Deaths in the Family

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Chapter 2: Deaths in the Family

Abstract

The purpose of this chapter is to evaluate the relative strengths of economic and social status in determining deaths in households in India. The first part of the chapter focuses on the "age at death" using National Sample Survey data for 2004 and 2014. The purpose was to ask if, after controlling for non-community factors, the fact that Indians belonged to different social groups, encapsulating different degrees of social status, exercised a significant influence on their age at death? The existence of a social group effect would suggest that there was a "social gradient" to health outcomes in India. The second part of the chapter, using data from the Indian Human Development Survey of 2011, investigated the determinants of infant and child mortality. The overriding concern now is gender bias with girls more likely to die than boys before attaining their first (infant) and fifth (child) birthdays. As this study has shown, gender bias in infant and child mortality rates is, with singular exceptions, a feature of all the social groups. In conducting this investigation, the chapter addresses for India an issue which lies at the heart of social epidemiology: estimating the relative strengths of individual and social factors in determining mortality outcomes.

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2.1. Introduction

The publication of the Black report (Black *et. al.*, 1980) spawned a number of studies in industrialised countries which examined the social factors underlying health outcomes. The fundamental finding from these studies, particularly with respect to mortality and life expectancy, was the existence of "a social gradient" in mortality: "wherever you stand on the social ladder, your chances of an earlier death are higher than it is for your betters" (Epstein, 1998). The social gradient in mortality was observed for most of the major causes of death: for example, Marmot (2000) showed that, for every one of twelve diseases, the ratio of deaths (from the disease) to numbers in a Civil Service grade rose steadily as one moved down the hierarchy.

Since, in the end, it is the individual who falls ill, it is tempting for epidemiologists to focus on the risks inherent in individual behaviour: for example, smoking, diet, and exercise. However, the most important implication of a social gradient to health outcomes is that people's susceptibility to disease depends on more than just their individual behaviour; crucially, it depends on the social environment within which they lead their life (Marmot, 2000 and 2004). Consequently, the focus on inter-personal differences in risk might be usefully complemented by examining differences in risk between different social environments.

For example, even after controlling for inter-personal differences, mortality risks might differ by occupational class. This might be due to the fact that while low status jobs make fewer mental demands, they cause more psychological distress than high status jobs (Karasek and Marmot, 1996; Griffin *et. al.*, 2002; Marmot, 2004) with the result that people in higher level jobs report significantly less job-related depression than people in lower-level jobs (Birdi *et.al.*, 1995).

In turn, anxiety and stress are related to disease: the stress hormones that anxiety releases affect the cardiovascular and immune systems with the result that prolonged exposure to stress is likely to inflict multiple costs on health in the form of *inter alia* increased susceptibility to diabetes, high blood pressure, heart attack, and stroke (Marmot, 1986; Wilkinson and Marmot, 1998; Brunner and Marmot, 1999). So, the social gradient in mortality may have a psychosocial basis, relating to the degree of control that individuals have over their lives.[1]

The "social gradient to health" is essentially a Western construct and there has been very little investigation into whether, in developing countries as well, people's state of health is dependent on their social status. For example, in India, which is the country studied in this chapter, we know from studies of specific geographical areas that health outcomes differ systematically by gender and economic class (Sen, Iyer, and George, 2007). In addition, local government spending on public goods, including health-related goods, is, after controlling for a variety of factors, lower in areas with greater caste fragmentation compared to ethnically more homogenous areas (Sengupta and Sarkar, 2007).

Considering India in its entirety, two of its most socially depressed groups - *Adivasis*[2] and the Scheduled Castes (*Dalits*)[3] - have some of the worst health outcomes: for example, as Guha (2007) observes, 28.9 percent of Adivasis and 15.6 percent of Dalits have no access to doctors or clinics and only 42.2 percent of *Adivasi* children and 57.6 percent of *Dalit* children have been immunised. Of course, it is possible that the relative poor health outcomes of India's socially backward groups has less to do with their low social status and much more to do with their weak economic position and with their poor living conditions. The purpose of this chapter is to evaluate the relative strengths of economic and social status in determining the health outcomes of persons in India. In other words, even after controlling for non-community factors, did the fact that Indians belonged to different social groups, embodying different degrees of social status, exercise a significant influence on the state of their health?

The first health outcome is that of "age at death" and the question here is whether, after controlling for non-social factors, there was a significant difference between persons from different

[1] Psychologists distinguish between stress caused by a high demand on one's capacities – for example, tight deadlines – and stress engendered by a low sense of control over one's life.
[2] There are about 85 million Indians classified as belonging to the "Scheduled Tribes"; of these, *Adivasis* (meaning original inhabitants") refer to the 70 million who live in the heart of India, in a relatively contiguous hill and forest belt extending across the states of Gujarat, Rajasthan, Maharashtra, Madhya Pradesh, Chhattisgargh, Jharkhand, Andhra Pradesh, Orissa, Bihar, and West Bengal (Guha, 2007).
[3] The Scheduled Castes (or, *Dalits*), who number about 18 million, refer to those who belong to the formerly "untouchable" castes i.e. those with whom physical contact – most usually taken to be the acceptance of food or water – is regarded by upper-caste Hindus as ritually polluting or unclean

social groups in the age at which they died. The second health outcome concerns deaths of infants and young children. The relevant question here is the relative strength of factors that determined the rates of infant and of child mortality – defined as the proportion of live births that did not survive their first (infant mortality) and fifth years (child mortality). Anticipating the results presented in subsequent sections of this chapter, the central conclusion with respect to infant and child deaths is that the social gradient is supplemented by a "gender bias" in infant survivals – with males more likely to survive their first and fifth years than females – allied to a "geographic gradient" by which the size of the gender bias in infant and child survivals depended on where in India the births occurred. This gender bias affects all the social groups, and two of the five regions, distinguished in this chapter.

In broad terms, the adverse female to male ratio in South Asian countries stems from the unequal treatment of women.[4] 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 (Borooah, 2004). 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. Bongaarts and Guilmoto (2015) conclude, however, that, in spite of the recent rise in prenatal selection, *excess mortality* has been, and is expected to remain, the dominant cause of missing females.

2.2 Health Data from the National Sample Survey for India

The age at death of persons was analysed using data from the 60th Round (January-June 2004) and the 71st Round (January-June 2014) of the specialist *Morbidity and Health Care Surveys* of the National Sample Survey (NSS).[5] Hereafter, these are referred to in the chapter as, respectively, the

[4] The female to male ratio is substantially below unity in several developing countries: in 2015, it was 0.94 in China, 0.93 in India, 0.94 in Pakistan, and 0.98 in Egypt (CIA, 2015).
[5] See Tendulkar (2007).

71st NSS and the 60th NSS. [6] The 60th NSS surveyed 73,911 (grossed up, 1,982,395) households and the 71st Round surveyed 65,975 (grossed up, 2,479,214) households. An item of particular interest to this study was the construction of the social groups with each person in the estimation sample being placed in one, and only one, of these groups. The NSS categorised persons by four social groups (Scheduled Tribes (ST); Scheduled Castes (SC); Other Backward Classes (OBC); and 'Others' and simultaneously by eight religion groups (Hindus; Islam; Christianity; Sikhism; Jainism; Buddhism; Zoroastrianism; 'Other'). Combining the NSS 'social group' and 'religion' categories, we subdivided households into the following groups which are used as the basis for analysis in this chapter:

1. Scheduled Tribes (ST). These comprised 9.1 percent of the grossed up 2,479,214 households in the 71st NSS round and 8.3 percent of the grossed up 1,982,395 households in the 60th NSS: approximately 85.5 percent of these households were Hindu and 9.3% were Christian.[7]
2. Scheduled Castes (SC). These comprised 18.6 percent of the grossed up 2,479,214 households in the 71st NSS and 20.1 of the grossed up 1,982,395 households in the 60th NSS and 94% of the households in this category in the 71st NSS were Hindu.[8]
3. Non-Muslim Other Backward Classes (NMOBC). These comprised 36.8 percent of the grossed up 2,479,214 households in the 71st NSS and 35.7 percent of the grossed up 1,982,395 households in the 60th NSS and 97 percent of the households in this category in the 71st NSS were Hindu.
4. Muslims. These comprised 12.5 percent of the grossed up 2,479,214 households in the 71st NSS and 10.8 percent of the grossed up 1,982,395 households in the 60th NSS.[9]
5. Non-Muslim upper classes (NMUC). These comprised 23 percent of the grossed up 2,479,214 households in the 71st NSS round and 25.1 percent of the grossed up 1,982,395 households in the 60th NSS; 93.4 percent of the households in this category in the 71st NSS were Hindu.

[6] It is important to draw attention to the fact that all the results reported in it are based upon *grossing up* the survey data using the observation-specific weights provided by the NSS for each of the surveys.
[7] Figures relate to the 71st Round. The 60th Round figures are similar and not shown. This category also included 3,063 Muslim households. Since Muslim ST persons are entitled to reservation benefits these households have been retained in the ST category.
[8] This category also included some Muslim households. Since Muslims from the SC are not entitled to SC reservation benefits, these Muslim SC households were moved to the Muslim OBC category.
[9] Including Muslim SC households (see previous footnote).

In addition to information about the social group of the households, the Surveys also provided information about the households' living conditions. Listed below is information about these conditions that was reported in *both* the 60th and the 71st Rounds and the variables constructed for the purposes of this study from this information:

1. The first component of living conditions related to the *quality of the latrines* used by the deceased: the variable "latrine" was assigned the value 1 if the latrines were flushing toilets or emptied into a sceptic tank; and 0 otherwise.
2. The second component of living conditions related to the *quality of the drains*: the variable "drain" was assigned the value 1 if the drains associated with the deceased's home were underground or were covered *pucca*; and 0 otherwise.
3. The third component of living conditions related to the *quality of the source of drinking water* used by the deceased: the variable "water source" was assigned the value 1 if the source of drinking water was from a tap; and 0 otherwise.
4. The fourth component of living conditions related to the *nature of the cooking fuel* used by the deceased's household: the variable "cooking fuel" was assigned the value 1 if the cooking fuel was gas, *gobar* gas, kerosene, or electricity; and 0 otherwise.

2.3 The Age at Death in Households

Each household was asked if there had been a death (or deaths) in the household in the previous 365 days and particulars of these deaths: 2,395 households (grossed up to 34,857households) and 1,716 households (grossed up to 35,766) households reported that there been such deaths for, respectively the 71st and 60th NSS. [10] The specific information that this study was interested in was the *age at death* of the person concerned and specifically, whether the age at death varied with respect to the five social groups distinguished in this study: Scheduled Tribe (ST), Scheduled Caste (SC), Non-Muslim Other Backward Classes (NMOBC), Muslims, and Non-Muslim Upper Class (NMUC).

<Figure 1>

[10] Of the 1,716 households in the 60th Round, reporting deaths in the previous year: 1,634 households reported a single death, 70 households reported two deaths, and 12 households reported three deaths. Of the 2,395 households in the 71st Round reporting deaths in the previous year: 2,310 households reported a single death, 82 households reported two deaths, and three households reported three deaths.

Figure 1 shows that, in the 71st NSS (2014), the mean age at death was highest for persons from NMUC households (63.2 years) and lowest for persons from ST households (46 years).[11] In the 10 years between the 60th and 71st Round, the mean age at death had increased for all households reporting a death: from: 43.3 to 46 years for SC households; 49.7 to 55.3 years for NMOBC households; 43.6 to 59.4 years for Muslim households; and 54.5 to 63.2 years for NMUC households. Overall, the mean age at death increased by nearly seven years in the 10 year period 2004 to 2014, from 48.3 in the 60th round to 54.8 years in the 71st round.

<Table 2.1>

Table 2.1 shows the results from a regression of the age at death of persons from households in which a death (or deaths) occurred in the 71st Round (2,384 sample households, grossed up to 34,853 households) and the 60th Round (1,708 households, grossed up to 33,598 households) using the following explanatory variables:

1. The gender of the deceased
2. The social group of household (defined earlier) in which the death occurred
3. Whether the household, in which the death occurred, was a 'casual labourer' household or, else, was self-employed or in regular salaried employment.
4. Whether the household, in which the death occurred, lived in a rural or urban area.
5. Whether the household, in which the death occurred, lived in a 'forward' or a 'backward' state.[12]
6. The quality of the household's latrine and cooking fuel, as discussed above.
7. The quintile of monthly household per capita consumption expenditure (HPCE) to which the household belonged from lowest (=1) to highest (=5).

[11] All the figures in Figure 1 relate to households whose social group was defined in terms of one of the five categories: ST, SC, NMOBC, Muslim, and NMUC. Of the 2,395 households which reported a death in the 71st round, and of the 1,716 households which reported a death in the 60th round, social group was defined for, respectively, 2,384 and 1,708 households.

[12] For the 71st Round: *Forward States* were Himachal; Punjab; Chandigarh; Haryana; Delhi; West Bengal; Gujarat; D&D; D&N Haveli; Maharashtra; AP; Karnataka; Goa; Kerala; TN; Pondicherry; Telangana; *Backward States* were: Uttaranchal; Rajasthan, UP, Bihar; Sikkim; Arunachal; Nagaland; Manipur; Mizoram; Tripura; Meghalaya; Assam; Jharkhand; Odisha; Chhattisgarh; Lakshadweep; A&N Islands.

The results from the estimated equation are presented in Table 2.1 in the form of the *predicted age at death* (PAD) from the estimated regression coefficients of the 'age at death' equation where these predictions relate to the average age at death.[13] It should be emphasised, in respect of the predictions shown in Table 2.1, that the relationship between social group and the age at death was analysed on a *ceteris paribus* basis that is after controlling for the effects of the variables 1-5, above. Consequently, the PAD for the five social groups shown in Table 2.1 will, and do, differ from the sample ages at death shown in Figure 2.[14] It should also be emphasised that, in the estimation, each observation in the sample was weighted by its corresponding weight as provided by the NSS.

The second column of Table 2.1 shows that, for the 71st Round, *after controlling for other variables*, NMUC households had the highest PAD (60.5 years) followed by Muslim households (58 years), followed by NMOBC households (55.2 years), followed by ST households (52.6 years) with SC households predicting the lowest ADD (48 years). These PAD for each social group (say, NMUC) was computed by assuming that *all* the 2,383 households in the 71st (or, as the case may be, the 60th) round were from that social group (NMUC), the values of the other attributes being as observed in the sample. Applying the NMUC coefficient applied to the household attributes yielded the age of death for deaths in each of the 2,383 households. The mean of these ages was the PAD for this social group (NMUC) under this scenario: this was 60.5 years for the 71st round and 50.3 years for the 60th round. The PAD for the other social groups were computed in similar fashion. Since the only factor that was different between these five 'social group' scenarios was the households' social group (ST, SC, NMOBC, Muslims, and NMUC), the observed differences between these five PAD were entirely the result of differences in the households' social group.

The marginal PAD, shown in column 3 of Table 2.1, are the *differences* between the PAD of the ST, SC. NMOBC, and Muslim households and that of (the reference) NMUC households. Column 4 shows the standard error associated with these marginal probabilities and the t values – obtained by dividing the marginal probability (shown in column 3) by its standard error (shown in column 5) – are

[13] Following the advice of Long and Freese (2014).
[14] For example, if living in a 'forward' state raises the average age at death and if ST households are disproportionately concentrated in 'backward 'states', then this will show up in the raw data as a low age at death for ST households; however, this age will be raised when the state of residence is controlled for.

shown in column 5. Lastly, column 6 shows, under the null hypothesis that the marginal probability was zero, the probability of obtaining a t-value in excess of the (absolute value of) calculated value. The fact that these were less than 5% shows that all the social group marginal PAD, for both the 71st and the 60th NSS, were significantly different from zero. In other words, the PAD for households from the four social groups (ST, SC, NMOBC, and Muslims) were *all* significantly lower than for NMUC households in 2014 and in 2004.

For both the 71st and the 60th NSS and, the difference in the PAD was significantly different for Muslim households compared to NMOBC households (58 versus 55.2 years for the 71st round and 43.8 versus 49.1 years for the 60th round) and between households from the Scheduled Tribes and the Scheduled Castes (52.6 versus 48 years for the 71st round and 48.5 versus 46.1 years for the 60th round. The PAD of female deaths was significantly higher than that of male deaths in the 71st round (56.4 versus 53.6 years) but significantly lower (47.3 versus 48.6 years) in the 60th round.

The non-social group variables showed that, compared to being a labourer, a non-labouring job significantly increased the PAD: by 0.6 years in the 71st NSS and by 8.0 years in the 60th NSS. [15] Similarly, compared to living in a 'forward' state, living in a 'backward' state significantly reduced the PAD by 6.3 years in the 71st NSS and by 6.6 years in the 60th NSS. Compared to living in a rural area, living in an urban area significantly reduced the PAD by 2.3 years in the 60th NSS but, in the 71st NSS, there was no significant difference between the PAD in rural and urban locations. Lastly, in terms of living condition, the most pernicious effect on the age at death in households was the type of cooking fuel that it used: in both the 71st and the 60th Rounds, the age at death was significantly lower in households that used fossil fuel for cooking instead of gas or electricity.

A noticeable feature of the PAD from the 71st and the 60th Rounds is that, in the 10 years separating the two rounds, the predicted ages at death increased for all the groups

- For the ST from 48.5 to 52.6 years
- for the SC from 46.1 to 48 years;
- for the NMOBC from 49.1 to 55.2 years;

[15] For the 71st round this difference was only significant at the 10% level.

- for Muslims from 43.8 to 58 years
- for the MUC from 44.3 to 48.5 years
- for the NMUC from 50.3 to 60.5 years

However, from a policy perspective, the relevant issue is whether these improvements were statistically significant or whether they could be accommodated within a ‘no change’ null hypothesis. In order to answer this question we re-estimated the ‘age at death’ equation, specified in Table 2.1, *jointly* over *all* the relevant observations for the 71st round and 60th Rounds (a total of 4,019 observations on households which reported a death) and then tested whether the PAD was significantly different between the two rounds.

<Table 2.2>

Columns 2 and 3 of Table 2.2 show the PAD for, respectively, the 71st and the 60th NSS while column 4 records the difference; column 5 shows the standard error the difference and column 6 shows the t-value associated with difference, computed by dividing the difference by its standard error and column 7 shows the probability of obtaining a t value great than under the null hypothesis that the difference was zero. These PAD for the 71st NSS, for NMUC households, were computed by assuming that *all* the 4,019 households in the *combined* sample were NMUC from the 71st NSS (that is, the 71st NSS coefficient for NMUC applied to their attributes) and computing the PAD under this scenario: this was 60.1 years (column 2). Similarly, the PAD for the 60th NSS for the NMUC households were computed by assuming that *all* the 4,019 households in the *combined* sample were NMUC from the 60th NSS (that is, the 60th NSS coefficient for NMUC applied to their attributes) and computing the PAD under this scenario: this was 51 years (column 3). The difference between the two rounds in their PAD for NMUC households was 9.1 years (column 4) and, as the t-value in column 6 shows, this was difference significantly different from zero.

Table 2.2 shows that the PAD was significantly higher in 2014 than in 2004 for households from all the social groups, except the SC for which there was no significant difference between the PAD from the two rounds. For labourer and non-labourer households the PAD was significantly higher in the 71st, compared to the 60th, Round (54.1 versus 42.8 years for labourer households and 54.7 years versus 50.8 years for non-labourer households). Similarly, the PAD was significantly higher for rural households, and for urban households, in the 71st, compared to the 60th, Round (54.5 versus 49.3 years for rural households and 54.8 years versus 47 years for urban households). Lastly, the PAD was significantly higher for households in forward states, and for households in backward states, in the 71st, compared to the 60th, Round (57.5 versus 51.8 years for households in forward states and 51.2 years versus 45.2 years for households in backward states).

2.4. Infant and Child Deaths

A number of empirical studies have examined demographic outcomes in India and in other countries with respect to fertility and infant and child mortality rates (*inter alia* Caldwell, 1979 and 1986; Subbarao and Rainey, 1992; Murthi *et. al*., 1995; Borooah, 2000). However, a weakness of these studies is that while they purported to examine the behaviour of individuals, they were, in fact, based on data pertaining to geographical units. For example, Murthi *et. al*., (1995) and Borooah (2000) were both based on district-level data. The dangers of inferring individual behaviour from an analysis of aggregate data were recognised, nearly half a century ago, by Theil (1954): "when models of individual behaviour are estimated from variation in average behaviour and average conditioning variables for large aggregates …[then] the properties of the estimates depend upon many tenuous aggregation assumptions". But, given the paucity of large sets of data relating to individuals, researchers sought exculpation in the fact that there was no alternative.

Parikh and Gupta (2001) enquired into the effectiveness of female literacy in reducing fertility in the two Indian states of Andhra Pradesh and Uttar Pradesh, using unit record data for 'ever married' women from the National Family Household Survey's 1992-93 data set. In a similar vein, Borooah (2003) examined the determinants of fertility and infant survivals using unit record data from a survey of 33,000 *rural* households for 1993-94, commissioned by the Indian Planning Commission, funded by a consortium of United Nations agencies, and carried out by the National Council of Applied Economic Research.[16] In so doing, both sets of authors noted that, to the best of their knowledge, these data had not been used for the multiple regression analysis of the relationship between literacy and fertility.

[16] This Survey, described in Shariff (1999) was the precursor to the Survey data used in this chapter, discussed in the following section.

These observations then point to a general problem that vitiates empirical studies of demographic outcomes India: when they are cast in a multiple regression mould, their results are derived from aggregate data; on the other hand, when they are based on unit record data they do little more than present bi-variate cross-tabulations[17]. This chapter, like that of Parikh and Gupta (2001) and Borooah (2003), addresses this general problem by marrying data on individuals to the methods of econometrics. However, over and above these studies, its innovation is that it is based on data on *individual* births and *individual* infant/child deaths to mothers rather than, as for example in Borooah (2003), their *total* number of births and infant/child deaths.

Mustafa and Odimegwu's (2008) in their study of infant mortality in Kenya drew attention to a number of variables that could influence infant deaths ranging from: the socioeconomic (education, income, location (rural/urban), province of residence, ethnicity, and religion of the mothers); the demographic (age of the mother at the time of birth; the sex of the child); and the biological (birth order, birth size, breast feeding, place of delivery). [18]

Consequently, there were eight variables which were hypothesised to play a significant role in determining the likelihood of an infant or child death:

1. The child's gender: male or female. The small number of females compared to males in India is well known and has been commented upon extensively (Dreze and Sen, 1996; Sen, 2001; Trivedi and Timmons, 2013). Although natal inequality, brought about through sex-selective abortions, and mortality inequality, engendered by the relative neglect of girls, both combine to ensure that there are fewer women than men, the excess mortality of girls over boys has been, and is expected to remain, the dominant cause of an adverse sex ratio (Bongaarts and Guilmoto, 2015).
2. The birth order of the child. Even 100 years ago it was observed that the chances of infant survival decreased with birth order (Woodbury, 1925) and Puffer and Serrano (1975) have

[17] See, for example, the chapters in Jeffery and Basu (1996). See also Bose (2001) on this point.
[18] See León-Cava *et. al.* (2002) for a review of the benefit of breast feeding. From these variables, this study had no information on the age of the mother at the time of a *specific* birth, whether that birth was breast-fed, and the place of delivery of that birth.

drawn attention to birth order, along with birthweight and maternal age, as being one of three important determinants of infant mortality.

3. The social group of the mother's household: Scheduled Tribe (ST), Scheduled Caste (SC), non-Muslim Other Backward Classes (NMOBC), Muslims, non-Muslim Upper Classes (NMUC).
4. The region in which the mother's household resided: North, Central, East, West, and South (defined in the subsequent section). The findings of this study are echoed in the "official" statistics which establish considerable inter-state variations in the IMR in India ranging, for 2013, from highs of 54 (per 1,000 live births) for Assam and Madhya Pradesh, 51 for Odisha, and 50 for Uttar Pradesh to lows of 12 for Kerala, 21 for Tamil Nadu, and 24 for Maharashtra.[19]
5. The location of the mother's household: rural or urban.
6. The highest level of education of a household adult: none, primary, secondary, higher secondary, graduate and above. In terms of its effect on the IMR, most studies focus on the education of the mother and hypothesise that the higher the mother's education, the better her feeding and care practices towards her children (Caldwell, 1979 and 1986; Hobcraft, 1993). However, in the estimation results reported in this chapter, the importance of education stemmed not so much from that of the mother but from the highest education of a household adult. The reason for this might be that Indian women lacked 'autonomy' in several areas and, in particular, in the care of their children. For example, as the Indian Human Development Survey for 2011 (discussed below) showed, 79 percent of mothers had to take permission from another adult in the household in order to visit the health centre and 57 percent of mothers said that their husbands had the most say in deciding what to do when the child was sick.
7. The household's per capita consumption by quintile: lowest, 2nd quintile, 3rd quintile, 4th quintile, highest quintile.

[19] *Niti Aayog* (National Institution for Transforming India), http://niti.gov.in/content/infant-mortality-rate-imr-1000-live-births (accessed 18 May 2017).

8. The mother's state of health: good/acceptable; poor.

2.5. The Data for Infant and Child Deaths

The data for this part of the study, on infant and child mortality, are from the India Human Development Survey (hereafter, IHDS-2011) which relates to the period 2011-12.[20] This is a nationally representative, multi-topic panel survey of 42,152 households in 384 districts, 1420 villages and 1042 urban neighbourhoods across India. Each household in the IHDS-2011 was the subject of two hour-long interviews. These interviews covered *inter alia* issues of: health, education, employment, economic status, marriage, fertility, gender relations, and social capital. The IHDS-2011, like its predecessors for 2005 and 1994, was designed to complement existing Indian surveys by bringing together a wide range of topics in a single survey. This breadth permits analyses of associations across a range of social and economic conditions.

The data in IHDS-2011 is organised in terms of 'files'. In the context of infant and child deaths – respectively, death occurring before the first and fifth birthdays - a particularly valuable feature of the IHDS-2011 is its *birth history* file in which it recorded the birth history of 36,794 mothers – drawn from 33,595 households – in respect of their live births, the birth gender, the "location" of each of their children in terms of living with the respondent, living elsewhere, or dead and, in the event that the child was dead, its age at death.[21] From this data, an *infant death* was said to have occurred if a woman reported that her child was dead and that the child had survived for less than 12 months; similarly, a *child death* was said to have occurred if a woman reported that her child was dead without reaching its fifth birthday. The IHDS recorded 111,151 live births, from 36,794 mothers living in 33,595 households and, of these births, 1,449 resulted in infant deaths and 2,825 resulted in child deaths. This yielded an infant mortality rate (IMR) of 13 infant deaths per 1,000 live births and a child mortality rate (CMR) of 25.4 child deaths per 1,000 live births. Although these

[20] Desai *et. al.*(2015).
[21] There was just one mother in 30,396 households and two mothers in 3,199 households.

figures understate the IMR and CMR for India, what is of relevance for this study is not so much the levels of these figures but, rather, their relative differences between the various groups delineated.[22]

<Table 2.3>

Table 2.3 shows that both the IMR and the CMR differed between the social groups (defined earlier in the chapter) with mothers from the Scheduled Tribes (ST) and the Scheduled Castes (SC) recording the highest IMR and CMR – respectively, 14.3 and 17.5 for IMR and 33.2 and 33.9 for CMR - and mothers from the non-Muslim Upper Classes (NMUC) recording the lowest IMR and CMR of, respectively, 10.1 and 16.0. Table 2.3 also pointed to a gender bias in infant and child mortality with both the IMR and the CMR being lower for male, than for female, births, with none of the social groups being exempt from this bias: for the 36,794 mothers in their entirety, the male and female IMR were, respectively, 12.1 and 14.1 while the male and female CMR were 22.8 and 28.2, respectively.

In order to capture the regional dimension to infant and child deaths, the sample was subdivided by mothers living in: the *North* (comprising the states of Jammu & Kashmir, Delhi, Haryana, Himachal Pradesh, Punjab (including Chandigarh), and Uttarakhand); the *Centre* (Bihar, Chhattisgarh, Madhya Pradesh, Jharkhand, Rajasthan, and Uttar Pradesh); the *East* (Assam, Orissa, West Bengal); the *West* (Gujarat and Maharashtra); and the *South* (Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu). Table 2.3 shows that the IMR was lowest in the West and the South (respectively, 3.9 and 5.1) and highest in the Centre (20.9) and, in similar vein, the CMR was lowest in the West and the South (respectively, 8.8 and 8.1) and highest in the Centre (43.0)

<Figures 2 and 3>

Figure 2 shows that the number of male births exceeded the number of female births: the all-India ratio of the number of male to female births was 1.08 and this ratio was greater than one for every social group. On the other hand, Figure 2 also shows that the number of male infant and child deaths was smaller than the corresponding number of female deaths: the all-India ratio of the number of male to female infant deaths was 0.92 and the ratio of the number of male to female child deaths

[22] The IMR for India in 2013 was 40 (per 1,000 births) and the CMR in 2012 was 52 (per 1,000 births) as obtained from the Sample Registration System. http://www.business-standard.com/article/pti-stories/india-unlikely-to-meet-infant-mortality-rate-target-of-2015-114122100067_1.html (retrieved on 27 April 2017).

was 0.87. Furthermore, this gender disparity in infant and child deaths was particularly marked for the NMOBC, Muslims, and the NMUC. Figure 3 shows that the ratio of the number of male to female births was greater than one for every region; however, when it came to infant and child deaths, the number of male deaths was markedly smaller than that of female deaths in two regions, the North and the Centre, but in the West and in the South the number of male infant and child deaths exceeded the corresponding number for females.

In addition to the birth history file, the IHDS-2011 also had two further files which are relevant to this study. The first was the Eligible Women's file. The IHDS-2011 interviewed all 'eligible' women (EW) – that is ever-married women between the ages of 15 and 49 – from every household and the eligible women's file contained fairly detailed information on the circumstances (both demographic and household), attitudes, and beliefs of these women and the constraints that they faced within their households in terms of their autonomy of action, in particular with respect of their children. Of these 39,523 EW, 2,729 did not have any children and hence were excluded from the birth history file.

The third file in IHDS-2011 related to the household – *inter alia* its social group, its location, its state of residence, the highest educational level of its adult males and females, its monthly per capita consumption, its location (rural, urban), its state of residence. Merging the birth history file with the EW and the household files yielded information for the 36,794 mothers on (i) their birth history (from the birth history file); (ii) on their circumstances, attitudes, beliefs, and degree of autonomy (from the EW file); and (iii) on their household circumstances (from the household file).

2.6 Estimation of the Infant and Child Mortality Equations

Suppose there are N (live) births (indexed $i=1...N$) to M mothers (indexed $j=1...M$) such that the dependent variable, y takes the value 1 if the condition is present (birth i results in an infant or child death: $y_i=1$) and the value 0 if the condition is absent (birth i survives through infancy or childhood: $y_i=0$). If $Pr[y_i=1]$ and $Pr[y_i=0]$ represent, respectively, the probabilities of an infant death and survival ($i=1...N$), the logit formulation expresses the log of the odds ratio as a linear function of K variables (indexed *k=1…K*) which take values, $X_{i1,}X_{i2}...X_{iK}$ with respect to birth *i*, *i=1…N*:

$$\log\left(\frac{\Pr[y_i=1]}{1-\Pr[y_i=1]}\right)=\sum_{k=1}^{K}\beta_k X_{ik}+u_i=Z_i \qquad (2.1)$$

where: β_k is the coefficient associated with variable *k, k=1…K*.

From equation (2.1) it follows that:

$$\Pr[y_i=1]=\frac{e^{z_i}}{1+e^{z_i}}=\frac{e^{X_i\hat{\beta}}}{1+e^{X_i\hat{\beta}}} \qquad (2.2)$$

where, the term '*e*', in the above equation represents the exponential term.

A novel feature of the estimation was that the gender variable was allowed to interact, separately, with the birth order of the child, the social group variable, and with the regional variable. This allowed the probability of gender bias in infant and child deaths to be different between the birth orders, the social groups and between the regions. To appreciate the difference between an 'interacted' and a 'non-interacted' equation consider the following equations for a variable *Y* which is explained by two explanatory variables *X* and *Z*, for observations indexed *i=1…N*, without and with interaction between *X* and *R*.

$$\begin{aligned} Y_i &= \alpha+\beta X_i+\gamma R_i \\ Y_i &= \alpha+\beta X_i+\gamma R_i+\phi\left(X_i\times R_i\right) \end{aligned} \qquad (2.3)$$

In the first equation of equation (2.3) - without the interaction term $X_i\times R_i$ - the marginal change in Y_i, given a small change in the value of the variable X_i , is β: the marginal effect, $\partial Y_i/\partial X_i$, is independent of the value of the variable R_i . In the second equation - with the interaction term $X_i\times R_i$ - the marginal change in Y_i, given a small change in the value of the variable X_i , is $\beta+\phi R_i$: the marginal effect, $\partial Y_i/\partial X_i$, depends on the value of the variable R_i . If interaction effects are significant then an equation which neglects them would be under specified.

The logit estimates showed that, for *infant deaths*, two of the three possible interactions between sex at birth and birth order, one of the four possible interactions between sex at birth and a household's social group, and three of the four possible interactions between sex at birth and a household's region of residence, were significantly different from zero. For *child deaths*, all three possible interactions between sex at birth and birth order, one of the four possible interactions between sex at birth and a household's social group, and three of the four possible interactions between sex at birth and a household's region of residence, were significantly different from zero. Taken together, these results implied that, had these interactions been neglected, the infant and child mortality equations would have been under-specified.

<Tables 2.4 and 2.5>

However, the logit estimates, that is the β_k of equation (2.1), themselves do not have a natural interpretation – they exist mainly as a basis for computing more meaningful statistics and the most useful of these are the predicted probabilities (of infant deaths) defined by equation (2.2). Consequently, as Long and Freese (2014) suggested, results from the estimated equation were computed, from the estimated logit coefficients of the infant and child mortality equations, as the predicted probabilities of, respectively, infant and child deaths. These are shown in Table 2.4 as the *predicted infant mortality rate* (PIMR), defined as predicted infant deaths per 1,000 births, and in Table 2.5, as the *predicted child mortality rate* (PCMR), defined as predicted child deaths per 1,000 births.[23]

The PIMR and PCMR associated with births in the different variable groups shown in Tables 2.4 and 2.5, respectively, were computed through a series of simulations. The PIMR and PCMR of male births was computed by first assuming that *all* the 108,517 births were male but with their non-gender attributes – birth order, region, location, highest education of household adult, consumption quintile, mothers' health status – unchanged at observed values. Then the male coefficient was applied to this synthetic sample of 108,517 male births in order to compute the male PIMR, shown in Table 2.4 as 12.4 infant deaths per 1,000 births, and the male PCMR, shown in Table 2.5 as 23.5 child deaths per 1,000 births.

The female PIMR and PCMR were computed similarly but this time assuming that *all* the 108,517 births were female, with non-gender attributes as observed. Applying the female coefficients

[23] For example a predicted probability of 0.4 of an infant death translated as a predicted IMR of 40 per 1,000 births.

to this synthetic sample of 108,517 female births, the female PIMR was 14.2 infant deaths per 1,000 births (Table 2.4) and the female PCMR was 28.5 child deaths per 1,000 births (Table 2.5). Since the *only* difference between the male and female 'synthetic' samples was the gender at birth, the difference between the two PIMR (12.4 and 14.2) and between the two PCMR (23.5 and 28.5) could be attributed *entirely* to gender difference.[24]

The marginal PIMR and PCMR, shown in column 3 of Tables 2.4 and 2.5 represent, respectively, the *differences* between the PIMR and the PCMR of the category in question and that of the reference category. For example, in the gender grouping, males are the reference category and the value of 1.8 in column 3 of Table 2.4 is the difference between the female (14.2) and male (12.4) PIMR; similarly, the value of 5.0 in column 3 of Table 2.5 is the difference between the female (28.5) and male (23.5) PCMR. Dividing these marginal PIMR and PCMR by their standard errors yields their respective z-values (column 4 of Tables 2.4 and 2.5); these show whether the marginal PIMR and PCMR were significantly different from zero in the sense that the likelihood of observing these values, under the null hypothesis of no difference was (as shown by the p-values in column 5 of Tables 2.4 and 2.5) greater or less than 5 (or 10) percent. The difference between the female-male PIMR and between the male-female PCMR were, with z-values of 2.7 (Table 2.4) and 5.2 (Table 2.5), significantly different from zero.

Table 2.4 also shows that, with the NMUC as the reference group, it was only the PIMR of the Scheduled Tribes (ST) and the Scheduled Castes (SC) that were significantly higher than the PIMR of the reference group of the non-Muslim Upper Classes (NMUC); the PIMR of the other groups –the non-Muslim OBC and Muslims - were not significantly different from that of the NMUC. In the context of child mortality, Table 2.5 shows the PCMR of the ST, the SC, and Muslims were significantly higher than the PCMR of the reference group of the NMUC while the PCMR of the NMOBC was not significantly different from that of the NMUC.

In terms of regions, the estimates, shown in Tables 2.4 and 2.5, suggest that the PIMR and PCMR were lowest in the West (respectively, 4.2 and 9.9) and in the South (respectively, 5.2 and 8.4)

[24] In computing these probabilities, all the interactions between gender and social group and gender and region (equation (2.3)) were taken into account.

and highest in the Centre (respectively, 20.2 and 40.7). With the North as the reference region, both the PIMR and PCMR were significantly lower in the East, the West, and the South and significantly higher in the Centre (column 3 of Tables 2.4 and 2.5).

The highest level of education of a household adult significantly affected the chances of both infant and child survival. As Tables 2.4 and 2.5 show, both the PIMR and PCMR fell for successively higher education levels from highs of 16.6 (PIMR) and 33.2 (PCMR) when no adult in a household had any education to lows of 7.6 (PIMR) and 14.1 (PCMR) when at least one of the household adults was a graduate. After controlling for education, monthly per-capita household consumption expenditure (HPCE) did not exercise a significant influence on infant and child mortality except, perhaps surprisingly, the PIMR and PCMR were lowest for births in the lowest decile of HPCE compared to births in the higher deciles. Lastly, as Tables 2.4 and 2.5 show, the state of a mother's health exercised a significant influence on the (predicted) survival chances of her infants and children: the PIMR and PCMR were significant lower for mothers in good to fair health compared to those in poor to very poor health.

Gender Bias in Infant and Child Deaths

The issue of the PIMR and PCMR, discussed above in the context of Tables 2.4 and 2.5, is separate from whether the PIMR and PCMR were significantly different between male and female births: underlying a low PIMR and PCMR might be significant differences between the predicted survival chances of male and female births while, on the other hand, a high PIMR and PCMR might go hand-in-hand with an absence of gender bias. Since, in the estimated equations, the sex at birth variable was allowed to interact with the birth order, the social group, and the regional variable, it is possible to test, in respect of these three variables whether the PIMR and the PCMR were significantly different between male and female births. The results of these tests are shown in Tables 2.6 and 2.7. The second and third columns of Tables 2.6 and 2.7 show, respectively, the male and female PIMR and PCMR. The third column shows the gender difference in PIMR (Table 2.6) and

PCMR (Table 2.7) while the fourth column in each Table shows the z-values associated with these differences.[25]

<Tables 2.6 and 2.7>

These show that the PIMR and PCMR were not significantly different for the *firs*t birth: the z-values associated with the male-difference of 0.7 in the PIMR, and 1.3 the PCMR, of the first birth were, respectively, 0.6 (Table 2.6) and 0.7 (Table 2.7). However, for the second birth onwards, the female PCMR was significant higher than the male PCMR and, for the fourth (and higher) birth, the female PIMR, too, was significant higher than the male PIMR.

In terms of social groups, it was only for the non-Hindu OBC (NMOBC) and the non-Hindu Upper Classes (NMUC) that the female PIMR was higher than the male PIMR; for the other three groups – the ST, the SC, and Muslims – there was no significant difference between the male and female PIMR. Gender bias in child mortality rates (shown in Table 2.7), however, existed in all the social groups, with the exception of the ST, with the PCMR for males being significantly lower than for females among the SC, the NMOBC, Muslims, and the NMUC.

In terms of the regions, it was only for the North and the Centre that there was clear evidence of gender bias in male and female survivals. The male PIMR and PCMR for the North was, at 10.4 and17.7, respectively, significantly lower than its female PIMR and PCMR of 15.5 and 26.0, respectively; for the Centre, the male PIMR and PCMR of 19.0 and 36.8, respectively, were both significantly lower than its female PIMR and PCMR of 21.6 and 44.9, respectively. There was no significant difference between male and female PIMR, and between male and female PCMR, for the East and for the West. For the South, the gender bias in mortality rates was reversed with the male PIMR and PCMR significantly exceeding their female counterparts.

The fact that the predicted survival probabilities of male infants and male children being greater than that of their female counterparts is due to "son preference" among households in India. As Borooah and Iyer (2005) point out, one way to think about this is that just as sons bring 'benefits' to their parents, daughters impose 'costs'. Complementing a desire *to have* sons is a desire *not to*

[25] The fifth column of Tables 2.6 and 2.7 shows the probability of exceeding the observed z-value on the null hypothesis of no gender bias.

have daughters so that the desire for sons tends to increase family size while the fear of daughters limits it. The evidence from IHDS-2011 is that women whose first child was a son had, on average, fewer births than women whose first child was a daughter (2.9 compared to 3.1) and that women whose first and second children were sons had, on average, fewer births than women whose first and second children were daughters. This suggests that the desire for sons and the fear of daughters operate in sequence to limit family size: first the family tries to have sons and this expands family size but, once this has been achieved, the fear of daughters limits family size.

2.7 Conclusions

This chapter investigated whether there was a social gradient to health in India with respect to two health outcomes: the age at death and the rates of infant and child mortality per 1,000 live births. In terms of age at death, the evidence suggested that the age at death was significantly higher in households living in a forward state (compared to living in a backward state) and was significantly lower in labourer (compared to non-labourer) households. The age at death in households was significantly affected by their living conditions: in particular, in both the 71st and the 60th rounds, the age at death was significantly lower in households that used fossil fuel for cooking instead of gas or electricity and, in the 70th round, the age at death was significantly lower in households which did not have a flushable toilet.

However, even after controlling for these "group independent" factors, the social group to which people in India belonged had a significant effect on their health outcomes. Compared to households from the non-Muslin Upper Classes, the predicted age at death in India in 2014 – after imposing all the controls - was nearly eight years lower for ST households, nearly 13 years lower for SC households, 5 years lower for non-Muslim OBC households, and nearly three years lower for Muslim households. Notwithstanding the fact that in the decade between 2004 and 2014, the predicted age at death rose for all the groups, inter-group disparities in the age at death remained stubbornly durable.

There can be little doubt, therefore, that, on the basis of data from the NSS samples, the analysis in this chapter offered *prima facie* evidence of a social group bias to health outcomes in India. However, it is important to note that there are several deficiencies inherent in this study. First, there are important health-related attributes of individuals (smoking, diet, taking exercise, the nature of work) which are not - and, indeed, given the limitations of the data, cannot – be taken account of. All these factors are included in the package of factors termed "unobservable". If these unobservable factors were randomly distributed among the population this, in itself, would not pose a problem. However, there is evidence that there may be a group bias with respect to at least some of these factors. For example, if hard physical work is more inimical to health than sedentary jobs, then of males aged 25-44 years, 42 percent of ST and 47 percent of SC, compared to only 10 percent of persons from the non-Muslim Upper Class, worked as casual labourers (Borooah *et. al*. 2007). There is a natural distinction between inequality and inequity in the analysis of health outcomes. Inequality reflects the totality of differences between persons, regardless of the source of these differences and, in particular, regardless of whether or not these sources stem from actions within a person's control. Inequity reflects that part of inequality that is generated by factors outside a person's control. In a fundamental sense, therefore, while inequality may not be seen as "unfair", inequity is properly regarded as being unfair. The point about group membership is that while it may not be the primary factor behind health inequality, it is the main cause of health inequity. This chapter's central message, conditional on the caveats noted earlier, is that belonging to the ST, the SC, or being Muslim in India seriously impaired, using the language of Sen (1992), the capabilities of persons to function in society.

The findings with respect to infant and child deaths is that it was only the predicted IMR for the Scheduled Castes that was significantly higher than that for the reference category of non-Muslim Upper Classes with the predicted IMR for the other social groups not significantly different from the that of the reference group. The contours of a social gradient to mortality begin to emerge, however, with respect to child deaths: now the predicted CMR for three groups - the Scheduled Tribes, the Scheduled Castes, and Muslims – were all significantly higher than that for the reference category of non-Muslim Upper Classes.

However, the overriding worry with respect to infant and child mortality is gender bias with girls more likely to die than boys before attaining their first (infant) and fifth (child) birthdays. As this study has shown, gender bias in infant and child mortality rates is, with stray exceptions[26], a feature of all the social groups. In addition, there is significant gender bias in favour of boys in two – the North and the Centre - of the five regions of this study. At least part of this excess mortality stems from the neglect of the girl child and, as Borooah (2004) showed, some of this neglect stemmed from the inferior diet offered to girls compared to boys and from parental laxity in fully immunising their daughters compared to their sons. In this context, the Indian Prime Minister, Narendra Modi's call to *"Beti Bachao"* (save a daughter) acquires a special urgency.

[26] These are the Scheduled Castes for infant mortality and the Scheduled Tribes for child mortality.

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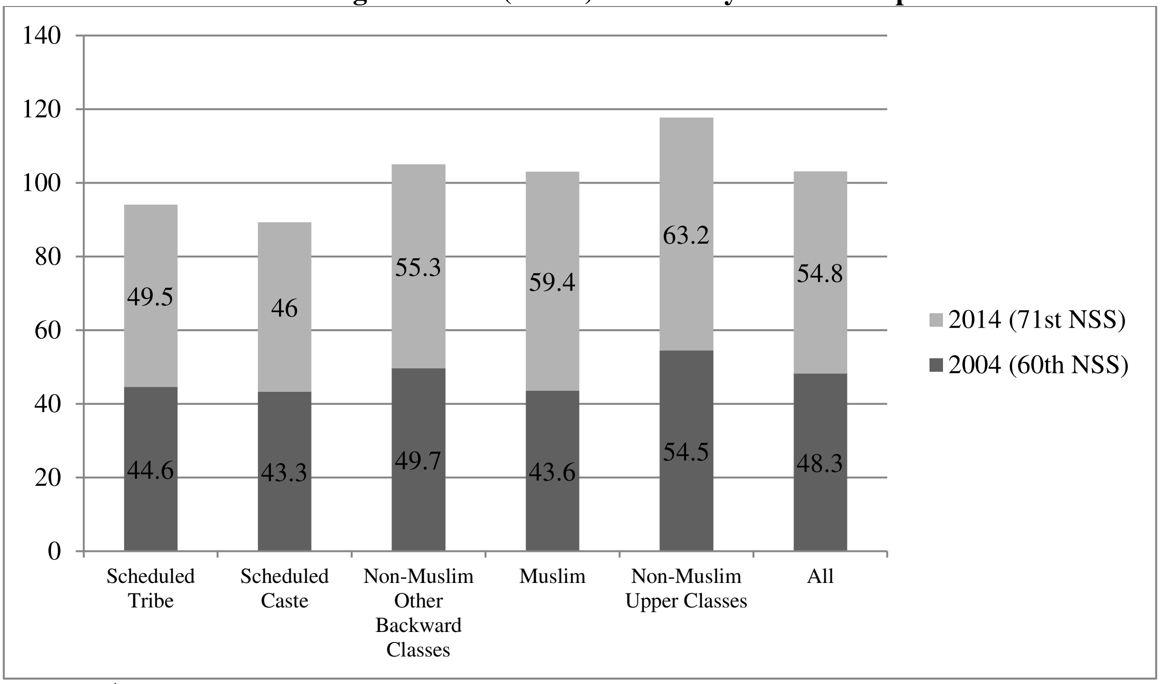
Figure 2.1
Mean Age at Death (Years) in India by Social Group



Source: NSS 60th and 71st NSS, Health File

Table 2.1: Predicted Age at Death from Regression Equations, 71st and 60th NSS Round

	71st NSS (2014)+				
Conditioning Variable	Age at Death	Marginal Change	Standard error of marginal change	t value	Pr>|t|
By gender of deceased					
Male	53.6				
Female	56.4	2.8	0.271	10.3**	0.00
By Social Group of Household					
Scheduled Tribe	52.6	-7.9	0.547	-14.5**	0.00
Scheduled Caste	48.0	-12.5	0.455	-27.4**	0.00
Non-Muslim OBC	55.2	-5.2	0.394	-13.3**	0.00
Muslims	58.0	-2.5	0.469	-5.3**	0.00
Non-Muslim Upper Class [R]	60.5				
Household Occupation					
Labourer Household [R]	54.3				
Non-Labourer Household	54.9	0.6	0.339	1.8*	0.07
Household's Location					
Rural[R]	54.7				
Urban	55.0	0.3	0.368	0.8	0.40
Household's State of Residence					
Forward State [R]	57.7				
Backward State	51.4	-6.3	0.282	-22.3**	0.00
Household Living Conditions: Latrine					
Flush or Septic Tank [R]	55.3				
Other Type of Latrine (including no latrine)	54.0	1.3	0.359	3.6**	0.00
Household Living Conditions: Cooking Fuel					
Gas, Gobar Gas, Electricity, Kerosene [R]	56.4				
Other Fuels	54.0	-2.4	0.383	-6.2**	0.00
Household Per-Capita Consumption Quintile					
Lowest quintile	49.4	-9.5	0.500	-19.1**	0.00
2nd quintile	58.4	-0.6	0.468	-1.2	0.22
3rd quintile	51.8	-7.1	0.504	-14.1**	0.00
4th quintile	55.1	-3.9	0.469	-8.3**	0.00
Highest quintile [R]	59.0				

Table 2.1 (continued)

	60th NSS (2004)++				
Conditioning Variable	Age at Death	Marginal Change	Standard error of marginal change	t value	Pr>|t|
By gender of deceased					
Male	48.6				
Female	47.3	-1.301	0.3	-4.11**	0.00
By Social Group of Household					
Scheduled Tribe	48.5	-1.8	0.663	-2.7**	0.01
Scheduled Caste	46.1	-4.1	0.507	-8.2**	0.00
Non-Muslim OBC	49.1	-1.2	0.429	-2.8**	0.01
Muslims	43.8	-6.5	0.569	-11.4**	0.00
Non-Muslim Upper Class [R]	50.3				
Household Occupation					
Labourer Household [R]	42.6				
Non-Labourer Household	50.6	8.0	0.376	21.3**	0.00
Household's Location					
Rural [R]	48.6				
Urban	46.3	-2.3	0.442	-5.3**	0.00
Household's State of Residence					
Forward State [R]	51.2				
Backward State	44.6	-6.6	0.327	-20.1**	0.00
Household Living Conditions: Latrine					
Flush or Septic Tank [R]	49.2				
Other Type of Latrine (including no latrine)	47.8	-1.5	0.501	-2.9**	0.00
Household Living Conditions: Cooking Fuel					
Gas, Gobar Gas, Electricity, Kerosene [R]	52.9				
Other Fuels	47.0	-5.9	0.546	-10.9**	
Household Per-Capita Consumption Quintile					
Lowest quintile	47.3	-2.4	0.588	-4.1**	0.00
2nd quintile	45.9	-3.8	0.583	-6.5**	0.00
3rd quintile	48.6	-1.1	0.565	-2.0**	0.05
4th quintile	50.0	0.3	0.561	0.5	0.64
Highest Quintile [R]	49.7				

+Estimated on data for 2,384 households in which a death occurred in the 71st NSS, after grossing up
++Estimated on data for 1,708 households in which a death occurred in the 60th NSS, after grossing up.
[R] denotes the reference category.
** Significant at 5%; * significant at 10%.
Source: Own Calculations from 71st and 60th Rounds of the NSS

Table 2.2: Predicted Age at Death: Differences between the 71st and 60th Rounds

	Age at Death 71st Round	Age at Death 60th Round	Difference	Standard Error of Difference	t-value	Pr>|t|
By gender of deceased						
Male	53.4	49.2	4.2	0.269	15.5**	0.00
Female	56.2	47.9	8.3	0.324	25.5**	0.00
By Social Group of Household						
Scheduled Tribe	52.2	49.2	3.0	0.687	4.3**	0.00
Scheduled Caste	47.7	46.9	0.8	0.461	1.7*	0.09
Non-Muslim OBC	54.9	49.8	5.1	0.344	14.8**	0.00
Muslims	57.6	44.5	13.1	0.575	22.8**	0.00
Non-Muslim Upper Class	60.1	51.0	9.1	0.476	19.2**	0.00
Household Occupation						
Labourer Household	54.1	42.8	11.3	0.429	26.3**	0.00
Non-Labourer Household	54.7	50.8	3.9	0.248	15.7**	0.00
Household's Location						
Rural	54.5	49.3	5.1	0.259	19.9**	0.00
Urban	54.8	47.0	7.8	0.470	16.6**	0.00
Household's State of Residence						
Forward State	57.5	51.8	5.7	0.291	19.7**	0.00
Backward State	51.2	45.2	6.0	0.311	19.3**	0.00
Household Living Conditions: Latrine						
Flush or Septic Tank	54.9	48.3	6.7	0.272	24.5**	0.00
Other Type of Latrine (including no latrine)	53.6	49.7	3.9	0.482	8.1**	0.00
Household Living Conditions: Cooking Fuel						
Gas, Gobar Gas, Electricity, Kerosene	56.3	53.1	3.2	0.530	6.1**	0.00
Other Fuels	53.9	47.1	6.8	0.270	25.2**	0.00
Household Per-Capita Consumption Quintile						
Lowest quintile	49.4	48.0	1.4	0.443	3.2**	0.00
2nd quintile	58.4	46.6	11.8	0.414	28.4**	0.00
3rd quintile	51.8	49.3	2.5	0.497	5.1**	0.00
4th quintile	55.0	50.7	4.4	0.481	9.1**	0.00
Highest Quintile	58.9	50.4	8.5	0.586	14.5**	0.00

Estimated on data for 4,019 households in which a death occurred in the 71st and 60th Rounds.

** Significant at 5%; * significant at 10%.

Source: Own Calculations from 71st and 60th Rounds of the NSS

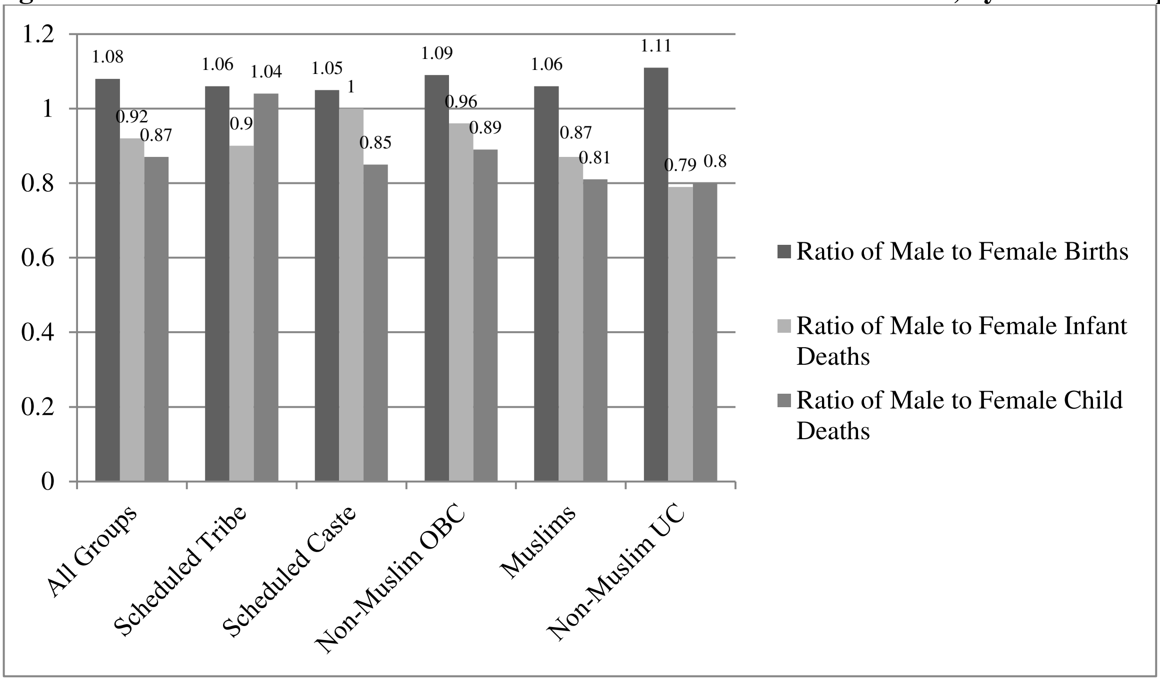
Table 2.3: Births and Infant and Child Deaths by Social Group and Region: 36,794 Mothers

	All Women (36,794)	Scheduled Tribe Women (3,009)	Scheduled Caste Women (7,768)	Non-Muslim Other Backward Classes Women (12,662)	Muslim Women (4,425)	Non-Muslim Upper Classes Women (8,910)
Both Genders						
All Births	111,151	9,751	25,184	37,426	16,279	22,472
All Infant Deaths	1,449	139	441	436	206	227
All Child Deaths	2,825	324	853	862	427	359
Infant Mortality Rate (per 1,000 births)	13.0	14.3	17.5	11.6	12.7	10.1
Child Mortality Rate (per 1,000 births)	25.4	33.2	33.9	23.0	26.2	16.0
Males						
Male Births	57,641	5,016	12,896	19,478	8,411	11,821
Male Infant Deaths	696	66	221	213	96	100
Male Child Deaths	1,315	166	393	406	191	159
Male Infant Mortality Rate (per 1,000 male births)	12.1	13.2	17.1	10.9	11.4	8.5
Male Child Mortality Rates (per 1,000 births)	22.8	33.1	30.5	20.8	22.7	13.5
Females						
Female Births	53,510	4,735	12,288	17,948	7,868	10,651
Female Infant Deaths	753	73	220	223	110	127
Female Child Deaths	1,510	159	460	456	236	200
Female Infant Mortality Rate (per 1,000 male births)	14.1	15.4	17.9	12.4	14.0	11.9
Female Child Mortality Rates (per 1,000 births)	28.2	33.4	37.4	25.4	30.0	18.8

	All Women (36,794)	North (6,407)	Central (11,667)	East (4,944)	West (4,713)	South (8,189)
Both Genders						
All Births	111,151	18,864	43,728	13,289	13,237	20,379
All Infant Deaths	1,449	246	914	133	49	103
All Child Deaths	2,825	397	1,880	261	112	166
Infant Mortality Rate (per 1,000 births)	13.0	13.0	20.9	10.0	3.9	5.1
Child Mortality Rate (per 1,000 births)	25.4	21.0	43.0	19.6	8.8	8.1
Males						
Male Births	57,641	9,918	22,530	6,984	6,907	10,457
Male Infant Deaths	696	104	433	64	27	65
Male Child Deaths	1,315	165	855	135	60	96
Male Infant Mortality Rate (per 1,000 male births)	12.1	10.5	19.2	9.2	4.1	6.2
Male Child Mortality Rates (per 1,000 births)	22.8	16.6	37.9	19.3	9.1	9.2
Females						
Female Births	53,510	8,946	21,198	6,305	6,330	9,922
Female Infant Deaths	753	142	481	69	22	38
Female Child Deaths	1,510	232	1,025	126	52	70
Female Infant Mortality Rate (per 1,000 male births)	14.1	15.9	22.7	10.9	3.6	3.8
Female Child Mortality Rates (per 1,000 births)	28.2	25.9	48.4	20.0	8.6	7.1

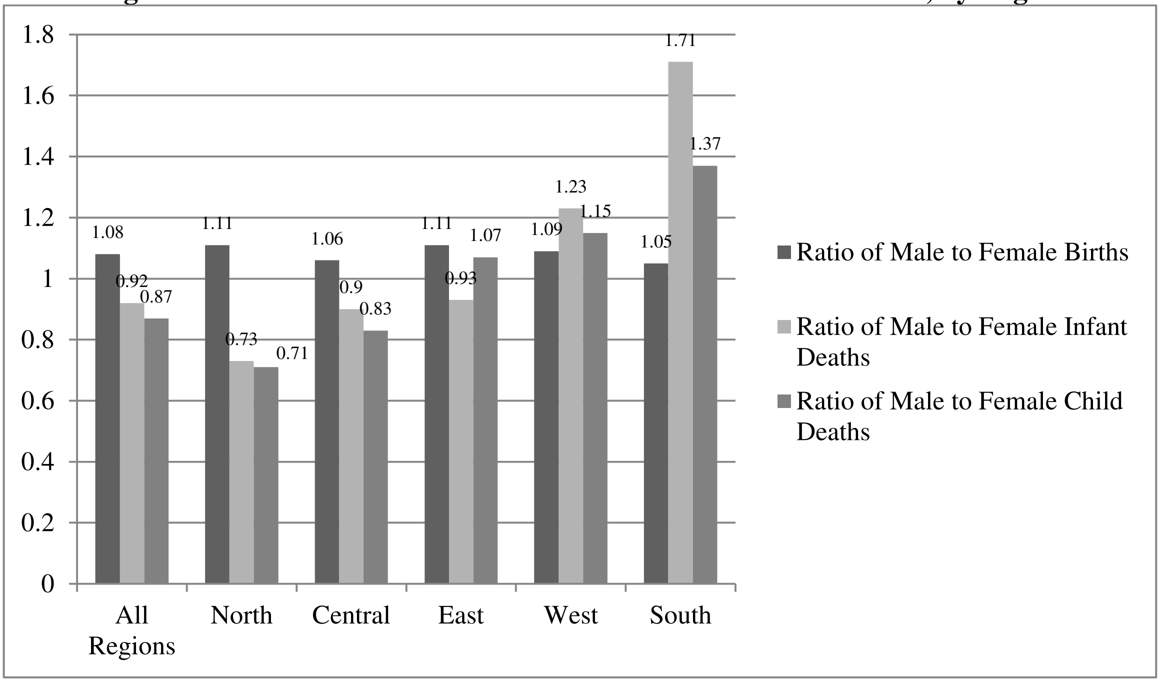
20 women were not in any of the five social groups identified in the Table.
North (Jammu & Kashmir; Delhi; Haryana; Himachal Pradesh; Punjab (including Chandigarh) Uttarakhand); *Central* (Bihar, Chhattisgarh; Madhya Pradesh; Jharkhand; Rajasthan; Uttar Pradesh); *East* (Assam; North-East; Orissa; West Bengal); *West* (Maharashtra; Gujarat; and Goa); *South* (Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu).
Source: Own calculations from IHDS 2011

Figure 2.2: Ratio of Male to Female Live Births and Infant and Child Deaths, by Social Group



Source: Own calculations from IHDS 2011

Figure 2.3: Ratio of Male to Female Live Births and Infant Deaths, by Region



Source: Own calculations from IHDS 2011

Table 2.4: Predicted Infant Mortality Rates (IMR) from the Logit Equation$^{\Psi}$

	Predicted IMR	Difference in IMR from that of [R] group	z-value	Pr >|z|
Gender				
Male [R]	12.4			
Female	14.2	1.8**	2.7	0.01
Birth Order				
First	13.7	-0.2	-0.2	0.81
Second	12.3	-1.7*	-1.7	0.09
Third	12.7	-1.3	-1.3	0.20
Fourth and higher [R]	14.0			
Social Group of Household				
Scheduled Tribe	14.7	2.4**	1.5	0.13
Scheduled Caste	17.1	4.8**	4.0	0.00
Non-Muslim OBC	11.6	-0.7	-0.7	0.52
Muslims	11.6	-0.7	-0.6	0.55
Non-Muslim Upper Class [R]	12.3			
Region				
North [R]	12.9			
Central	20.2	7.4**	6.4	0.00
East	9.9	-2.9**	-2.4	0.02
West	4.2	-8.7**	-8.3	0.00
South	5.2	-7.7**	-7.7	0.00
Location				
Rural [R]	13.7			
Urban	12.1	1.6*	-1.9	0.06
Highest Education of Household Adult				
None	16.6	8.9**	7.5	0.00
Primary	15.3	7.6**	6.3	0.00
Secondary	13.7	6.1**	6.3	0.00
Higher Secondary	9.7	2.0*	1.9	0.07
Graduate and above [R]	7.6			
Household per capita Consumption				
Lowest quintile	12.0	-2.6*	-1.9	0.06
2nd quintile	13.2	-1.4	-1.0	0.33
3rd quintile	13.4	-1.2	-0.8	0.41
4th quintile	15.1	0.5	0.3	0.73
Highest quintile [R]	14.6			
Mother's health				
Very good-Fair	12.9	-3.0**	-2.6	0.01
Poor-Very Poor [R]	15.9			

$^{\Psi}$Infant (12 months or under) deaths per 1,000 live births estimated on observations for 108,517 live births
[R] denotes the reference category.
** Significant at 5%; * significant at 10%.
Source: Own calculations from IHDS 2011

Table 2.5: Predicted Child Mortality Rates (CMR) from the Logit Equation$^{\Psi}$

	Predicted CMR	Difference in CMR from [R] group	z-value	Pr >|z|
Gender				
Male [R]	23.5			
Female	28.5	5.0**	5.2	0.00
Birth Order				
First	27.0	0.8	0.6	0.53
Second	23.8	-2.4*	-1.9	0.07
Third	26.5	0.3	0.2	0.86
Fourth and higher [R]	26.2			
Social Group of Household				
Scheduled Tribe	31.9	11.3**	5.2	0.00
Scheduled Caste	33.1	12.5**	7.7	0.00
Non-Muslim OBC	22.6	1.9	1.4	0.16
Muslims	24.3	3.7**	2.2	0.03
Non-Muslim Upper Class [R]	20.6			
Region				
North [R]	21.8			
Central	40.7	18.9**	12.3	0.00
East	19.1	-2.7	-1.6	0.11
West	9.9	-11.9**	-8.1	0.00
South	8.4	-13.3**	-10.3	0.00
Location				
Rural [R]	27.4			
Urban	21.3	-6.1**	-5.5	0.00
Highest Education of Household Adult				
None	33.2	19.0**	11.6	0.00
Primary	30.6	16.4**	9.9	0.00
Secondary	25.8	11.7**	8.8	0.00
Higher Secondary	17.4	3.3**	2.1	0.03
Graduate and above [R]	14.1			
Household per capita Consumption				
Lowest quintile	23.7	-3.9**	-2.0	0.04
2nd quintile	26.0	-1.7	-0.9	0.38
3rd quintile	26.8	-0.8	-0.4	0.67
4th quintile	28.6	0.9	0.5	0.65
Highest quintile [R]	27.7	0.0		
Mother's health				
Very good-Fair	25.5	2.6**	-1.8	0.08
Poor-Very Poor [R]	28.2			

$^{\Psi}$Child (5 years or under) deaths per 1,000 live births estimated on observations for 108,517 live births
[R] denotes the reference category.
** Significant at 5%; * significant at 10%.
Source: Own calculations from IHDS 2011

Table 2.6: Predicted Difference between Male and Female Infant Mortality Rates by Birth Order, Social Group, and Region[Ψ]

	Predicted Male Infant Mortality Rate	Predicted Female Infant Mortality Rate	Difference in IMR Between Males and Females	z-value	Pr >|z|
Birth Order					
First	14.1	13.4	0.7	0.6	0.56
Second	11.3	13.4	-2.1	-1.5	0.13
Third	12.6	12.8	-0.2	-0.1	0.89
Fourth or higher	11.6	16.6	-5.0**	-3.7	0.00
Social Group of Household					
Scheduled Tribe	13.6	15.8	-2.2	-0.9	0.39
Scheduled Caste	17.2	17.0	0.2	0.1	0.91
Non-Muslim OBC	10.7	12.6	-1.9*	-1.7	0.09
Muslims	10.6	12.6	-2.0	-1.3	0.20
Non-Muslim Upper Class	10.4	14.3	-3.9**	-2.4	0.02
Region					
North	10.4	15.4	-5.0**	-2.9	0.00
Central	19.0	21.6	-2.6*	-1.9	0.06
East	9.0	10.9	-1.9	-1.1	0.28
West	4.6	3.8	0.8	0.6	0.53
South	6.4	3.9	2.5**	2.4	0.02

[Ψ]Infant (12 months or under) deaths per 1,000 live births
Predictions based on observations for 108,517 live births
** Significant at 5%; * significant at 10%.
Source: Own calculations from IHDS 2011

Table 2.7: Predicted Difference between Male and Female Child Mortality Rates by Birth Order, Social Group, and Region$^{\Psi}$

	Predicted Male Child Mortality Rate	Predicted Female Child Mortality Rate	Difference in CMR Between Males and Females	z-value	Pr >|z|
Birth Order					
First	27.7	26.4	1.3	0.7	0.50
Second	22.0	25.6	-3.6*	-1.9	0.06
Third	24.6	28.5	-3.9*	-1.7	0.09
Fourth or higher	20.5	32.2	-11.7**	-6.7	0.00
Social Group of Household					
Scheduled Tribe	32.1	31.7	0.4	0.1	0.91
Scheduled Caste	30.4	36.0	-5.6**	-2.5	0.01
Non-Muslim OBC	20.5	24.8	-4.4**	-2.8	0.01
Muslims	21.4	27.4	-6.0**	-2.6	0.01
Non-Muslim Upper Class	17.3	24.2	-7.0**	-3.2	0.00
Region					
North	17.7	26.0	-8.3**	-3.7	0.00
Central	36.8	44.9	-8.2**	-4.3	0.00
East	18.7	19.5	-0.8	-0.3	0.74
West	10.2	9.6	0.6	0.3	0.75
South	9.4	7.4	2.1	1.6	0.12

$^{\Psi}$Child (5 years or under) deaths per 1,000 live births
Predictions based on observations for 108, 517 live births
** Significant at 5%; * significant at 10%.
Source: Own calculations from IHDS 2011