J: severely stunted (height-for-age, -3 SD), K: stunted (height-for-age, -2 SD), L: severely underweight (weight-for-age, -3 SD), M: underweight (weight-for-age, -2 SD), N: severely wasted (weight-for-height, -3 SD), O: wasted (weight-for-height, -2 SD); for fever/ cough—P: childhood fever/ cough with ‘received no treatment’, Q: childhood fever/ cough with ‘received medical treatment’, R: childhood fever/ cough with ‘received medical treatment in public health facility’, S: childhood fever/ cough with ‘received medical treatment in private health facility’; and for mortality—T: post-neonatal death, U: child death. Total number of observations for all India for all the indicators is presented in table-1.

State-wise gender gap for all the indicators are calculated using the following formula: $\text{Gender Gap} = \frac{\text{rate}_{\text{boy}} - \text{rate}_{\text{girl}}}{\text{rate}_{\text{girl}}} \times 100$ [1].

In multivariate analysis, a problem arises with considerable number of correlated variables even though each variable may constitute a different dimension in a multidimensional hyperspace. As the multidimensional hyperspace is quite difficult to think about, social scientists often use some tool to reduce dimensions.

The 21 dimensions were reduced by some ordinal measure. As an ordinal aggregator, the study used the well-known Borda rule (named after Jean-Charles de Borda who devised it in 1770). The rule gives a method of rank-order scoring, the method being to award each state a point equal to its rank in each indicator (A-U) of ranking, adding each

[1] This measure of gender gap is the relative gap between boy and girl minus one and then taken in per cent (used in Pande 2003: 403). Such a measure captures both the levels of coverage and gender equality. The value of gender gap decreases as coverage rates increase for both boys and girls with same absolute gap between them and it decreases as coverage rates increases for both boys and girls with lower absolute gap between them. A gender-equity-sensitive indicator (GESI) would have been a better measure though the choice of degree of inequality aversion equal to two is questionable.

state's scores to obtain its aggregate score, and then ranking states on the basis of their aggregate scores (Dasgupta 1995: 109-16), separately for each round of NFHS.

To check robustness of the results the study also uses Principal Component Analysis (PCA) technique as a second tool to reduce dimensions. PCA reduces a large set of variables to a much smaller set that still contains most of the information about the large set. It reduces the variation in a correlated multi-dimension to a set of uncorrelated components. Principal components are estimated from the Eigen vectors of the covariance or correlation matrix of the original variables. Eigen vectors provide the weights to compute the principal components whereas Eigen values measure the amount of variation explained by each principal component. Thus, the objective of PCA is to achieve parsimony and reduce dimensionality by extracting the smallest number of principal components that account for most of the variation in the original data without much loss of information (Chowdhury 2004: 40). Principal components (defined as a normalised linear combination of the original variables) are constructed from the 21 indicators. Then a composite index is constructed as a weighted average of the principal components or factors, where the weights are (Eigen value of the corresponding principal component)/ (sum of all Eigen values) (Kumar et al 2007: 107-9). On the basis of the values of the composite index all the states are ranked in ascending order separately for each round of NFHS.

4. ANALYSIS AND RESULTS:

Childhood full vaccination rate is calculated as the percentage among the living children age 12-23 months who received all six specific vaccinations (BCG, measles and, three doses each of DPT and Polio (excluding Polio 0[2])) at any time before the interview (from 'either

[2] Polio 0 is administered at birth along with BCG.

source'[3]) for boy and girl children separately for each state. Then gender gap is calculated using the formula mentioned earlier. State-wise gender gap in full immunisation is shown in figure-1.

Childhood diarrhea rates are calculated as percentage among the living children age 1-35 months who had diarrhea in the last two weeks before the interview for boy and girl children separately for each state. For all three indicators of diarrhea (B, C, and D), state-wise gender gap is presented in figures-2, 3 and 4.

Childhood breastfeeding rates (E, F, G, H, and I) are calculated as percentage among the living children age less than three years for boy and girl children separately for each state. State-wise gender gaps in childhood breastfeeding for all these five indicators are shown in figures-5-9. In the exclusively breastfed for first six months category (I), only the living children below six months who are currently breastfed and not having any of the following: plain water, powder/ tinned milk, fresh milk, other liquids, green leafy vegetables, fruits, solid & semi-solid foods are considered.

Childhood malnutrition rates (J, K, L, M, N, and O) are calculated as percentage among the living children age less than three years who are below -3 or -2 standard deviation from the international reference population median for boy and girl children separately for each state. Gender gap in childhood malnutrition is shown in figures-10-15.

Childhood fever/ cough rates (P and Q) are calculated as percentage among the living children age 1-35 months who had fever/ cough in the last two weeks before the interview for boy and girl children separately for each state. R (or S) are calculated as percentage among the living children age 1-35 months who had fever/ cough in the last two weeks before the interview and taken to any public (or private) health

[3] Vaccination coverage rates are calculated from information on immunisation cards where these are available, and mother's report where there are no cards. This is the practice usually followed by the Demographic Health Survey (DHS) (Boerma et al 1993; Boerma et al 1996) and validated by other research (Langsten et al 1998) (mentioned in Pande et al 2003:2078).

facility to seek treatment for boy and girl children separately for each state[4]. Gender gap in childhood fever/ cough treatment across the states are presented in figures-16-19.

Post-neonatal death rate is calculated as percentage of children age 1-11 months who died among the children ever born for boy and girl children separately for each state. Child death rate is calculated as percentage of children age 12-35 months who died among the children ever born for boy and girl children separately for each state. Gender gap in childhood deaths is shown in figures-20 and 21.

We are now with an estimate of the magnitudes of gender bias for each of the 21 selected indicators over all the 29 states of India for all three rounds of NFHSs. We use Borda rule and PCA to reduce dimensions.

4.1. Borda Rule:

Each state is ranked for each of the chosen indicators to capture the relative position of the Indian states in gender bias against girl children. A higher rank (number) indicates higher gender bias against girl children. Ranking is done in ascending order (a higher value indicates higher gender bias against girls) for the following indicators—A, C, D, G, H, I, Q, R, and S. For the rest of the indicators, ranking is done in descending order (a lower value indicates higher gender bias against girls). Borda rank is calculated for each state on the basis of their aggregate scores for each round of NFHS. State-wise Borda rank in gender bias against girl children in child health is presented in table-2. Again, a higher rank (number) signifies higher gender bias against girls. For any NFHS round, a Borda rank of one signifies lowest gender bias against girls in that state for that period.

[4] Percentage of the children (also for boy and girl children separately) who were sick and taken to any *public* health facility steadily declined over time from 27 percent in 1992-93 to 18 percent in 2005-06. But percentage of the children who were sick and taken to any *private* health facility steadily increased over the same time from 80 percent to 90 percent. This raises serious concern about the quality and acceptability of the public health facilities in India.

From table-2, one can see that there are lot of ups and down in the state-wise rankings as we move from NFHS-I to NFHS-III. Over almost the one and a half decade of the study period, Gujarat, Himachal Pradesh, Uttarakhand, Jharkhand, Chhattisgarh and Meghalaya consistently improved their ranks, i.e., gender bias against girl children has consistently reduced relative to the other states. But the picture is just the reverse for Punjab and Mizoram where gender bias against girl children in child health has consistently increased over time. Table-3 provides the (Spearman) correlation coefficient for each pair of Borda rankings from the three rounds of NFHSs (given in table-2). The correlation coefficients are not significant even at 10 percent level, suggesting that the state-wise pattern of gender bias against girl children in child health is not consistent.

To check the robustness of the absence of a consistent state-wise pattern in gender bias in child health, the analysis needs further calibration. First, instead of all the 21 indicators we took only six indicators[5] (A, C, G, L, Q and U) for all the 29 states. Doing the same exercise as above, the (Spearman) correlation coefficients for each pair of Borda rankings from the three rounds of NFHSs (not reported) are not significant even at 10 percent level as before (table-4). Second, we do the same exercise for the major 19 states with the same six indicators (A, C, G, L, Q and U). Again the correlation coefficients are also not significant (see table-5 and -6). For some more observations, we have to look at table-5 again. Among the major 19 states, Himachal Pradesh, Rajasthan, Jharkhand, Chhattisgarh, and West Bengal consistently improved their ranks over the study period, i.e., gender bias against girl children has

[5] We choose only one indicator for each of the health dimension, i.e., immunisation, diarrhea, breastfeeding, malnutrition, fever/ cough treatment, and mortality. The choice of a particular indicator within a dimension is not only due to the data unavailability but also due to the other available guidelines. For example, World Health Organisation (WHO) prescribes for at least six months breastfeeding. Similarly, weight-for-age (underweight) is a composite index of height-for-age (stunting) and weight-for-height (wasting). It takes into account both acute and chronic malnutrition. Weight-for-age, prescribed by the WHO, is most commonly used for child welfare work in India.

consistently reduced relative to the other states. But the scenario is just the reverse for Jammu and Kashmir, Uttar Pradesh, Maharashtra, Andhra Pradesh and Tamil Nadu where gender bias against girl children in child health has consistently increased over time. More strikingly, in NFHS-III, West Bengal has the least gender bias against girl children in child health and hence West Bengal succeeded to place itself even ahead of Kerala as far as gender bias in child health is concerned (see Rajan et al 2000 on worsening women's status in Kerala). Overall, there is high gender bias in the four Empowered Action Group[6] of states (namely, Rajasthan, Uttar Pradesh, Madhya Pradesh, and Bihar) and in Punjab, Andhra Pradesh, and Gujarat as well. The 'offshoots', namely, Uttarakhand, Chhattisgarh and Jharkhand performed better in NFHS-III than their mother states namely, Uttar Pradesh, Madhya Pradesh and Bihar respectively after the division of the latter set of states (Dreze et al 2007: 385).

4.2. Principal Component Analysis (PCA):

For calculation of PCA, all the 21 indicators were made *unidirectional*[7]. Say, for b, we used the B: childhood diarrhea with 'no treatment'. We deducted the percentages of boy and girl received 'no treatment' from 100 to get percentages of boy and girl received 'any treatment'. Then gender gap is calculated using the previously mentioned

[6] A group of eight backward states with miserable socio-demographic indicators was formed as *Empowered Action Group* (EAG). This consists of Bihar, Jharkhand, Madhya Pradesh, Chattisgarh, Orissa, Rajasthan, Uttar Pradesh, and Uttarakhand. The group was formed on 20th March, 2001 under the Ministry of Health and Family Welfare to design and implement area specific programmes to strengthen the primary health care infrastructure.

[7] The chosen indicators are: Immunisation—a: childhood full vaccination; Diarrhea—b: childhood diarrhea with 'any treatment', c: childhood diarrhea with 'medical treatment', d: childhood diarrhea with 'given ORS'; Breastfeeding—e: childhood breastfeeding with 'ever breastfed', f: childhood breastfeeding with 'not less than six months breastfed', g: childhood breastfeeding with 'at least six months breastfed', h: childhood breastfeeding with 'currently breastfeeding', i: childhood breastfeeding with 'exclusively breastfed for first six months'; Malnutrition—j: childhood nutrition (height-for-age, above -3 SD), k: childhood nutrition (height-for-age, above -2 SD), l: childhood nutrition (weight-for-age, above -3 SD), m: childhood nutrition (weight-for-age, above -2 SD), n: childhood nutrition (weight-for-height, above -3 SD), o: childhood nutrition (weight-for-height, above -2 SD); Fever/ Cough—p: childhood fever/ cough (received any treatment), q: childhood fever/ cough (received medical treatment), r: childhood fever/ cough (received medical treatment in public health facility), s: childhood fever/ cough (received medical treatment in private health facility); Mortality—t: post-neonatal survival, u: child survival.

formula. The same method is applied for b, e, f, j, k, l, m, n, o, p, t, and u also. Principal components are constructed using PCA with all the selected 21 indicators. The principal components with Eigen value greater than one are considered. With those selected principal components, we calculate a composite index as a weighted average of these principal components, where the weights are (Eigen value of the corresponding principal component)/ (sum of all Eigen values), separately for three rounds of NFHSs. With the values of composite index, states are ranked in ascending order, separately for each round of NFHS. A higher rank (number) indicates higher gender bias against girls.

Here we consider six principal factors with Eigen values greater than one in both NFHS-I and –II; and in NFHS-III, seven principal factors with Eigen values greater than one are considered. The cumulative variance explained by these principal factors is 83 percent for NFHS-I, 78 percent for NFHS-II and 82 percent for NFHS-III. With these principal factors, we construct a composite index and rank the states accordingly. Table-7 presents the state-wise composite index and their rank. From table-7 one can see that there are lot of ups and down in the state-wise rankings as we move from NFHS-I to NFHS-III. Over the study period of thirteen years, Gujarat, Himachal Pradesh, Rajasthan, Karnataka and to some extent Orissa, consistently improved their ranks, i.e., gender bias against girl children has consistently reduced relative to the other states. But the picture is just reverse for Punjab, Bihar and Mizoram where gender bias against girl children in child health has consistently increased over time. For the entire picture of state-wise pattern of gender bias over the three rounds of NFHSs, we need table-8. Table-8 provides the (Spearman) correlation coefficient for each pair of rankings from the three rounds of NFHSs (given in table-7). The correlation coefficients are not significant even at 10 percent level suggesting that there is no consistent state-wise pattern of gender bias against girl children in child health.

To check the robustness of the absence of a consistent state-wise pattern in gender bias in child health, the analysis is calibrated further. First, we consider only one principal component that explains the largest proportion of total variation in all the 21 indicators. The total variance explained by the first principal component is only 24 percent for NFHS-I, 23 percent for NFHS-II, and 20 percent for NFHS-III. The states are ranked on the basis of the values of these principal factors. But, the (Spearman) correlation coefficients are not significant except for the correlation coefficient between the ranks in NFHS-I and NFHS-II (significant at five percent level; results not presented). As the total explained variance is quite low, we should not place much value on this solitary exception. Second, we considered only the 19 major states. Now, we are considering only two principal factors with Eigen values greater than one in NFHS-I and three principal factors with Eigen values greater than one for both NFHS-II and -III. The cumulative variance explained by these principal factors is 57 percent for NFHS-I, 79 percent for NFHS-II and 76 percent for NFHS-III. With these principal factors, we construct a composite index and rank the states accordingly. Again, the correlation coefficients of the ranks are not significant as before (results not presented). Among the major 19 states, Rajasthan and Jharkhand consistently improved their ranks over the study period, i.e., gender bias against girls has consistently reduced relative to the other states. But the scenario is just reverse for Jammu and Kashmir, Uttar Pradesh, Madhya Pradesh, Maharashtra, Andhra Pradesh and Tamil Nadu where gender bias against girl children in child health has consistently increased over time. More strikingly, in NFHS-III, West Bengal has least gender bias against girl children in child health. Overall, there is high gender bias in three Empowered Action Group of states (namely, Uttar Pradesh, Madhya Pradesh, and Bihar) and in Punjab, Andhra Pradesh, and Gujarat.

5. CONCLUDING DISCUSSION:

The study uses 21 selected indicators of health outcome and health-seeking behaviour from three rounds of National Family Health Survey data. Borda rule and PCA tools are applied for the analyses of the data. Children under three years are the unit of the analysis. The study found that any consistently robust state-wise pattern of gender bias against girl children in child health is not present among all the 29 Indian states over the three rounds of NFHSs. However, the absence of any consistent state-wise pattern in gender bias does not mean that there is no gender bias in child health in the Indian states. Among the 19 major states, overall, there is high gender bias in three Empowered Action Group of states (namely, Uttar Pradesh, Madhya Pradesh, and Bihar) and in Andhra Pradesh, Punjab, and Gujarat as well. The states which succeeded in reducing gender bias against girl children in child health over the years as compared to the other states are Gujarat, Himachal Pradesh, Rajasthan, West Bengal, Uttarakhand, Chhattisgarh, and Jharkhand. But for the states of Jammu and Kashmir, Punjab, Uttar Pradesh, Madhya Pradesh, Bihar, Maharashtra, Andhra Pradesh and Tamil Nadu gender bias against girl children has consistently increased over time relatively.

Along with the gender gap one should also look at the absolute level of health achievement for both boys and girls. There may be untoward cases of low gender gap with low absolute achievement level for both sexes. By the Rawlsian (Rawls 1971) theory of justice which gives complete priority to the worst-off group's gain (Sen 2000: 70), one should focus on the health achievement by the girl children only with reduction in gender bias in child health being the ultimate motto.

An attempt has been made to see if there is any state-wise pattern in health status for girl children only over the three rounds of NFHSs. For this we selected only six indicators (A, C, G, L, Q and U) of health-seeking behaviour and health outcome for girl children only. Based on these six indicators, the Borda ranks of the states are presented in table-

9 for three rounds of NFHSs. Table-10 shows that the (Spearman) rank correlations of the ranks of states for various NFHS rounds are strongly significant now. Thus there is a consistent state-wise pattern of girl children's health status. This finding may be interpreted as, overall, girl children's health achievement in different states moved more or less in the same direction, but girl children's relative achievement compared to boys in health has not moved in the same direction for all the states over the study period.

Concentrating on the consistent state-wise pattern of girl children's health achievement is fairly justified on the Rawlsian premise as in the social valuation function it assumes the degree of inequality aversion tending to infinity. As a policy measure, to reduce gender bias in child health, we need to focus on the states with low health achievement by girls (i.e., lower Borda ranks in table-9), viz., Rajasthan, Uttar Pradesh, Uttarakhand, Madhya Pradesh, Chhattisgarh, Bihar, Jharkhand, Orissa, Assam and Andhra Pradesh.

The scope of the present study is rather limited. It does not address the questions like why there exists a specific state-wise pattern in gender bias in a particular time period or if such pattern is related to the state-wise public health expenditure or why such pattern changes inconsistently over time. The study can be extended further on these lines.

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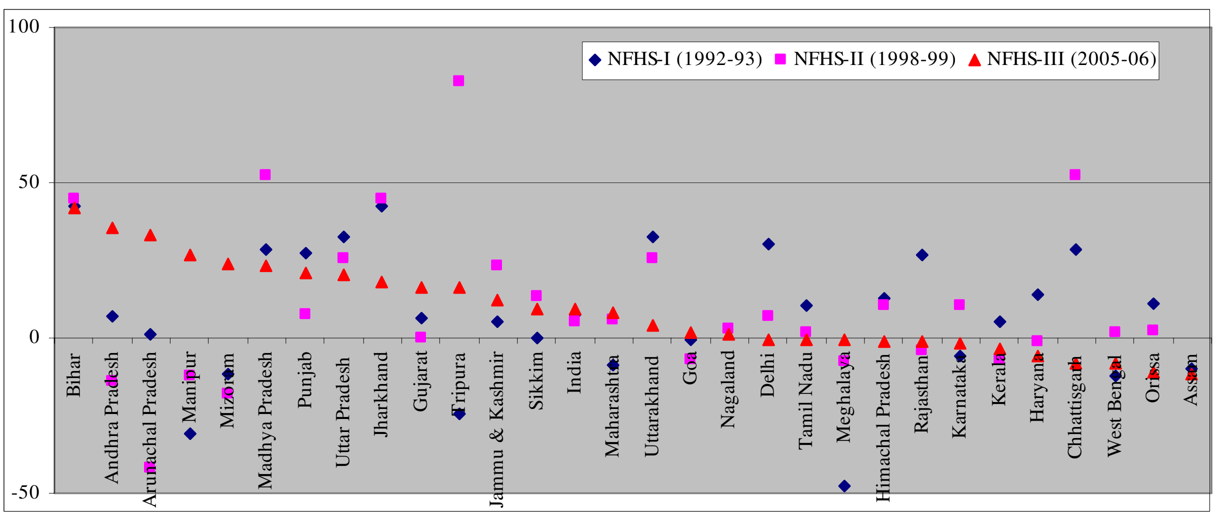
APPENDIX:

TABLE-1: INDICATOR-WISE TOTAL NUMBER OF OBSERVATIONS IN INDIA

Indicator		NFHS-I (1992-93)			NFHS-II (1998-99)			NFHS-III (2005-06)		
		Total	**Boy**	**Girl**	**Total**	**Boy**	**Girl**	**Total**	**Boy**	**Girl**
Immunisation	**A**	11853	6053	5800	10076	5163	4913	10419	5546	4873
Diarrhoea	**B**	3975	2068	1907	5721	3015	2706	3778	2051	1727
	C	3975	2068	1907	5721	3015	2706	3778	2051	1727
	D	3975	2068	1907	5721	3015	2706	3778	2051	1727
Breastfeeding	**E**	34626	17576	17050	30317	15741	14576	31205	16314	14891
	F	34626	17576	17050	30317	15741	14576	31205	16314	14891
	G	34626	17576	17050	30317	15741	14576	31205	16314	14891
	H	34626	17576	17050	30317	15741	14576	31205	16314	14891
	I	7404	3712	3692	6494	3400	3094	6062	3029	3033
Malnutrition	**J**	19380	9818	9562	24831	12941	11890	26580	13925	12655
	K	19380	9818	9562	24831	12941	11890	26580	13925	12655
	L	27683	13944	13739	24831	12941	11890	26580	13925	12655
	M	27683	13944	13739	24831	12941	11890	26580	13925	12655
	N	19460	9853	9607	24989	13008	11981	26582	13926	12656
	O	19460	9853	9607	24989	13008	11981	26582	13926	12656
Fever/ Cough	*	9299	4959	4340	10544	5748	4796	7856	4258	3598
	P	3149	1496	1653	4198	2137	2061	2589	1334	1255
	Q	6150	3463	2687	6346	3611	2735	5267	2924	2343
	R	1659	931	728	1454	840	614	965	514	451
	S	4906	2732	2174	5726	3210	2516	4722	2620	2102
Death	**T**	12336	6298	6038	10572	5578	4994	10494	5321	5173
	U	24581	12486	12095	21348	10987	10361	22193	11780	10413

Note: Definitions of A-U are in the text. *: number of children who had fever/ cough; P-S are expressed as a percentage of *.

FIGURE-1: STATE-WISE GENDER GAP IN CHILDHOOD FULL VACCINATION



Note: Figure excludes two outliers for Nagaland in NFHS-I (555) and Assam for NFHS-II (139)

FIGURE-2: STATE-WISE GENDER GAP IN CHILDHOOD DIARRHEA WITH 'NO TREATMENT'

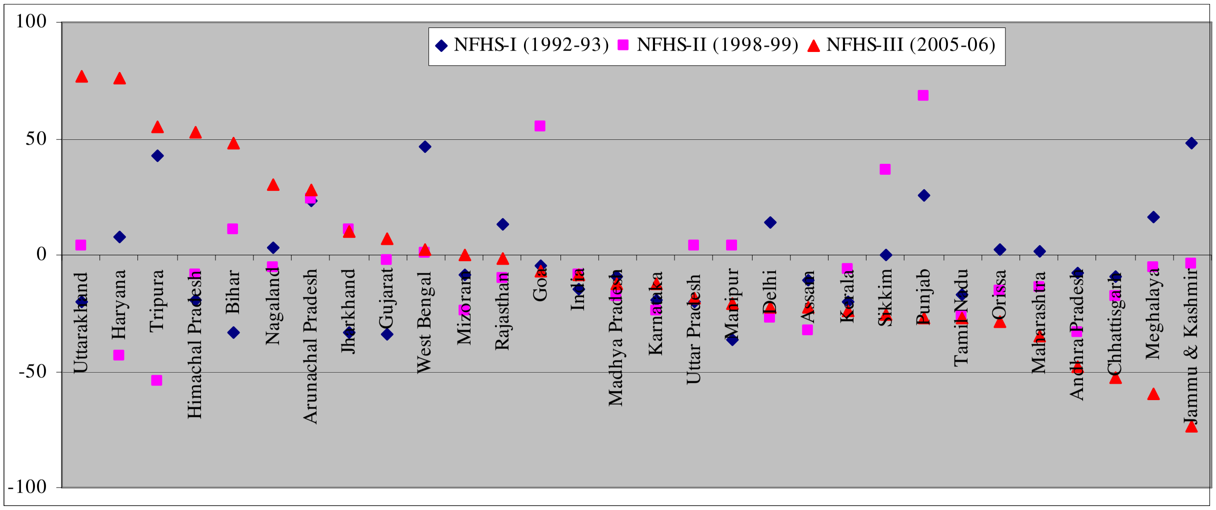


FIGURE-3: STATE-WISE GENDER GAP IN CHILDHOOD DIARRHEA WITH 'MEDICAL TREATMENT'

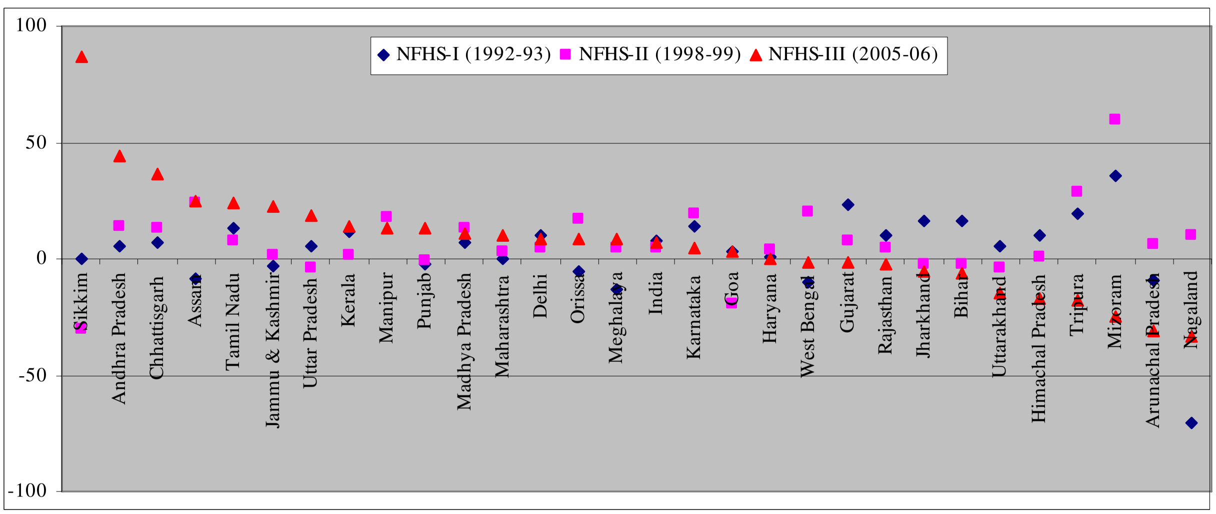
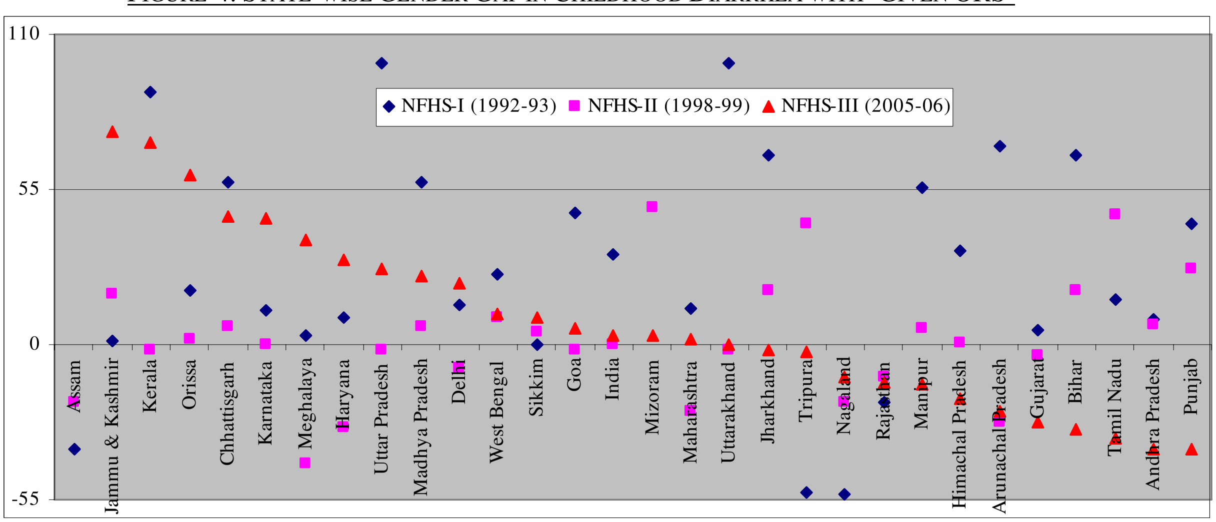
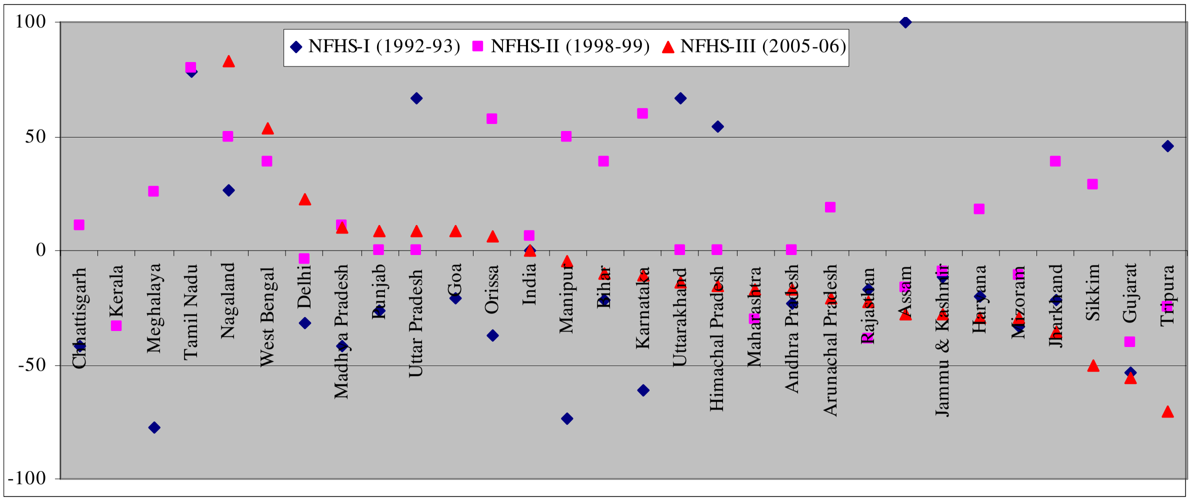


FIGURE-4: STATE-WISE GENDER GAP IN CHILDHOOD DIARRHEA WITH 'GIVEN ORS'



Note: Figure excludes two outliers for Mizoram (139) in NFHS-I and Assam (382) for NFHS-III.

FIGURE-5: SATE-WISE GENDER GAP IN CHILDHOOD BREASTFEEDING (NEVER BREASTFED)



Note: Figure excludes the outliers for Kerala (233), West Bengal (129) and Arunachal Pradesh (178) in NFHS-I and Meghalaya (173), Tamil Nadu (160) for NFHS-III.

FIGURE-6: STATE-WISE GENDER GAP IN CHILDHOOD BREASTFEEDING (LESS THAN SIX MONTHS BREASTFED)

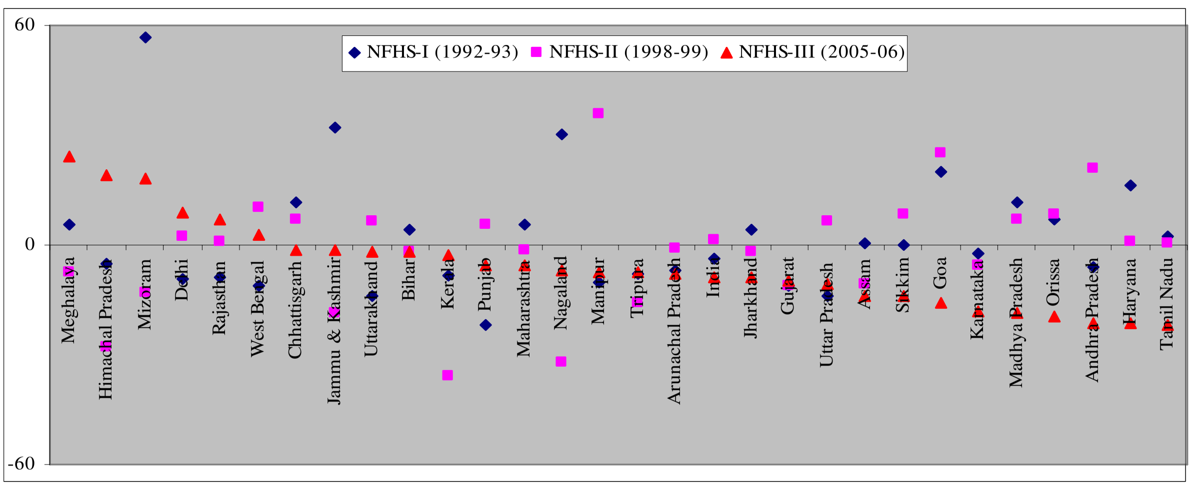


FIGURE-7: STATE-WISE GENDER GAP IN CHILDHOOD BREASTFEEDING (AT LEAST 6 MONTHS BREASTFED)

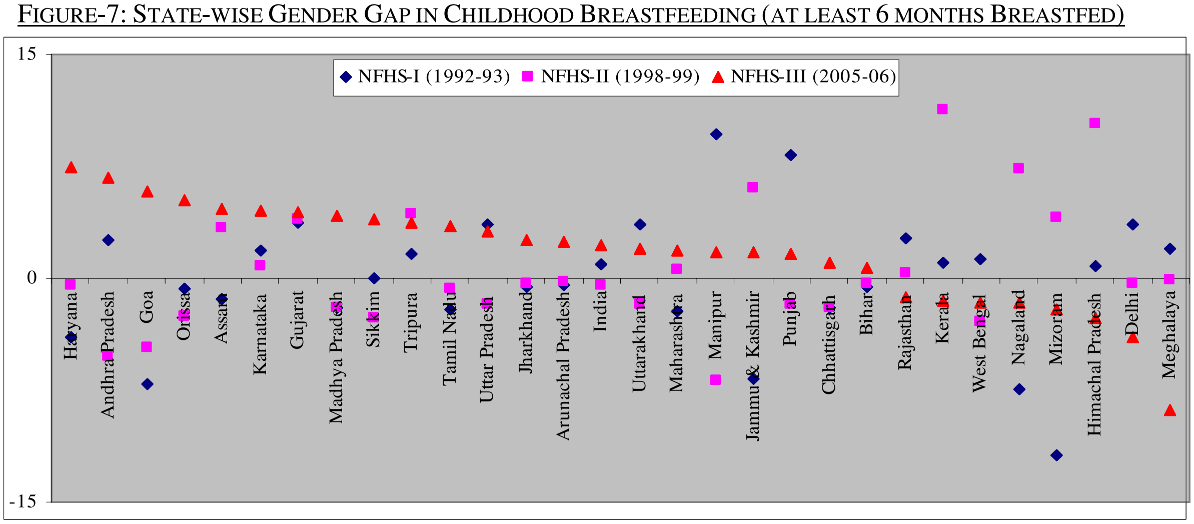


Figure-8: State-wise Gender Gap in Childhood Breastfeeding (Currently Breastfeeding)

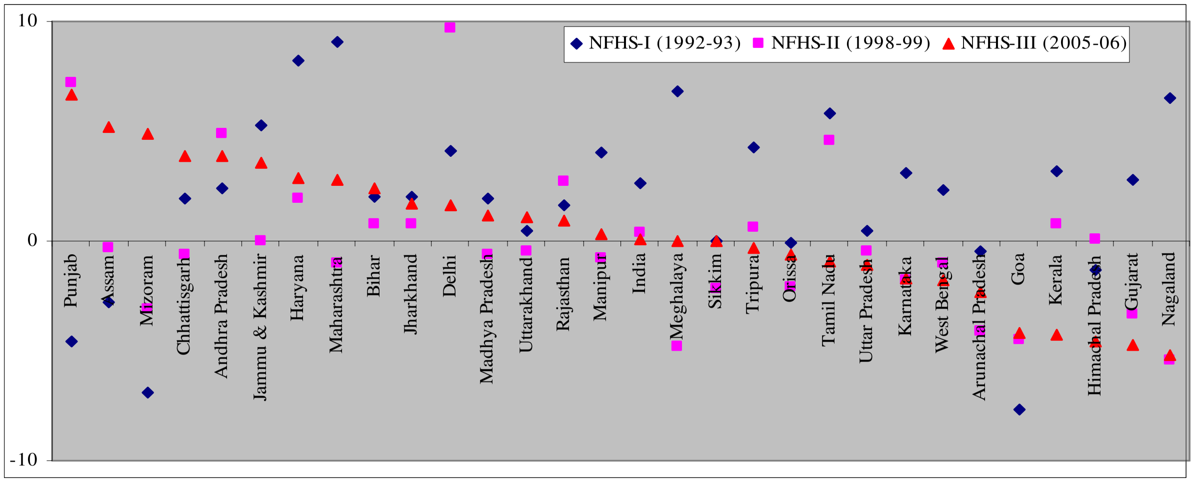


Figure-9: State-wise Gender Gap in Childhood Breastfeeding
(Exclusively Breastfed for first Six months)

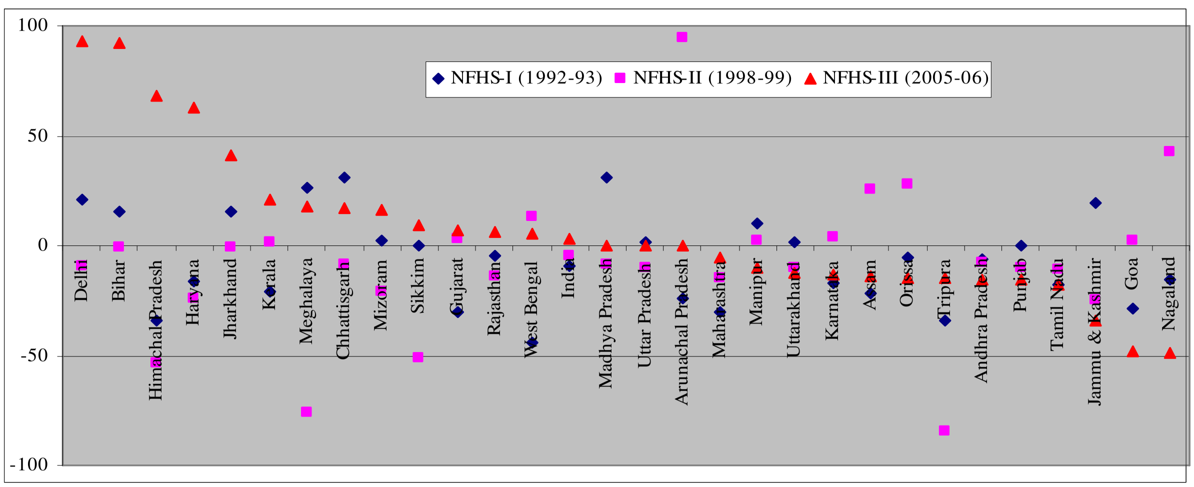
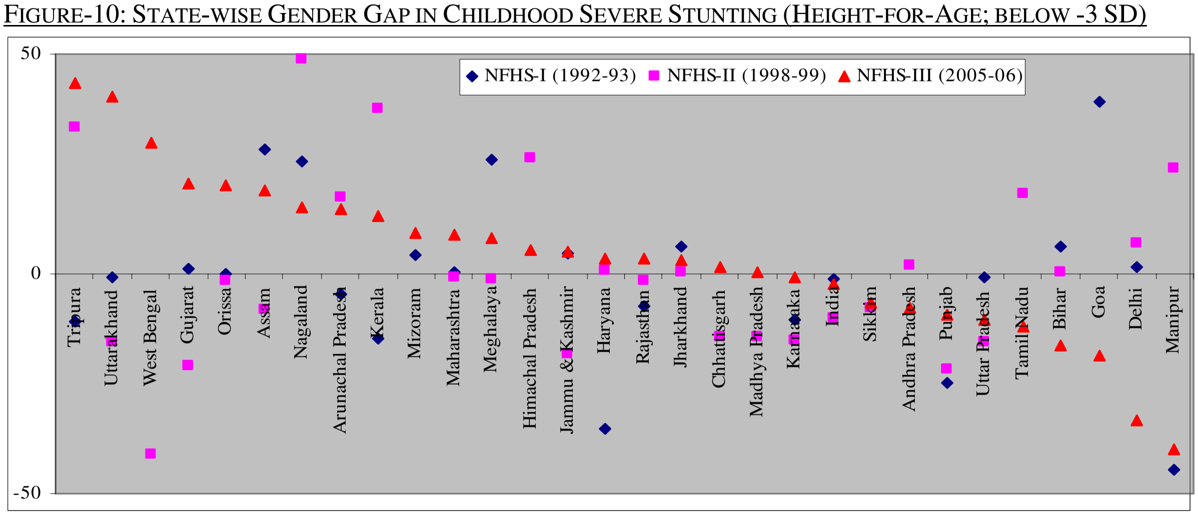
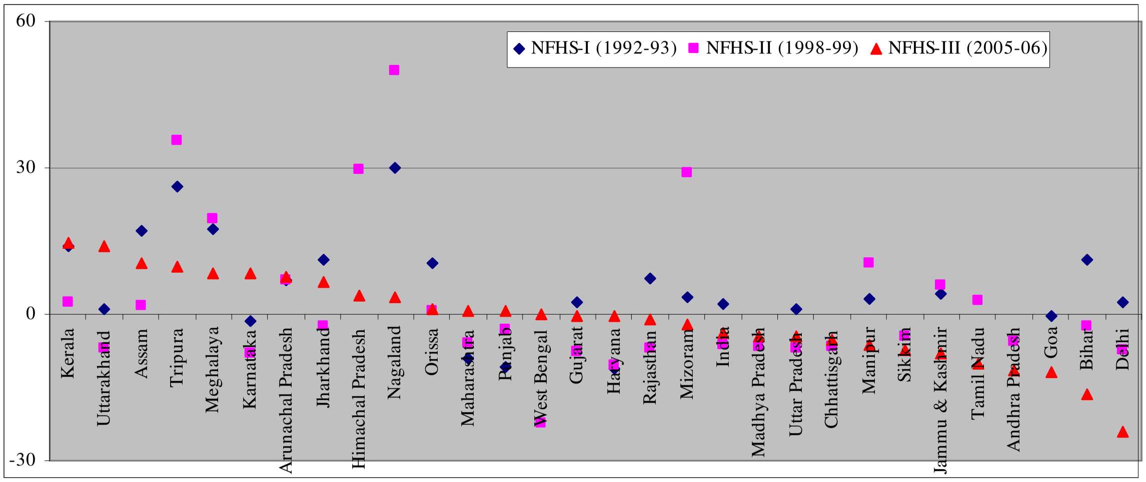


Figure-10: State-wise Gender Gap in Childhood Severe Stunting (Height-for-Age; below -3 SD)



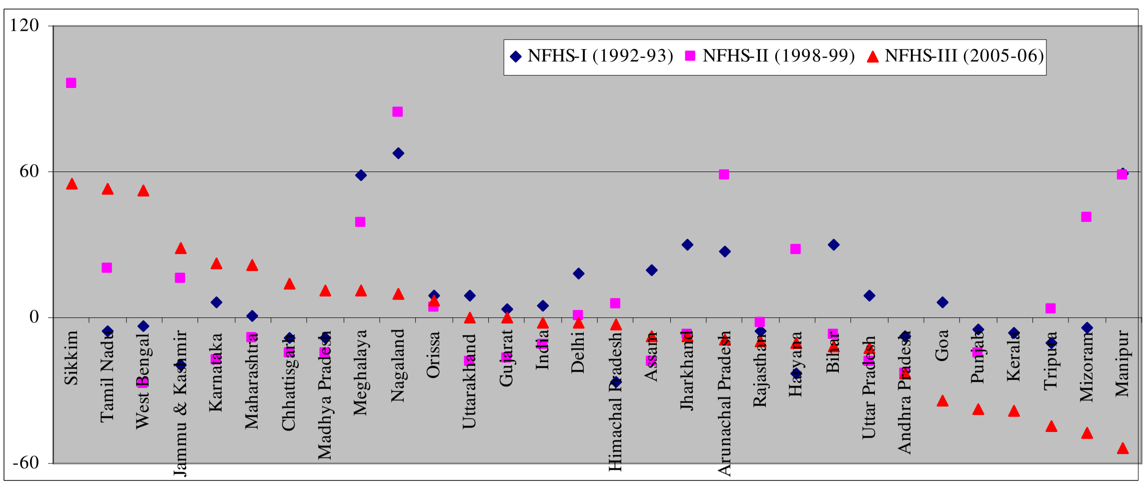
Note: Figure excludes the outliers for Mizoram (116) and Goa (344) in NFHS-II.

FIGURE-11: STATE-WISE GENDER GAP IN CHILDHOOD STUNTING (HEIGHT-FOR-AGE; BELOW -2 SD)



Note: Figure excludes the outlier Goa (118) in NFHS-II.

FIGURE-12: STATE-WISE GENDER GAP IN CHILDHOOD SEVERE UNDERWEIGHT (WEIGHT-FOR-AGE; BELOW -3 SD)



Note: Figure exclude the outliers Goa (183) and Kerala (311) in NFHS-II.

FIGURE-13: STATE-WISE GENDER GAP IN CHILDHOOD UNDERWEIGHT (WEIGHT-FOR-AGE; BELOW -2 SD)

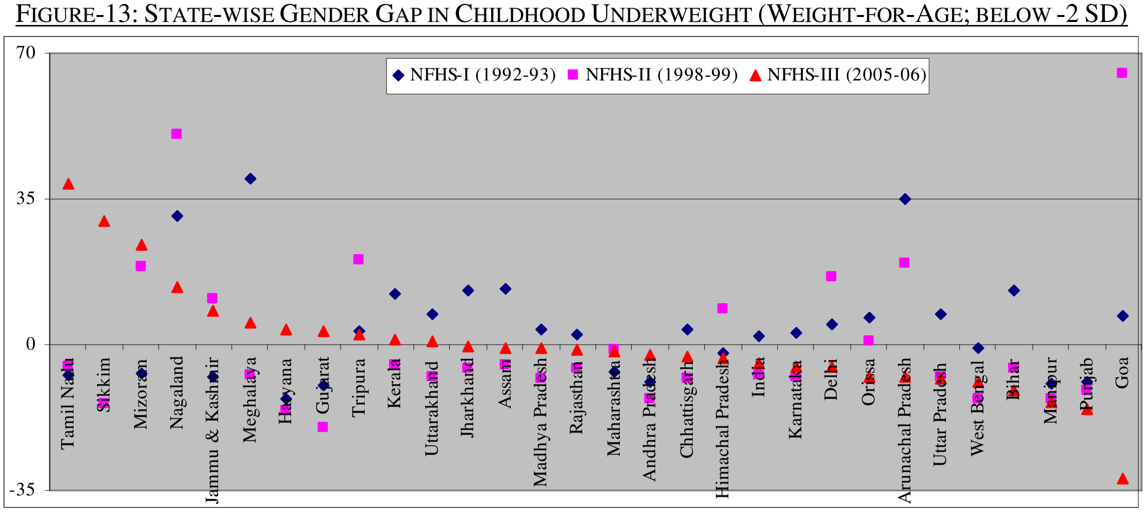
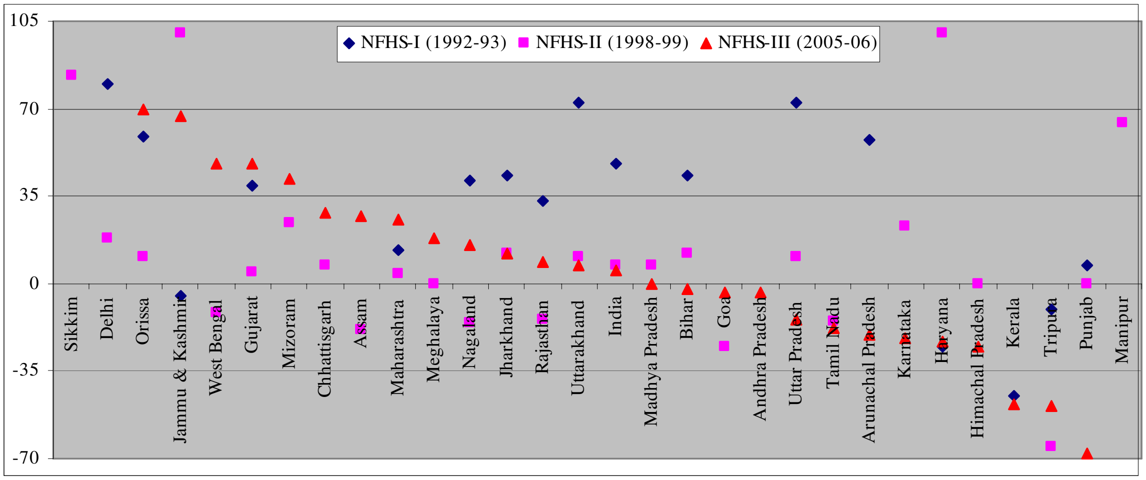
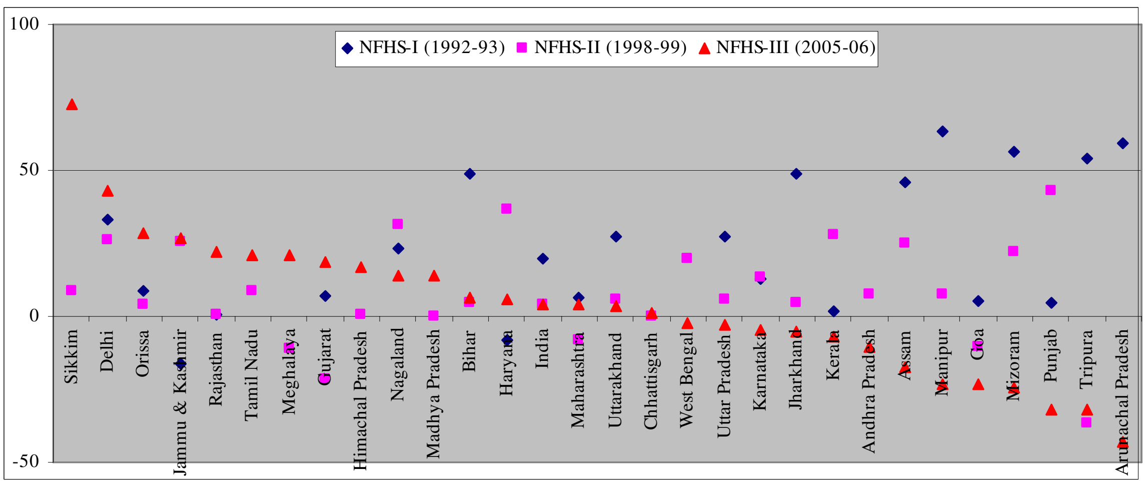


FIGURE-14: STATE-WISE GENDER GAP IN CHILDHOOD SEVERE WASTING (WEIGHT-FOR-HEIGHT; BELOW -3 SD)



Note: Figure exclude the outliers Assam (136), Meghalaya (179), Goa (119), Karnataka (269) and Manipur (217) in NFHS-I, Andhra Pradesh (156), Arunachal Pradesh (433) and Kerala (150) in NFHS-II and Sikkim (125), Delhi (119) in NFHS-III.

FIGURE-15: STATE-WISE GENDER GAP IN CHILDHOOD WASTING (WEIGHT-FOR-HEIGHT; BELOW -2 SD)



Note: Figure exclude the outliers Meghalaya (137) in NFHS-I and Arunachal Pradesh (126) in NFHS-II.

FIGURE-16: STATE-WISE GENDER GAP IN CHILDHOOD FEVER/ COUGH (RECEIVED NO TREATMENT)

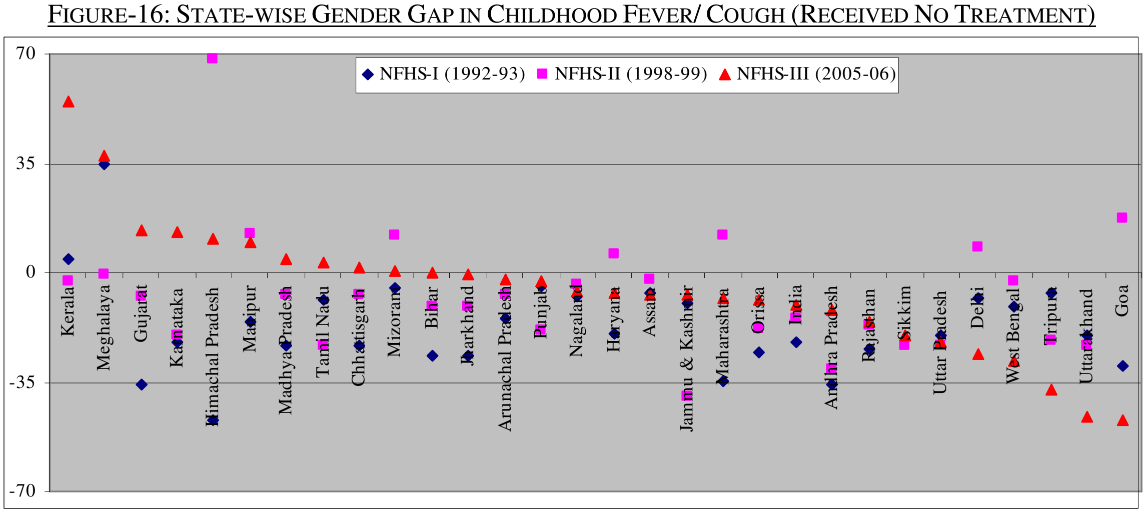


Figure-17: State-wise Gender Gap in Childhood Fever/ Cough (Received Medical Treatment)

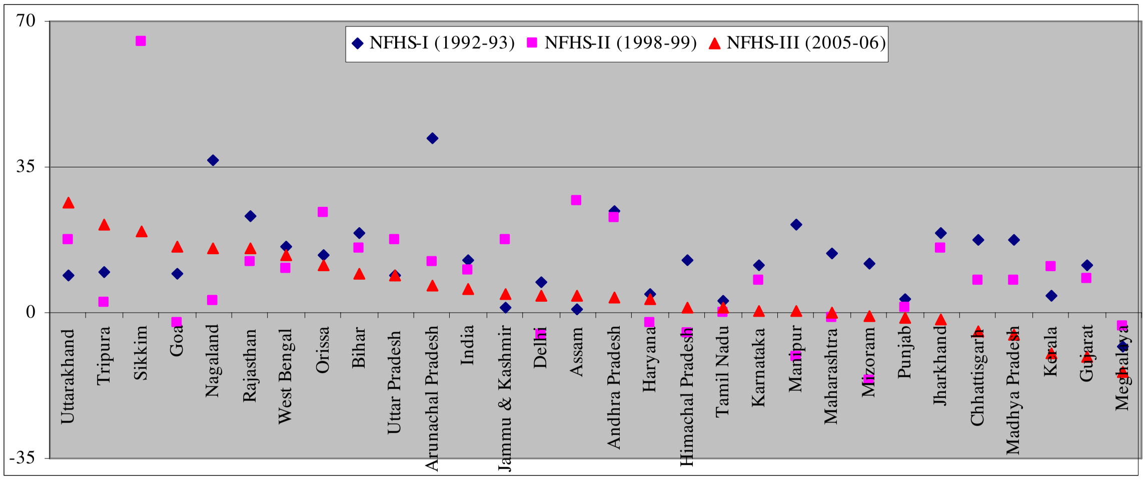
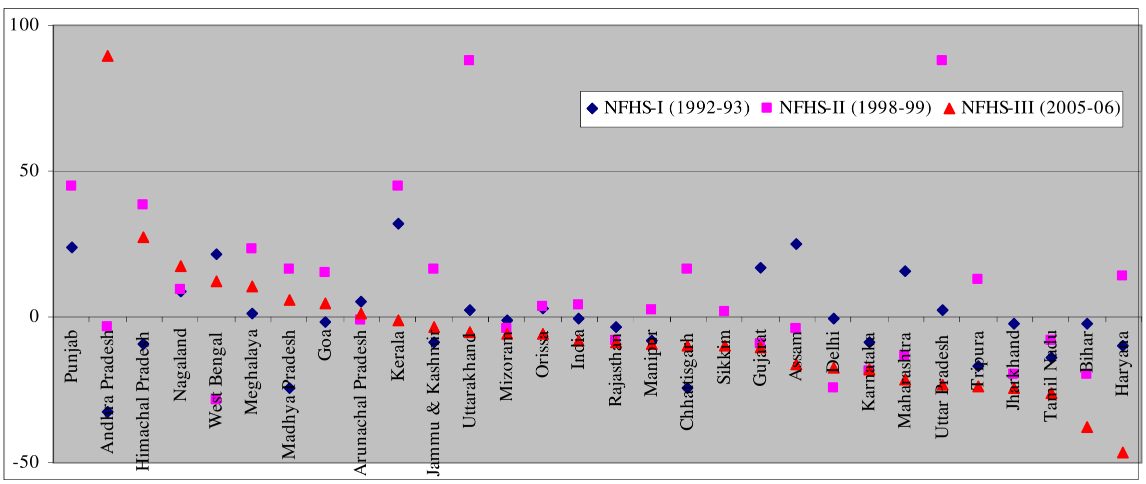
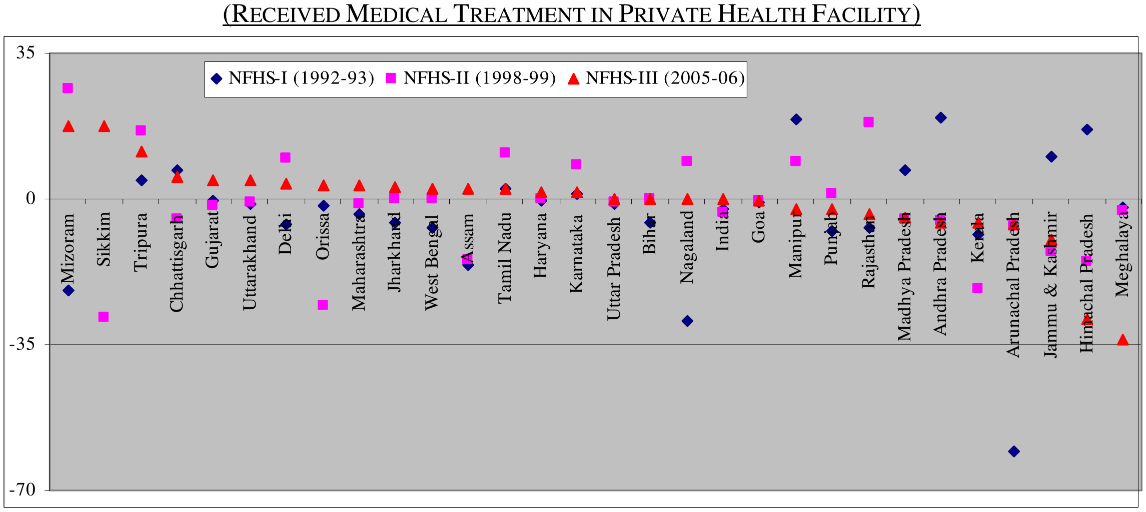


Figure-18: State-wise Gender Gap in Childhood Fever/ Cough
(Received Medical Treatment in Public Health Facility)

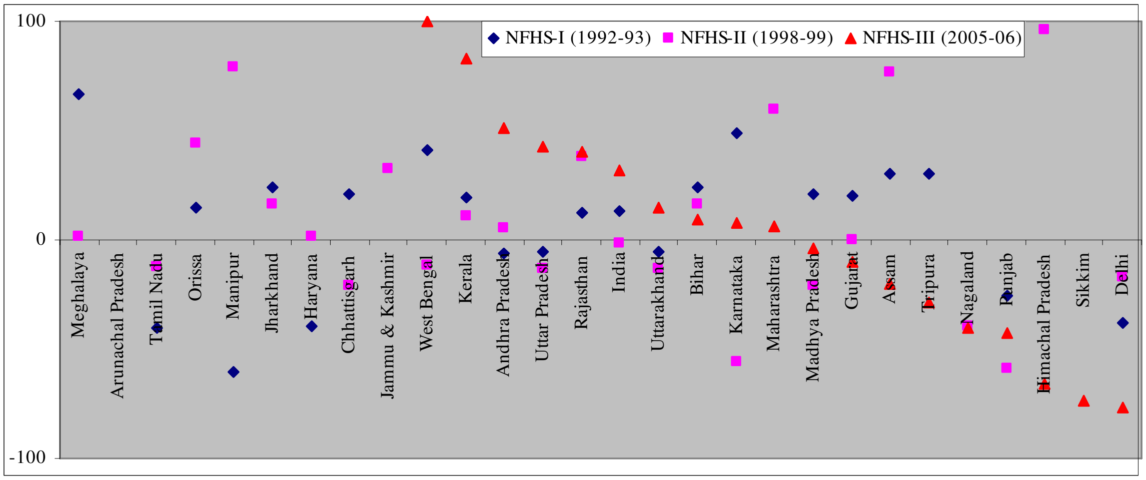


Note: Figure excludes the outlier Punjab (189) in NFHS-III.

Figure-19: State-wise Gender Gap in Childhood Fever/ Cough
(Received Medical Treatment in Private Health Facility)

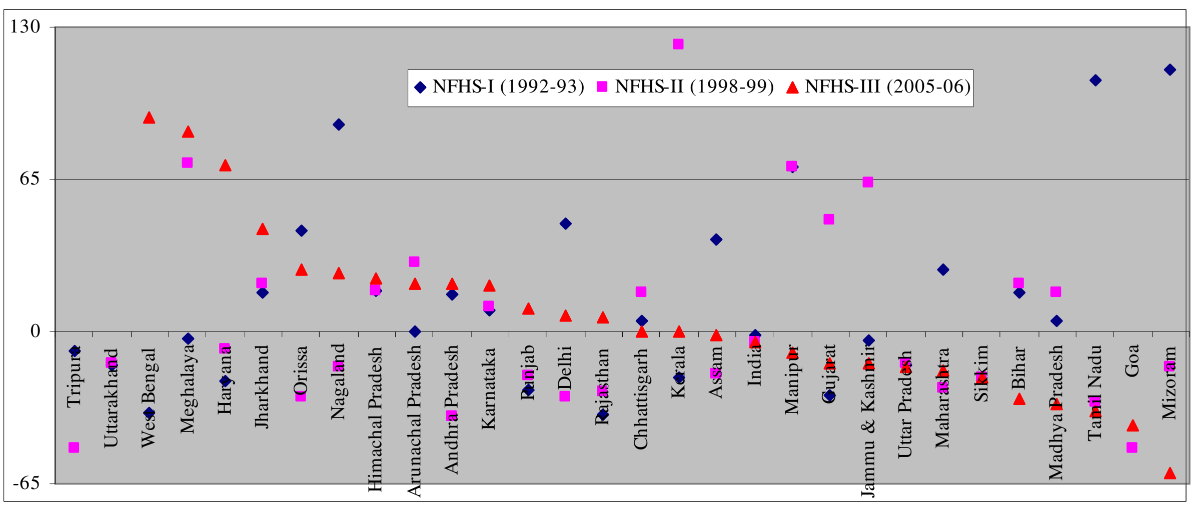


<u>FIGURE-20: STATE-WISE GENDER GAP IN POST-NEONATAL DEATH</u>



Note: Figure exclude the outliers J & K (115), Maharashtra (129) and HP (227) in NFHS-I, Arunachal Pradesh (181) in NFHS-II and Meghalaya (644), Arunachal Pradesh (238), TN (182), Orissa (155), Manipur (125), Jharkhand (122), HR (122), Chhattisgarh (113) and J & K (111) in NFHS-III.

<u>FIGURE-21: STATE-WISE GENDER GAP IN CHILD DEATH</u>



Note: Figure exclude the outliers Goa (457) and Mizoram (112) in NFHS-I, WB (139) and Kerala (122) in NFHS-II and Tripura (347) and Uttarakhand (217) in NFHS-III.

TABLE-2: STATE-WISE BORDA RANK IN GENDER BIAS AGAINST GIRL CHILDREN, VARIOUS NFHS ROUNDS

	NFHS-I (1992-93)	NFHS-II (1998-99)	NFHS-III (2005-06)
Nagaland	**2**	**10**	**1**
Meghalaya	**5**	**4**	**2**
H.P.	**17**	**8**	**3**
Gujarat	**28**	**26**	**4**
W.B.	**8**	**17**	**5**
Uttarakhand	**24**	**18**	**6**
Rajasthan	**21**	**25**	**7**
Kerala	**14**	**5**	**8**
Jharkhand	**19**	**13**	**9**
Karnataka	**18**	**27**	**10**
Arunach.P.	**4**	**1**	**11**
Tamil Nadu	**10**	**23**	**12**
Tripura	**8**	**29**	**13**
J.& K.	**7**	**16**	**14**
Orissa	**10**	**15**	**14**
Maharashtra	**12**	**11**	**16**
Haryana	**13**	**9**	**17**
Mizoram	**6**	**7**	**18**
Delhi	**15**	**11**	**19**
Chhattisgarh	**22**	**20**	**20**
Assam	**1**	**28**	**21**
M.P.	**22**	**20**	**22**
Bihar	**19**	**13**	**23**
Sikkim	**NA**	**6**	**24**
Punjab	**16**	**22**	**25**
Manipur	**27**	**3**	**26**
U.P.	**24**	**18**	**27**
Andhra P.	**26**	**24**	**28**
Goa	**3**	**2**	**29**

Note: Total excludes the ranks obtained in the indicators—for NFHS-I: J, K, N, O, and T due to non-availability of data for some of the states other than Sikkim; for NFHS-II and III: E, and T due to non-availability of data for some of the states. States are ordered according to NFHS-III rankings.

TABLE-3: RANK-CORRELATION (SPEARMAN) MATRIX OF BORDA RANKINGS IN THREE ROUNDS OF NFHSS

	NFHS-I	NFHS-II	NFHS-III
NFHS-I	—		
NFHS-II	**0.3**	—	
NFHS-III	**0.2**	**-0.01**	—

Note: none significant even at 10% level (two tail).

TABLE-4: RANK-CORRELATION (SPEARMAN) MATRIX OF BORDA RANKINGS IN THREE ROUNDS OF NFHS

	NFHS-I	NFHS-II	NFHS-III
NFHS-I	—		

NFHS-II	**0.26**	**—**	
NFHS-III	**0.10**	**0.04**	**—**

Note: None significant even at 10% level (two tail).

TABLE-5: BORDA RANK IN GENDER BIAS AGAINST GIRL CHILDREN FOR MAJOR NINETEEN STATES

	NFHS-I (1992-93)	NFHS-II (1998-99)	NFHS-III (2005-06)
W.B.	**8**	**7**	**1**
H.P.	**15**	**4**	**2**
Chhattisgarh	**16**	**11**	**3**
Kerala	**5**	**3**	**4**
Karnataka	**5**	**19**	**4**
Uttarakhand	**9**	**16**	**6**
Jharkhand	**11**	**9**	**7**
Rajasthan	**19**	**14**	**8**
Maharashtra	**1**	**6**	**9**
Orissa	**1**	**18**	**10**
Gujarat	**18**	**8**	**11**
Haryana	**5**	**1**	**12**
M.P.	**16**	**11**	**13**
Tamil Nadu	**4**	**4**	**14**
Punjab	**13**	**2**	**15**
J.& K.	**1**	**11**	**16**
Bihar	**11**	**9**	**17**
U.P.	**9**	**16**	**18**
Andhra P.	**14**	**15**	**18**

Note: States are ordered according to NFHS-III rankings.

TABLE-6: RANK-CORRELATION (SPEARMAN) MATRIX OF BORDA RANKINGS IN THREE ROUNDS OF NFHS

	NFHS-I	NFHS-II	NFHS-III
NFHS-I	**—**		
NFHS-II	**0.045**	**—**	
NFHS-III	**-0.059**	**0.084**	**—**

Note: none significant even at 10% level (two tail).

TABLE-7: STATE-WISE COMPOSITE INDEX[8] AND RANK IN GENDER BIAS AGAINST GIRL CHILDREN, VARIOUS NFHS ROUNDS

[8] Total composition excludes the following indicators—NFHS-I: j, k, n, o, and t; NFHS-II & -III: e, and t —due to non-availability of data for some of the states.

	Composite Index[9]			Rank		
	NFHS-I	NFHS-II	NFHS-III	NFHS-I	NFHS-II	NFHS-III
Meghalaya	-0.54	-0.4	-1.18	**3**	**5**	**1**
H.P.	0.3	-0.06	-0.49	**24**	**12**	**2**
Nagaland	-0.48	-0.34	-0.41	**4**	**6**	**3**
Kerala	-0.39	-0.08	-0.33	**7**	**10**	**4**
Gujarat	0.37	0.33	-0.33	**26**	**22**	**5**
W.B.	-0.11	0.39	-0.33	**11**	**23**	**6**
Assam	-0.59	0.97	-0.16	**1**	**29**	**7**
Uttarakhand	-0.03	0.5	-0.16	**16**	**27**	**8**
Rajasthan	0.34	0.06	-0.15	**25**	**15**	**9**
J.& K.	-0.13	0.15	-0.14	**8**	**21**	**10**
Maharashtra	0.05	-0.13	-0.14	**19**	**9**	**11**
Orissa	-0.05	0.03	-0.14	**14**	**14**	**12**
Karnataka	0.16	0.11	-0.12	**20**	**17**	**13**
Tamil Nadu	-0.04	-0.08	-0.1	**15**	**10**	**14**
Jharkhand	-0.12	0.12	-0.08	**9**	**18**	**15**
Chhattisgarh	0.26	0.48	-0.08	**22**	**25**	**16**
Mizoram	-0.58	-0.44	-0.07	**2**	**4**	**17**
Haryana	0.03	-0.25	-0.01	**16**	**8**	**18**
M.P.	0.26	0.48	0.04	**22**	**25**	**19**
Delhi	-0.08	-0.34	0.06	**12**	**6**	**20**
Arunach.P.	-0.41	-0.99	0.08	**6**	**1**	**21**
Sikkim	NA	0.13	0.28	**NA**	**20**	**22**
Tripura	0.21	0.39	0.31	**21**	**23**	**23**
Manipur	1.51	-0.78	0.4	**28**	**3**	**24**
U.P.	-0.03	0.5	0.48	**16**	**27**	**25**
Goa	-0.45	-0.95	0.59	**5**	**2**	**26**
Punjab	-0.07	0.06	0.65	**13**	**15**	**27**
Bihar	-0.12	0.12	0.73	**9**	**18**	**28**
Andhra P.	0.77	0.02	0.77	**27**	**13**	**29**

Note: States are ordered according to NFHS-III rankings.

TABLE-8: RANK-CORRELATION (SPEARMAN) MATRIX OF RANKINGS IN THREE ROUNDS OF NFHS

	NFHS-I	NFHS-II	NFHS-III
NFHS-I	—		
NFHS-II	**0.25**	—	
NFHS-III	**0.18**	**-0.07**	—

[9] NFHS-I: Here six principal components/ factors are constructed with Eigen-values greater than one. The corresponding Eigen-values are—3.911, 2.465, 2.204, 1.883, 1.665, and 1.088. The cumulative total variance explained is 83%. Composite Index is constructed as a weighted average of the six principal factors. The corresponding weights are Eigen value/ Sum of six Eigen-values.
NFHS-II: Here six principal components/ factors are constructed with Eigen-values greater than one. The corresponding Eigen-values are—4.447, 2.963, 2.579, 2.053, 1.618 and 1.155. The cumulative total variance explained is 78%. Composite Index is constructed as a weighted average of the six principal factors. The corresponding weights are Eigen value/ Sum of six Eigen-values.
NFHS-III: Here seven principal components/ factors are constructed with Eigen-values greater than one. The corresponding Eigen-values are—3.715, 3.230, 2.842, 2.003, 1.357, 1.305 and 1.049. The cumulative total variance explained is 82%. Composite Index is constructed as a weighted average of the seven principal factors. The corresponding weights are Eigen value/ Sum of seven Eigen-values.

Note: none significant even at 10% level (two tail).

TABLE-9: BORDA RANK OF HEALTH STATUS FOR GIRL CHILDREN, VARIOUS NFHS ROUNDS

	NFHS-I	**NFHS-II**	**NFHS-III**
Kerala	**27**	**28**	**29**
W.B.	**17**	**14**	**28**
Goa	**26**	**29**	**27**
Haryana	**23**	**25**	**26**
H.P.	**25**	**26**	**25**
Maharashtra	**21**	**27**	**24**
Tamil Nadu	**19**	**24**	**23**
Delhi	**22**	**22**	**22**
Karnataka	**18**	**20**	**21**
Punjab	**23**	**23**	**20**
J.& K.	**28**	**20**	**19**
Sikkim	**NA**	**12**	**18**
Meghalaya	**16**	**4**	**17**
Tripura	**7**	**18**	**16**
Uttarakhand	**2**	**9**	**15**
Mizoram	**20**	**13**	**14**
Manipur	**9**	**18**	**13**
Gujarat	**14**	**15**	**12**
Orissa	**8**	**6**	**11**
Chhattisgarh	**10**	**6**	**9**
Nagaland	**13**	**11**	**9**
Andhra P.	**12**	**17**	**8**
M.P.	**10**	**6**	**7**
Bihar	**2**	**1**	**6**
Jharkhand	**2**	**1**	**5**
Rajasthan	**1**	**5**	**4**
Arunach.P.	**15**	**16**	**3**
U.P.	**2**	**9**	**2**
Assam	**6**	**3**	**1**

Note: The chosen indicators are A, C, G, L, Q and U. Ranking is done in ascending order (a higher value indicates better status of girls) for the following indicators— A, C, G, and Q. For L and U, ranking is done in descending order (a lower value indicates better status of girls). A higher rank (number) indicates better status of girl children. States are ordered according to NFHS-III rankings.

TABLE-10: RANK-CORRELATION (SPEARMAN) MATRIX OF BORDA RANKINGS IN THREE ROUNDS OF NFHS

	NFHS-I	**NFHS-II**	**NFHS-III**
NFHS-I	—		
NFHS-II	**0.81***	—	
NFHS-III	**0.79***	**0.78***	—

Note: Level of significance (two tailed) — *: 1%.