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SEX RATIO AT BIRTH AND EXCESS FEMALE CHILD MORTALITY IN INDIA:
Trends, Differentials and Regional Patterns

By

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Abstract

The sex ratio of India's population has been on the declining course during the last one century, currently indicating a massive deficit of females. Sex ratio trends vary considerably across the regions of India consistent with the degree of gender inequalities in education, employment and empowerment indicators. Female discrimination and correspondingly the extent of female deficit are highest in the north and west regions and lowest in the south region of the country. The female deficit and its exacerbation in the recent decades are the outcome of both large volume of excess female child mortality and rise in the sex ratio at birth resulting from sex-selective abortion and stopping rule behaviour. Evidences from the two rounds of national family health survey (1992-93 & 1998-99) suggest that the recent rise in sex ratio at birth is greater in urban areas, among educated and economically better of households. Female child neglect in health care is the primary determining factor of excess female child mortality which tends to rise with increasing number of girls in the family. Consistent with the regional patterns, sex ratio at birth has declined steeply and excess female child mortality is also extremely high in the northern states of the country.

Introduction

The declining trend in sex ratio of India's population during the last one century indicates massive deficit of females. Sex ratio trends vary considerably across the regions of India consistent with the degree of female discrimination across the states. Gender inequalities and correspondingly the extent of female deficit are highest in the north and central regions and lowest in the southern states. Regional variations in the scale of gender biases, and gender inequalities in a broader context reflect the *extent of patriarchy* and its demographic influence across the regions in India.

Female child neglect in nutrition and health care leading to excess female child mortality was known be the primary determining factor of high female deficit in north Indian states until the late 1980s. However, with rapidly declining fertility in the 1990s, 2001 census indicated a sharp rise in child sex ratio (0-6). The national family health survey data -2 (NFHS-2, 1998-99) also provides confirmation that sex ratio of recent births in the north and western states of Indian was abnormally high, exceeding 110 males per 100 females. The NFHS-2 further shows no evidence of decline in the levels of excess female child mortality in the high female deficit states, although overall child mortality rates have declined in several states. These two complementary patterns suggest that fertility decline has led to exacerbated parental discrimination-both prenatal and postnatal. The massive female deficit in India are the outcome of both large volume of excess female child mortality (quantum effect) and the recent rise in sex ratio at birth (intensity effect) due to sex-selective abortion and stopping rule behaviour.

Female child neglect in India is primarily the result of patriarchy and son preference. Son preference, the greater preference for male children is the direct fall-out of patriarchy and inferior status of women. Son preference is in the interest of the family lineage, whose continuity depends on sons alone while daughters are considered as transient members. For every individual, brothers and sons are more valuable than sisters and daughters. This does not mean that sisters and daughters may not be loved as much as brothers and sons. However, a girl values her brother more than her sister because the former is expected to provide care or support for her throughout life, while the latter will effectively disappear after marriage. Similarly a woman values her sons more than her daughters because the former will be her major source of support for the family and in old age. Indeed, in traditional societies a woman's position in her husband's home is not consolidated unless she produces at least one son. In short, sons provide support to parents both before and after marriage while daughters move on to their husbands families and provide little economic and emotional support. More importantly, in the Hindu religious tradition, sons are needed for the cremation of deceased parents and to help in the salvation of their parents' soul.

Evidence of son preference in India is clearly demonstrated in terms of desired and actual sex composition of children. The ratio of number of sons and daughters desired on the average is 1.5, indicating 50 percent higher preference for sons (NFHS, 1992-93). In the north and western states the ratio rises between 1.5 and 1.91. In contrast, in the south Indian states, the ratio falls to the range of 1.0 -1.2 indicating just marginally higher preference for sons. Parental preferences are also revealed by the common finding that the decision to determine child bearing is strongly related to the number of surviving sons couples have. This raises the possibility that parents may realise their desire to have fewer girls than boys by discriminating particularly heavily against some of their daughters.

The region comprising northern and western states of India where evidence of stronger son preference is documented than any other region in India, have a history of most imbalanced sex ratio. The corresponding link of adverse male/female child mortality rates and more recently a sharp decline in child sex ratios as a result of sex differences in foetal mortality is the main focus of this analysis. In this context, this paper assesses the evidence of regional patterns in sex bias against female children. The analysis explores the dynamics of gender bias in terms of two proximate determinants of sex ratio, namely, sex ratio at birth and excess female child mortality of which the later is directly linked to female discrimination in health care.

Evidence on the following aspects of sex ratio determinants are examined in this paper:
First, the trends and the changing regional patterns in sex ratio at birth and the last birth (SRLB) are examined. Directly related and complementary evidence of use of ultrasound and amniocentesis and stopping rule behaviour is compared;
Second, given that overall excess female child mortality is about 60-65 percent in the north and north central regions, the extent of excess female child mortality compared to

boys of respective rank is explored. The evidence of female neglect in child health as direct link to excess female child mortality is explored; and

Third, the analysis deals with the hypothesis that given the cultural constraints of patriarchy, whether development factors tend to exacerbate the rise in sex ratio at birth or alternately, reduce gender differences in health care and child mortality; because in macro context, it might operate in the opposite direction also where gender inequalities might dampen development.

Data and Methods

The two rounds of national family health survey data (NFHS-1and 2, 1992-93 and 1998-99) are used, both to compare and assess changing trends and regional patterns. The birth histories obtained from women's questionnaire of both rounds are used in the analysis of sex ratio at birth and excess female child mortality. NFHS-1 lists 275172 births and 32836 deaths within four years of birth. NFHS-2 lists 268879 births and 28854 deaths within four years of birth. Evidence on the above stated three objectives are examined.

State-wise trends and differential in sex ratio at birth are examined using birth histories of NFHS surveys. Data of NFHS-2 on two births in the last three years prior to survey are used to find the extent of use ultrasound and sex at birth is compared across the states. Secondly analysis is focused on excess female child mortality in ages 1-4 years as it tends to occur significantly and mostly in these ages. Multivariate logistic regression models have been employed to study sex differentials in child mortality and child health care utilization. The odds of children dying between 12-47 months and the odds of children of age 12-47 months (12-35months in NFHS-2) receiving immunization are estimated. The unexposed cases to the risk of mortality for children aged 12-47 months were censored in models of child mortality analyses.

A unique child index namely 'sex-specific rank order of children' is used to study the dynamics of sex differences in child mortality. The indexing of children by sex-wise rank will provide more precision in assessing sex differentials in child mortality than using conventionally used methods such as sex composition and sex-wise birth order of children.

Factors influencing sex ratio trends in India

The demographic factors that directly determine over all sex ratio of the population are sex ratios at birth, sex differentials in mortality, sex-selective migration and sex differentials in under-enumeration. The trends and changes in these factors shape the sex ratio trends and patterns. Evidence in the Indian context so far does not point to a significant contribution from sex differences in migration and under-enumeration to the declining sex ratio. In adult ages the marginal surplus mortality for women over men has turned into marginal excess mortality for men in the last two decades.

Lower sex ratio in India, therefore, mainly arises from higher female (child) compared to male (child) mortality, which in the literature is frequently referred to as gender bias in child mortality (Visaria, 1971). Male children face hurdles of survival only during neonatal and possibly during post neonatal period. However, sex differentials in child mortality in ages 1-5 indicate a huge surplus mortality for girls as the result of discriminations against female children in terms of food, nutrition and health care (Miller, 1981; Das Gupta, 1987). The sharp 'deficit' of women, of relative neglect of the health and well-being of women particularly young girls including female infants, leading to survival disadvantage of females vis-à-vis males exist over long periods in India. In recent times, in addition to female disadvantage in child mortality, male favourable sex ratio at birth beyond normal range of 106 boys per 100 girls provide an early warning system about sex-selective abortion, differential foetal mortality, and unreported female infanticide.

In the1990s the decline in sex ratio of child population in age 0-6 years (defined as number of females per 1000 males) is an important concern. The state variations point to the earlier region patterns in the degree of son preference and the extent of gender inequalities. The 2001 census shows extremely lower sex ratios of child population in Himachal Pradesh, Haryana, Punjab, Madhya Pradesh, Rajasthan, Gujarat, and Maharashtra. This decline is a continuation of a previous declining trend. In most of the remaining states, the decline in sex ratio of child population is moderate to marginal, however.

Trends and differentials in sex ratio at birth

The decline in juvenile sex ratio between 1991-2001 censuses of India shifted the concern from overall sex ratio to sex ratio of child population. An excess of about 5 percent in the number of boys compared to girls reflects a natural biological balance in the sex ratio of child population (0-5). In India, considering the level of excess female child mortality, a lower level of child sex ratio of 935 is considered as reasonable. Child sex ratios below this should be viewed with serious concern. In the last 50 years, the proportion of girls has declined by 5 percent in India. A clear declining trend is indicated in the sex ratio of the child population in almost all the states except Kerala during the past four decades (Parasuraman, 2001). The north-south divide is also indicated.

The above trend corresponds to a rising trend in sex ratio at birth in most states of India in during the last two decades (Table1). The rise in sex ratio at birth is steeper in the states of Delhi, Haryana, Himachal Pradesh, Punjab, Assam, and Maharashtra. Figure 1 further depicts the regional patterns, with the northern region indicating the steepest rise and western and eastern regions showing moderate rise. The trends fluctuate in EAG states with south Indian states also showing some intermittent and marginal increase. The sex ratio at birth for the country as a whole, though, remains just marginally higher between 106 and 107 in the last two decades; however, in terms of absolute size, it's huge. The reason is that extremely high sex ratio at birth is mostly prevalent in smaller northern states; however, excess female child mortality is more widely prevalent and very significant at the country level.

What is most surprising is almost consistently throughout the four periods (two decades), the sex ratio at birth is higher in urban compared to rural areas in most states. The maps depicting sex ratio at birth demonstrate the widening spread of higher sex ratio at birth in urban areas. Except the northern and western states, rural sex ratio at birth either remained same. Rural sex ratio at birth in fact shows fluctuating or declining trend in southern states, Uttar Pradesh and Madhya Pradesh. Consistent with this pattern, except in Kerala and West Bengal, the sex ratio at birth is lowest for illiterate women and women in poor households (low standard of living).

Sex ratio at last birth and use of ultrasound/amniocentesis

The link between the rise in the sex ratio at birth and sex-selective abortion are further assessed by comparing state-wise sex ratio at birth and the extent of use sonogram/ultrasound or amniocentesis. These performance tests in general are supposed to be used to check the normal growth, development and health status of foetus. However, these tests are now widely used for detecting the sex of the foetus when parents have strong desire for sons.

Between the two NFHS survey periods, the *sex ratio at last birth* shows a steep rise in northern and western states and moderate to marginal increase in the remaining states (Table 6). The sex ratio at last birth shows a huge rise of above 150 in Haryana, Himachal Pradesh, and Punjab. In Maharashtra, Gujarat, and Delhi, the sex ratio at last birth rose above 140. In addition, table 6 shows sex ratio at birth of recent two births that occurred in the last three years prior to survey (NFHS-2).

The pattern of extremely high 'sex ratio for last birth' and 'for two recent births in the last three years' both in northern and western states is consistent with the higher levels of use of either sonogram/ultrasound or amniocentesis in those states. However, the use of these tests is also higher in south Indian states where sex ratios have risen only marginally. To establish a closer link on the impact of sex-selective abortion on female deficit at birth, the 'sex ratio of two births in the last three years on which ultrasound or amniocentesis was performed' is explored. The results in table 6 demonstrate a clear evidence of extremely high sex ratios of last two births on which sonogram/ultrasound or amniocentesis is performed. Haryana shows the highest sex ratio at birth of 182 for these two births, followed by 165 in Orissa, 163 in Uttar Pradesh, 147 in Delhi, and 142 in Himachal Pradesh. In contrast in the south Indian states, although sex ratio at last birth is high, the sex ratio of births on which sonogram/ultrasound or amniocentesis is performed, is lower.

The following conclusions emerge from the above trends. First, sex-selective abortion has a major contribution to the rise in sex ratio at birth in northern, western and also in Uttar Pradesh, Orissa and Rajasthan. Second, parents' 'stopping rule behaviour' strategy is also part of the reason for the rise in sex ratio at birth in these states. Third, in contrast, in the south Indian states, the marginal rise in sex ratio at last birth appears to be caused by stopping rule behaviour. The pattern of results suggest that modern technological tests such as sonogram, ultrasound and amniocentesis have been widely used for sex-detection consequently abortion of female foetuses especially in the north, west and partly in EAG states. In the south Indian states, these technologies seem to have been used more commonly for checking growth and health status of foetuses.

Excess female child mortality

In the absence of any biological basis, excess female child mortality is attributed to be caused by son preference, patriarchal structure and the consequent inferior position of women in society. In India and in developing countries in general, excess female child mortality tends to occur significantly and mostly over the ages 1-4 (see also Tabutin and Williems in UN, 1998). Male disadvantage of neonatal mortality turns into female disadvantage of child mortality. Excess female child mortality tend be small and insignificant during infancy (after accounting for biological male disadvantage and also from age 5.

NFHS-1 data presented in table 6 shows that the female-male ratio of infant mortality 1q0 (83.9/88.6) is 0.95, child mortality is 4q1 (42.0/29.4) is 1.43, and under-five mortality 5q0 (122.4/115.4) is 1.06. Notice that excess female child mortality is very high (43 percent higher than males) for children in ages 1-4 (4q1); for infancy and under five mortality it is not. Aggregated measures such as under-five mortality in ages 0-5 or 1-5 will be less suitable as age variations in sex differences in child mortality is seen to clearly mask excess female mortality in ages 1-4.

At ages 1-4, the male-female ratio of child mortality indicates the level of excess female child mortality for each state. The ratios show extremely high level of excess female child mortality with the highest in Haryana (134 percent), followed by Punjab (81 percent) and Uttar Pradesh (70 percent). West Bengal (63 percent), Rajasthan (59 percent), Delhi (56 percent), Bihar (55 percent), Orissa (45 percent) and Himachal Pradesh (44 percent) are the other states which have greater than the national level excess female child mortality of 43 percent. The NFHS-2 results also indicate excess female child mortality in this order in general; however, about half of the states show a decline and in other states a rise in excess female child mortality. Kerala is the only state where both NFHS-1 and 2 results indicate no evidence of excess female child mortality at all.

The reversal from male disadvantage in neonatal mortality to female disadvantage in post neonatal mortality is abrupt for most states of the north and north central region where excess female child mortality is more than 50 percent (Table 6). Two earlier studies in the Khanna and Matlab project areas have also observed that female mortality was lower than male mortality in the early months after birth but beginning in the later part of the first year of life female death rates were higher than male death rates (Wyon and Gordon, 1971; D'Souza and Chen, 1980).

A number of studies have confirmed that higher mortality of girls than boys is not a general phenomenon but the extent of its concentration increases with increasing number of girls in the family (Das Gupta, 1987; Arnold et al, 1998, Arokiasamy, 2004). The results in this analysis more importantly provide greater precision about the regional pattern of the dynamics of sex differences in child mortality (figure 2). In the north and north central regions the likelihood of excess female child mortality is greater by about a half for the first girl child, two-thirds for the second and nearly twice for the third, fourth and higher rank girls. Given that overall child mortality is not as high in the north as in the north central region, gender bias is more intense and selective in the north compared to the north central region. In the other regions of east, west and south excess risks of female child mortality are marginal and they do not rise systematically with increasing number of female children in the family. This apart, high female child mortality is not universally so, that in the south and west regions, male compared to female mortality is higher for the fourth and higher rank children. This is some substantiation of the point suggested by Muhuri and Preston (1991) that parents might consciously neglect individual children.

Female child neglect in heath care

In south Asian societies with strong patriarchal values and son preference, there is a generalized tendency to give preferential treatment to boys over girls that is rooted in the low social and economic values placed on females. Boys are favoured while girls are neglected. The excess or surplus mortality of female children is commonly hypothesized to be due to discrimination against particularly female children, relative to males, in the allocation of food and health care within the household. Miller (1981) illustrated that discrimination of girls occurs mainly in three categories: feeding, provision of medical care and allocation of love and warmth.

Although discrimination in nutrition, love and deprivation causes growth failure and also has emotional and psychological implications, both Wyon and Gordon (1971) analysis of Kanna study data and Basu (1992) study have found greater evidence to the hypothesis that discrimination of girls in the provision of both preventive and curative modern health care is the direct determinant of excess female child mortality. In the north Indian states significant differences are found in the provision of medical care given to the child compared to the differences in food and nutrition. Strong evidence of discrimination of girls in both preventive and curative care has been reported in accordance with the regional pattern of excess female child mortality in India (Timeaus, 1998).

Discrimination against female children in the provision of health care is assessed in this analysis, primarily in terms of coverage of children for all recommended childhood vaccinations on which the NFHS provide data. Focussing on childhood immunization has a comparative advantage since it covers all children in ages 12-47 months. The second domain of curative health care provision comprised indicators such as whether medical treatment was provided to the child for the reported episodes of diarrhoea, fever and cough. Analyses of these indicators on curative treatment are not incorporated in this paper due to apparent limitations of such data.

Results in figure 3 shows very high levels of female neglect (25-45 percent shortfall compared to males) are observed in immunization coverage for many northern states. On the other hand, in correspondence with very low levels of excess female child mortality, there is no significant evidence of female neglect in nutrition and health care south Indian states. The lack of access to immunization and health care negates the biological advantage that female children have. The corresponding regional variations in health care utilization by sex for surviving children in ages 12-47 are presented in figures 2 and 3. The degree of female neglect in the utilization of health care is central in explaining excess female child mortality. The odds of health care utilization also to tend to decline with increasing rank of girl children compared to boys.

Curative health care nearly always involves expense, and in societies where sons are perceived to be more important than daughters for the medium or long-term economic welfare of the household or family unit, there may be a greater willingness to incur health costs for sons than for daughters. In the stark language of neo-classical economics, under that scenario, given the extremely rigid patriarchal social structure parents are merely behaving rationally by following the best interests of their family kin group. Despite higher morbidity and malnutrition among females, they receive less health care than males.

Development and gender bias against female children

An important hypothesis that is dealt in this analysis is: given the cultural constraints of patriarchy, whether development factors somewhat tend to reduce gender bias against female children; because, it might operate in the opposite direction also where gender inequalities might dampen development. The development effects on gender bias are examined based on differences in 'sex ratio at birth', 'female child neglect health care' and 'excess female child mortality' by women's education and household economic status (standard of living index).

Results indicate that the rise in sex ratio at birth and the consequent deficit of females is greater in urban areas, among educated and economically better of households. The rise in sex ratio at birth in the states of Delhi, Punjab, Haryana, Himachal Pradesh, Gujarat and Maharashtra is therefore greatly contributed by a steeper rise in sex ratio at birth for women with high school and above education and those women in economically better of households. The practice of sex-selective abortion has increased with the advent of sex detection technology since the late eighties. The use of these tests for sex-detection is more widely prevalent in urban areas, among the educated and economically better off parents.

The differentials in child mortality are analysed by women's education, index of living amenities, and duration of preceding birth interval. Other related socio-demographic factors are used as constants in the models. In sum, for the illiterate and poor women both odds of excess of female child mortality and odds of lower health care utilization for female children shows relative statistical robustness compared to those for educated and richer women in the north and north central regions (Table 8). In the south region, odds of female child mortality is lower and odds of health care use is higher in favour of female children for educated and women from richer households. However, as a contrast to the results in sex ratio at birth, the above trends suggest that within the cultural context, development indices such as education, economic condition and exposure to mass media may tend to have a dampening effect on gender bias.

A major mediating factor is the fertility impact on sex –selective abortion and sex bias in child mortality, which several researchers have recently addressed. Das Gupta and Bhat (1997) have argued that a fall in fertility should benefit girls since it reduces the 'parity effect'; however, an 'intensification effect' results in increased discrimination against girls at lower parities. The impact of son preference on sex ratio at birth and excess child mortality for girls tends to vary with overall level of fertility. The parity effects refer to higher risk of mortality of girls (discrimination of girls) than boys for high parity (fertility) mothers, as a result of large proportion of high parity women. This would lead to very significant excess female child mortality. The intensification effects refer to increased discrimination of girls when fertility falls rapidly and reaches low levels and where son preference continues to be strong. Girls (lower birth order) of low parity women tend to face intense discrimination. This is likely resulting in sex (female foetus) selective abortion leading to adverse sex ratio at birth and indicating dramatic shortfall of girls in juvenile age (see also Bhat and Zavier, 2003)

Conclusion

The evidence on trend and differentials in sex ratio at birth suggest that first, sex-selective abortion has a major contribution to the rise in sex ratio at birth in northern, western and also in Uttar Pradesh, Orissa and Rajasthan. Second, parents' 'stopping rule behaviour' strategy is also part of the reason for the rise in sex ratio at birth in these states. Third, in contrast, in the south Indian states, the marginal rise in sex ratio at last birth appears to be caused by stopping rule behaviour. The region pattern suggest that modern technological tests such as sonogram, ultrasound and amniocentesis have been widely used for sex-detection consequently abortion of female foetuses in the north, west and partly in EAG states. In the south Indian states, these technologies seem to have been used more commonly for checking health and growth status of foetuses.

The emphasis on the impact of development factors on female deficit arising from rising sex ratio at birth, excess female child mortality and the discrimination used against female children in health care provision is within this regional dynamics of gender bias. However, the evidences suggest that education and economic condition impact appear to mediate in opposite direction with respect to prenatal vis-à-vis postnatal discrimination. Evidences on trends and differentials in sex ratio at birth suggest, that falling fertility in recent times has led to intensification of gender bias among urban, educated and richer parent, resulting in prenatal discrimination of children. In contrast, neglect of female children in health care and corresponding excess female childe mortality tend to be somewhat greater among the poorer and illiterate compared to richer and educated parents suggesting that postnatal discrimination female children is more concentrated among the poor and illiterate. However, it is important to note that either way the female disadvantage is contributing to the increasing female deficit in the country.

Table 1 Trends in sex ratio at birth (male/female*100) by states and India

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<tr><th rowspan="3">Region</th><th colspan="6">National Family Health Survey-1</th><th colspan="6">National Family Health Survey -2</th><th rowspan="3">Census 2001*</th></tr>
<tr><th colspan="3">1983 - 1986</th><th colspan="3">1987 – 1990</th><th colspan="3">1991 – 1994</th><th colspan="3">1995 – 1998</th></tr>
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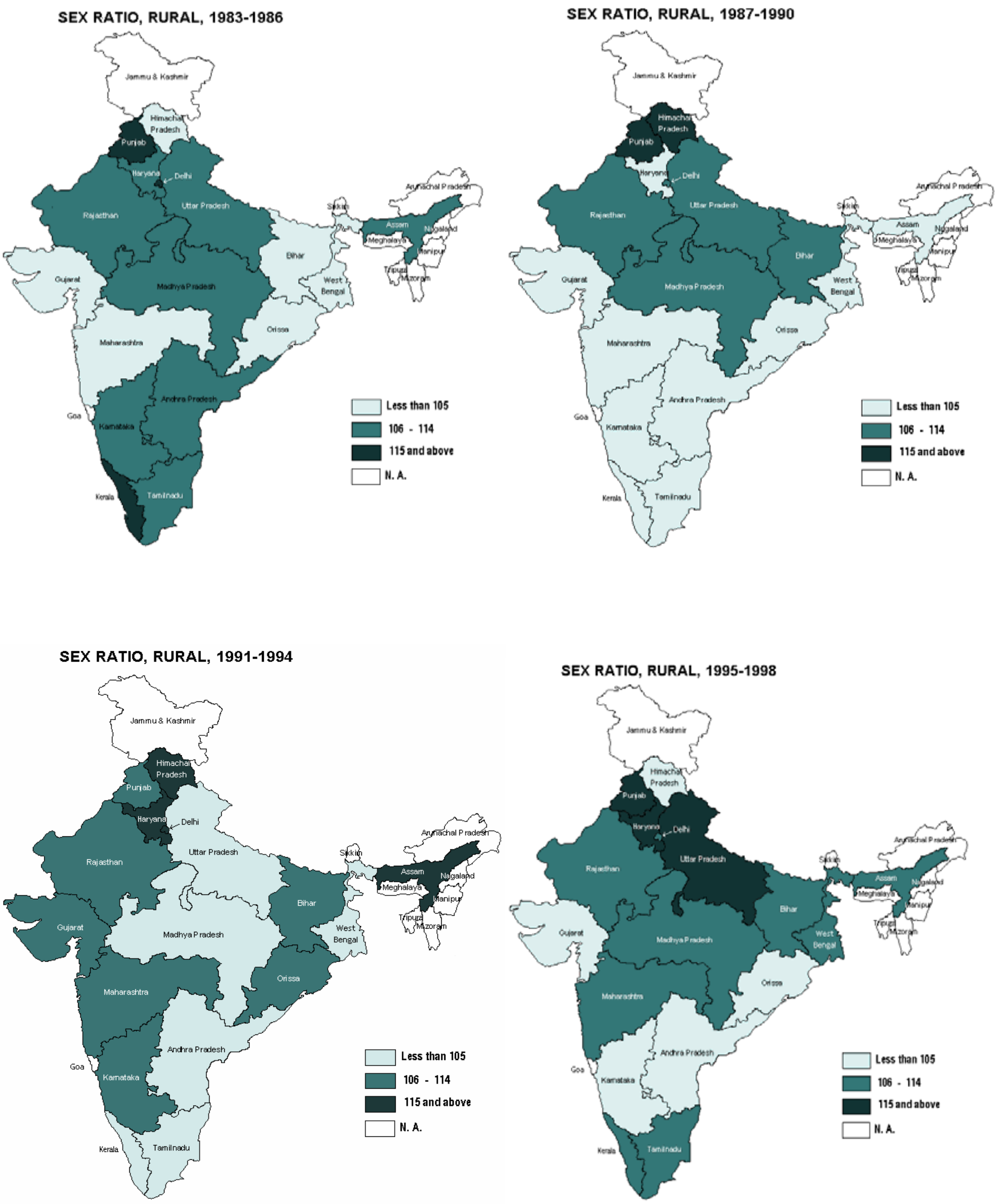
<tr><td>Karnataka</td><td>109</td><td>109</td><td>109</td><td>112</td><td>103</td><td>105</td><td>111</td><td>100</td><td>103</td><td>102</td><td>107</td><td>105</td><td>105</td></tr>
<tr><td>Kerala</td><td>101</td><td>115</td><td>111</td><td>100</td><td>103</td><td>102</td><td>121</td><td>110</td><td>112</td><td>110</td><td>106</td><td>107</td><td>104</td></tr>
<tr><td>Tamil Nadu</td><td>119</td><td>108</td><td>112</td><td>95</td><td>100</td><td>99</td><td>98</td><td>102</td><td>101</td><td>114</td><td>103</td><td>106</td><td>106</td></tr>
<tr><td>India</td><td>110</td><td>106</td><td>107</td><td>105</td><td>106</td><td>106</td><td>108</td><td>107</td><td>108</td><td>108</td><td>106</td><td>107</td><td>106</td></tr>
</table>

*Sulabha Parasuraman, 2001, "Declining sex ratio of child population in India", *IIPS Newsletter*.

MAP-1 TRENDS IN SEX RATIO AT BIRTH, RURAL



MAP-2 TREND IN SEX RATIO AT BIRTH, URBAN

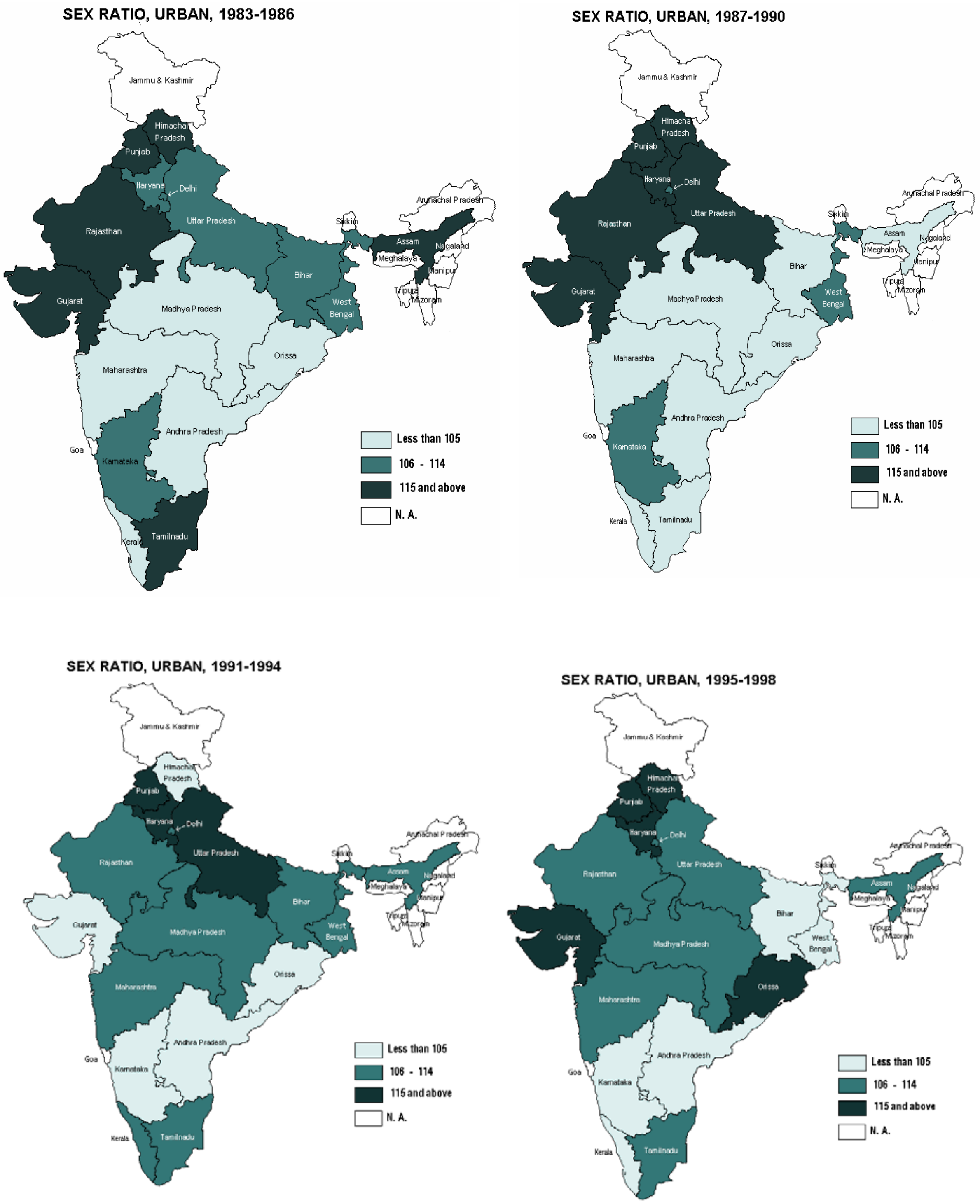


Figure1 Trends in sex ratio at birth by regions in India, NFHS 1 (1992-93) & NFHS-2 (1998-99)

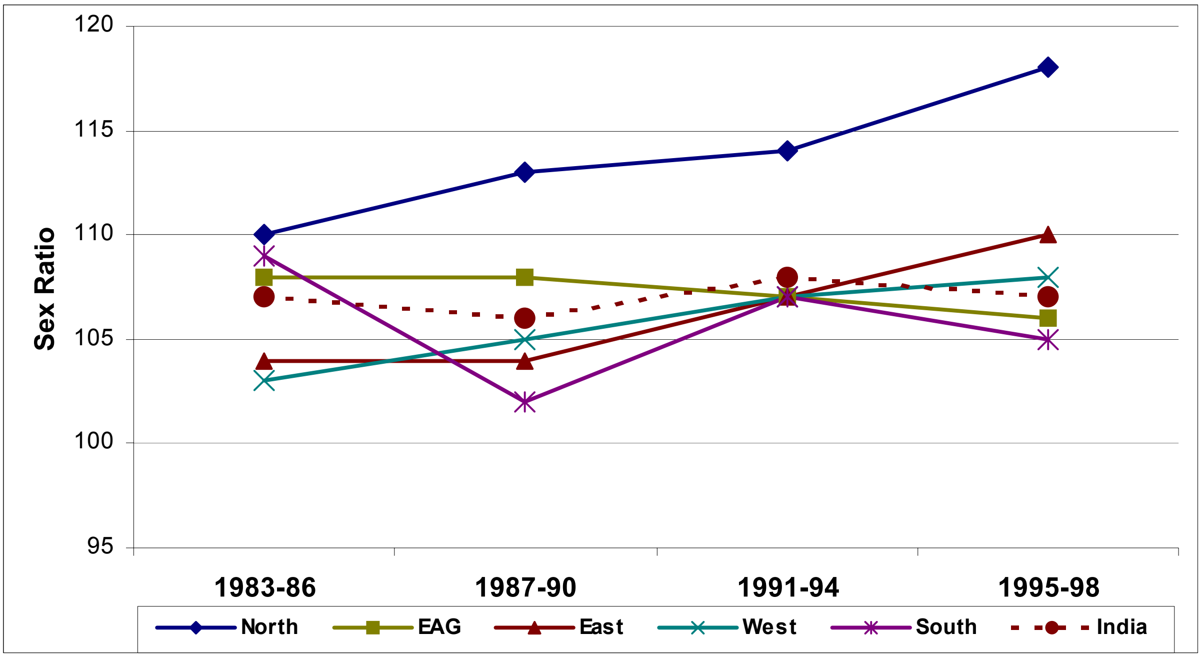


Table 2 Sex ratio at last birth and percentage of pregnancies for which sonogram/ultrasound or amniocentesis performed in states and India

States	*Sex ratio for the last birth*						
	NFHS 1	*NFHS 2*	*SR* [1]	*SR* [2]	*Sonogram / Ultra-sound*	**Amnioce -ntesis**	**Either Sonogram/Ultra-sound or Amniocentesis**
Delhi	115	142	129	147	41	2	42
Haryana	108	157	146	186	18	1	19
Himachal Pradesh	111	153	139	142	15	0	15
Punjab	107	177	148	118	21	2	21
Bihar	111	120	116	89	6	1	7
Madhya Pradesh	113	128	124	96	9	2	12
Rajasthan	115	134	127	130	13	1	16
Uttar Pradesh	110	123	118	163	13	3	14
Orissa	109	125	119	165	3	1	5
Assam	108	120	114	61	4	2	4
West Bengal	106	118	116	107	7	0	7
Gujarat	110	143	131	124	23	2	30
Maharashtra	104	146	132	116	29	6	33
Andhra Pradesh	104	118	119	91	23	1	24
Karnataka	107	122	116	120	22	3	24
Kerala	103	108	108	96	44	3	45
Tamil Nadu	106	117	112	99	31	7	37
India	**108**	**127**	**121**	**113**	**18**	**2**	**21**

Note: 1. Sex ratio for the last two births preceding the survey.
2. Sex ratio for the last two births who had undergone either sonogram/ultrasound or amniocentesis

Table3 Sex ratio at birth (M/F*100) by women's education by states & India, NFHS-2, 1995-98

States	Illiterate	Less than middle school	Middle school complete	High school complete
Delhi	106	123	149	120
Haryana	121	116	114	138
Himachal Pradesh	104	152	110	117
Punjab	105	93	123	134
Bihar	106	122	113	98
Madhya Pradesh	100	99	143	101
Rajasthan	110	111	99	121
Uttar Pradesh	102	99	131	94
Assam	101	126	138	155
Orissa	103	107	115	109
West Bengal	112	102	98	100
Gujarat	99	99	122	133
Maharashtra	111	93	96	150
Andhra Pradesh	100	108	116	100
Karnataka	100	121	95	111
Kerala	120	97	104	110
Tamil Nadu	102	93	114	131
India	**104**	**103**	**114**	**118**

Table 4 Sex ratio at birth (M/F*100) by household standard of living in states and India, NFHS-2, 1995-98

State	Low	Medium	High
Delhi	103	110	126
Haryana	110	112	144
Himachal Pradesh	104	92	122
Punjab	86	105	123
Bihar	111	104	95
Madhya Pradesh	108	97	104
Rajasthan	113	105	121
Uttar Pradesh	102	106	112
Assam	109	119	127
Orissa	98	117	102
West Bengal	111	99	104
Gujarat	100	104	120
Maharashtra	77	115	116
Andhra Pradesh	101	104	100
Karnataka	107	105	105
Kerala	130	96	117
Tamil Nadu	95	107	136
India	**105**	**106**	**114**

Table 5 Percentage of last two pregnancies on which sonogram/ultrasound or amniocentesis was performed by household standard of living and education in states and India, NFHS-2

	Household standard of living		**Educational level**	
States	***Low and medium*** [1]	***High***	***Illiterate and < middle school*** [2]	***Middle school and above*** [3]
Delhi	24	52	26	53
Haryana	7	33	9	32
Himachal Pradesh	8	31	5	23
Punjab	10	30	12	32
Bihar	3	22	3	15
Madhya Pradesh	5	29	5	29
Rajasthan	8	27	9	34
Uttar Pradesh	7	29	6	28
Orissa	2	18	1	12
Assam	3	23	3	9
West Bengal	5	32	3	24
Gujarat	13	52	12	49
Maharashtra	23	61	20	50
Andhra Pradesh	18	49	16	44
Karnataka	16	49	14	41
Kerala	37	64	30	50
Tamil Nadu	31	63	29	46
India	**13**	**41**	**11**	**37**

Note: 1. the low and medium category of household standard of living is combined.
2. Illiterate and less than middle school is combined.
3. Middle school complete and high school and above is combined.

Table 6 Neonatal, post neonatal and child mortality by sex (for births in the last 10 years) by state and India, NFHS 1 (1992-93) & NFHS-2 (1998-99)

States	Neonatal Mortality (NN) 1		Neonatal Mortality (NN) 2		Post neonatal Mortality (PNN) 1		Post neonatal Mortality (PNN) 2		Child Mortality (4q1) 1		Child Mortality (4q1) 2	
	M	F	M	F	M	F	M	F	M	F	M	F
Delhi	36.2	30.3	34.3	19.9	24.1	34.1	17.1	20.4	13.6	21.2	10.6	13.4
Mariana	47.1	37.6	32.2	36.0	28.8	45.9	20.6	30.0	18.4	43.2	13.8	30.2
Hibachi Pradesh	41.6	34.4	27.9	21.4	25.6	28.5	16.9	12.4	17.6	25.3	9.0	9.3
Punjab	32.9	27.0	34.4	37.9	22.8	22.1	15.3	27.3	12.7	23.0	5.9	23.8
Bihar	64.0	50.0	51.9	46.6	37.3	42.4	23.6	29.1	34.5	53.5	31.4	43.6
Madhya Pradesh	63.1	49.5	67.3	51.7	36.7	43.4	29.8	35.9	46.7	56.8	49.4	66.3
Rajasthan	42.3	42.0	57.5	50.4	31.3	37.5	31.4	36.8	26.5	42.2	29.4	52.3
Uttar Pradesh	71.1	68.3	64.5	59.4	41.5	51.6	30.3	36.5	38.5	65.6	28.8	53.4
Assam	63.0	47.9	42.1	31.5	37.9	36.4	24.8	24.2	52.9	59.6	21.4	16.9
Orison	70.4	57.6	64.6	46.4	56.5	54.1	29.9	37.8	16.1	23.4	29.6	27.9
West Bengal	56.5	53.7	36.9	30.6	28.2	23.6	20.4	13.6	21.7	35.4	18.5	23.9
Gujarat	47.8	44.6	46.6	37.0	24.4	30.2	22.5	22.4	27.1	38.6	25.1	31.4
Maharashtra	46.2	28.8	38.8	37.4	16.5	20.0	15.9	14.3	19.1	23.6	15.5	20.0
Andhra Pradesh	54.4	40.9	45.0	50.2	23.2	28.0	27.9	18.5	21.5	27.6	16.6	27.8
Karnataka	54.4	45.4	53.6	34.8	24.3	25.8	16.5	19.3	25.6	33.4	21.1	23.8
Kerala	23.4	20.7	19.6	10.6	10.5	7.1	5.1	6.0	10.0	9.4	6.0	4.5
Tamil Nadu	53.5	38.9	35.3	36.6	26.0	22.7	14.9	15.2	29.0	23.2	12.7	15.8
India	**57.0**	**48.1**	**50.7**	**44.6**	**31.7**	**35.8**	**24.2**	**26.6**	**29.4**	**42.0**	**24.9**	**36.7**

National Family Health Survey, 1992-93 & 1992-93

Table 7 Ratio of female/male(*100) in neonatal, post-neonatal and child mortality states and India, NFHS 1 (1992-93) & NFHS-2 (1998-99)

Region	*Neonatal Mortality (NN)*		*Post neonatal Mortality (PNN)*		*Child Mortality ($_4q_1$)*	
	NFHS- 1	NFHS- 2	NFHS- 1	NFHS- 2	NFHS- 1	NFHS- 2
Delhi	0.84	0.58	1.41	1.19	1.56	1.26
Haryana	0.80	1.12	1.59	1.46	2.35	2.19
Himachal Pradesh	0.83	0.77	1.11	0.73	1.44	1.03
Punjab	0.82	1.10	0.97	1.78	1.81	4.03
Bihar	0.78	0.90	1.14	1.23	1.55	1.39
Madhya Pradesh	0.78	0.77	1.18	1.20	1.22	1.34
Rajasthan	0.99	0.88	1.20	1.17	1.59	1.78
UttarPradesh	0.96	0.92	1.24	1.20	1.70	1.85
Assam	0.76	0.75	0.96	0.98	1.13	0.79
Orissa	0.82	0.72	0.96	1.26	1.45	0.94
West Bengal	0.95	0.83	0.84	0.67	1.63	1.29
Gujarat	0.93	0.79	1.24	1.00	1.42	1.25
Maharashtra	0.62	0.96	1.21	0.90	1.24	1.29
Andhra Pradesh	0.75	1.12	1.21	0.66	1.28	1.67
Karnataka	0.83	0.65	1.06	1.17	1.30	1.13
Kerala	0.88	0.54	0.68	1.18	0.94	0.75
Tamil Nadu	0.73	1.04	0.87	1.02	0.80	1.24
India	**0.84**	**0.88**	**1.13**	**1.10**	**1.43**	**1.47**

Source: National Family Health Survey, 1992-93 & 1998-99.

ORm/ORf, NFHS-1 (1992-93)

Figure 2 Region-wise excess female child mortality at ages 12-47 months by rank of female children (all children under exposure)

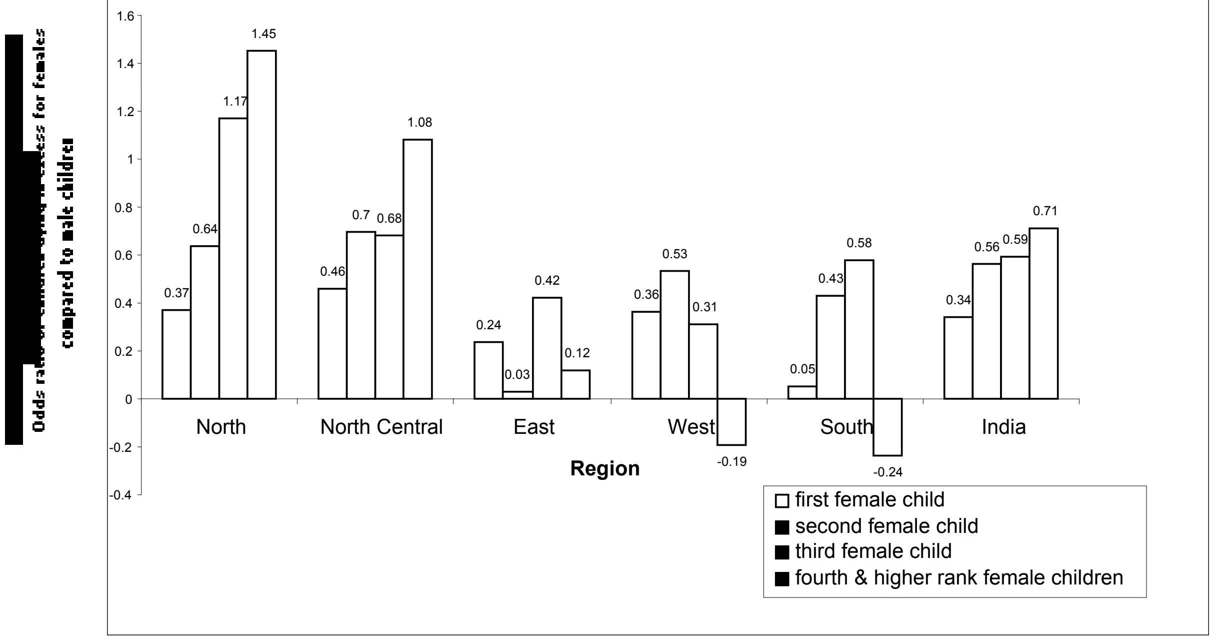


Figure 3 Neglect of female children in health care (all vaccination) by birth order and region in India, NFHS-1

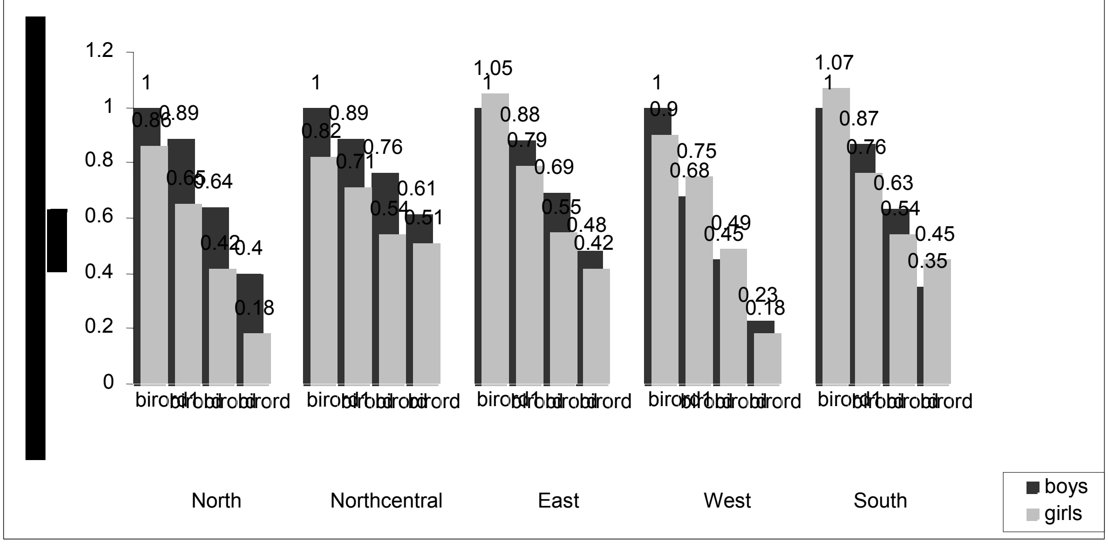


Figure 4 Neglect of female children of age 12-35 in health care (all vaccinations) by birth order and region in India, NFHS-2

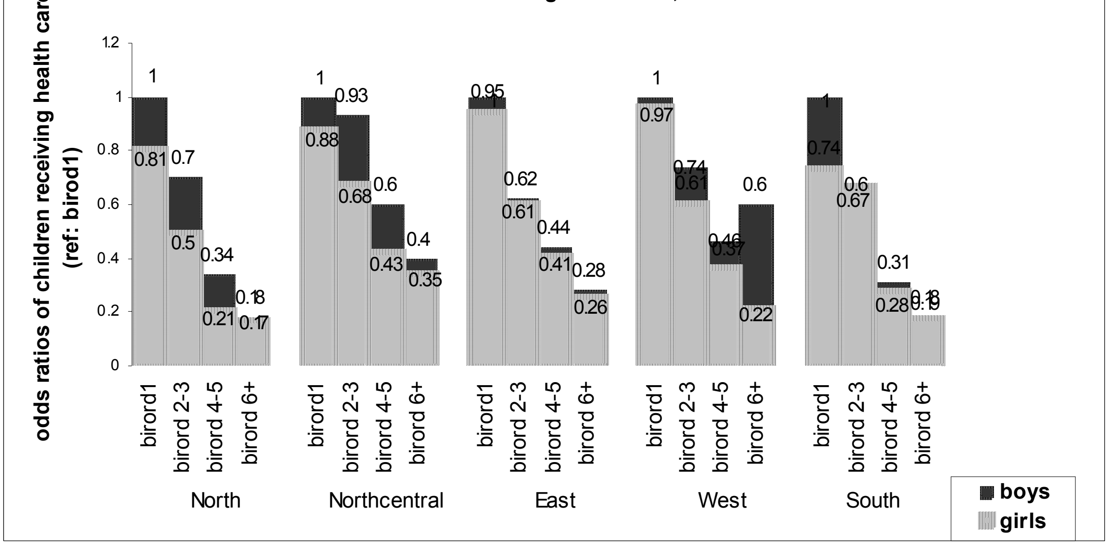


Table 8 Logistic regression analysis of impact of development factors and birth interval on excess female child mortality by region [a], India, NFHS-1

Stratum of development variables and birth interval ©	Odds ratio of female child experiencing childhood mortality[1] (with male child as the reference category and) with all other predictor variables© held constant in the model				
	North	North Central	East	West	South
Women's education					
Illiterate	1.69***	1.61***	1.26	1.40	0.99
Secondary and above	1.01	1.09	0.79	1.08	0.42
Index of living amenities[b] (0-4)					
None-0	1.98**	1.46***	1.28	1.14	1.13
All the four-4	1.18	1.34	0.69	2.81*	0.96
Duration of preceding birth interval					
Up to 24 months	2.28***	1.71***	1.20	1.84*	1.02
24+ months	1.24	1.78***	1.25	1.23	1.45

***P<.001 ** P<.01 *P<.05

[2] excludes deaths if age at death is <12 and > 47 months; includes births in the 10 years period preceding the date of survey but excludes births in the last 47 months period in order to consider only fully exposed children.

[a] as in the endnote to table 2; [b] includes electricity, pipe/pump water, cooking fuel gas/electricity, and indoor toilet; [c] watches TV/ listens to radio once in a week, visits cinema once in a month.

® A logistic regression model was constructed by each stratum of the development variables and by region. Each value of odds ratio in Table 6 represents a model for the particular stratum. Each of the models included sex of the child as predictor and all other variables as in end note to table 2 (other than the particular stratum variable) were used as control variables.

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