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Research Article

Sex-Differentials in Childhood Mortality in Punjab and Haryana – Are They Reality?†

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† The views expressed in this paper are entirely of the authors but not of the organization in which they belong.

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Abstract

Excess female mortality during childhood is a distinct and unrelieved phenomenon in India, particularly in the two northern Indian states—Punjab and Haryana. This paper investigates the basic facts of sex differentials in child mortality in a very comprehensive manner using the three rounds of NFHS data sets from 1992 to 2006. More specifically, this paper examines the following three basic questions: (1) Have the sex differentials in child mortality in Punjab and Haryana narrowed down during the past two decades? (2) Does discrimination in food as well as preventive and curative care explain the existing sex differentials in child mortality? And (3) What are factors that explain the sex differentials in child mortality? The determinants of childhood mortality have been studied through Poisson regression. The survival curves resulted from Cox regression reveal two important findings: survival chances for females during neonatal period is higher, while an opposite phenomenon appears in the post-neonatal and childhood ages.

Keywords: ***sex differential, child mortality, survival curve, Poisson regression***

I. Introduction

The relative survival rate of the two sexes is a major public health concern in all developing and less developed countries. Extant demographic literature is full of studies of postnatal discrimination against female children and the high female child mortality (Miller 1981; Das Gupta 1987; Sen 1988; Kishor 1993). Sex differential in the early childhood mortality, or female disadvantage in child survival, is well documented in most of the South Asian countries. In India, this has been a subject of great concern, especially in recent times. This disadvantage for the female remains to be a great challenge for gender equity. Eliminating or controlling such differences may substantially reduce the overall child mortality.

Child mortality indicators from the last three decades reveal that though levels of child mortality have declined, the sex differentials in mortality have actually widened in many countries of south-central Asia, particularly during the childhood period. In India, the estimates of child mortality obtained from the abridged life table of Sample Registration System (SRS) reveal a declining trend since 1993 (average between 1991-1995). After 1993, estimates of child mortality for male children show almost a stable trend, while the female child mortality estimates showed an increasing trend after 1993. As a result, the absolute difference between male and female child mortality showed an increasing trend after the year 1993 (Singh et al. 2007). Such sex differentials in child mortality are considered as one of the contributing factors to the secular decline in child sex ratio (0-6 years old, female per 1000 male). A strong sex bias or preference for sons among Indian couples is frequently reported in various Indian studies (Arokiasamy 2004; Arnold et al. 1998; Das 1984, 1987;

Lahiri 1974, 1975, 1977, 1979, 1984; Mutharayappa et al. 1997). Furthermore, it has been found in another study that the intensity of son preference in India is very closely associated with under-five child mortality (Lahiri 2011).

Punjab and Haryana, the two economically developed Indian northern states, still maintain a rather low sex ratio and a strong son preference. A secular decline in sex ratio of child population had been observed in India throughout the various census years, particularly in the northern part of the country. According to the Population Census of India, in 2001, the sex ratios[1] (females per 1000 males) among children aged 0-6 in Punjab and Haryana declined considerably to 798 and 819 respectively compared to 875 for Punjab and 879 for Haryana back in 1991. These ratios slightly increased to 846 and 830 for the two states respectively in the 2011 Census (Office of the Registrar General and Census Commissioner of India 2011). The reasons for such low sex ratios could be due to female foeticide on a massive scale, female infanticide and higher female mortality in the early childhood. Furthermore, a variety of technologies (like amniocentesis and ultra sonography) are widely applied to pre-determine the sex of the embryo, despite of the fact that these actions are deemed illegal (Bose 2001; Tandon and Sharma 2006). Low sex ratio is a matter of serious concern for such a long period and poses tricky issues to Indian societies in general and women in particular. A good deal of discussions on sex-selective abortions can be found elsewhere (Arnold et al. 2002; Tandon and Sharma 2006).

1 The Census of India, which is more than a century old in its operation, defines the sex-ratio of population as the number of females per 1000 males. This is followed traditionally and customarily starting from the British India census operations which is also the same definition of sex-ratio adopted by the Census of India used in this paper. Further discussion on Indian sex-ratio may be found elsewhere (Agnihotri 2000; Office of the Registrar General and Census Commissioner of India 2011).

In Punjab, the overall death rate is lower than the national level but the difference between male and female mortality is higher when compared with the national standard (Office of the Registrar General of India 2006). In the absence of gender discrimination, female infant and child mortality rate is generally lower than those of their male counterpart because of the biological factors. But with the course of time from infancy to childhood, female children are often discriminated in terms of nutritious food and health care, resulting in higher female mortality during childhood (Singh et al. 2007). According to the data from SRS, there is no clear pattern for the ratio of female-male mortality during infancy, but an imbalance seemed to increase slightly over time. The female-male ratio of child mortality over time indicates an increasing gender gap in mortality in Punjab, while no or insignificant change is noticed at the national level.

Many studies at the international and national levels have dealt with child mortality, focusing on indentifying the determinants of mortality during the childhood period. In a study in Malaysia, Butz et al. (1982) found the influence of breast feeding on infant mortality. Finch et al. (2000) studied the role of behavioral factors on racial ethnic disparities in infant mortality. Bolstad and Manda (2001) studied the sociological and biological factors affecting infant mortality; they found that the variation in child mortality is largely due to family and community effect. Whitworth and Stephenson (2002) studied association of birth spacing, sibling rivalry and child mortality in India; they found that the incidence of child mortality is higher for children with a large number of siblings (Makepeace and Pal 2008). Sastry (1996) studied the differential in child survival between the poor communities in Northeast and Southeast of Brazil. By studying the water supply, sanitation and health facilities in these communities, he found out that child mortality is affected by the level of education of these communities. Pebley et al. (1996) studied prenatal, delivery care, and childhood immunization related to family and community matter.

Among the various Indian studies, Gandotra and Das (1984) studied the levels, trends, correlations, causes, and interrelationships between infant mortality and fertility. Along with other factors, they found out that inadequate supply of safe drinking water, unsatisfactory housing conditions, poor environmental sanitation, poor nutrition, and low level of medical facilities are important factors responsible for high infant mortality in the country. Ashraf (1990) have studied infant mortality in rural India and found socio-economic, demographic and risk factors affecting infant mortality. Rao et al. (2004) found that giving food supplementation at the right time is important for child's nutrition and childhood survival in Northeast India. Jatrana (2003) studied the effect of socio-cultural practices on infant mortality in rural north India and found that colostrum is an important nutrient for child survival and those children whose mother did not squeeze out breast milk during first time feeding have a higher chance of survival. In the study on the determinants of child mortality in rural Punjab, Das Gupta (1990) found the existence of death clustering in child mortality, and that the women's autonomy, social class and the mother's education significantly influence child survival. Singh et al. (2007) found that the chances of sex differential in childhood mortality decrease with increase in the autonomy of the mothers.

Search for reasons for sex differentials in child mortality in Punjab and Haryana poses a serious problem. The fertility levels in Punjab and Haryana have reached considerably low levels (total fertility rate is 1.9 in Punjab and 2.6 in Haryana, according to SRS estimates for 2007). With such low levels of fertility, any child born, a boy or a girl, is unlikely to be an unwanted child and is expected to receive more resources and investments than a child born in a high fertility region. This suggests that as we move from a high fertility region to a low fertility region, the postnatal discrimination against a child of a particular sex should be the same as that during prenatal period. This is likely to happen because when fertility levels are high, parents have many chances in getting the child of their desired sex. On the other hand, in low fertility regions, parents need to assure in advance that they get the child of the desired sex, because usually they have decided to have one or two children only. This leads to the increasing use of technology to detect the sex of the unborn child and often abortion in case the fetus is of the unwanted sex. Under such circumstances, the sex differentials in child mortality and discrimination among the surviving children should reduce.

In light of the above discussions, this paper investigates three very basic research questions: (1) Have the sex differentials in child mortality in Punjab and Haryana narrowed down during the past two decades? (2) Does discrimination in food as well as preventive and curative cares explain the existing sex differentials in child mortality? And (3) What are the factors that explain the sex differentials in child mortality? Data from the three rounds of National Family Health Surveys (NFHS) are used in investigating the above research questions.

II. Data and Methods

The present study focuses on two northern Indian states—Punjab and Haryana, which are well-known for imbalanced sex ratio (males per 1000 females) and strong son preference over the decades even though these two states are economically developed and have reasonably high literacy levels compared to many other Indian states (around 77 percent literacy rate according to the 2011 census). This paper utilizes data from the three rounds of NFHS carried out in India by the International Institute for Population Sciences (IIPS), Mumbai between 1992-2006, as a nodal agency appointed by the Ministry of Health and Family Welfare, Government of India. Data sets NFHS-1 (1992-93), NFHS-II (1998-99) and NFHS-III (2005-06) provide a unique opportunity to examine the changes in sex-differential in mortality during childhood periods over a 15-year time span. These surveys cover a sufficiently large national and state representative sample (a total of 90,000 and more households over the three NFHS) and provide quite reliable estimates of indicators of population, health, and nutrition by background characteristics including birth history, household facilities, socio-economic characteristics, child feeding practices, reproductive and child health care, etc.[2] Apart from using experienced and well trained field investigators, supervisors, and strict supervision, various checks were introduced at different phases of all projects to control non-sampling errors.

Detailed information on survival status, including preventive and curative measures of each and every child, who was alive at the time of the surveys, were collected from their mothers. The present analysis is based on the births that have taken place in the sample households in the 10 years preceding the survey (for each round) in Punjab and Haryana. For the purpose of the analysis, the states of Punjab and Haryana were clubbed together, as the number of child deaths was insufficient to carry out the analysis if the two states were to be considered separately. It is worth mentioning that the two states are neighboring states and bear almost similar characteristics of interest. Therefore, merging the data of the two states does not affect the analysis to a great extent. The total number of births and child

2 For details, see: http://www.nfhsindia.org/nfhs1.html, http://www.nfhsindia.org/nfhs2.html, and http://www.nfhsindia.org/nfhs3.html.

deaths that occurred in Punjab and Haryana (combined) for the three survey periods are shown in Table 1. Four indicators have been used to represent the mortality during childhood. These are neonatal mortality, post-neonatal mortality, infant mortality, and child mortality (1-4 years).

Table 1. Total number of births and child deaths in the last 10 years preceding the survey, Punjab and Haryana (combined), 1992-2006

States	1992-93	1998-99	2005-06
Total Births	8530	7215	5304
Neonatal Mortality	312	253	142
Post-neonatal Mortality	246	159	85
Infant Mortality	558	412	227
Child Mortality (1-4 Years)	138	98	43

To bring out comparison between the preventive and curative cares offered to male and female children, the present study makes use of NFHS data on measles and all vaccination coverage, treatment for acute respiratory infections (ARI) and fever, initiation of breastfeeding within an hour and within a day, stunting, wasting, any anemia, and consumption of foods rich in vitamin A in 24 hours preceding the NFHS III (2005-06). Stunting[3] and wasting[4] are two commonly used indicators to measure under-nutrition among young children. Acute respiratory infection, primarily pneumonia, is a major cause of illness among infants and children and the leading cause of childhood mortality in almost all over the World.

3 Height-for-age index measures stunting, that is failure to reach the optimal linear growth. Children who are more than two standard deviations below the reference median on this index are considered as stunted.

4 Weight-for-height index examines the body mass in relation to body length. Children whose weight-for-height is more than two standard deviations below the median of the reference population are considered wasted.

III. Analysis Through the Use of Survival Curves

The survival curves have been used to understand the trends in sex differentials in mortality during the childhood period. The survival curves present probability of survival for various independent variables over the observation period. Here the survival curves are plotted separately for male and female children during the first five years of their life.

To examine the factors affecting mortality during childhood in India, Poisson regression has been carried out as the predictor information to the rate of susceptibility of the response to the increase or decrease in counts. The Poisson regression has been utilized to model mortality risk during the childhood period because of the simple reason that the dependent variable is a count variable. Poisson regression is a statistical model that assumes the outcome variable follows a Poisson distribution and is appropriate when the dependent variable is a count, such as death, which can take only integer values. A Poisson random variable Y has a probability density function, $f(y)=P(Y=y)$ defined by,

$$f(y)=\frac{e^{-\mu}\mu^{y}}{y!} \quad \cdots\cdots \quad (1)$$

where, $f(y)$ denotes the probability that the variable Y takes only non-negative integer values, for example 0, 1, 2, 3, etc. The parameter μ is the mean value of the random variable Y and $\mathrm{E}(Y)=\mu=\mathrm{V}(Y)$, where $\mathrm{V}(Y)$ stands for variance of the random variable.

Mathematically, the Poisson regression model may be written as

$$Y=E(Y_i)+u_i=\mu_i+u_i$$

where Y_i's are independently distributed as Poisson random variables with means μ_i for each individual expressed as a linear model of the dependent count variable (that is, deaths during the childhood period) (Gujarati 2004).

For estimation purposes, one may write the model as

$$Y_i = \frac{e^{-\mu}\mu^y}{y!} + \mu_i \qquad (2)$$

The dependent variable for the Poisson regression is the occurrence of death of a child within a specified age interval, and the independent variables include several bio-demographic (sex of the index child, sex composition of all living children, birth order, birth interval, size of baby at birth and age of women at the time of delivery) and socio economic variables (place of residence, wealth index, mass media exposure, women's education and women's autonomy).

In order to measure women's autonomy, several questions were asked in the NFHS-III regarding the women's decision-making, as well as their freedom of movement, and control over resources. On the basis of the available information in the dataset, a Composite Index of Women Autonomy (CIWA) was constructed to capture the above three dimensions of women's autonomy. Two categories of CIWA, viz. lower and higher, are obtained from the average value of the index taking all the states together. The women receiving a score less than the average score are put in the lower autonomy category. The remaining women were treated as having relatively higher autonomy. The women who took decision on their own or took decision jointly with others on a majority of the items were treated as having higher autonomy, while the rest of the women was treated as having lower autonomy. The question "who decides on what to cook" was not included in the construction of CIWA as often women decide what to cook in most of the Indian families. Therefore, it may not have any bearing on women's autonomy in the household and community at large.

Exposure to the mass media is measured by using three indexes: whether one reads newspaper, listens radio, or watches TV. A Woman exposed to none of these three are considered to have no exposure. Exposure to any of the three would qualify the exposure to mass media.

Literature suggests that birth order and birth interval jointly have a significant impact on mortality during childhood (Arokiasamy and Gautam 2008). In order to examine the joint effect rather than the individual effect of birth order and birth interval, the interaction of these two have been used as one single variable in this paper.

Wealth index is generally used to determine a household's relative economic status. In the NFHS-III, the wealth index was constructed by using the Principal Component Analysis to combine 33 household assets and housing characteristics, such as ownership of consumer items, type of dwelling, source of water and availability of electricity, into a single index. The household population is divided into five equal groups of 20 percent each (quintiles) from 1 (lowest, poorest) to 5 (highest, wealthiest).

Sex composition of children is also found to have impact on differential mortality. As pointed out by Das Gupta (1987), parents may apply selective discrimination to a particular child because of the sex composition of his or her older siblings. Once parents have achieved their optimal gender composition of children, extra children, or children not wanted at the time of birth, are likely to receive less care and will be exposed to higher risk of dying.

IV. Interpretation of Results

(1) Differential in Childhood Mortality

The data on mortality during early infancy from NFHS III suggests lower neonatal mortality rates per 1000 live births among female children during the neonatal period for both the states of Punjab and Haryana (33 for males and 26 for females in Punjab and 26 for males and 23 for females in Haryana) compared to most of the other Indian States. However, it is the female child who was exposed to higher risk of mortality during the post neonatal period and early childhood period in Punjab and during early childhood period in Haryana (International Institute for Population Sciences and Macro International 2007). Survival curves for male and female children for the three rounds of NFHS are presented in Figures 1, 2 and 3. A steep survival curve represents low survival rate or short survival time. On the other hand, a gradual or flat curve represents high survival rate or longer survival time. The results suggest an increase in the survival chances for both male and female children in the last fifteen years. In addition, a reduction in the male-female gap in child survival is also found during the neonatal and post-neonatal periods and during the early childhood period (1-4 years of life).

The international experiences suggest that female new-born babies were more likely to survive during the neonatal and post-neonatal periods. The trend of mortality during the neonatal period, as mentioned earlier, was found in all the three NFHS rounds. On the other hand, the male babies were found more likely to survive than female babies during the post-neonatal and early childhood (1-4 years) periods. It is the post-neonatal period or

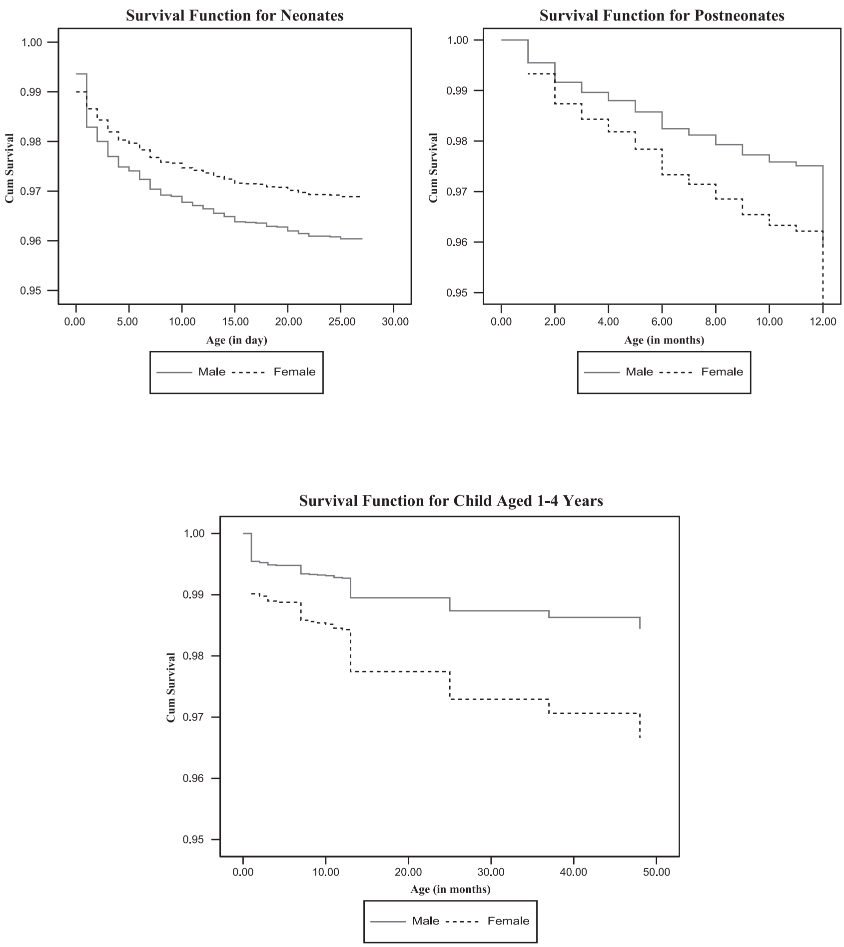

Figure 1. Survival curve for neonatal, post-neonatal and child mortality in Punjab and Haryana, 1992-93

early childhood where the female children are more likely to experience discrimination as during this period only as the social and cultural factors start to play a role. During the neonatal period, it is the biological and genetic factors that play a predominant role in child survival. It is needless to emphasize that the female children being biologically stronger are normally (that is without any discrimination) more likely to survive during

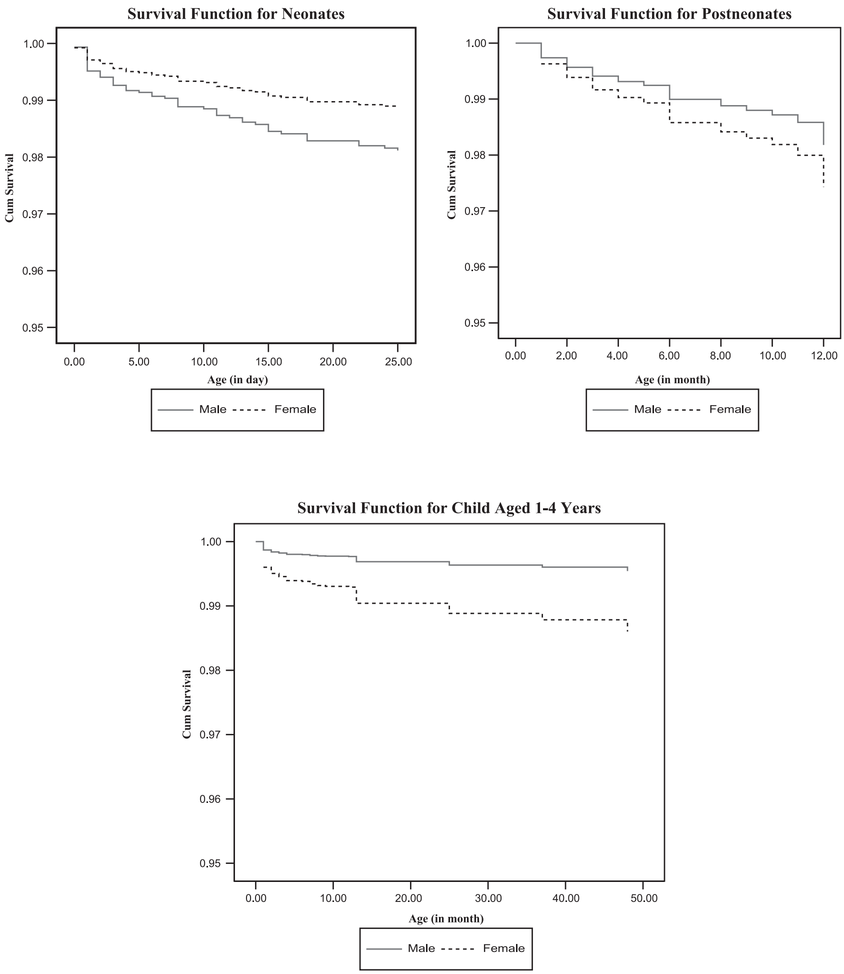

Figure 2. Survival curve for neonatal, post-neonatal and child mortality in Punjab and Haryana, 1988-99

the neonatal and post-neonatal periods, compared to their male counterparts. The analysis of the NFHS data suggest that in India the social and cultural factors associated with the child survival start to exert an influence predominantly during the post-neonatal period and become more prominent in childhood, especially during the early childhood period. The

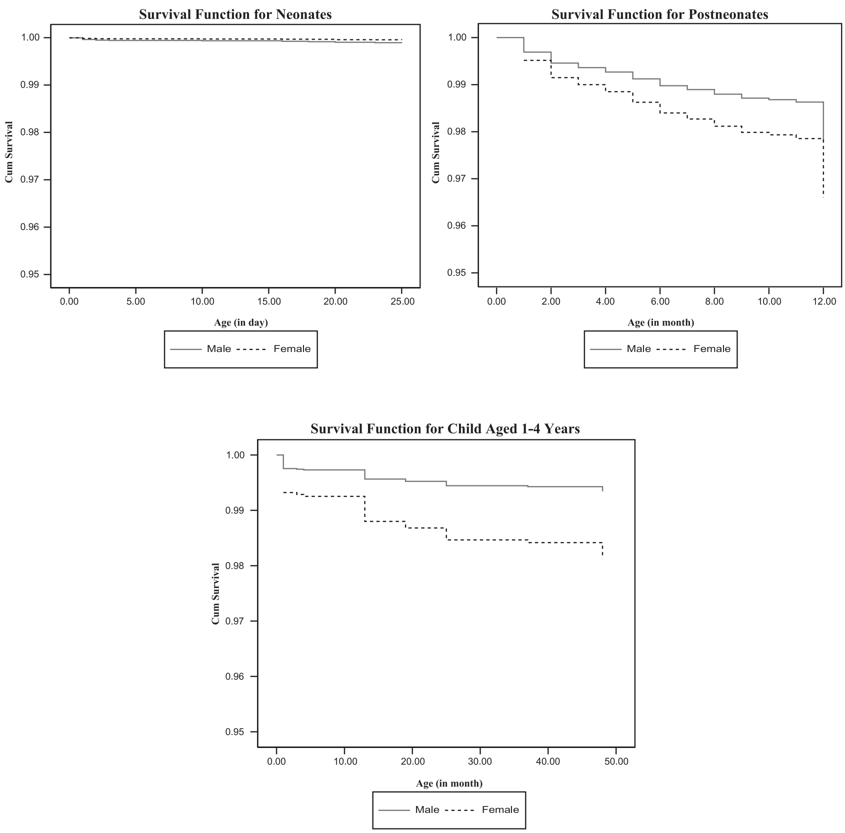

Figure 3. Survival curve for neonatal, post-neonatal and child mortality in Punjab and Haryana, 2005-06

variations in the male-female gap in the chances of survival during different stages of infancy and childhood periods are quite consistent with the above observation.

(2) Differential in Child Care

It is very clear from the above discussions that the female children are exposed to higher chances of dying than their male counterparts during the early childhood period. If we agree with the logic that this difference in the chance of survival is only because of the differential care provided to the children of two sexes, then we should find significant differences in nutrition, as well as preventive and curative cares offered to male and female children; more specifically, the care should be higher among male compared to female. Unfortunately, the analyses of the NFHS data in the following paragraphs do not support the above statement.

Discrimination against girls in allocation of food and resources, has been demonstrated in a number of studies in the developing countries, including India. Such discrimination would lower the health and nutritional status of the girls, resulting in higher female mortality during childhood. It is a well-established fact that mortality in the childhood period (1-4 years) is primarily affected by environmental factors rather than bio-medical factors. Becker and Black (1996) have discussed the indicators to understand sex differential in child care and have used the information on the study of current incidence of diseases such as diarrhea, pneumonia, neonatal tetanus or birth trauma/asphyxia, along with current coverage and efficacy of interventions. Regarding the intervention part, oral rehydration therapy use, antibiotic treatment for pneumonia, measles immunization, tetanus immunization and vitamin A supplementation were taken.

The data on some of these indicators of nutrition, preventive and curative cares for male and female children are presented in Table 2. Here we are trying to examine whether the resources, preventive and curative cares are disproportionately distributed among the male and female children using the data from NFHS III. Of the two kinds of cares, curative care has a more important role compared to preventive care in explaining sex differential in child mortality. The information on the preventive and curative cares provided to the children are collected only from the mothers of surviving children.

Table 2. Sex differential in selected important child care indicators, Punjab and Haryana, 2005-06

	Punjab and Haryana	
	Male	Female
Vaccination		
Measles*	78.9	74.0
All Vaccination	64.0	60.8
Treatment of symptoms of		
ARI	88.0	85.8
Fever	85.0	87.6
Initiation of breastfeeding		
Started within 1 hour	17.8	16.6
Started within 1 day	52.4	55.3
Nutritional status, anemia and micro-nutrient intake		
Stunting	41.6	40.2
Wasting	14.8	13.0
Any anemia	68.9	69.9
Consumed foods rich in Vit-A in last 24 hours	35.4	37.8

Note: Z-test reveals that the differences in the percentages for male and female are not significant for any of the indicators except for measles.

To examine the sex-differential in some selected child care indicators for Punjab and Haryana, the Z-test of significance was applied. The Z distribution was originally derived by Fisher under the assumption that the parent population was normally distributed. Such an assumption may not hold in many practical situations. Several studies have examined the Z distribution or its related functions obtained from non-normal populations, particularly related to Poisson distribution where Z-test can be applied (Chapman 1938; Eden and Yates 1933).

The data presented in Table 2 apparently suggests that male children were more likely than the female children to receive all six of the recommended vaccinations. However, the results of Z-test do not suggest significant differences in all vaccination among male and female children except for the case of measles vaccination, where male children were found significantly more likely to receive the vaccination than their female counterparts. No significant differences were found between male and female children in the treatment for symptoms of ARI and fever, and initiation of breastfeeding within an hour and within a day. In addition, nutritional status and micro-nutrient intake did not vary across the two sexes of children. No differential is found between male and female children in the indicators related to nutrition and curative cares. The data from the three rounds of NFHS does not seem to be sufficient enough to explain the reasons behind the sex differential in mortality during the early childhood period. Surprisingly, the data from NFHS III does not give us much clue regarding discrimination against female children in terms of offering nutritious food and seeking preventive and curative cares when the child falls sick. This finding supports our earlier proposition that with declining fertility, the post-natal discrimination against female children shifts to pre-natal discrimination. This also strengthens our argument that in low fertility regions female children are also mostly wanted children and receive the same investments in terms of nutrition, preventive and curative cares to those of the male children.

(3) Determinants of Child Mortality

The results of Poisson regression presented in Table 3 do not suggest any significant male-female differentials in neonatal and post-neonatal mortality. Children born to rural women and women who belong to poorer and poorest wealth quintiles were significantly more likely to die during the neonatal period, compared to their respective counterparts, that is, urban women and those belonging to the other quintiles (middle and richer/richest

Table 3. Results of Poisson regression for predictors of neonatal, post-neonatal and child deaths, Punjab and Haryana, 2005-06

		IRR		
		Neonatal	Post-nenatal	Child
Sex of the child	Male	—	—	—
	Female	0.82 (0.49, 1.38)	1.11 (0.49, 2.5)	3.46* (1.68, 7.14)
Birth order (BO) & birth interval (BI)	BO-2/3 & BI > 24	—	—	—
	First BO	1.24 (0.62, 2.48)	1.85 (0.62, 5.5)	0.47 (0.17, 1.35)
	BO-2/3 & BI < 24	1.05 (0.47, 2.35)	2.30 (0.71, 7.36)	1.17 (0.49, 2.83)
	BO-4+ & BI > 24	1.10 (0.41, 2.96)	4.04* (1.01, 13.73)	1.06 (0.37, 3.06)
	BO-4+ & BI < 24	1.65 (0.56, 4.92)	9.93* (2.69, 33.85)	2.73* (1.09, 6.81)
Size of the baby	Larger than average	—	—	
	Average	1.01 (0.66, 4.39)	0.85 (0.34, 2.16)	
	Smaller than average	1.74 (0.6, 5.04)	0.92 (0.29, 2.71)	
	Very small	2.07 (0.61, 6.96)	0.99 (0.22, 3.88)	
Age at delivery	< 20	—	—	—
	20-34	0.77 (0.38, 1.58)	0.53 (0.22, 1.32)	1.60 (0.53, 4.86)
	35+	0.64 (0.12, 3.36)	1.20 (0.29, 5.56)	1.76 (0.33, 9.44)
Safe delivery	Yes	—	—	—
	No	1.20* (1.01, 3.3)	1.27* (1.02, 1.69)	2.17* (1.17, 2.24)
Drinking water	Unsafe water	—	—	—
	Safe water	0.71 (0.89, 3.29)	0.48 (0.66, 3.32)	0.93 (0.47, 1.83)
Sex composition of children	Equal number son & daughter		—	—
	Daughters only		0.83 (0.32, 2.1)	2.27 (0.8, 6.44)
	Daughters > sons		1.15* (1.04, 1.53)	1.54 (0.19, 1.55)
	Sons only or > daughters		0.38* (0.16, 0.91)	0.32 (0.08, 5.5)
Education of women	No education	—	—	—
	Primary	0.95 (0.39, 2.33)	0.56 (0.17, 2.07)	0.84 (0.31, 2.29)
	Secondary	1.18 (0.58, 2.38)	0.67 (0.31, 1.58)	0.66 (0.27, 1.6)
	Higher	0.28 (0.03, 2.3)	1.09 (0.25, 4.5)	0.34 (0.0, 0.01)
Type of place of residence	Urban	—	—	—
	Rural	2.48* (1.14, 5.42)	0.72 (0.33, 1.43)	0.88 (0.41, 1.89)

Table 3. Results of Poisson regression for predictors of neonatal, post-neonatal and child deaths, Punjab and Haryana, 2005-06 (contd.)

		IRR		
		Neonatal	Post-nenatal	Child
Wealth index	Poorest/Poorer	—	—	—
	Middle	0.20* (0.08, 0.51)	1.98 (0.66, 5.96)	0.98 (0.43, 2.24)
	Richer/Richest	0.40* (0.19, 0.84)	1.59 (0.51, 4.97)	0.63 (0.25, 1.59)
Exposure to mass media	No			—
	Any			1.54 (0.72, 3.3)
Women's autonomy	Lower			—
	Higher			1.44 (0.78, 2.67)

categories). The children who were born under unsafe circumstances were more likely to die during the neonatal period (OR = 1.20; CI = 1.01, 3.3). Birth order and birth interval were found to be an important predictor of mortality during the post-neonatal period. Sex composition of previous children also influences the death during the post-neonatal period of the last born baby. Children of mothers having more daughters than sons were more likely to die during the post-neonatal period (OR = 1.15; CI = 1.04, 1.53) than children of mothers having equal number of sons and daughters Children of mothers having more sons than daughters were less likely to die during the post-neonatal period compared to children of mothers having equal number of sons and daughters (OR = 0.38; CI = 0.16, 0.91). However, the female children were about three times more likely to experience mortality during childhood (i.e., 1-4 years) as compared to their male counterparts (OR = 3.46; CI = 1.68, 7.14).

V. Conclusion

The results of the analysis based on NFHS data sets suggest narrowing sex differentials in mortality during the early childhood for the last 15 years in the two northern India States—Punjab and Haryana. Further, the data on nutrition, preventive and curative cares further suggest no significant difference in any of the above indicators between male and female children. No significant difference among male and female children was observed in the experience of mortality during the post-neonatal period which is marked by the operation of social and cultural factors. If we put these three pieces of information together, it is clear that post-natal discrimination against female children is reducing and probably getting manifested into pre-natal discrimination. The data from the three NFHS rounds is not sufficient enough to test the hypothesis that the postnatal discrimination gets converted into pre-natal discrimination with decline in fertility. However, the current analysis provides some clues.

It was hard to attribute any appropriate reason for sex differentials in mortality during early childhood as none of the indicators of nutrition, preventive and curative cares varied across male and female children. The only indicator that showed some variation was measles vaccination. The data on full vaccination was also not conclusive. An earlier study conducted in India concluded that differences in vaccination appear to explain about 30 per cent of the excess female mortality in the Indian population out of which measles vaccination alone explained about 21 per cent of the gender imbalance (Oster 2006). One plausible explanation could be that a large proportion of women belonging to the relatively well-off but traditional society have strong preference for sons, undergone induced abortions illegally for the reasons of sex-selection, might have reported that they had a still birth or a child's death during late infancy or early childhood period to hide the information on illegal induced abortions. This is especially likely to happen when probing is done in large-scale surveys in the case of long birth intervals. This issue, however, is rather difficult to investigate using only quantitative data from large-scale surveys, such as NFHS. Qualitative data collected in a primary survey through in-depth interview would throw more light to the above question.

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印度旁遮普省與哈里亞納省孩童死亡率之性別差距

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中文摘要

在印度，過盛的女性孩童死亡率一直是個無法紓解的特有現象，尤其是在北印度的旁遮普省與哈里亞納省。本文欲運用三份 1992-2006 期間之印度國家家庭衛生調查（National Family Health Survey, NFHS）統計資料，全面性的探討孩童死亡率性別差距之基本真相。更詳細的說，本文欲探討以下三個問題：（一）旁遮普省與哈里亞納省的孩童死亡率之性別差距在過去二十年間是否有減少？（二）糧食、預防與治療照護之分配不均，是否能解釋既有的孩童死亡率之性別差距？（三）有哪些因素能夠解釋孩童死亡率之性別差距？本文使用卜瓦松迴歸（Poisson Regression）研究孩童死亡率性別差距之決定因素。考克斯迴歸（Cox Regression）研究結果所呈現的存活曲線，顯示兩個重要的發現：初生女嬰的存活率較男嬰高；而在嬰兒後期與孩童時期則有相反現象。

關鍵詢：性別差距、孩童死亡率、存活曲線、卜瓦松迴歸

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