Explaining gender disparity in child health in India: an inter state comparison

The strong preference for sons over daughters and resulting discrimination against daughters in India is well known, though the preference is not uniformly observed across different regions of the country. India exhibits wide variations in the degree of son preference, with stronger son preference found in northern India than in the south (Dyson and Moore, 1983; Clark 2000). However, one recent study reported that for certain variables discrimination against girls is as strong (or stronger) in the South India as in the North. This variation makes studies within a single country attractive. A World Bank study (Filmer et al., 1998) suggested that while gender disparity is pervasive in South Asia, its worst manifestations are regionally concentrated and that efforts therefore need to focus first on understanding the root causes of gender disparity and eliminating its adverse consequences in those places. The fact that some states have achieved much lower levels of gender disparity also means that greater gender equality is possible even within the South Asian context. States with lower gender disparity can act as a reference for states with higher level of gender disparity.

This study is the first of its kind to document and identify regional patterns of gender disparity for children for states of India in health outcomes. Hill and Upchurch (1995) considered it as "unfortunate" that India and China were not included in their study. The study by Filmer et al (1998) focussed more on cross-country comparisons and also used the NFHS Phase I dataset. Moreover cross-country studies are not able to capture the effect of gender on health outcomes (Obermeyer and Cardenas, 1997), hence individual rather than aggregate level studies have been suggested. This also takes care of the problem faced by cross-national comparisons of the degree of comparability and reliability of the data across countries. Despite exhibiting great disparity in son preference in India, detailed explorations into the extent, pattern and nature of gender disparity in various possible parameters of discrimination has not been undertaken. Most research of this type has been concentrated in comparing a few states of north and south India and mainly documented gender differentials in child mortality. A recent study examined North-South sex differentials in childhood feeding, health care and nutrition status after pooling the data for four Northern states (Bihar, Madhya Pradesh, Rajasthan, and Uttar Pradesh) and four Southern states (Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu), thus masking the individual state level differences in child health. Moreover the literature contains a number of contradictory claims and findings on the subject (see Kishor, 1995; Arnold, Choe & Roy, 1998; Mishra et al., 2004) and there is a need for further empirical investigation.

Aims of the study

This study aims to update the documentation and examine patterns of gender disparities for children (12-35 months of age) between states of India in health outcomes, including use of preventive health care services and nutrition, using phase II of National Family and Health Survey (NFHS-2). The focus is on two questions: First, are boys more likely to have complete vaccination coverage than girls? Second, are girls more likely to be malnourished than boys? The focus on these outcomes for children is mainly because these outcomes, such as childhood immunization or nutrition, are relatively less influenced by the choices of the children themselves and potentially more indicative of differential treatment by their parents (and other adults) and hence may indicate more clearly one particular source of gender disparity. Specifically this research has the following aims:

1. To update the documentation of gender disparities for children in different states of India in complete vaccination coverage and nutritional status;
2. To investigate regional variations in gender disparity and to assess if a regional pattern of gender disparity in health outcomes exists;
3. To examine whether gender disparity in various field is influenced by various socioeconomic and demographic factors?

A knowledge of levels and patterns of sex differentials in use of health care services and malnutrition is important for policy makers and programme managers to understand in order to (1) ensure equitable access to service utilisation and (2) avoid any adverse impact of a preference in a population. For example, a high level of son preference in countries with low level of fertility has resulted in a skewed sex ratio at birth because the women have access to methods of identifying the sex of foetuses and to induced abortions (Park and Cho, 1995). A skewed sex ratio, in turn, has worrisome implications for future population structure, the marriage and labour market, and personality development. In this regard, population policy needs to pay special attention to the possible consequences of high son preference that go beyond the retardation of fertility decline. This is particularly important in states like Haryana where the practice of sex-selective abortion is most widespread (Das Gupta and Mari Bhat, 1997: 312).

Sex discrimination in nutrition has implications for reproductive health. Some women face difficulties in carrying a pregnancy successfully to completion because of childhood discrimination (Royston and Armstrong, 1989). Failure to nourish girl children can limit their capacity for healthy motherhood through, for example stunting and a small pelvis, while a reluctance to provide medical care may compound these problems (World Health Organisation (WHO), 1998). If a pregnancy goes wrong, lack of obstetric care may be fatal and millions of women continue to face such risks every year (Thaddeus and Maine, 1991; Royston and Armstrong, 1989).

Methods and Materials

Data sources

The data for the proposed project come from the second National Family and Health Survey (NFHS-2), undertaken in 1998-99. The NFHS-2 is a nationally representative survey, which was conducted in 26 Indian States using a format very similar to that of the Demographic and Health Surveys (DHS), modified to meet Indian conditions and the needs of policy makers and programme planners. The survey covered a representative sample of more than 90,000 ever-married women age 15-49. The analyses for this paper are based on data from a sub sample of children aged 12-35 months born to eligible women in the three years preceding the surveys and who were alive at the time of survey. The NFHS-2 provides high-quality, up-to-date information on all of the key variables required for the analysis. It has collected information on child nutrition, and vaccinations at various ages, all of which can be examined by sex of the child. Compared with previously available data, the survey permits substantial expansion of the examination of gender differences in child health practices.

Because this analysis uses information about children alive at the time of survey, addressing the question of censoring is very important; that is, children who died before the survey will be excluded from the analysis. If excess female mortality were high enough, this would imply a bias in the sample towards including surviving girls for those families that do not discriminate against girls, thus to some extent invalidating any analysis of differential treatment. However, an examination of the sex ratios in the sample, when children who have died are included or excluded, shows that they are not significantly different from each other, suggesting that the selectivity bias of the sample should be negligible. Moreover, the differential in health indicators in favour of boys, if any, would be lower if treatment had been identical. Another point to note about the sample used in the analysis is that all children born three years preceding the survey were included; in other words, if a woman gave birth to two children in this time period, both the children were included in the subsample.

One important limitation of this study is the small number of cases in some states on which the analyses are based. The present study focuses on child health among alive children between 12 to 25 months of age. In some states like Delhi, Punjab, Himachal Pradesh and Haryana, only 336, 506, 510 and 594 cases met the criteria. This limitation might have an effect on the analysis; in particular, the small number of cases will limit the statistical methods to be used. In addition, since all children who met the criteria were included in the analyses, some characteristics of women and their husbands may be duplicated if they had more than one child. However, the number of children who fall in such groups are quite small, and thus will not have a significant effect on variables under study.

Secondly, the validity of anthropometric indices is determined by many factors, including the coverage of the population of children and accuracy of the anthropometric measurements. The NFHS-2 was not able to measure the height and weight of all eligible children, usually because the child was not at home at the time of the health investigator's visit or because the mother refused to allow the child to be weighed and measured. In India as a whole, NFHS-2 failed to measure 13 percent of children under age three (IIPS, 2001). Moreover, weight-for-age and height-for-age indices are sensitive to misreporting of children's ages, including heaping on preferred digits. This problem was well known before NFHS-2 began; therefore, interviewer training stressed this issue to try to reduce the extent of biases due to misreporting. Age reporting including the completeness of data on birth dates is exceptionally good in NFHS-2 (IIPS, 2001).

Study Variables

The study variables are defined into two broad categories: dependent and explanatory variables. The dependent variable, health status of children, is expressed in terms of immunization status, and nutritional status, whereas sex of the child is considered as the explanatory variable. A set of demographic and socioeconomic variables are considered as control variables. These variables are defined below.

Dependent variables:

Vaccinations: According to the Universal Immunization Programme that was introduced in 1985-86 in India and which was used in NFHS-2, children who at age one have received three vaccination doses of diphtheria, pertussis, and tetanus each, three doses of poliomyelitis vaccine, a dose of measles vaccine, and a dose of tuberculosis vaccine (BCG) are considered to be fully vaccinated. The NFHS-2 collected information from mothers on vaccination for each child born three years preceding the survey. Children aged 12-35 months old were chosen for the analysis because both international and

Government of India (GOI) guidelines specify that children should be fully immunized by the time they complete their first year of life. The ratio of males to females with all vaccinations (i.e. BCG, measles, and three doses of DPT and polio vaccine) indicate underlying gender discriminating behaviour that produces disparity in vaccination coverage. Logistic regression is used to model the effect of the sex of the child on the likelihood of having been fully immunized.

Anthropometrics among children: The NFHS-2 provides information on three summary indices of nutritional status: weight-for -age, height- for-age, and weight-for-height. Only weight-for-age and height-for age are used in the multivariate analyses. Weight-for-height is left out of the multivariate analysis due to the prevalence of low weight-for-height or wasting among the study population being very low (5.3 percent). These two indices of nutritional status (weight-for-age and height-for-age) are expressed in standard deviation units (z-score) from the median for the international reference population. Ratio of male to female children of 12-35 months of age is used to measure gender disparity in nutrition status[1]. For logistic regression analyses, the nutritional status variables (weight-for-age and height-for-age) which are continuous variables, were treated as dichotomous , with two values 'well-nourished' and 'under-nourished'. In order to assess malnutrition, cut-off points need to be used to estimate the prevalence of anthropometric abnormality. The conventional cut-off point, which is applied in the present study, is -2 standard deviation units (z-score) from the median reference population. Children whose z-score falls below -2 standard deviation units are classified as under-nourished (coded 1) and those above -2 standard deviation as well nourished (coded 0).

Independent and control variables:

The independent or control variables are composed of a set of socioeconomic and

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[1] children under one year of age have been excluded from the analysis to cancel out the effect of breastfeeding.

demographic variables. The selection of control variables is guided by theoretical reasons, availability of data and prior research on discrimination against female children. The categorisation of the independent variables was based on theoretical grounds, as well as on the basis of the distribution of births with respect to the different variables. The following variables are included:

(i) Sex of the child categorised as male and female.

(ii) Age of the child classified as 12-23 and 24-35 months.

(iii) Birth order is considered to be one of the factors influencing child health, which captures a woman's past experience in child bearing and rearing. Three categories were classified: first, second and third and fourth or higher birth order.

(iv) Age of woman was grouped into three broad age groups: below 19, 20-29 and 30 years or more.

(v) Preceding birth interval was classified into two categories; first birth and more than or equal to 24 months and less than 24 months.

(vi) Education of mother is viewed as important in health behaviour and health practices which have a great influence on the health and survival of young children. In this study education of both women and their husbands were categorised as either illiterate or literate including primary, middle or secondary or higher.

(vii) Mother's current work status can greatly influence child health through lack of time for child care and feeding, particularly breast-feeding. This variable was categorised as currently not working and working.

(viii) Caste was grouped into scheduled caste and non-scheduled caste.

(ix) Religion was classified into Hindu and non-Hindu.

(x) Area of residence was classified into urban and rural.

(xi) Access to amenities was categorised into not having access to either piped water or flush or pit toilet, having access to one and having access to both the amenities.

(xii) Ownership of asset is categorised as not owning a television or refrigerator or motorcycle, owning one to two and owning all three assets. This variable is used as a proxy for economic status of the household.

(xiii) Watching television every week is grouped into yes and no.

(xiv) Listening to radio every week is classified into yes and no.

Data Analysis

The data were analysed using two approaches. In the first part of the analysis, all indicators of gender disparity are measured either as percentages or as ratios - the estimates for boys divided by the estimates for girls. This level of analysis simply examined the relationship between the sex of the child and health disparity indicator without taking into account other explanatory variables. Having established the detailed patterns of gender disparity for all the major states of India, I move on to my second level of analysis. In this section I estimate the effect of the sex of the child on the various outcomes of gender disparity, controlling for the demographic and socio-economic characteristics of women. Given the dichotomous nature of the dependent variable (0, 1), this is done using binary-logistic regression. For the analysis of completeness of immunization, the dependent variable was equal to 1 if the child is fully immunized and 0 otherwise. For the analysis of the undernourished children, the dependent variable was equal to 1 if the child's z-score was below -2 standard deviation units (under-nourished child) and equal to 0 if a z-score falls above -2 standard deviation (well nourished child). Coefficients are estimated using the maximum likelihood method (MLM) of estimation. The independent variables are recoded into categorical indicator variables. The relationship between sex and other covariates and each health variable was analysed for each Indian state separately.

Results

Sex differentials in immunization

The first step in the analysis is to consider immunization coverage among the subsample of children aged 12-35 months. Table 1 shows sex differentials in adequacy of immunization, regardless of any other characteristics of the child or mother. The overall figures for immunization coverage suggests that while boys were more likely than girls to have received all recommended doses of immunization in the northern state, however, interstate variations do exists in complete vaccination among North Indian states. Boys are more likely to have complete vaccination coverage than girls in Delhi, Punjab, Madhya Pradesh, Uttar Pradesh and Bihar. There is no evidence of discrimination against girls in immunization coverage in the South Indian states and in other states of North, West and East Indian states. However, in Andhra Pradesh, girls are more likely than boys to be fully immunized.

To investigate whether these differences are statistically significant, the adequacy of immunization was modelled taking into account the sex of the child, along with a number of other background variables (Table 2). Three things are clear from the analysis. First, All the states which showed discrimination against girls or boys at the bivariate level, maintain the effect of the sex at the multivariate level as well. Second, not all the variables are equally important in determining gender disparity in immunization coverage, and Third, the variables which are important for gender disparity in immunization in one state may not necessarily be relevant in another state, and if they are important, it may not necessarily be to the same extent or in the same direction as in another state. The odds ratios presented in Table 2 indicate that the effect of the sex of the child in having complete vaccination is significant in Delhi (OR=0.68; $p<0.05$), Madhya Pradesh (OR=0.63; $p<0.05$), Uttar Pradesh (OR=0.08; $p<0.05$), Bihar (OR=0.67; $p<0.05$) and Andhra Pradesh (OR=1.88; $p<0.05$).

However, the determinants of the sex differentials in adequacy of immunization are different in these states. In general the demographic factors including age of the mother at the time of birth, preceding birth interval, age of the child were not found to be important predictors of complete vaccination coverage of children in these states. However, birth order was negatively associated with the adequacy of vaccination in three out of four north Indian states. In Delhi, Madhya Pradesh, and Bihar children of birth order 4 and over were less likely to have received all the recommended doses of immunization compared to first order births. In Andhra Pradesh, children of birth order

2-3 were almost 60% less likely to have complete vaccination coverage compared to first order births.

Mother’s and father’s education were found to be important predictor of adequacy of immunization in all these north Indian sates except in Delhi. In these states, children whose mothers had some education were at least 40% more likely to have complete vaccination coverage compared to those children whose mothers had no education. The effect of maternal education was greatest in Bihar state, followed by Madhya Pradesh and Uttar Pradesh. Similarly, children whose fathers had some education were 2.1, 1.2 and 1.8 times more likely to have complete vaccination coverage compared to those children whose fathers had no education, in Madhya Pradesh, Uttar Pradesh and Bihar respectively. However, there was no significant difference in the likelihood of having complete vaccination between children whose fathers had no education and some education in any of the south Indian states. Lack of the effect of maternal as well as paternal education on vaccination coverage in the South Indian states may be because the vaccination coverage is very high in these states.

Mother’s work status was a significant predictor of complete vaccination coverage in Orissa state only. Children whose mothers were working were 34 percent less likely to have received all the recommended doses of vaccination, compared to children whose mothers were not working in Orissa state. The results might suggest that for most of the women in Orissa state, participating in economic activity outside home is a necessity to supplement household’s income and perhaps the opportunity cost of not going to work is greater than the immunisation effect of children. Even when the services are provided free of cost as in publicly funded programmes, there are other costs like travel cost to the immunisation site, waiting cost, the opportunity cost of waiting several hours or a day spent away from work which act as a disincentive for working mothers to immunize their children.

Caste was a significant predictor of complete vaccination coverage only in Andhra Pradesh where children belonging to non-scheduled caste community were three times more likely to have complete vaccination coverage than children belonging to scheduled caste/tribe community. In Andhra Pradesh women belonging to scheduled caste or scheduled tribes were found to be 30% less likely to receive antenatal check up as compared to non-scheduled caste/ scheduled tribe (Navaneetham and Dharmalingam, 2002). Religion and place of residence did not turn out to be a significant predictor of complete vaccination coverage of children in any of these states.

Access to both piped water and a toilet (flush or pit toilet) and ownership of assets (television, refrigerator and motorcycle) significantly increased the likelihood of full vaccination of children in Madhya Pradesh and Uttar Pradesh. Children who belonged to households, which had access to both these facilities, were 2.5 and 1.5 times more likely to have complete vaccination coverage than those without access to both these facilities in Madhya Pradesh and Uttar Pradesh respectively. Similarly children who belonged to households, which owned all these three assets, were 3.15 and 1.7 times more likely to have complete vaccination coverage than those without owning any of these facilities in Madhya Pradesh and Uttar Pradesh respectively. Watching TV every week was a significant predictor of complete vaccination coverage in Madhya Pradesh, Uttar Pradesh and Bihar. Children of women who watched TV every week were 1.5, 1.3 and 1.7 times more likely to have complete vaccination coverage than children of those women who were not exposed to TV every week in Madhya Pradesh, Uttar Pradesh and Bihar respectively.

Sex differentials in nutrition

The next set of questions relate to nutritional status of boys and girls. Table 1 shows sex differentials in nutritional status of children in different states of India as calculated according to "weight-for-age", "height-for-age", and "weight-for-height", measures, regardless of any other characteristics of the child or mother. The overall figures again suggest that there is inter-state variations in discrimination against girls in the nutritional status as depicted by these three measures. Undernutrition (low weight-for-age) is more common among female children in Uttar Pradesh and Gujarat, stunting or undernutrition (low height-for-age) is more common among female children in Haryana, Uttar Pradesh and West Bengal. However, in none of the major states girls are more likely than boys to be wasted. Rather, in Delhi and Andhra Pradesh, boys are more likely to be wasted (low weight-for-height) than girls. There is no evidence of discrimination against girls in nutrition status in any of the South Indian states.

The effect of the sex of the child on the nutritional status is assessed in two different models (Table 2). In the first, the effect of the sex for the likelihood of low weight-for-age is modelled, taking into account various demographic and socioeconomic characteristics. In the second, the dependent variable is the odds of having a low height-for-age as comparing with normal height-for-age. Both models control for the effect of a number of demographic and socio-economic variables. Three things are clear from the analysis. First, there are significant variations among north Indian states in female discrimination in nutrition. Except for Uttar Pradesh, the states that showed discrimination against girls in immunization, do not show discrimination in nutrition. Second, stunting is more prevalent among children than underweight. Third, there was no evidence of female discrimination in nutrition in any of the south Indian states. The odds ratios presented in Table 2 indicate that the effect of the sex of the child on being underweight is significant in Delhi, and Gujarat only. The results indicate that girls are more likely to be underweight in Gujarat (OR=1.73; $p<0.05$) while boys are more likely to be underweight in Delhi (OR=0.67; $p<0.05$). The results presented in Table 2 also indicate that the effect of the sex of child on being stunting is significant in Haryana, Rajasthan, Uttar Pradesh, West Bengal and Gujarat. Girls are significantly more likely to be stunted than boys in Haryana (OR=1.32; $p<0.10$), Rajasthan (OR=1.35; $p<0.01$), Uttar Pradesh (OR=1.29; $p<0.05$), West Bengal (OR=1.32; $p<0.10$), and Gujarat (OR=1.37; $p<0.510$).

However, the determinants of the sex differentials in nutrition are different in these states. Caste, area of residence and listening to radio were significant predictor of low weight-for-age in Delhi, but not in Gujarat. On the other hand, mother's age at birth, preceding birth interval, education of the mother, ownership of assets, exposure to mass media (watching TV and listening to radio) were significant predictors of low weight-for-age in Gujarat but not in Delhi (except for listening to radio which was significant in Delhi as well). Mother's age of 20-29 years at the time of birth and first birth and or a preceding birth interval of 24 months or more are significant predictors of low weight-for-age in Gujarat state. Children of first birth order and or of a preceding birth interval of 24 months or more and whose mothers aged 20-29 years at the time of birth were almost 50 percent less likely to be underweight as compared to children born less than 24 months of preceding birth interval and whose mothers aged 19 years or less respectively in Gujarat. Mother's education was found to be important predictor of underweight in Gujarat state where children whose mothers had some education were 60% less likely to have low weight-for-height compared to those children whose mothers had no education.

Ownership of assets (television, refrigerator and motorcycle) significantly reduced the likelihood of low weight-for-age in Gujarat state. Children who belonged to households, which owned one or two of these assets and all these three assets, were 46% and 75% respectively less likely to have low weight-for-age than those without owning any of these assets in Gujarat state. Watching TV every week significantly increased the likelihood of low weight-for-age in Gujarat state and the reasons are not clear for that. Children of women who watched TV every week were 1.6 times more likely to have low weight-for-age than children of those women who were not exposed to TV every week in Gujarat state. Listening to radio every week significantly reduced the likelihood of low weight-for-age in both the states where sex of the child was significantly related with low weight-for-age. Children of women who listened radio every week were 40% and 36% less likely to have low weight-for-age than children of those women who were not listening to radio every week in Gujarat and Delhi state respectively. For Delhi state, children belonging to non-scheduled caste community were 47% less likely to have low weight-for-age than children belonging to scheduled caste/tribe community. Children living in rural areas were 3.6 times more likely to have low weight-for-height than children living in urban areas in Delhi state.

Mother's age at the time of birth is a significant predictor of low height-for-age in Uttar

Pradesh, West Bengal and Gujarat, however it was not a significant predictor in Haryana and Rajasthan. In Uttar Pradesh, the odds ratio decreases as the mother's age at the time of birth increases, indicating that prevalence of stunting decreases with an increase in mother's age. For example, children born to mothers aged 20-29 and 30 years or more at the time of birth were 35% and 53% respectively less likely to be stunted as compared to children born to mothers aged 19 years or less in Uttar Pradesh. In West Bengal, however, only children born to mothers aged 30 years or more were 47% less likely to be stunted as compared to children born to mothers aged 19 years or less. In Gujarat, children born to mothers aged 20-29 and 30 years or more at the time of birth were 68% and 54% respectively less likely to be stunted as compared to children born to mothers aged 19 years or less. Preceding birth interval was found to be an important predictor of low height-for-age in Haryana and Gujarat only. Children of first birth order and or of a preceding birth interval of 24 months or more were 48% and 37% less likely to be underweight as compared to children born less than 24 months of preceding birth interval in Haryana and Gujarat respectively. Age of the child was not a significant predictor of low height-for-age in any of the states. Birth order was positively associated with low height-for age Rajasthan, Uttar Pradesh and Gujarat. In Rajasthan children of birth order 4 and over were 1.4 times more likely to stunted compared to first order births. In Uttar Pradesh children of birth order 2-3 and 4 and over were two times more likely to be stunted compared to first order births. However, in Gujarat, the odds ratio increases as the birth order increases, indicating that prevalence of stunting increases with an increase in the order of birth. For example, children of birth order 2-3 and 4 and over were1.6 and 2.3 times respectively more likely to be stunted compared to first order births.

Mother's education was found to be important predictor of low height-for-age in all the states except Haryana and father's education was significantly associated with low height-for-age only in Uttar Pradesh and West Bengal. In these states, children whose mothers had some education were at least 30% less likely to be stunted compared to those children whose mothers had no education. The effect of maternal education was similar in all the states except in Gujarat where the effect of maternal education on stunting of children was the greatest among all these states. In Gujarat children whose mothers had some education were 50% less likely to be stunted compared to those children whose mothers had no education. Similarly, children whose fathers had some education were 25% and 50% less likely to be stunted compared to those children whose fathers had no education, in Uttar Pradesh and West Bengal respectively. However, there was no significant difference in the likelihood of having low height-for-weight between children whose fathers had no education and some education in other states. Lack of the effect of maternal as well as paternal education on vaccination coverage in the South Indian states may be because the vaccination coverage is very high in these states. Mother's current work status was a significant predictor of low height-for-age in Gujarat state only. In Gujarat, children whose mothers were working were 1.4 times more likely to be stunted than those children whose mothers were not working.

Caste was a significant predictor of stunting only in Rajasthan and Uttar Pradesh where children belonging to non-scheduled caste community were 25% less likely to be stunted than children belonging to scheduled caste/tribe community. Religion was a significant predictor of stunting only in West Bengal where children belonging to non-Hindu group were 1.6 times more likely to be stunted than children belonging to Hindu religion and place of residence was a significant predictor of stunting only in Uttar Pradesh where children residing in rural areas were 32% less likely to be than children residing in urban areas.

Access to amenities did not turn out to be a significant predictor of low height-for-age among children in any of these states. Ownership of assets (television, refrigerator and motorcycle) significantly reduced the likelihood of low height-for-age in all the states except West Bengal. Children who belonged to households, which owned all these three assets, were 64%, 55%, 79%, and 71% less likely to have low height-for-age than those without owning any of these assets in Haryana, Rajasthan, Uttar Pradesh and Gujarat respectively. Similar to low weight-for-age, watching TV every week significantly increased the likelihood of low height-for-age as well in Gujarat state and the reasons are not clear for that. Children of women who watched TV every week were 1.6 times more likely to have low weight-for-age than children of those women who were not exposed to

TV every week in Gujarat state. Listening to radio every week was not a significant predictor of low weight-for-age in any of the states where sex of the child was significantly related with low height-for-age.

Discussion and conclusion

What do the results from the present study show? First, consistent with the previous literature on India, the gender disparities in immunization as well as in nutritional status are worse in North Indian states than in the south Indian states (Dyson and Moore, 1983). However, contrary to the study by Mishra et al (2004), this study found a complete lack of female disadvantage in any of the health indicators in any of the south Indian states. Rather, in Andhra Pradesh, females are at an advantage in case of immunization and wasting. This may be due to the reason that Mishra et al (2004) was an aggegrate level study and it suggests that aggregate level studies not capture the full effect of gender on the health outcomes and we need more individual level studies. While discrimination against girls in many parameters of health has been oversated in the north Indian states, the relative disadvantage of boys in health in the South has been neglected and should be addressed in future studies.

However, a second notable finding from these analyses is that gender disparity is not uniform within North India. There are significant variations among the north Indian states in gender disparity in health. We have also found that the magnitude of regional difference is not the same for all the health care indicators among the north Indian states. For example, Delhi state shows very high preferential treatment of boys in case of immunization but girls fare better than boys in case of nutrition (weight-for-age) in the same state. On the other hand, Haryana, Rajasthan, West Bengal and Gujarat states show no evidence of discrimination against girls in immunization but there is a strong tendency in these states for the preferential treatment of boys in case of nutrition. There is an evidence of discrimination against girls in immunization in Madhya Pradesh and Bihar but there is a lack of evidence of discrimination against girls in nutrition in these states.

Uttar Pradesh is the only state which shows evidence of discrimination against girls in both immunization and nutrition.

Third, discrimination against girls in nutrition in a band across north Indian states comprising Gujarat in the West, through to Rajasthan, Haryana, and Uttar Pradesh in the North. Gujarat shows the largest magnitude of discrimination against girls in terms of low weight-for-height while Haryana state shows the largest magnitude of discrimination against girls in terms of low height-for-age. Contrary to the literature (Das Gupta, 1987; Das Gupta & Mari Bhat, 1997; Miller, 1981), we did not find any evidence of discrimination against girls either in immunization or nutrition in Punjab state.

Fourth, the effect of various socioeconomic and demographic factors in influencing the gender disparity has also varied depending on the state and the type of health indicator. For example, while a preceding birth interval of 24 months or more was associated with a lower underweight and stunting than those with a preceding birth interval of less than 24 months, there was no difference between children with preceding birth interval of less than 24 months or 24 and more than 24 months interval in immunization adequacy. Also, age of the mother at the time of birth was not found to be important predictor of complete vaccination coverage of children in Uttar Pradesh (the only state which showed discrimination against girls in both immunization as well as in nutrition) but it was an important predictor of stunting among children in the same state. In Utter Pradesh, children born to mothers aged 20-29 and 30 years or more at the time of birth were 35% and 53% respectively less likely to be stunted as compared to children born to mothers aged 19 years or less in Uttar Pradesh. Similarly, while children belonging to non-scheduled caste and non-scheduled tribe in Rajasthan and Uttar Pradesh were less likely to be stunted than children belonging to scheduled caste and scheduled tribes, it was not the case in Haryana, West Bengal and Gujarat.

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Table 1 Percent of children 12-35 months old classified as undernourished on weight-for-age, and height-for-age indices of nutritional status, according to states, India, 1998-99

	Percentage fully immunized[1]			Wight-for-age (underweight)			Height-for-age (stunted)			Weight-for-height (wasted)			N^3
				Percentage below –2SD[2]			Percentage below –2SD[2]			Percentage below –2SD[2]			
	Boys	Girls	Boys/Girls	Boys	Girls	Boys/Girls	Boys	Girls	Boys/Girls	Boys	Girls	Boys/Girls	
North													
Delhi	52.2	44.7	1.16*	42.9	38.5	1.11	41.2	49.4	0.83	16.3	7.9	2.06**	336
Haryana	65.1	66.0	0.98	42.3	48.0	0.88	58.6	69.1	0.84***	6.5	5.5	1.18	594
Himachal Pradesh	81.9	79.6	1.02	47.8	53.8	0.88	48.8	46.2	1.05	16.3	20.8	0.78	510
Punjab	75.9	68.1	1.11**	35.9	36.9	0.97	46.9	43.9	1.06	8.8	7.0	1.25	506
Rajasthan	18.0	19.0	0.94	63.2	66.9	0.94	62.8	69.2	0.90	14.8	14.9	0.99	1529
Central													
Madhya Pradesh	25.3	18.1	1.30***	65.3	69.2	0.94	61.5	64.9	0.94	21.9	22.0	0.99	1689
Uttar Pradesh	23.4	18.7	1.25***	61.5	67.0	0.91**	65.7	73.1	0.89**	12.7	13.0	0.97	2604
East													
Bihar	12.4	9.2	1.34**	67.6	70.1	0.96	66.6	69.9	0.95	24.7	21.7	1.13	1359
Orissa	45.2	43.5	1.03	64.4	65.3	0.98	53.6	55.7	0.96	27.8	28.2	0.98	915
West Bengal	51.5	47.8	1.07	55.3	56.0	0.98	44.1	53.1	0.83**	17.9	15.0	1.19	789
West													
Gujarat	54.6	49.2	1.10	52.0	61.8	0.84**	54.4	58.9	0.92	16.5	20.5	0.80	802
Maharashtra	73.2	69.4	1.05	59.7	57.6	1.03	43.9	48.1	0.91	22.4	24.3	0.92	1118
South													
Andhra Pradesh	14.0	21.7	0.64*	32.6	29.7	1.09	31.1	32.2	0.96	13.3	5.9	2.2**	279
Karnataka	59.6	54.4	1.09	54.7	55.3	0.98	48.8	50.0	0.97	23.1	21.1	1.09	803
Kerala	67.2	70.6	0.95	32.7	35.5	0.92	23.7	27.4	0.86	15.0	13.4	1.11	462
Tamil Nadu	89.8	86.6	1.03	44.8	47.5	0.94	39.8	39.5	1.00	19.7	18.7	1.05	869

Source: National Family and Health Survey: 1998-1999 (for different states).

Note: [1] Full immunization = a dose of BCG vaccine, three doses of diphtheria, pertussis and tetanus, three doses of polio, and a dose of measles.
Each index is expressed in standard deviation units (SD) from the median of the International Reference Population.
[2] Includes children who are below –3SD from the International Reference Population median.
[3]This may be less because heights and weights were not measured for some children.
*p<0.10, **p<0.05, ***p<0.01

Table 2 Odds ratios of adequacy of immunization, low weight-for age, low height-for-age for female children aged 12-35 months, by selected demographic and socioeconomic characteristics, states, 1998-99

	Adequacy of immunization	Low weight-for-age	Low height-for-age
North			
Delhi	0.68**	0.67*	1.22
Haryana	1.07	1.21	1.51**
Himachal Pradesh	0.84	1.29	0.84
Punjab	0.69	1.00	0.86
Rajasthan	1.08	1.16	1.35***
Central			
Madhya Pradesh	0.63**	1.15	1.11
Uttar Pradesh	0.80**	1.15	1.29**
East			
Bihar	0.67**	1.15	1.19
Orissa	0.93	1.01	1.11
West Bengal	0.89	0.86	1.32*
West			
Gujarat	0.81	1.73***	1.37*
Maharashtra	0.85	0.88	1.18
South			
Andhra Pradesh	1.88**	0.78	0.92
Karnataka	0.81	1.01	1.04
Kerala	1.11	1.22	1.27
Tamil Nadu	0.70	1.12	0.96

Source: National Family and Health Survey: 1998-1999 (for different states).

Note: [1] Full immunization = a dose of BCG vaccine, three doses of diphtheria, pertussis and tetanus, three doses of polio, and a dose of measles.

Each index is expressed in standard deviation units (SD) from the median of the International Reference Population.

[2] Includes children who are below –3SD from the International Reference Population median.

[3] This may be less because heights and weights were not measured for some children.

*p<0.10, **p<0.05, ***p<0.01

Table 3 Odds ratios of adequacy of immunization for children aged 12-35 months in the states where sex of the child was an important predictor of adequacy of immunization, by selected demographic and socioeconomic characteristics, states, 1998-99

Variables	Delhi	Madhya Pradesh	Uttar Pradesh	Bihar	Andhra Pradesh
Sex of the child					
Male	1.00	1.00	1.00	1.00	1.00
Female	**0.68****	**0.63****	**0.80****	**0.67****	**1.88***
Mother's age at birth of child (years)					
<19	1.00	1.00	1.00	1.00	1.00
20-29	1.46	1.46*	1.21	1.02	3.10*
30+	2.05	1.24	1.37	1.13	2.54
Preceding birth interval					
<24 months	1.00	1.00	1.00	1.00	1.00
First birth / ≥ 24 months or more	0.74	0.88	1.03	1.14	0.86
Age of the child in months					
12-23	1.00	1.00	1.00	1.00	1.00
24-35	0.99	1.19	1.13	1.11	0.87
Birth order					
1	1.00	1.00	1.00	1.00	1.00
2-3	0.63**	0.75	1.02	1.07	0.41*
4+	0.36***	0.63**	0.78	0.58*	0.52
Education level of mother					
None	1.00	1.00	1.00	1.00	1.00
Some	0.93	1.51***	1.43***	1.71***	0.94
Father's level of education					
None	1.00	1.00	1.00	1.00	1.00
Some	1.20	2.19***	1.28*	1.88***	2.18
Mother's current work status					
Not employed	1.00	1.00	1.00	1.00	1.00
Employed	1.14	1.15	0.66***	0.92	0.95
Caste/Tribe					
Schedule Caste	1.00	1.00	1.00	1.00	1.00
Non-Scheduled caste	1.34	1.22	0.90	0.97	3.33**
Religion					
Hindu	1.00	1.00	1.00	1.00	1.00
Non-Hindu	0.72	1.33	0.92	0.67	0.97
Area of residence					
Urban	1.00	1.00	1.00	1.00	1.00
Rural	1.25	1.01	0.94	0.72	1.03
Access to amenities (piped water, flush or pit toilet)					
None	1.00	1.00	1.00	1.00	1.00
One	1.03	2.03***	0.86	1.40	1.71
Both	1.01	2.52***	1.55*	1.13	1.84
Ownership of assets (television or refrigerator or motorcycle)					
None	1.00	1.00	1.00	1.00	1.00
One to two	0.97	0.97	1.33*	1.34	0.80
All three	0.68	3.13***	1.72*	1.81	2.58
Watches television every week					
No	1.00	1.00	1.00	1.00	1.00
Yes	1.43	1.52**	1.34*	1.70*	2.04
Listens to radio every week					
No	1.00	1.00	1.00	1.00	1.00
Yes	1.43	1.02	0.98	1.13	1.73

Source: National family and Health survey: Haryana (1989-99).

Note: Adequate immunization = a dose of BCG vaccine, three doses of diphtheria, pertussis and tetanus, three doses of polio, and a dose of measles.
*p<0.10, **p<0.05, ***p<0.01

Table 4 Odds ratios of the low weight for height and low height-for-age as a function of selected explanatory variables in the sates where sex was an important predictor of underweight and stunting, 1998-99

	low weight for height		low height-for-age				
Variables	Delhi	Gujarat	Haryana	Rajasthan	Uttar Pradesh	West Bengal	Gujarat
Sex of the child							
Male	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Female	**0.67***	**1.73*****	**1.51****	**1.35*****	**1.29****	**1.32***	**1.37***
Mother's age at birth of child (years)							
<19	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20-29	1.11	0.46**	1.09	0.87	0.65**	0.67	0.32***
30+	0.85	0.49	0.85	0.75	0.47***	0.53*	0.41**
Preceding birth interval							
<24 months	1.00	1.00	1.00	1.00	1.00	1.00	1.00
First birth / ≥ 24 months or more	0.85	0.52**	0.52**	0.77*	1.11	0.91	0.63*
Age of the child in months							
12-23	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24-35	1.25	1.15	0.81	0.86	0.86	0.80	1.25
Birth order							
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2-3	1.04	1.30	1.01	1.13	2.01***	1.08	1.64**
4+	1.26	1.47	1.51	1.47**	1.94***	1.17	2.30***
Education level of mother							
None	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Some	0.62	0.38***	0.74	0.63***	0.64***	0.64**	0.50***
Father's level of education							
None	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Some	0.58	1.44	0.74	0.85	0.75*	0.50***	0.93
Mother's current work status							
Not employed	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Employed	1.06	1.14	1.65	0.0*	1.05	1.26	1.44*
Caste/Tribe							
Schedule Caste	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Non-Scheduled caste	0.53**	0.84	0.98	0.75**	0.74**	0.84	1.07
Religion							
Hindu	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Non-Hindu	0.63	0.76	1.28	1.00	1.09	1.60**	0.82
Area of residence							
Urban	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Rural	3.60***	0.88	0.98	0.95	0.68*	0.88	0.69
Access to amenities							
None	1.00	1.00	1.00	1.00	1.00	1.00	1.00
One	1.18	0.98	0.92	0.91	0.83	0.71	1.01
Both	1.24	0.86	0.62	0.77	0.66	0.65	0.79
Ownership of assets							
None	1.00	1.00	1.00	1.00	1.00	1.00	1.00
One to two	1.41	0.58**	1.18	0.75	0.67**	0.57**	0.81
All three	0.62	0.25***	0.34**	0.45**	0.21***	0.48	0.29***
Watches television every week							
No	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Yes	1.82	1.67**	0.69	0.92	1.13	0.73	1.73**
Listens to radio every week							
No	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Yes	0.64*	0.59**	1.39	0.97	0.81	1.10	0.83

Source: National family and Health survey: Haryana (1989-99).
Note: Adequate immunization = a dose of BCG vaccine, three doses of diphtheria, pertussis and tetanus, three doses of polio, and a dose of measles.
*p<0.10, **p<0.05, ***p<0.01