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Gender bias among children in India in their diet and immunisation against disease

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Abstract

This paper conducts an econometric analysis of data for a sample of over 4000 children in India, between the ages of 1 and 2 years, with a view to studying two aspects of the neglect of children: their likelihood of being immunised against disease and their likelihood of receiving a nutritious diet. The starting hypothesis, consistent with an universal interest in gender issues, was that girls were more likely to be neglected than boys. The analysis confirmed this hypothesis. In respect of vaccinations, the likelihood of girls being fully vaccinated, after controlling for other variables, was 5 percentage points lower than that for boys. In respect of receiving a nutritious diet, the treatment of girls depended very much on whether or not their mothers were literate: there was no gender discrimination between children of literate mothers; on the other hand, when the mother was illiterate, girls were 5 percentage points less likely to be well-fed relative to their brothers and the presence of a literate father did little to dent this gender gap. But the analysis also pointed to a broader conclusion which was that *all* children in India suffered from sharper, but less publicised forms of disadvantage than that engendered solely by gender. These were the consequences which stemmed from children being born to illiterate mothers and being brought up in the more impoverished parts of India.

Keywords: Children; Gender; Diet; Vaccination; India

Introduction

A feature of developing countries that is particularly worrying is the adverse ratio of the number of women to that of men. Even though males outnumber females at birth (and even more at conception) women tend to outnumber men in North America and Europe with an average ratio of 1.05. By contrast, the female–male ratio is substantially below unity in many countries of the third world: 0.96 in North Africa; 0.94 in China, Bangladesh and West Asia; 0.93 in India; 0.91 in Pakistan. Dreze and Sen (1996), who present these figures, have termed these low female–male ratios as a "missing women" phenomenon: on the basis of European ratios, the number of "missing women" in Asia and North Africa is between 60 and 90 million (Coale, 1991; Klasen, 1994).

In broad terms, the problem of "missing women" stems from the unequal treatment of women. This could take the form of "natal inequality" where the preference for sons, in conjunction with modern techniques to determine the gender of the foetus, results in sex-selective abortions. This type of inequality is particularly prevalent in countries of East and South Asia (Sen, 2001). It could also take the form of "mortality inequality" whereby there is, relative to boys and men, a general neglect of girls and women in respect of factors that contribute to physical well-being: for example, girls and women could be relatively deprived in terms of their diet and in terms of their access to, and utilisation of, health care facilities. Natal inequality and mortality inequality then combine to ensure that there are fewer women than men in countries where such forms of gender discrimination are particularly marked (Kishor, 1993, 1994).

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Against this background, this paper exploits information from a rich set of data for India to examine and to quantify two important aspects of the relative neglect of girls. The first is the degree to which girls between the ages of 1 and 2 years (inclusive), relative to boys of the same age, were 'fully immunised' (defined below) against: tuberculosis (by means of a Bacille Calmette Guerin (BCG) vaccination); polio; diptheria–pertussis–tetanus (DPT); and measles. The second aspect (of the neglect of girls) is the extent to which, relative to boys, they received a 'nutritious' diet (defined below).

In this context, this paper attempts an econometric investigation of:

(i) the likelihood of a child, between the ages of 1 and 2 years, being fully immunised and
(ii) the likelihood of such a child receiving a nutritious diet.

As the title of paper suggests, the sex of the child is hypothesised to be a significant determinant of both probabilities. Underlying any gender bias in the likelihood of full immunisation and of a nutritional diet is the literacy status of the mother and/or the father of the child. This paper asks whether the relative neglect of girls can be blunted, if not eliminated, by parental literacy.

It is important to ask this question because a recurring theme in the literature on the welfare of children in developing countries is the importance of having literate parents and, in particular, of having a literate mother. There is a body of evidence to suggest that the number of children born to a woman is inversely related to her level of education (Borooah, 2000, 2002; Parikh & Gupta, 2001). Furthermore, there is considerable evidence to suggest that children's health (including the likelihood of their surviving infancy and childhood), nutritional status and educational attainments are enhanced by having better educated parents, particularly the mother (Behrman & Wolfe, 1984; Thomas, Strauss, & Henriques, 1991; Sandiford, Cassel, Montenegro, & Sanchez, 1995; Lavy, Strauss, Thomas, & de Vreyer, 1996; Ravallion & Wodon, 2000; Gibson, 2001). Evidence also suggests that a farm-household's total income depends upon the highest education level reached by a household member rather than by the mean educational level of the household or by the educational level of the household head (Foster & Rosenzweig, 1996). To add to this litany, education also raises the wages of both men and women (Kingdon & Unni, 2001).

Augmenting the theme of the benefits of literacy is another, more recent, issue relating to the nature of literacy. This argues that some of the disadvantages to a person of being illiterate may be mitigated if he/she lives in a household in which other members are literate since, for many activities, having access to the ability of the literate members to read and write may serve as a form of 'surrogate' or 'proximate' literacy. In that sense, an illiterate person living with a literate person(s) may not, by virtue of his/her illiteracy, be so badly off as an illiterate person living in a household in which all are illiterate since, in the former situation, he/she is 'proximate literate' while in the latter situation, he/she is illiterate (Basu & Foster, 1998; Basu, Narayan, & Ravallion, 2002).

In order to take account of this aspect of literacy the children in this study were distinguished according to whether their mothers were:

(i) literate;
(ii) proximate literate, that is mother illiterate but father literate;
(iii) illiterate, that is mother and father illiterate;

and an important feature of this study is an examination of whether gender bias in the likelihood of being fully immunised and in the likelihood of receiving a nutritious diet were different for these three different types of maternal literacy/illiteracy.

The econometric estimates which underpin the analysis are based on unit-record data for over 4000 children, between the ages of 1 and 2 years (inclusive), living in rural households drawn from the 16 major states of India. The features of the Survey which provided these data are described in the appendix of this paper. The data provided information on the vaccination history of each child as well as details of the nature of the food ingested by the child in the previous 2 days.

Using information on vaccination records, children between the ages of 1 and 2 years were said to be 'fully immunised' if they had received: three DPT doses; three polio doses; one BCG dose; and one measles dose. In terms of the diet of the children, the survey focused on whether the child had received milk, cereals and pulses, and green vegetables and/or fruit in the past 2 days. Using this information, a child was defined to have received a 'nutritious' diet if, in the 2 days prior to survey questionnaire being administered, he/she had been given *all* three of: milk; cereals and pulses; vegetables and/or fruit.

This information on vaccination and diet could then be related to inter alia: the household circumstances of the children, with particular reference to the region of India in which they resided; the circumstances of the mothers; the quality of the relevant infra-structure available to the households in which the children lived, with particular reference to the availability of health care facilities and mother-and-child centres (known in India as *anganwadis*); the occupations of the parents; and their caste and religion.

Econometric specificationThe binary variables, R_i and S_i, were defined as

(a) $R_i = 1$ if the child was fully immunised, in the sense of having received the full complement of eight vaccination doses (as defined above), $R_i = 0$, otherwise.
(b) $S_i = 1$ if the child received a 'nutritious' diet (as defined above), $S_i = 0$, otherwise.

The probabilities of a child being fully immunised and of receiving a nutritious diet were modelled, *separately for boys and for girls*, as logit models (Greene, 2000):

$$\frac{Pr(R_i = 1)}{1 - Pr(R_i = 1)} = e^{\sum_{k=1}^{K} \beta_k x_{ik}}$$

and

$$\frac{Pr(S_i = 1)}{1 - Pr(S_i = 1)} = e^{\sum_{j=1}^{J} \alpha_j z_{ij}}, \qquad (1)$$

where x_{ik} and z_{ij} are the values of the kth and the jth determining variables for the ith child in, respectively, the vaccination and the diet equations for: $k = 1, \ldots, K$, $j = 1, \ldots, J$, $i = 1, \ldots, N$. The vaccination and the diet equations were estimated separately for boys (2269 observations) and for girls (2064 observations). Depending on the context, therefore, the α and the β represent the coefficients for boys *or* for girls.

The vector of determining variables (see Eq. (1)) were specified, for each child, in terms of the following variables:

(i) *Maternal literacy status*: literate; proximate literate; illiterate.[1]
(ii) *Caste/religion*: Dalits;[2] Muslim; Hindu.[3]
(iii) *Household assets*: The NCAER Survey offered two measures of household assets: business assets (tractors, threshing machines, etc.) and consumption assets (television, motor car/cycle, etc.). These assets were then aggregated (using appropriate weights) to form a *business assets index and a consumption assets index*.
(iv) *Household income*: The NCAER Survey gave the total annual income of a household and also placed each household in the appropriate income quintile.
(v) *Household poverty*: A household was classed as 'poor' if its income was below the poverty line income.[4]
(vi) *Female empowerment*: Women in a household were said to be 'empowered' if a female member of the household, at least 1–2 days per week: read a newspaper; listened to the radio; watched television.
(vii) *Region*: the Survey contained information for each of 16 states. In this study, the states were aggregated to form five regions: the *Centre* consisting of Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh; the *South* consisting of Andhra Pradesh, Karnataka, Kerala and Tamil Nadu; the *West* consisting of Maharashtra and Gujarat; the *East* consisting of the North-Eastern region, Bengal and Orissa; and the *North* consisting of Haryana, Himachal Pradesh and Punjab.[5]
(viii) *Parental Occupation*: For fathers, the mutually exclusive and collectively exhaustive occupational categories were:
(a) cultivator: if the man was (primarily) engaged in cultivation or allied agricultural activities;
(b) labourer: if the man was (primarily) a (agricultural or non-agricultural) labourer, cattle tender or domestic servant;
(c) non-manual worker.
For women, in addition to (a)–(c) above, there was a fourth (residual) category: 'unoccupied'.
(ix) *Village-level health care facilities*:
(a) whether there was an *anganwadi* in the village;[6]
(b) whether there was a trained midwife within 5 km of the village.
(x) *The level of village-level development*. On the basis of their general level of facilities,[7] the 1758 villages in the NCAER Survey were classified as (a) low-development villages; (b) medium-development villages; (c) high-development villages.

Table 1 shows the distribution of some of these characteristics across the 4333 children analysed. Of the

[1] Note that literacy, proximate literacy and illiteracy are collectively exhaustive with illiteracy being the residual category.

[2] The Indian government has drawn up a list of castes and tribes entitled to reservation in terms of parliamentary seats, public sector jobs and educational places. These castes/tribes are synonymous with the 'untouchable' castes of India and persons belonging to these castes/tribes refer to themselves, and prefer others to refer to them, as 'Dalits' (meaning 'oppressed'). Nearly 90% of Dalits in the NCAER Survey gave their religion as 'Hindu'.

[3] That is, non-Dalit Hindus (see footnote above). Note that the caste/religion categories are collectively exhaustive with Hindus being the residual category.

[4] Constructed by the Survey.

[5] The North was treated as the residual region.

[6] *Anganwadis* are village-based early childhood development centres. They were devised in the early 1970s as a baseline village health centre, their role being to: provide government-funded food supplements to pregnant women and children under five; work as an immunisation outreach agent; provide information about nutrition and balanced feeding and provide vitamin supplements; run adolescent girls' and women's groups; and monitor the growth, and promote the educational development, of children in a village.

[7] For example: quality of roads; presence of transport, educational, health care, financial and commercial facilities.

Table 1
Proportions of children (1–2 years) who were fully vaccinated and receiving a nutritious diet, by selected variables

	% children fully vaccinated	% children with nutritious diet
All children (4333)	53	25
All boys (2269)	55	26
All girls (2064)	50	23
Mother literate	66	32
Mother proximate literate	59	28
Mother illiterate	42	18
Dalit households	47	21
Muslim Households	40	24
Hindu households	60	28
Households with empowered females	61	29
Households without empowered females	46	22
Poor household	45	21
Non-poor household	55	26
Central	43	23
South	78	29
West	85	26
East	39	15
North	70	45
Father labourer	48	21
Father Cultivator	53	24
Mother labourer	54	17
Mother cultivator	56	19
Midwife in village	63	25
No. midwife in village	48	25
Anganwadi in village	62	25
No. Anganwadi in village	46	25
Low-developed village	43	21
Medium-developed village	53	27
Highly developed village	68	27

Source: NCAER Survey.

2269 boys in the sample, 55% had been fully vaccinated and 26% received a nutritious diet while, of the 2064 girls in the sample, 50% had been fully vaccinated and 23% received a nutritious diet.

The proportion of children who were fully vaccinated and who received a nutritious diet was substantially higher when their mothers were literate (66% and 32%, respectively) than when their mothers were proximate literate (59% and 28%) or illiterate (42% and 18%).

In the context of caste and religion, the proportion of children fully vaccinated was lowest for Muslims (40%) and highest for Hindus (60%); on the other hand, in terms of diet, there was not much difference between Dalits, Muslims and Hindus in the proportion of children receiving a nutritious diet.

The proportions of fully vaccinated children and children receiving a nutritious diet in households with 'empowered females' (as defined above) was much higher (61% and 29%) than the corresponding proportions in households with 'non-empowered' females (46% and 22%).

There was, as Table 1 shows, considerable difference between poor and non-poor households in the proportions of children fully vaccinated and receiving a nutritious diet. Some of the poverty-related aspects of vaccination and diet are reflected in the occupations of the parents. Households in which the mother worked, either as a labourer or as a cultivator, had much lower proportion of children receiving a nutritious diet than households in which the mother was not working.

Table 1 also demonstrates strong regional differences in the proportions of children fully vaccinated and receiving a nutritious diet: in the more prosperous parts of India—the West, the North and the South—over 70% of children were fully vaccinated, while in the less prosperous parts—the Centre and the East—less than half the children were fully vaccinated.

In terms of health care facilities, the two most important items were the easy access to a trained midwife and the presence of an *anganwadi* in a village: a higher proportion of children living in the presence of these facilities were fully vaccinated (63% for midwife and 62% for anganwadi) than the corresponding proportion of children living without these facilities (48% for 'no midwife' and 46% for 'no anganwadi').

Econometric results

Table 2 and 4 show, respectively, the logit estimation results from the vaccination and the diet equations, both equations estimated separately for boys and for girls, and Tables 3 and 5 show the associated equation statistics.[8] For each of the equations, variables whose associated coefficients were 'insignificant' (defined as a *z*-score less than 1) in the boys' *and* the girls'

[8] The equations were also estimated as a probit but there was little difference, in terms of the marginal probabilities and the standard errors, between the logit and probit models. The equations were also estimated with 'robust' standard errors, but there was little difference between the 'conventional' standard errors and the 'robust' standard errors.

Table 2
Logit estimates of, and marginal probabilities from, the vaccination equation: by gender

$y = 1$ if 'fully' immunised, $Y = 0$, otherwise	Vaccination equation		Marginal probabilities: dy/dx	
$x\downarrow$	Boys	Girls	Boys	Girls
Intercept	0.118246	0.2836151		
	(0.63)	(1.41)		
Mother literate	0.5967863	0.5696606	0.142	0.141
	(4.56)	(4.21)	(0.030)	(0.033)
Mother proximate literate	0.3031691	0.2118058	0.073	0.052
	(2.66)	(1.80)	(0.027)	(0.029)
Dalit	−0.2374566	−0.3471104	−0.058	−0.087
	(2.29)	(3.25)	(0.026)	(0.027)
Muslim	−0.4098643	−0.4915614	−0.102	−0.122
	(2.64)	(3.17)	(0.039)	(0.037)
Consumption asset index	0.0614373	0.0477898	0.015	0.012
	(3.02)	(2.28)	(0.005)	(0.005)
Poor household	−0.0522088	−0.2519352	−0.013	−0.063
	(0.44)	(2.12)	(0.029)	(0.030)
Central	−0.7470144	−0.773124	−0.180	−0.191
	(4.62)	(4.54)	(0.038)	(0.041)
South	0.4780218	0.584973	0.112	0.142
	(2.08)	(2.41)	(0.051)	(2.54)
West	1.039602	0.8801784	0.226	0.209
	(4.06)	(3.78)	(0.046)	(4.17)
East	−1.029119	−1.170602	−0.252	−0.278
	(5.72)	(6.14)	(0.042)	(0.041)
Easy access to midwife (within 5 km of village)	0.4513057	−0.0132296	0.108	−0.003
	(4.25)	(0.12)	(0.025)	(0.028)
Anganwadi in village	0.2114453	−0.0148247	0.052	−0.004
	(2.08)	(0.14)	(0.025)	(0.027)
Highly developed village	0.1332645	0.2676925	0.032	0.067
	(1.07)	(2.02)	(0.030)	(0.033)
Empowered females	0.0755236	0.1562711	0.018	0.039
	(0.67)	(1.37)	(0.027)	(0.029)

z-values in parentheses under coefficient.
Standard errors in parentheses under marginal probablities.

Table 3
Equation statistics: vaccination equations

	Boys	Girls
Number of observations	2269	2064
Pseudo-R^2	0.1319	0.1220
Wald test of H_0: slope coefficients = 0; $\chi^2(14)$	411.49	349.0

specifications were dropped from both specifications; otherwise they were retained in both specifications. While there was an a priori specification of the equations (discussed above), the data were used to see how this specification was borne out empirically. Since there was no theoretical reason for including such variables they were excluded on the ground of empirical irrelevance: such variables did not make a ''significant'' contribution to the explanatory power of either equation; indeed, in the context of a linear equation, the inclusion of variables with a z-score of less than unity would have reduced the adjusted R^2 value and, arguably, misspecified the equation.

So in consequence, the same set of variables entered the vaccination equation for boys and for girls: for some of these variables, the associated coefficients were significantly different from zero for both genders; for others, the associated coefficients were significantly different from zero for one gender, but not for the other.[9] Ditto for the diet equation (Tables 4 and 5).

It was clear from the estimation results that, in the presence of the consumption assets index, there was little extra mileage to be gained from the business assets index or from the income variable, expressed either as

[9] See Ai and Norton (2001) for a discussion of the dangers of eliminating non-significant 'interaction' terms in non-linear models.

Table 4
Logit estimates of, and marginal probabilities from, the diet equation: by gender

$y=1$ if diet is 'nutritious', $y=0$, otherwise	Diet equation		Marginal probabilities: dy/dx	
$x\downarrow$	Boys	Girls	Boys	Girls
Intercept	−0.7564171	−0.5957986		
	(3.95)	(2.85)		
Mother literate	0.4036629	0.8285263	0.078	0.151
	(2.98)	(5.51)	(0.027)	(0.029)
Mother proximate literate	0.2272914	0.3183739	0.044	0.056
	(1.82)	(2.23)	(0.024)	(0.026)
Dalit	0.00	−0.2347836	0.00	−0.039
	(0.00)	(1.98)	(0.02)	(0.019)
Consumption asset index	0.0110045	0.0327897	0.002	0.006
	(0.65)	(1.79)	(0.003)	(0.003)
Central	−0.5926752	−0.9980279	−0.111	−0.169
	(3.85)	(5.83)	(0.029)	(0.029)
South	−0.6173488	−0.7048156	−0.101	−0.099
	(3.04)	(3.04)	(0.029)	(0.027)
West	−0.6353847	−0.8425159	−0.104	−0.116
	(3.14)	(3.87)	(0.029)	(0.024)
East	−1.4662	−1.606683	−0.211	−0.201
	(7.69)	(7.74)	(0.021)	(0.019)
Mother labourer	−0.5998543	−0.1442088	−0.099	−0.024
	(3.30)	(0.75)	(0.026)	(0.030)
Mother cultivator	−0.6191579	−0.0647598	−0.099	−0.011
	(2.45)	(0.25)	(0.034)	(0.042)
Medium developed village	0.3995908	0.0192371	0.077	0.003
	(3.24)	(0.14)	(0.024)	(0.022)
Highly developed village	0.2560001	0.2042803	0.049	0.033
	(1.73)	(1.22)	(0.029)	(0.027)

z-values in parentheses.
Standard errors in parentheses under marginal probablities.

Table 5
Equation statistics: diet equations

	Boys	Girls
Number of observations	2269	2064
Pseudo-R^2	0.0461	0.0632
Wald test of H_0: slope coefficients = 0; $\chi^2(12)$	120.7	141.1

household income or as quintile of household income. In both the vaccination and the diet equations, the z-scores associated with the coefficients on these variables were less than 1, for both the male and the female specifications. Consequently, they do not feature in Tables 2 and 4. Identical comments apply with respect to any of the variables which, though catalogued in the list of possible covariates, do not appear in Table 2 and/or 4.

Tables 2 and 4 also show the marginal probabilities associated with the different explanatory variables. For discrete variables, taking the value 0 or 1, the effect is calculated as the change in the average probability of the outcome when the value of the variable changes from 0 to 1, the values of the other variables being held at their mean values. For the only continuous variable—the consumption assets index—the probability change was calculated consequent upon an unit increase in the value of the index.

Tables 2 and 4 also report, parenthetically, the standard errors associated with the marginal probabilities. These standard errors, in conjunction with the estimated marginal probabilities for boys and for girls, can be used to test the null hypothesis that there was no gender difference in the underlying probabilities against the null hypothesis that there was a gender difference.[10] For none of the estimated marginal probabilities—except for the marginal probability of being fully immunised under the circumstance of maternal literacy—the null hypothesis of "no gender difference"

[10] The test statistic $z = (\hat{m}^B - \hat{m}^G)/\sqrt{(\hat{\sigma}^B)^2/N^B + (\hat{\sigma}^G)^2/N^G} \sim N(0,1)$, where superscripts B and G refer, respectively, to boys and girls, $\hat{m}$ and $\hat{\sigma}$ are the estimated marginal probabilities and standard errors and N refer to sample numbers.

was accepted. Consequently, one could say that a unit change in the explanatory variables would—with the exception noted earlier—lead to a change in the average probabilitiy of boys being fully vaccinated and of receiving a nutritious diet, that would be significantly different from the corresponding probability changes for girls.

Leaving aside the regional effects, the marginal probabilities of being fully immunised and of receiving a nutritious diet were highest when ceteris paribus the children had literate mothers: this raised the likelihood of boys and of girls being fully immunised by 14 (percentage) points and of receiving a nutritious diet by, respectively, 8 and 15 percentage points. Indeed, when mothers were literate, the gender bias against girls, in their likelihood of receiving a nutritious diet, was nullified and, indeed, reversed with the likelihood of girls receiving a nutritious diet (32%) being slightly higher than that for boys (31%). However, maternal literacy, by raising the likelihood of being fully immunised by the same amount for boys as for girls, did nothing to erode the 5-point 'immunisation gap' between boys and girls.

Table 1 shows that the likelihood of being fully vaccinated varied according to whether the child came from a Dalit, Muslim, or Hindu family. Ceteris paribus, as Table 2 shows, the likelihood of boys and girls being fully vaccinated would fall by 6 and 9 points, respectively, if they were Dalits and by 10 and 12 points, respectively, if they were Muslim[11]. So, not only did Dalit and Muslim parents have, relative to Hindus, a lower propensity to fully immunise their children, they also embedded a gender bias into this lower propensity. Table 4 shows that ceteris paribus having Dalit parents reduced the likelihood of girls receiving a nutritious diet by 4 points.

As Table 1 showed, there were considerable differences between the regions both in the proportion of children who were fully vaccinated and in the proportion who were receiving a nutritious diet. The worst-performing region was the East, with only 39% of children fully vaccinated and only 15% receiving a nutritious diet. In all the regions, approximately 20–25% of the parents who did not have their children fully immunised gave as their reason a "fear of an adverse reaction". However, the main difference between the richer regions (West, North and South) and the poorer regions (Central and East) was the non-availability of vaccines: non-availability was cited as the reason for incomplete (including no) vaccination in the case of 14% of the non-vaccinated children in the East but only 4% of the non-vaccinated children in the West. Poor organisation also played a major role in children not being fully vaccinated: in the low-immunisation regions of the East and the Centre, nearly 15% of incomplete vaccinations were due to the place/time of immunisation not being known; in the high-immunisation regions of the West and the South, only 4% cited this as a reason. These features were reflected in the computed marginal probabilities of Table 2: living in the East reduced the likelihood of being fully immunised by 25 points for boys and by 28 points for girls; the corresponding reductions from living in the Central region were 18 and 19 points, respectively.

The fact that 45% of children in the North, but only 15% of children in the East, received a nutritious diet (Table 1) had much to do with the availability and price of food, in particular milk, in these regions. Although there was hardly any difference between the North and the East in household consumption of cereals and pulses and of vegetables and fruits, there was considerable difference between the two regions in their respective milk consumption: the average, monthly, household consumption of milk and milk-related products was 64 kg in the North, but only 7 kg in the East. Once again, these features are reflected in the computed marginal probabilities of Table 4: living in the East reduced the likelihood of receiving a nutritious diet by 21 points for boys and by 20 points for girls; the corresponding reductions from living in the Central region were 11 and 17 points, respectively.

The econometric results showed that of the different types of health care facilities in a village (pharmacy; dispensary; hospital) only two really exercised a significant effect on the likelihood of children being fully vaccinated: the presence of an *anganwadi*(*s*) in a village and the easy access of villagers to the services of a trained midwife. However, as Table 2 shows, it was only boys who were the beneficiaries of these facilities: the marginal probabilities of boys being fully vaccinated were 11% and 5% in the presence, respectively, of midwives and *anganwadis* but these facilities did not affect the marginal probabilities of girls being fully vaccinated.

The decomposition of the gender-based immunisation and nutrition gaps

The analysis of the previous sections revolved around the gender-based immunisation and nutrition gaps, defined, respectively, as the difference between boys and girls in their *average* probabilities (sample proportions) of being fully immunised and of receiving a

[11] The Indian news magazine *Outlook* reported (24 February 2003, p. 70) that Muslim children accounted for 60% of the polio cases in the largest Indian state, Uttar Pradesh. This was because of a feeling among Muslims that polio vaccination was "dangerous medicine", which would cause impotence and infertility among vaccinated children, and should, therefore, be shunned.

nutritious diet. These gaps were engendered by the fact that parents valued girls less than they did boys. A plausible explanation for this stems from the practice of 'patrilocal exogamy' whereby adult males, even after marriage, continue to live with their parents and contribute to the household economy, while adult females, after marriage, leave the parental home (often with a dowry that her parents can ill-afford) to live in their husbands' households (Foster & Rosenzweig, 2001). As a consequence, investment in girls yields parents a lower return than investment in boys.[12]

A corollary of this is that, as noted earlier, girls faced both natal and mortality inequalities. There is, however, the possibility that the incidence of natal inequality could be higher in certain types of families (and in certain regions) than others—the fact that the practice of natal inequality requires knowing that the sex of the foetus can be determined; the ability to pay for sex-selective abortions; and the supply of appropriate medical facilities, means that such inequality might be more prevalent among better-off and better-educated parents and in more prosperous regions.[13] This has two implications:

(i) Girls born to parents who were able to practice natal inequality are more likely to be fully immunised and to receive a nutritious diet than girls born to parents who are unable to practice natal inequality, simply because the former set of parents are better off/better educated than the latter set.
(ii) Girls born to parents who were able to practice natal inequality are more likely to be 'wanted' children and, therefore, not discriminated against (in favour of their brothers) to the same degree as the 'unwanted' girls born to parents who were unable to practice—did not know about—natal inequality. The point is that, for individual families, the practice of natal and mortality inequality might be *inversely* related.

Under these circumstances, the immunisation and nutrition gaps that girls experienced may have been partly due to the fact that they were discriminated against, in favour of their brothers, and partly due to the fact that, relative to boys, they were more likely to be born in families in which *all* children, irrespective of gender, were disadvantaged with respect to immunisation and diet. The contribution of the 'discrimination' and the 'residual' factors to the immunisation (and the nutrition gaps) may be disentangled by means of the decomposition formulas:[14]

$$\mathrm{I\bar{M}N}^{\mathrm{B}} - \mathrm{I\bar{M}N}^{\mathrm{G}} = [\bar{P}(\mathbf{X}_i^{\mathrm{G}}, \hat{\boldsymbol{\beta}}^{\mathrm{B}}) - \bar{P}(\mathbf{X}_i^{\mathrm{G}}, \hat{\boldsymbol{\beta}}^{\mathrm{G}})] + [\bar{P}(\mathbf{X}_i^{\mathrm{B}}, \hat{\boldsymbol{\beta}}^{\mathrm{B}}) - \bar{P}(\mathbf{X}_i^{\mathrm{G}}, \hat{\boldsymbol{\beta}}^{\mathrm{B}})] \quad (2)$$

and

$$\mathrm{I\bar{M}N}^{\mathrm{B}} - \mathrm{I\bar{M}N}^{\mathrm{G}} = [\bar{P}(\mathbf{X}_i^{\mathrm{B}}, \hat{\boldsymbol{\beta}}^{\mathrm{B}}) - \bar{P}(\mathbf{X}_i^{\mathrm{B}}, \hat{\boldsymbol{\beta}}^{\mathrm{G}})] + [\bar{P}(\mathbf{X}_i^{\mathrm{B}}, \hat{\boldsymbol{\beta}}^{\mathrm{G}}) - \bar{P}(\mathbf{X}_i^{\mathrm{G}}, \hat{\boldsymbol{\beta}}^{\mathrm{G}})]. \quad (3)$$

The superscripts B and G in Eqs. (2) and (3) refer to boys and girls; the $\mathbf{X}_i$ and the $\hat{\boldsymbol{\beta}}$ are, respectively, the vectors of observations on the variables and the estimated coefficients; $\mathrm{I\bar{M}N}^{\mathrm{B}} = \bar{P}(\mathbf{X}_i^{\mathrm{B}}, \hat{\boldsymbol{\beta}}^{\mathrm{B}})$ and $\mathrm{I\bar{M}N}^{\mathrm{G}} = \bar{P}(\mathbf{X}_i^{\mathrm{G}}, \hat{\boldsymbol{\beta}}^{\mathrm{G}})$ are the sample proportions (average probabilities) of boys and girls who are fully vaccinated; $\bar{P}(\mathbf{X}_i^{\mathrm{G}}, \hat{\boldsymbol{\beta}}^{\mathrm{B}})$ is the average probability of being fully vaccinated when girls are treated as boys; $\bar{P}(\mathbf{X}_i^{\mathrm{B}}, \hat{\boldsymbol{\beta}}^{\mathrm{G}})$ is the average probability of being fully vaccinated when boys are treated as girls.

Eq (2) decomposes the immunisation gap between boys and girls as the sum of a 'discrimination factor' (the difference between what the average probability of girls being fully immunised would have been, *had they been treated as boys*, and the sample proportion of fully immunised girls) and a 'residual' factor. This is the logit extension of the (regression based) Oaxaca (1973) type decomposition. Eq. (3) does the same but defines discrimination as the difference between the sample proportion of fully immunised boys and what the average probability of boys being fully immunised would have been, *had they been treated as girls*). Identical decomposition exercises, alà Eqs. (2) and (3), can be performed with respect to the nutritional gap between boys and girls.

Table 6 shows that 83% of the immunisation gap, and 91% of the nutritional gap, between boys and girls could be explained by the fact that girls were treated differently from boys and the remainder was due to the fact that girls were born to less advantageous familial circumstances than boys.

[12] Though the gender ratio is much better in the South than in the North of India. Some demographers believe that the dominant Aryan culture of the North—with its emphasis on caste hierarchy, patrilineal inheritance and male kinship patterns—is different from the Dravidian (indigenous) culture of the South where women play a prominent part in society and in the economy (*Financial Times*, 8/9 February, 2003, p. III).

[13] In the northern states of Punjab and Haryana, the two richest Indian states, ultrasound tests for determining the sex of the foetus have become routine making it easier to identify and abort female foetuses (*Financial Times*, 8/9 February, 2003, p. III).

[14] See Blackaby, Leslie, Murphy, and O'Leary (1998) and Nielsen (1998) for the derivation of the decomposition formulas of Eqs. (2) and (3).

Table 6
The decomposition of gender differences in the proportion of children who are fully immunised and are receiving a nutritious diet

Sample average	Girls treated as boys		Boys treated as girls	
Immunisation				
$\bar{\text{IMN}}^B - \bar{\text{IMN}}^G$	$\bar{P}(\mathbf{X}_i^G,\hat{\boldsymbol{\beta}}^B) - \bar{P}(\mathbf{X}_i^G,\hat{\boldsymbol{\beta}}^G)$	$\bar{P}(\mathbf{X}_i^B,\hat{\boldsymbol{\beta}}^B) - \bar{P}(\mathbf{X}_i^G,\hat{\boldsymbol{\beta}}^B)$	$\bar{P}(\mathbf{X}_i^B,\hat{\boldsymbol{\beta}}^B) - \bar{P}(\mathbf{X}_i^B,\hat{\boldsymbol{\beta}}^G)$	$\bar{P}(\mathbf{X}_i^B,\hat{\boldsymbol{\beta}}^G) - \bar{P}(\mathbf{X}_i^G,\hat{\boldsymbol{\beta}}^G)$
0.553−0.500 = 0.053	0.544−0.500 = 0.044	0.553−0.544 = 0.009	0.553−0.510 = 0.043	0.510−0.500 = 0.010
Diet				
$\bar{\text{NDT}}^B - \bar{\text{NDT}}^G$	$\bar{P}(\mathbf{X}_i^G,\hat{\boldsymbol{\beta}}^B) - \bar{P}(\mathbf{X}_i^G,\hat{\boldsymbol{\beta}}^G)$	$\bar{P}(\mathbf{X}_i^B,\hat{\boldsymbol{\beta}}^B) - \bar{P}(\mathbf{X}_i^G,\hat{\boldsymbol{\beta}}^B)$	$\bar{P}(\mathbf{X}_i^B,\hat{\boldsymbol{\beta}}^B) - \bar{P}(\mathbf{X}_i^B,\hat{\boldsymbol{\beta}}^G)$	$\bar{P}(\mathbf{X}_i^B,\hat{\boldsymbol{\beta}}^G) - \bar{P}(\mathbf{X}_i^G,\hat{\boldsymbol{\beta}}^G)$
0.263−0.231 = 0.032	0.260−0.231 = 0.029	0.263−0.260 = 0.003	0.263−0.236 = 0.027	0.236−0.231 = 0.005

The decomposition of inequality in the distribution of likelihoods

The previous section used the econometric estimates (shown in Tables 2 and 4) to decompose the difference between boys and girls in the *average* proportions of those fully immunised (the immunisation gap) and those receiving a nutritious diet (the nutrition gap). However, the estimated equations allow these probabilities of being fully immunised and of receiving a nutritious diet to be predicted for *each* child in the sample, conditional upon the relevant values of the determining variables for the child. Armed with a knowledge of these individual probabilities, one can estimate how much of the overall inequality in these probabilities can be explained by a particular factor. For example, how much of the inequality in the 4333 probabilities of being fully vaccinated can be accounted for by differences in: gender; maternal literacy status; region; caste/religion?

This section provides an answer to this question, using the methodology of 'inequality decomposition'. Suppose that the sample of $N = 4333$ children is divided into M mutually exclusive and collectively exhaustive groups with N_m ($m = 1, \ldots, M$) persons in each group. Let $\mathbf{p} = \{p_i\}$ and $\mathbf{p}_m = \{p_i\}$ represent the vector of (estimated) probabilities of being fully vaccinated of, respectively, all the children in sample ($i = 1, \ldots, N$) and the children in group m. Then an inequality index $I(\mathbf{p}; N)$ defined over this vector is said to be additively decomposable if

$$I(\mathbf{p}; N) = \sum_{m=1}^{M} I(\mathbf{p}_m; N_m)w_m + \mathbf{B} = \mathbf{A} + \mathbf{B}, \quad (4)$$

where $I(\mathbf{p}; N)$ represents the *overall* level of inequality; $I(\mathbf{p}_m; N_m)$ represents the level of inequality within group m; $\mathbf{A}$—expressed as the weighted sum of the inequality in each group, w_m being the weights—and $\mathbf{B}$ represent, respectively, the *within-group* and the *between-group* contribution to overall inequality.

If, indeed, inequality can be 'additively decomposed' along the lines of Eq. (4) above, then, as Cowell and Jenkins (1995) have shown, the proportionate contribution of the between-group component ($\mathbf{B}$) to overall inequality is the income inequality literature's analogue of the R^2 statistic used in regression analysis: the size of this contribution is a measure of the amount of inequality that can be 'explained' by the factor (or factors) used to subdivide the sample (gender, maternal literacy status, etc.).

Only inequality indices which belong to the family of *Generalised Entropy Indices* are additively decomposable (Shorrocks, 1980). These indices are defined by a parameter θ, and when $\theta = 0$, the weights are the population shares of the different groups (that is, $w_j = N_j/N$); since the weights sum to unity, the within-group contribution $\mathbf{A}$ of Eq. (4) is a weighted average of the inequality levels within the groups. When $\theta = 0$, the inequality index takes the form

$$I(\mathbf{p}; N) = \left(\sum_{i=1}^{N} \log(p_i/\bar{p})\right)/N, \quad (5)$$

where $\bar{p} = \sum_{i=1}^{N} p_i/N$ is the mean probability over the entire sample. The inequality index defined in Eq. (5) is known as the Theil's (1967) mean logarithmic deviation (MLD) and, because of its attractive features in terms of the interpretation of the weights, it was the one used in this study to decompose inequality in the likelihood of being fully vaccinated and of receiving a nutritious diet.

Table 7 shows the results from decomposing these likelihoods by subdividing the sample of 4333 children along one of the following lines:

(i) gender;
(ii) maternal literacy status;
(iii) caste/religion;
(iv) region.

These results, in turn, highlight three points.

The first is that the level of inequality associated with the distribution of the two likelihoods, across the 4333 children, was actually quite low. The values of the MLD index (and of the Gini coefficient) were 0.07 and 0.09 (0.22 and 0.24, for the Gini), respectively, for vaccination and diet.[15] By contrast, the distribution of incomes, across the households in which these children lived, had

[15] Not shown in Table 7.

Table 7
Percentage within- and between-group contributions to inequality in the probabilities of being fully vaccinated and receiving a nutritious diet: mean logarithmic index

Decomposition by↓	Fully vaccinated	Nutritious diet
Gender		
Within-group contribution	98	98
Between-group contribution	2	2
Mother's literary status		
Within-group contribution	75	73
Between-group contribution	25	27
Caste/religion		
Within-group contribution	84	91
Between-group contribution	16	9
Region		
Within-group contribution	40	50
Between-group contribution	60	50

an associated MLD value of 0.44 and a Gini value of 0.50.

The second point is that gender provided a very poor explanation for the observed inequality in the distributions of the likelihood of being fully vaccinated and of receiving a nutritious diet: when the sample of children was subdivided by gender, only 2% of overall inequality was due to between-group inequality and 98% was due to inequality *within* the subgroups of boys and of girls. Maternal literacy proved to have better explanatory power: when the sample of children was subdivided according to the literacy status of the mothers (literate; proximate literate; illiterate), 25% of overall inequality in the distribution of vaccination likelihoods, and 27% of overall inequality in the distribution of nutritious diet likelihoods, was due to between-group inequality. However, the best explanation for inequality in the distribution of the likelihoods was region: when the sample of children was subdivided according to the regions in which they lived, (Central; South; West; East; North) then 60% of the overall inequality in the distribution of vaccination likelihoods, and 50% of overall inequality in the distribution of nutritious diet likelihoods, could be ascribed to regional differences[16] (Caldwell, 1993).

The third point is that although the overall level of inequality in the distribution of the vaccination and the nutritious diet likelihoods was low, the between-group contribution to this inequality—whether through differences in caste/religion; or maternal literacy status; or region—was very high. For example, in contrast, the contributions of regional differences; of differences in caste/religion; and of differences in maternal literacy status to overall inequality in the distribution of household incomes (of the 4333 children) were, respectively, only: 4%, 9% and 11%.

Conclusions

There can be little doubt that life is not easy for many children living in the poorer parts of the world. High rates of infant mortality mean that more than a quarter of new born babies often do not live out their first year; if they do, the survivors are prey to further disease and illnesses which often leave them severely malnourished; to add to this litany, the high incidence of child labour means that, for many children, childhood and schooling are sacrificed at the altar of economic necessity. In summary, many children in developing countries suffer from a general, and often severe, neglect of their welfare.

One aspect of the neglect of children that has rightly received a great deal of attention in the literature is the neglect of girls, relative to boys (Sen, 2001; Osmani, 2001). Indeed, in the context of India, the results from the latest (2001) Census have led to considerable concern about the decline in the sex ratio of the population aged 0–6 years from 945/1000 in 1991 to 927/1000 in 2001 (Premi, 2001).

This paper examined the extent to which girls between 1 and 2 years were neglected, relative to boys of the same age, in two respects: (i) being fully immunised against tuberculosis, polio, diptheria–pertussis–tetanus, and measles (ii) receiving a nutritious diet containing milk, cereals and pulses and vegetables/fruit. The conclusion of this paper is that girls were undoubtedly disadvantaged in both respects. In respect of vaccinations, the likelihood of girls being fully vaccinated, after controlling for other variables, was 5 percentage points lower than that for boys. In respect of receiving a nutritious diet, the treatment of girls depended very much on whether or not their mothers were literate: there was no gender discrimination between children of literate mothers; on the other hand, when the mother was illiterate, girls were 5 percentage points less likely to be well-fed relative to their brothers and the presence of a literate father did little to dent this gender gap.

But the main conclusion of this paper is that *all* children in India suffered more severe, but less publicised, forms of disadvantage than that engendered solely by gender. There was, first, the disadvantage that resulted from living in particularly impoverished parts of an already poor country. Children living in the Central and the Eastern regions of India, relative to children in other regions, suffered from a lack of vaccines and the

[16] That is, due to between-group inequality. Note also that differences in caste/religion provided a less adequate explanation for inequality than either regional differences or differences in maternal literacy status.

poor organisation of vaccination facilities. They also suffered from the relative lack of milk in these regions.

The second form of disadvantage, from which all children suffered, was being born to mothers who were illiterate: the likelihood of children whose mothers were literate of being fully vaccinated and of receiving a nutritious diet was, respectively, 67% and 32%; these fell to 52% and 25% when the mothers were proximate literate and fell further to 42% and 18% when the mothers were illiterate.

The third form of disadvantage stemmed from the communities (defined in terms of caste/religion) to which the children belonged: the likelihood of Hindu children being fully vaccinated was 20 percentage points higher than that for Muslim children.

These conclusions, based on an analysis of average probabilities, was confirmed when the focus was shifted to an analysis of the distribution of the individual probabilities. Once again, the capacity of region, maternal literacy status and caste/religion to explain inequality in this distribution was much greater than that of gender. In summary, therefore, this study suggests that the issue of 'children's neglect'—at least as far as India goes—is one that has many facets. There is, of course, the very important aspect of gender discrimination and, indeed, this is the aspect that has attracted the most attention. But, no less important, are the relative disadvantages, from which boys *and* girls in India suffered, stemming from being born to the 'wrong' mothers, belonging to the 'wrong' community and living in the 'wrong' region. That is the central message of this paper.

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Appendix A. Data

The data used in this paper were obtained from the National Council of Applied Economic Research (NCAER) Human Development Survey, described in Shariff (1999). This survey—commissioned by the Indian Planning Commission and funded by a consortium of United Nations agencies—was carried out by the NCAER over January–June 1994 and most of the data from the survey pertains to the year prior to the survey, that is to 1993–1994. These data are based on unit record data from a survey of 33,000 *rural* households—encompassing 195,000 individuals—which were spread over 1765 villages, in 195 districts, in 16 states of India. Details of the survey—hereafter referred to as the NCAER Survey—are to be found in Shariff (1999), though some of the salient features of data from the NCAER Survey, insofar as they are relevant to this study, are described in this appendix.

The Survey used rural female literacy and income from agriculture as stratification variables for the districts: in each state, districts were cross-classified by rural female literacy and by income from agriculture to form a homogenous strata with respect to these two variables. From each of these strata, a pre-assigned number of districts were selected with probability proportional to the rural population of the district. Then, a list of villages in the selected districts was obtained from census records. A pre-assigned number of sample villages were selected after arranging the villages in a *tehsil* (an administrative block) in ascending and descending order of female literacy. The households in the chosen villages were listed along with some other auxiliary information of the households.[17] Two groups of listed households were separated as Stratum 1 and Stratum 2, respectively:

(i) households with at least one pregnant woman;
(ii) households with at least one child less than 12 months, but no pregnant woman.

The remaining households were stratified according to religion (Hindu, Muslim, etc.), caste group (SCT, non-SCT) and the occupation of the head of household.[18]

The sample tree is illustrated below:

- **States**
  Stratified by rural female literacy, income from agriculture
  Probability proportional to rural population
- **Districts**
  Linear systematic selection method
- **Villages**
  Stratified by various economic and demographic attributes
  Linear systematic selection method
- **Households**

The Sample Tree for the NCAER Survey
Source: Shariff (1999), p. 23.

[17] Religion, caste, major source of income, cultivable land operated, etc.

[18] Marginal farmer; small farmer; large farmer; agricultural labourer.

A comprehensive survey instrument was canvassed to one or more adult household members by a team comprising a trained female and a male investigator. All those involved with the survey were trained at state level and the survey instrument was translated into the local languages. A comprehensive village schedule was also made to collect community-level information.

The data from the NCAER survey are organised as a number of 'reference' files, with each file focusing on specific subgroups of individuals. However, the fact that in every file an individual was identified by a household number and, then, by an identity number within the household, meant that the 'reference' files could be joined—as will be described below—to form larger files.

So, for example, the 'vaccination' and the 'diet' equations were estimated on data from the 'children' file. This file, as the name suggests, gave information on those individuals in the sample who were between the ages of 0 and 12, with particular reference to their health-related environment. In particular, this file contained information on their vaccination record and on their diet. Information on the vaccination record of children was, however, only collected for those children between the ages of 1 and 2 years. This age restriction was also applied, in this study, to the diet equation yielding a total sample of 4333 children—of whom, 2269 were boys and 2064 were girls—all of whom were between the ages of 1 and 2 years (inclusive). These data were then used to construct the binary variables R_i and S_i (described above). Of the 4333 children studied, 53% had been fully vaccinated ($R_i = 1$) and 25% were given a nutritious diet ($S_i = 1$).

To the children's file was appended the 'household file': this associated with each child, information on the economic and social circumstances of his/her household. The third, and last, appendage to the children's file was the 'village file' which contained data relating to the existence of infrastructure in, and around, each of the 1765 villages over which the survey was conducted: this then yielded information on the health-related facilities in child's geographical vicinity.

References

Ai, C., Norton, E. C. (2001). *Interaction terms in nonlinear models*. Working Paper No. 2, Triangle Health Economics Working Paper Series, www.unc.edu/the.

Basu, K., & Foster, J. (1998). On measuring literacy. *Economic Journal*, *108*, 1733–1749.

Basu, K., Narayan, A., & Ravallion, M. (2002). Is literacy shared between households? *Labour Economics*, *8*, 649–665.

Behrman, J. R., & Wolfe, B. L. (1984). The socio-economic impact of schooling in a developing country. *Review of Economics and Statistics*, *66*, 296–303.

Blackaby, D. H., Leslie, D. G., Murphy, P. D., & O'Leary, N. C. (1998). The ethnic wage gap and employment differentials in the 1990s: Evidence for Britain. *Economics Letters*, *58*, 97–103.

Borooah, V. K. (2000). The welfare of children in Central India: Econometric analysis and policy simulation. *Oxford Development Studies*, *28*, 263–287.

Borooah, V. K. (2002). Births, infants and children: An econometric portrait of women and children in India. *Development and Change*, *34*, 67–103.

Caldwell, J. C. (1993). Health transition: The cultural, social and behavioural determinants of health in the Third World. *Social Science & Medicine*, *36*, 125–135.

Coale, A. J. (1991). Excess female mortality and the balance of the sexes: An estimate of the number of missing females. *Population and Development Review*, *17*, 517–523.

Cowell, F. A., & Jenkins, S. P. (1995). How much inequality can we explain? A methodology and an application to the United States. *Economic Journal*, *105*, 421–430.

Dreze, J., & Sen, A. K. (1996). *Economic development and social opportunity*. New Delhi: Oxford University Press.

Foster, A. D., & Rosenzweig, M. R. (1996). Technical change and human capital returns and investments: Evidence from the green revolution. *The American Economic Review*, *86*, 931–953.

Foster, A. D., & Rosenzweig, M. R. (2001). *Missing women, the marriage market and economic growth*. Working Paper No. 49, Center for Research on Economic Development and Policy Reform, Stanford University, Pao Alto.

Gibson, J. (2001). Literacy and intra-household externalities. *World Development*, *29*, 155–166.

Greene, W. H. (2000). *Principles of econometrics*. Upper Saddle River, NJ: Prentice-Hall Inc.

Kingdon, G. G., & Unni, J. (2001). Education and women's labour outcomes in India. *Education Economics*, *9*, 173–195.

Kishor, S. (1993). May God give sons to all: gender and child mortality inequality in India. *American Sociological Review*, *58*, 247–265.

Kishor, S. (1994). Gender differentials in child mortality: A review of the evidence. In M. Das Gupta, T. N. Krishnan, & L. Chen (Eds.), *Women's health in india: Risk and vulnerability*. Bombay: Oxford University Press.

Klasen, S. (1994). Missing women reconsidered. *World Development*, *22*, 1061–1071.

Lavy, V., Strauss, J., Thomas, D., & de Vreyer, P. (1996). Quality of health care, survival and health outcomes in Ghana. *Journal of Health Economics*, *15*, 333–357.

Nielsen, H. S. (1998). Discrimination and detailed decomposition in a logit model. *Economics Letters*, *61*, 115–120.

Oaxaca, R. (1973). Male–female wage differentials in urban labor markets. *International Economic Review*, *14*, 693–709.

Osmani, S. R. (2001). Hunger in South Asia: A study in contradiction. *The Little Magazine*, *2*, 35–40.

Parikh, K., & Gupta, C. (2001). How effective is female literacy in reducing fertility? *Economic and Political Weekly*, *XXXVI*, 3391–3398 (September 1–7).

Premi, M. K. (2001). The missing girl child. *Economic and Political Weekly*, *36*, 1875–1880.

Ravallion, M., & Wodon, Q. (2000). Does child labour displace schooling? Evidence on behavioural responses to a enrolment subsidy in Bangladesh. *Economic Journal*, *110*, 158–176.

Sandiford, P., Cassel, J., Montenegro, M., & Sanchez, G. (1995). The impact of women's literacy on child health and its interaction with health services. *Population Studies*, *49*, 5–17.

Sen, A. K. (2001). The Many Faces of Gender Inequality. *Frontline*, *18*, 4–14.

Shariff, A. (1999). *India human development report*. New Delhi: Oxford University Press.

Shorrocks, A. F. (1980). A class of additively decomposable measures. *Econometrica*, *50*, 613–625.

Theil, H. (1967). *Economics and information theory*. Amsterdam: North-Holland.

Thomas, D., Strauss, J., & Henriques, M.-H. (1991). How does mother's education affect child height. *The Journal of Human Resources*, *26*, 183–211.