Introduction

Closing gender gaps in schooling and health outcomes, wages and labour force participation, and access to land and financial resources has become an important challenge for policy makers in regions with most pronounced male bias, such as East and South Asia, Middle East and some countries in the North Africa (Holmes 2006). Despite the knowledge that discrimination in nutrition and health care may lead to severe growth faltering and increased mortality, people tend to discriminate. In most of these countries, sons are preferred over daughters for a number of economic, social and religious reasons including financial support, old age security, property inheritance, dowry, family lineage, prestige and power, birth and death rituals and beliefs about religious duties and salvation (The World Bank 1991). A strong preference for sons, leads to gender discrimination in feeding, health care, nutrition and education. In patriarchal societies, because of differential social evaluation of sons and daughters, daughters receive less care (medical and nutritional) than boys (Basu 1989). A number of studies show the evidence of gender differentials in immunization, feeding practices and medical treatment (Borooah 2004; Mishra, Roy and Retherford 2004; Pande 2003).

The World Development Indicators (2004) show a large proportion of malnourished children, in the third world countries. India accounts for 40 percent of world's malnourished children, while having 20 percent of global child population. Despite India's substantial progress in food production, disease control and economic and social development, more than half of its children under four years of age are severely or moderately malnourished and 30 percent of newborns are significantly underweight (Measham and Chatterjee 1999). Malnutrition is seriously retarding improvement in human development and productivity and economic growth of the nations.

Poor nutrition in early childhood is linked with increased mortality risk, poor cognitive development, and greater functional impairments in adulthood, as well as lower earnings (Martorell and Arroyave 1988). Relative to those in developed countries, children in less developed countries typically exhibit considerable cumulative deficits in linear growth early in life. The most immediate cause of growth faltering may be delayed onset of the childhood phase of growth that begins around weaning, and is likely to be related to the nutritional content of complementary feeding as well as exposure to infectious diseases (Liu, Jalil and Karlberg 1998). Poor health has implications for surviving girls' health in reproductive years and may be perpetuated across the generations (Merchant and Kurz 1992). Malnourished children are more likely to be on the risk of mortality and morbidity, and the girls are in the most vulnerable group. There is need of addressing the problem of malnutrition, particularly among the girl children.

One way to improve nutritional status is through public health interventions to increase children's access to curative and preventive health care and mother's access to information about nutrition and feeding practices. A reduction in the cost of human capital investment leads to a larger increase in the human capital investment of daughters than sons (Alderman and Gertler 1997). The biology of child growth suggests that interventions that affect child nutrition will be of greatest benefit to children between the ages of 1 and 4 (Frankenberg, Suriastini and Thomas 2005).

Literature Review

Alderman and Gertler (1997) had given a model, which addresses the discriminatory behavior of households in human capital investment. This is a two period model, which suggests that parents derive satisfaction from their consumption and children's wealth. In the first period, parents invest their income in their own consumption and in the children's development. In the second period, transfers from the children finance their consumption. The amount of transfer depends upon the investment made by parents in the first period and the wealth of the children.

In patriarchal societies, women are confined to subordinate, low wage jobs, which affects the remittance rate of women. In these societies, sons are expected to provide financial support in the old age of parents. Daughters are not supposed to be the resource of household and their wealth is not considered to be of the household. Lastly, parental preferences and cultural norms may lead to son preferences.

Alderman and Gertler's model suggest that in a situation, when the human capital investment is more in sons than daughters, parents derive more satisfaction, if the remittance rate from the sons is more than daughters, wealth of sons is more than daughters or the rate of return of investments from the sons is more than the daughters. They suggested that policies, which tend to reduce the cost of human capital investment, could be helpful in bringing significant changes in the health outcomes of girls, who have lesser access to human capital investments. Therefore, the reduction in prices can have a beneficial impact on the daughters. In patriarchal societies like India, this model can explain the gender disparities in feeding and health care. If the food and medical facilities become available and accessible to the people at lower costs, then girl child may benefit. Thus the public investments that reduce the cost of utilization of food and medical services may disproportionately affect the girl child.

The performance of a country in terms of its population's health is largely dependent on how the available health care services are being utilized, but the utilization is affected by the availability and accessibility of the health services. Analysis of health care utilization has therefore increasingly been a major focus for researchers, policy makers and programme managers (Pokhrel and Sauerborn 2004). Mainly four factors influence women's access to health care, broadly termed, need, permission, ability and availability (The World Bank 1991). Need is related to the perception of illness and the symptoms of illness, permission to the status of women, ability and availability can be in terms of price and distance. So if we could control accessibility and availability, these two factors in the form of intervention of Anganwadi and Primary health centers (which provides services almost free of cost) the utilization of services may increase. A study done by Holmes (2006) found that improvements in the access and quality of public services have a larger impact on the nutritional status of girls, particularly in the longer duration of time.

Gender inequalities in health are part of the gender inequalities in social, economic and political lives of the third world societies (Okojie 1994). Analysis done by Mishra et al. (2004) indicates the presence of discrimination in childhood feeding, immunization coverage, treatment seeking, and nutritional status. The presence and extent of gender discrimination depends largely on the birth order of the index child and the sex composition of older siblings (Mishra et al. 2004). Gender differentials in immunization appear to be spread throughout the country such that even states that perform relatively well on the other counts may have medium or high gender differentials (Pande and Yazbeck 2003). Girls are undoubtedly disadvantaged in being fully immunized and receiving a nutritious diet (Borooah 2004). Girls with older sisters fare particularly badly (Pande 2003). At the same time, some studies found no gender differences in weight for age scores (Griffiths, Matthews and Hinde 2000). A study done by Thomas, Lavy and Strauss (1996) found that the reduced availability and quality of health care services and increases in relative food prices (under economic adjustment programmes of 1980s) has adversely affected the health of Ivorians. Basic services such as immunizations, simple materials such as common drugs in stock and higher food prices have a significant detriment impact on the health of both children and adults (Thomas, Lavy and Strauss 1996). Studies have also found significant association between child height and local infrastructure, particularly the availability of modern sewerage, piped water supply and electricity. Also higher dairy and sugar prices are found to be associated with poor child health (Thomas and Strauss 1992).

Need for the study

Most of the studies, done in the past, have examined the gender differentials in terms of household and individual characteristics and not given attention to the impact of availability and accessibility of community factors on gender differentials. The present study is an attempt to examine the impact of community level factors on the health outcomes of boys and girls.

Objectives

This paper examines the evidence for gender differences in the impact of local infrastructure and prices on the health outcomes of children in rural India. The major objectives are:

1. To examine gender differences in the impact of local infrastructure and prices on height for age of children
2. To examine gender differences in the impact of local infrastructure and prices on weight for age of children
3. To examine gender differences in the impact of local infrastructure and prices on weight for height of children

The null hypothesis, we propose to test in the paper is that there is no difference in the impact of local infrastructure and prices on health outcomes of boys and girls.

Data and Methods

The present study has used data from the Indian National Family Health Survey (NFHS-2), 1998-99. The NFHS-2 covered a representative sample of more than 90,000 eligible women of age 15-49 from 26 states that comprise more than 90 percent of India's population. It provides a variety of demographic and socio-economic background information. The survey collected information on 32,393 children born in the three years preceding the survey. The sample of children born to rural ever-married women in the age group of 15-49 has been considered for the present analysis. It has also used information collected in the community questionnaire for the rural areas.

The dependent variables used in the analysis are standardized z-scores for height for age, weight for age and weight for height respectively. These three scores are internationally recognized standards to assess children's nutritional status. The nutritional status of children calculated according to these three measures is compared with the nutritional status of an international reference population recommended by the World Health Organization (Dibley et al. 1987a; Dibley et al. 1987b). The WHO standard is

generally applicable to Indian children (Agarwal et al. 1991). The use of this reference population is based on the empirical finding that well-nourished children in all population groups follow very similar growth patterns (Martorell and Habicht 1986).

The height for age index measures linear growth retardation. It is frequently used as a proxy for longer run health status or chronic under-nutrition. Weight for age is a composite measure that takes into account both chronic and acute under-nutrition. Weight for age index shows both short-term nutrition and general health. The weight for height index examines body mass in relation to body length and indicates the prevalence of acute under nutrition. Standardized z-scores have been computed for each child, where a z-score of zero implies that the child's height for age (HAZ) or weight for age (WAZ) or weight for height (WHZ) is equal to the median level of a well-nourished child of the same sex and age.

Two types of independent variables are considered in the present analysis: 1. Individual and household characteristics and, 2. Community characteristics

Individual and household characteristics

The individual and household characteristics considered in the analysis are child age, birth order, mother's age, mother's age square, mother's education, father's education, mother's body mass index (BMI), mother's occupation, standard of living (SLI), caste and religion.

Child's age

Age of children is included to see the age specific differences in the health outcomes of children. Little gender discrimination seems to occur in infancy (Pande 2003). In the initial few months of life, when child survives on the breast-feeding, discrimination is not so prevalent. The discrimination starts after 6 months of age when child starts getting other prepared food. This causes stress and trauma in the young child, and often it coincides with the increased mobility of the child. It is expected that with the increase in child age, disparity in height and weight for age will increase.

Birth Order

Birth order may have impact on anthropometric status in several ways. The children whose birth order is one/two may be more malnourished due to limited household resources early in the life cycle. There is another possibility where earlier born children receive greater share of nutritional resources if parents' desire earlier returns on their child health investments. Later born children may face maternal depletion

syndrome. Sometimes they may be at an advantage if parents have more experience in producing child health.

Mother's age (years and age squares)

Mother's age is considered to have positive association with the height for age and weight for age of the children. Older mothers may have better information of feeding and medical care of children. But this may not have linear relationship, with anthropometric measures for children. Therefore, to account for the non-linearity we use variable mother's age square. The coefficient of this variable will inform us whether the relationship between mother's age and various anthropometric measures is linear or not.

Mother's Education (years) and Father's Education (years)

Mother's and father's education is added in the analysis on the assumption that women having sufficient years of schooling may have better knowledge and information about utilization of services, feeding practices and appropriate medical care. It is expected that women having higher level of education may also have higher level of autonomy.

Mother's Body Mass Index (BMI)

Mother's BMI is considered to have positive association with the height for age and weight for age of the children. A mother in good health may give birth to a healthy child. Mother's BMI is categorized into two groups: less than 18.5 (<18.5) and equal to or more than 18.5 (≥18.5). Separate category for obese women was not created because the number of cases is not enough in that category.

Mother's Employment

The employment of mothers was categorized into two groups - working and not working. The working women are assumed to have better autonomy than not working women and are also expected to have relatively higher control over finances and other household resources. In this case the work status of women is likely to improve child's health. On the other hand, if the woman is forced to work because of her poor economic conditions and the care of children is left to less experienced siblings then one may also get a negative relationship between women's work status and child health outcomes.

Community characteristics

The community level variables considered in the analysis are distance to Primary Health Center, distance to private clinic, availability of a fair price shop in the community, availability of pharma shop, availability of Anganwadi center, availability of private doctor and the geographic region.

Distance to primary health centre (in km.) and private clinic (in km.)

The distance to PHC or a private clinic is treated as a proxy of access to health services and exposure to health information. The distance to PHC also reflects the time cost, travel cost and service cost of obtaining health care and immunization. It is supposed to be positively associated with the health outcomes i.e. if center is too far, malnourishment among children will be more. Furthermore, impact may be larger for daughters than sons.

Availability of fair price shop

Since food is one of the important inputs in the production of child health, it is expected that the effect of a fair price shop should be greater for daughters than sons.

Availability of Pharma shops

The availability of pharma shop is likely to be positively associated with standard heights and weights.

Availability of Anganwadi centers

The Anganwadi centers were the core of Integrated Child Development Services (ICDS, 1975) in which feeding centers of tribal, rural and slums were to be converted into the Anganwadi centers. The Anganwadi is the focal point for delivery of the package of services to mothers and children. An Anganwadi is a Mother and Child Development center, covers about 1000 population in rural/urban area and 700 in tribal areas(Lal 1988). An Anganwadi worker is expected to provide the following services in a community:

1. Supplementary feeding of children and mothers
2. Primary health care and first-aid
3. Health and nutrition education
4. Referral services to severely malnourished, sick and at risk children
5. Community survey and enlisting beneficiaries
6. Non-formal pre-school education
7. Enlisting community support for Anganwadi functions
8. School enrolment of children
9. Maintenance of records and registers

Availability of private doctors

The private doctors' availability is likely to have positive impact on the children's standard heights and weights. However, parents generally prefer to provide costly services only to the children of preferred sex.

Geographic Regions

The NFHS covered 26 states of India. These states are merged into five regions. The Eastern states and North-Eastern states are kept together as the total no. of cases was too less in the North-Eastern states. The five regions are as follows:

1. South (Andhra Pradesh, Tamil Nadu, Karnataka and Kerala).
2. North (Rajasthan, Punjab, Haryana, Himachal Pradesh, New Delhi and Jammu & Kashmir).
3. Central (Uttar Pradesh and Madhya Pradesh).
4. East (Bihar, West Bengal, Orissa and North-Eastern states).
5. West (Gujarat, Maharashtra and Goa).

Method Used

Descriptive statistics and multiple regression has been used in the present paper. Multiple regression is used to examine the effect of community factors, individual level factors and household level factors on height for age score and weight for age score and weight for height scores. The variables birth order, mother's age, mother's age square, mother's education, mother's body mass index, father's education, distance to PHC and distance to private clinic is treated as continuous variables. The other variables included in the analysis are categorical in nature. The multiple regression used in this study can be described as:

$$\mathbf{Y_i = b_0 + b_1 X_{1i} + b_2 X_{2i} + ... + b_k X_{ki} + e_i}$$

Where, Yi is the HAZ/WAZ/WHZ scores and b_1.....b_k is the parameter to be estimated. X_1.....X_k are predictor variables and e is normally distributed error terms. k denotes the no. of predictor variables and i denotes the i^{th} member of the population.

The null hypothesis to be tested was,

$$\mathbf{H_0 : \beta_m = \beta_f}$$

as against, $\mathbf{H_1 : \beta_m \neq \beta_f}$

where, β_m is the regression coefficient for males and β_f is the regression coefficients for females. To test this hypothesis, we first pooled the data for males and females. We created a dummy variable called 'gender' that is coded 1 for female and 0 for male. Subsequently we created various interaction terms that are product of gender and all the other independent variables used in the analysis. We then used the various independent variables, gender and the various interaction variables as predictors in the regression equations for height for age, weight for age and weight for height. It can be easily shown that the coefficients of the interaction variables test the null hypothesis $H_0 : \beta_m = \beta_f$. The significance of the interaction variable indicates that the regression coefficient β_m significantly differs from β_f. The coefficient of the interaction term gives the difference in the slopes for females and males (i.e. $\beta_f - \beta_m$). The methodology discussed above has been used in the present paper to test the proposed null hypothesis.

Results

The Table 1 presents the summary statistics for rural children aged less than 3 years. The negative values of height for age and weight for age of boys and girls of rural India show that they are shorter and lighter than the referenced population. The mean z-score value suggests that the boys are closer to the internationally referenced population than the girls. Girls are in a slight poor condition than the boys.

The Table 1 also suggests that for a rural child, average distance to primary health center is about 8 km. Private clinic is also available on an average distance of 8 km. Only 24 percent of children live in a village where a medical shop is available. Fifty seven percent children live in a village where fair price shop is available. The percent of children, living in a village where an anganwadi center is available, is 62 percent. Fourty one percent children belong to villages having private doctors' facility.

Table 2 presents height for age, weight for age and weight for height for rural children by various socio-economic, demographic and community characteristics. The nutritional status of children is better if the various community level facilities are present in the villages. Improvements in the nutritional status are observed in case of both male and female children. The nutritional status of children is found to be best for the children from South Indian states. Nutritional status of children is found to deteriorate with the increase in age of the child. Better nutrition is observed for children whose mother's are not working, having BMI > 18.5, have high standard of living and belong to general caste.

The Table 3 shows the multiple regression results of the determinants of height for age, weight for age and weight for height standardized scores. Column 1 and 2 show the coefficients of height for

age for boys and girls. Column 4 and 5 show the coefficients of weight for age for boys and girls. Column 7 and 8 show the coefficients of weight for height scores for boys and girls. Columns 3, 6 and 9 show the significant difference between the boys' and girls' coefficient. The entries in the columns 3, 6 and 9 are based on gender interactions from pooled ordinary least square estimation of the determinants of height for age, weight for age and weight for height for rural boys and girls. The details of the gender interactions are given in Table 4.

A comparison of columns 3, 6 and 9 reveals more gender differences in the height for age model than in the weight for age and weight for height model. The standardized height results show that the determinant of long run nutritional status differ by gender and the community level factors have different impact on the standardized height of girls and boys. Comparison of column 1 and 2 reveals that availability of a fair price shop has significant impact on the girls' standardized height, but no impact on boys' standardized heights. Availability of anganwadi center on the other hand, is found to have a significant impact on boys' standardized heights, but no impact on girls' standardized height. The distance to primary health centre is found to have negative impact on girls' standardized heights although not statistically significant but has significant positive impact on boys standardized heights. On the other hand, distance to private clinic is found to have negative impact on the boys' standardized scores (the coefficient is again not significant). The availability of private doctor has positive impact on boys' height for age scores but the value is not significant. Further column 3 indicates that the impact of availability of a fair price shop in the community, availability of a private doctor in the community and the distance to primary health center and private clinic on height for age is significantly greater for girls than boys. We find significantly greater impact of availability of an anganwadi center on the height for age of boys than girls.

One standard deviation reduction in distance to primary health center is likely to reduce the mean gap in height for age for rural Indian girls and the reference population by one percent. The availability of a fair price shop in the community is found to reduce the average female height for age by three percent, but has no significant impact on the male gap. Availability of pharma shop in the community is likely to improve the average gap by two percent for girls' height for age z-scores.

It is clear from table 3 that determinants of weight for age also differ by gender. Again, the community level factors are found to have greater impact on standardized weights for girls than boys. Availability of a fair price shop in the community, availability of a pharma shop in the community, distance to primary health center and distance to private clinic are significantly associated with the

standardized weights of girls. Availability of pharma shop and distance to primary health center are found to be significantly associated with the weight for age of boys.

The availability of a fair price shop in the community reduces the average female weight for age gap by six percent and the male gap by seven percent. The availability of pharma shop has positive impact on both the sexes, and its availability in the community is likely to reduce the mean gap in standardized scores by one percent for boys and three percent for girls. Although the availability of fair price shop is found to have significant impact on average weight for age gap for both boys and girls, there is significant difference in the coefficients across gender and the impact is larger for girls. There is differential impact of availability of pharma shop by gender; girls benefit more than boys. Again the increase in distance to a primary health centre is likely to increase the average female weight for age gap. On the contrary, the increase in distance to a primary health centre is likely to reduce the average male weight for age gap.

The regression estimates of weight for height, given in columns 7 and 8, show that the availability of fair price shop and pharma shop in the community have significant positive impact on both the sexes. Availability of an anganwadi center is found to have a significant negative impact on the weight for height of both boys and girls. Availability of private doctor in the community is likely to improve the girls' weight for height scores. The availability of a private doctor in the community will improve the average gap in weight for height for girls by eight percent for girls but is likely to have no impact on the weight for height score for boys.

The other covariates included to explain standardized height for age, weight for age and weight for height, behave as predicted. The increase in birth order is significantly likely to increase the average height for age and average weight for age for both the sexes but has no significant impact on weight for height scores. The increase in birth order by one unit widens the average height for age by almost three percent for boys and five percent for girls. Similarly one unit increase in birth order widens the average weight for age by almost two percent for boys and three percent for girls. Changes in birth order are going to disproportionately affect boys' and girls' nutritional outcomes.

The age coefficients of Table 3 suggest that when rural Indian children reach the period of weaning and have increased exposure to the outer environment, they are significantly shorter and leaner than the international healthy standard. We find significant differences in the coefficients of male and female child in the age group of 24 – 35 months. Moving to the age group 24 – 35 months from the age

group 0 – 11 months is likely to widen the average height for age gap for males and females by 22 percent and 26 percent respectively. This gap widens by 18 percent for males and 20 percent for females in case of weight for age. The increase in age of child is found to have differential impact on the height for age and weight for age of boys' and girls' in rural India.

Standard of living of household is positively associated with the nutritional status of both sons and daughters and the impact is greater for boys than girls. Average male weight for age gap reduces by eight percent, when male child comes from a medium standard of living household in comparison to a child from low standard of living household. This reduction in case of female is only five percent. In case of a male child coming from a high standard of living household the average gap reduces by 17 percent compared to a male child who is from low standard of living. This reduction for a female child coming from high standard of living is only 13 percent compared to a female child coming from low standard of living household. Standard of living of household is again found to have significant impact on the weight for height scores of both boys and girls. The impact of medium standard of living in reference to low standard of living is likely to be significantly more on the weight for height scores of boys than girls. With improvement in standard of living boys are more likely to gain in comparison to girls. Improvement in standard of living from low to medium is likely to reduce the average male weight for height gap by 16 percent, but this improvement in standard of living is likely to reduce the average female weight for height gap by six percent.

We do not find gender differences in the impact of mother's education and father's education on the height for age and weight for age. However, increase in father's education is significantly like to improve the weight for height for girls, but is not likely to affect the weight for height for boys. Mother's work status is negatively associated with all the three anthropometric measures of child health. This may be because of the fact that the sample is from the rural areas of India. The female work participation in rural areas of India may be mostly poverty driven. These women are again more likely to work in unorganized sectors for smaller wages.

Conclusion

It has been argued in the literature that public investments, which can reduce the cost of human capital investment, have potential to appease the gender differential in intra-household resource allocation. To support this arguement, the present study tried to examine the role of better accessibility and availability of local infrastructure and prices in reducing gender differential in child care. If the services are available at the doorstep and at nominal charges, there is no reason to believe why people do not use the

services for children of less preferred sex. Children of the preferred sex are in any case more likely to get care at the time of need. Therefore, with improvement in local infrastructure and decrease in prices is most likely to affect the children of less preferred sex. In settings like India it is the female child who is more likely to benefit from improvement in local infrastructure and decrease in prices of necessary commodities.

To test this argument, we selected few community level variables to take care of local infrastructure and prices. These variables were distance to various types of health facilities, availability of anganwadi center, availability of fair price shop and availability of pharma shop. An anganwadi center provides nutritious food to the children without any charge. One can buy food items and other necessary items at a reasonable rate from a fair price shop as against buying these items from any other shop. So, these variables are likely to indirectly capture prices prevailing in the community. If such facilities are available in the community the involvement in child health is likely to be less. Under such conditions, female child is more likely to gain compared to a male child.

The data presented in the paper clearly indicates that community level factors (i.e. local infrastructure and prices) have differential impact on the nutritional outcome of boys and girls of rural India. The results presented in the paper do indicate that availability of better prices and better availability and accessibility to local health facilities may reduce the impact of intra-household gender discrimination in the long run. With the availability of a fair price shop, availability of a pharma shop and availability of a primary health center in the vicinity of the community, gender gaps in nutritional outcomes are likely to narrow down. However the mere existence of these may not be the true indicator of the reduction in child health investments. Therefore, we may get stronger impact of availability of local infrastructure and diminishing prices on child health outcomes of boys and girls, if we can get direct information on prices, which in this case is not available. It can be concluded that, the policies which can reduce the cost of accessibility and availability of services and food can benefit children disproportionately.

References

Agarwal, K.N., D.K. Agarwal, D.G. Benakappa, S.M. Gupta, P.C. Khanduja, S.P. Khatua, K. Ramchandran, P.M. Udani, and C. Gopalan. 1991. *Growth performance of affluent Indian Children (under fives): Growth Standard for Indian Children*. New Delhi: Nutrition Foundation of India.

Alderman, H. and P. Gertler. 1997. "Family resources and gender differences in human capital investments: the demend for children's medical care in Pakistan." in *Intra household resource allocation in developing countries: models, methods, and policy.*, edited by L. Haddad, J. Hoddinott, and H. Alderman. Baltimore: Johns Hopkins University Press for the International Food policy Research Institute.

Basu, A.M. 1989. "Is discrimination in food really necessary for explaining differentials in childhood mortality." *Population Studies* 43:193-210.

Borooah, V. 2004. "Gender bias among children in India in their diet and immunisation against disease." *Social Science & Medicine* 58:1719-1731.

Dibley, M.J., J.B. Goldsby, N.W. Staehling, and F.L. Trowbridge. 1987a. "Development of normalized curves for the International growth reference: historical and technical cosiderations." *American Journal of Clinical Nutrition* 46(5):736-748.

Dibley, M.J., N.W. Staehling, P. Neiburg, and F.L. Trowbridge. 1987b. "Interpretation of z-score anthropometric indicators derived from the International growth reference." *American Journal of Clinical Nutrition* 46(5):749-762.

Frankenberg, E., W. Suriastini, and D. Thomas. 2005. "Can expanding access to basic healthcare improve children's health status? Lessons from Indonesia 'midwife in the village' programme." *Population Studies* 59(1):5-19.

Griffiths, P., Z. Matthews, and A. Hinde. 2000. "Understanding the Sex Ratio in India: a simulation approach." *Demography* 37(4):477-488.

Holmes, J. 2006. "Do community factors have a differential impact on the health outcomes of boys and girls? Evidence from rural Pakistan." *Health Policy and Planning* 21(3):231-241.

Lal, S. 1988. *National programme on integrated child development services*. New Delhi: National Institute of Health and Family Welfare.

Liu, Y., F. Jalil, and J. Karlberg. 1998. "Risk factors for impaired length growth in early infancy-childhood-puberty." *Acta Pawdiatrica* 87(3):237-243.

Martorell, R. and G. Arroyave. 1988. Malnutrition, work output, and energy needs. edited by K. J. Collins and Derek F. Roberts. *Capacity for work in the tropics.* Cambridge: Cambridge University Press.

Martorell, R. and J.P. Habicht. 1986. "Growth in early childhood in developing countries." in *Human Growth: A Comprehensive Treatise*, edited by F. Falkner and J.M. Tanner. New York: Plenum Press.

Measham, A.R. and M. Chatterjee. 1999. *Wasting Away: The Crisis of Malnutrition in India*. Washington DC: The World Bank

Merchant, K.M.and K.M. Kurz. 1992. "Women's nutrition through the life cycle: Social and biological vulnaribilities." in *The Health of Women: A Global Perspective*, edited by M. Koblinsky, J. Timyan, and J. Gay. Boulder: Westview Press.

Mishra, V., T.K. Roy, and R.D. Retherford. 2004. "Sex differentials in childhood feeding, health care, and nutritional status in India." *Population and Development Review* 30(2):269-295.

Okojie, C.E. 1994. "Gender inequalities of health in the third world." *Social Science & Medicine* 39(9):1237-1247.

Pande, R.P. 2003. "Selective gender differences in childhood nutrition and immunization in rural India." *Demography* 40(3):395-418.

Pande, R.P. and A.S. Yazbeck. 2003. "What's in a country average? Wealth, gender, and regional inequalities in immunization in India." *Social Science & Medicine* 2003(57):2075-2088.

Pokhrel, S. and R. Sauerborn. 2004. "Household decision-making on child health care in developing countries: the case of Nepal" *Health Policy and Planning* 19(4):218-233.

The World Bank. 1991. *Gender and Poverty in India: A World Bank Country Study*. Washington DC: The World Bank.

The World Bank. 2004. *2004 World Development Indicators*. Washington DC: The World Bank.

Thomas, D., V. Lavy, and J. Strauss. 1996. "Public Policy and Anthropometrics outcomes in the Cote d'Ivore." *Journal of Public Economics* 61:155-192.

Thomas, D. and J. Strauss. 1992. "Prices, infrastructure, household characteristics and child height." *Journal of Development Economics* 39:301-331.

TABLE 1: Background characteristics of the rural boys and rural girls

Variables	Boys Mean or frequency		Girls Mean or frequency	
Child characteristics				
Z-score height for age (HAZ)	-1.88	(1.64)	-1.96	(1.70)
Z-score weight for age (WAZ)	-1.86	(1.70)	-1.94	(1.36)
Z-score weight for height (WHZ)	-0.89	(1.23)	-0.90	(1.22)
Age of the child				
Age is 0-11 months	34.9%		34.0%	
Age is 12-23months	32.8%		33.9%	
Age is 24-35 months	32.3%		32.1%	
Birth Order	2.93	(1.95)	2.94	(2.00)
Family characteristics				
Mother's age (years)	24.95	(5.47)	24.87	(5.48)
Mother's Education (years)	2.73	(3.99)	2.63	(3.87)
Father's Education (years)	5.52	(4.88)	5.43	(4.82)
Mother's BMI <18.5	42.2%		42.1%	
Mother is working	34.6%		35.9%	
Standard of Living				
Low	42.5%		43.1%	
Medium	46.3%		46.5%	
High	11.2%		10.3%	
Caste				
SC/ST	32.5%		32.5%	
OBC	32.7%		33.6%	
Others	34.8%		34.0%	
Religion				
Hindu	81.6%		81.8%	
Muslim	13.8%		13.8%	
Others	4.6%		4.4%	
Region				
South	17.1%		18.0%	
North	12.4%		11.8%	
Central	30.5%		31.3%	
East	29.1%		28.2%	
West	11.0%		10.6%	
Community characteristics				
Distance to primary health centre (in km.)	8.07	(9.87)	8.00	(9.71)
Distance to private clinic (in km.)	7.75	(11.62)	7.75	(11.69)
Availability of fair price shop	57.9%		59.9%	
Availability of pharma shop	24.3%		24.0%	
Availability of anganwadi center	61.7%		61.6%	
Availability of private doctor	40.5%		41.1%	

Note: Values in the bracket refer to the standard deviation

TABLE 2: The mean z-scores of height for age, weight for age and weight for height for rural boys and rural girls, according to selected background characteristics

Variables	HAZ		WAZ		WHZ	
	Boys	Girls	Boys	Girls	Boys	Girls
Community characteristics						
Fair price shop available						
No	-1.96 (1.65)	-2.12 (1.73)	-1.95 (1.29)	-2.11 (1.34)	-0.94 (1.21)	-0.99 (1.19)
Yes	-1.82 (1.64)	-1.85 (1.67)	-1.80 (1.31)	-1.84 (1.36)	-0.86 (1.24)	-0.84 (1.24)
Pharma shop available						
No	-1.91 (1.64)	-2.02 (1.71)	-1.91 (1.30)	-2.01 (1.35)	-0.93 (1.23)	-0.94 (1.21)
Yes	-1.78 (1.64)	-1.78 (1.68)	-1.73 (1.31)	-1.74 (1.37)	-0.79 (1.24)	-0.76 (1.22)
Anganwadi center available						
No	-2.01 (1.70)	-2.07(1.74)	-1.91 (1.34)	-2.01 (1.40)	-0.83 (1.29)	-0.88 (1.27)
Yes	-1.81 (1.61)	-1.90 (1.68)	-1.84 (1.29)	-1.91 (1.34)	-0.92 (1.20)	-0.90 (1.20)
Private doctor available						
No	-1.91 (1.66)	-1.99 (1.74)	-1.91 (1.31)	-2.02 (1.37)	-0.91 (1.24)	-0.96 (1.23)
Yes	-1.82 (1.62)	-1.92 (1.66)	-1.80 (1.30)	-1.85 (1.34)	-0.86 (1.21)	-0.80 (1.21)
Region						
South	-1.50 (1.49)	-1.49 (1.56)	-1.65 (1.21)	-1.65 (1.26)	-0.92 (1.19)	-0.90 (1.18)
North	-1.99 (1.61)	-2.05 (1.66)	-1.76 (1.29)	-1.80 (1.33)	-0.66 (1.20)	-0.62 (1.21)
Central	-2.11 (1.71)	-2.28 (1.71)	-1.99 (1.31)	-2.15 (1.37)	-0.85 (1.16)	-0.91 (1.22)
East	-1.92 (1.72)	-1.80 (1.79)	-1.91 (1.36)	-2.00 (1.41)	-0.91 (1.35)	-0.91 (1.33)
West	-1.78 (1.46)	-1.96 (1.70)	-1.95 (1.27)	-1.99 (1.28)	-1.11 (1.14)	-1.14 (1.15)
Age of child						
0-11 months	-1.07 (1.52)	-1.01 (1.52)	-1.18 (1.32)	-1.21 (1.39)	-0.52 (1.32)	-0.54 (1.30)
12-23months	-2.32 (1.49)	-2.35 (1.55)	-2.25 (1.14)	-2.24 (1.17)	-1.17 (1.21)	-1.11 (1.22)
24-35 months	-2.29 (1.59)	-2.54 (1.61)	-2.20 (1.16)	-2.38 (1.19)	-0.99 (1.05)	-1.04 (1.03)
Work status of mother						
Not working	-1.78 (1.64)	-1.87 (1.69)	-1.73 (1.31)	-1.83 (1.37)	-0.79 (1.25)	-0.81 (1.23)
Working	-2.06 (1.64)	-2.10 (1.71)	-2.09 (1.27)	-2.14 (1.32)	-1.06 (1.19)	-1.04 (1.19)
Mother's Body Mass Index						
<18.5	-2.03 (1.58)	-2.10 (1.66)	-2.12 (1.21)	-2.20 (1.24)	-1.11 (1.15)	-1.11 (1.11)
≥18.5	-1.76 (1.68)	-1.85 (1.74)	-1.66 (1.35)	-1.75 (1.41)	-0.72 (1.26)	-0.74 (1.28)
Standard of Living						
Low	-2.09 (1.66)	-2.12 (1.75)	-2.11 (1.29)	-2.15 (1.36)	-1.045 (1.25)	-1.03 (1.22)
Medium	-1.84 (1.62)	-1.93 (1.67)	-1.79 (1.29)	-1.89 (1.32)	-0.82 (1.21)	-0.85 (1.21)
High	-1.30 (1.64)	-1.42 (1.58)	-1.32 (1.21)	-1.38 (1.36)	-0.64 (1.19)	-0.59 (1.21)
Caste						
SC/ST	-2.05 (1.65)	-2.10 (1.73)	-2.02 (1.33)	-2.08 (1.37)	-0.95 (1.28)	-0.96 (1.26)
OBC	-1.89 (1.69)	-1.93 (1.72)	-1.91 (1.29)	-1.96 (1.35)	-0.95 (1.19)	-0.94 (1.22)
General	-1.70 (1.57)	-1.83 (1.67)	-1.67 (1.28)	-1.79 (1.35)	-0.78 (1.21)	-0.79 (1.18)
Religion						
Hindu	-1.89 (1.64)	-1.97 (1.69)	-1.88 (1.31)	-1.97 (1.35)	-0.91 (1.22)	-0.92 (1.21)
Muslim	-1.93 (1.66)	-2.03 (1.77)	-1.88 (1.30)	-1.97 (1.36)	-0.84 (1.28)	-0.87 (1.24)
Others	-1.54 (1.59)	-1.56 (1.54)	-1.46 (1.28)	-1.40 (1.32)	-0.68 (1.21)	-0.50 (1.22)

Note: Values in the bracket refer to the standard deviation

TABLE 3: The multiple regression estimates of the determinants of height for age, weight for age and weight for height for rural boys and girls under age three

Variables	HAZ			WAZ			WHZ		
	(1) Boys Coefficient	(2) Girls Coefficient	(3) Sig. Diff.	(4) Boys Coefficient	(5) Girls Coefficient	(6) Sig. Diff.	(7) Boys Coefficient	(8) Girls Coefficient	(9) Sig. Diff.
Community characteristics									
Distance to primary health centre	0.0045***	-0.0022	yes(0.005)	0.0028**	-0.0023*	yes(0.006)	0.00003	-0.0013	
Distance to private clinic	-0.0006	0.0036**	yes(0.041)	0.00002	0.0023*		0.0007	0.0002	
Availability of fair price shop	-0.0293	0.0647*	yes(0.057)	0.0371	0.1141***	yes(0.048)	0.0808**	0.1040***	
Availability of pharma shop	-0.0392	0.0360		0.0590*	0.0574*		0.1174***	0.0648**	
Availability of anganwadi center	0.0697**	-0.0105	yes(0.097)	-0.0467*	-0.0419		-0.1233***	-0.0501*	yes(0.059)
Availability of private doctor	0.0174	-0.0768**	yes(0.064)	0.0153	0.0072		-0.0089	0.0677**	yes(0.057)
Region									
South (reference)									
North	-0.5245***	-0.5787***		-0.1630***	-0.1730**		0.2299***	0.2693***	
Central	-0.4906***	-0.6167***	yes(0.093)	-0.2448***	-0.3430***	yes(0.094)	0.0909**	0.0637	
East	-0.3019***	-0.4331***	yes(0.059)	-0.1636***	-0.2284***		0.0319	0.0754*	
West	-0.2837***	-0.2188***		-0.2517***	-0.2853***		-0.1125**	-0.1975***	
Child characteristics									
Age of child									
0-11 months (reference)									
12-23 months	-0.6336***	-0.6747***		-0.5306***	-0.5025***		-0.3076***	-0.2636***	yes(0.038)
24-35 months	-0.4174***	-0.5222***	yes(0.000)	-0.3413***	-0.3889***	yes(0.001)	-0.1541***	-0.1594***	
Birth Order	-0.0498***	-0.0937***	yes(0.021)	-0.0335**	-0.0643***	yes(0.039)	-0.0044	-0.0051	
Family characteristics									
Mother's age (years)	0.0839**	0.0549**		0.0472**	0.0302*		-0.0043	-0.0079	
Mother's age (age square)	-0.0012***	-0.0005		-0.0007**	-0.0003		0.00002	0.00003	
Mother's Education (years)	0.0390***	0.0338***		0.0251***	0.0301***		0.0044	0.0119**	
Father's Education (years)	0.0150***	0.0097**		0.0084**	0.0138***		-0.0001	0.0107**	yes(0.019)
Mother's BMI									
<18.5 (reference)									
≥18.5	0.1434***	0.1341***		0.3343***	0.3256***		0.3069***	0.2925***	
Work status of mother									
Not working (reference)									
Working	-0.0642*	-0.0441		-0.1214***	-0.0659**		-0.1173***	-0.0392	yes(0.048)

*** $p < 0.001$, ** $p < 0.05$, * $p < 0.10$

Variables	HAZ			WAZ			WHZ		
	(1) Boys Coefficient	(2) Girls Coefficient	(3) Sig. Diff.	(4) Boys Coefficient	(5) Girls Coefficient	(6) Sig. Diff.	(7) Boys Coefficient	(8) Girls Coefficient	(9) Sig. Diff.
Standard of Living									
Low (reference)									
Medium	0.0673*	0.0714*		0.1455***	0.0876**		0.1340***	0.0529*	yes(0.046)
High	0.3077***	0.3182***		0.3646***	0.2843***		0.2246***	0.1181**	
Caste									
SC/ST (reference)									
OBC	0.0532	-0.0230		0.0010	-0.0658**		-0.0628**	-0.0658**	
General	0.2233***	0.0700	yes(0.011)	0.2145***	0.0661*	yes(0.002)	0.0717**	0.0305	
Religion									
Others (reference)									
Hindu	-0.1938**	-0.1607**		-0.2303***	-0.2792***		-0.1123**	-0.2331***	
Muslim	-0.2356**	-0.1744*		-0.2874***	-0.2618***		-0.1146*	-0.1968**	
R-squared	0.196	0.223		0.231	0.235		0.096	0.094	
No. of observations	9738	8918		9738	8918		9792	8990	

*** p < 0.001, ** p < 0.05, * p < 0.10

TABLE 4: Gender interactions from multiple regression estimates of the determinants of height for age, weight for age and weight for height for rural boys and girls under age three

Variables	**(1) HAZ Coefficients**	**(2) WAZ Coefficients**	**(3) WHZ Coefficients**
Interaction terms			
Female*Distance to nearest primary health center	-0.0067**	-0.0051**	-0.0014
Female*Distance to nearest private clinic	0.0043**	0.0023	-0.0005
Female*Availability of fair price shop	0.0950*	0.0776**	0.0231
Female*Availability of pharma center	0.0750	-0.0017	-0.0525
Female*Availability of anganwadi center	-0.0820*	0.0038	0.0732*
Female*Availability of private doctor	-0.0952*	-0.0087	0.0766*
Female*North	-0.0565	-0.0113	0.0392
Female*Central	-0.1241*	-0.0970*	-0.0273
Female*East	-0.1341*	-0.0665	0.0434
Female*West	0.0652	-0.0335	-0.0852
Female*Age is 12-23 months	-0.0417	0.0278	0.0439**
Female*Age is 24-35 months	-0.1056***	-0.0480**	-0.0053
Female*Birth order	-0.0433**	-0.0304**	-0.0007
Female*Age of the mother	0.0092	0.0052	-0.0029
Female* Mother's education	-0.0056	0.0048	0.0074
Female* Father's education	-0.0058	0.0052	0.0107**
Female*Mother is working	0.0200	0.0554	0.0781**
Female*BMI of the mother (≥18.5)	-0.0100	-0.0091	-0.0144
Female*Medium SLI	0.0044	-0.0577	-0.0810**
Female*High SLI	0.0069	-0.0823	-0.1065
Female*OBC	-0.0781	-0.0679	-0.0029
Female*General	-0.1541**	-0.1489**	-0.0411
Female*Hindu	0.0358	-0.0473	-0.1208
Female*Muslim	0.0684	0.0298	-0.0822
R-squared	0.209	0.234	0.095

*** $p < 0.001$, ** $p < 0.05$, * $p < 0.1$