



## CHAPTER 8

### MORBIDITY AND MORTALITY

This chapter presents data on the prevalence of certain diseases as well as mortality rates, especially for infants and young children. This type of information is relevant both to the demographic assessment of the population and to health policies and programmes. Mortality estimates are also useful (in conjunction with fertility estimates) for projecting the future size of the population. Detailed information on the mortality of children can be used to identify sectors of the population that are at high risk and in need of health services.

The NFHS collected information on mortality and morbidity in both the Household and Woman's Questionnaires. The Household Questionnaire includes questions on individuals in the household suffering from blindness, tuberculosis, leprosy, physical impairment of the limbs, and malaria. The Household Questionnaire also includes a question on deaths occurring in the household during the past two years. The Woman's Questionnaire collects information on the survival status of all births, the age at death if the child died, and the prevalence of common childhood diseases for children under 4 years of age. The prevalence and treatment of childhood diseases are discussed in Chapter 9.

#### 8.1 Morbidity and Physical Impairments

Because demographic sample surveys generally do not include questions on the prevalence of diseases, there is little experience on which to base an assessment of the validity and reliability of such questions. The patterns shown by the morbidity data analyzed in this section are generally plausible, suggesting that the questions have provided useful information. At the same time, there is little to indicate whether the overall prevalence levels are correct. It is certainly possible that the results of the survey substantially understate the prevalence of certain conditions because some survey respondents fail to report them.

It is worth noting some of the possible reasons for failure to report particular health conditions. Conditions carrying a stigma, such as leprosy, may be underreported due to intentional concealment by respondents or embarrassment on the part of interviewers about asking these questions. Respondents are aware of certain conditions, such as blindness and physical impairment, but may be unaware of others unless they have been diagnosed by medical personnel. Moreover, given the linguistic diversity in India, locally as well as nationally, respondents may know that a household member suffers from a given condition but fail to report it because they do not recognize the words used by the interviewer in asking the question.

Table 8.1 shows, for all India, the prevalence in the household population of the five health conditions listed in the Household Questionnaire. Of the five, malaria has the highest incidence, afflicting 3,324 per 100,000 population during the three months prior to the survey. Blindness (partial or complete), reported for 3,001 per 100,000 population, is second most prevalent. The remaining diseases all show an overall incidence of less than 700 per 100,000.

**Table 8.1 Morbidity and physical impairments**

Number of persons per 100,000 household population suffering from blindness, tuberculosis, leprosy, physical impairment of the limbs, and malaria, according to age, sex and residence, India, 1992-93

Demographic characteristic	Number of persons per 100,000 suffering from:						Number of usual residents
	Blindness		Tuberculosis	Leprosy	Physical impairment of limbs	Malaria during the last three months	
	Partial	Complete					
<b>URBAN</b>							
<b>Age</b>							
0 - 4	97	164	140	42	366	2072	13964
5 - 14	366	698	181	74	512	1789	31174
15-59	2055	177	368	104	521	1634	77904
60-69	12747	877	998	150	900	1800	5669
70+	17772	2035	1033	72	2141	1817	3341
<b>Sex</b>							
Male	1972	366	397	104	671	1655	68595
Female	2666	386	286	79	439	1810	63456
<b>Total</b>	<b>2306</b>	<b>375</b>	<b>344</b>	<b>92</b>	<b>559</b>	<b>1729</b>	<b>132051</b>
<b>RURAL</b>							
<b>Age</b>							
0 - 4	220	195	81	29	461	3650	47207
5 - 14	324	525	117	68	688	4026	96109
15-59	2210	204	617	152	598	3749	195415
60-69	15096	1244	1812	371	1183	5005	18666
70+	21222	3252	1731	297	1721	4546	11044
<b>Sex</b>							
Male	2482	411	625	162	814	3984	188843
Female	2900	450	393	95	513	3804	179599
<b>Total</b>	<b>2686</b>	<b>430</b>	<b>512</b>	<b>130</b>	<b>667</b>	<b>3896</b>	<b>368441</b>
<b>TOTAL</b>							
<b>Age</b>							
0 - 4	192	188	95	32	440	3290	61172
5 - 14	334	567	132	69	645	3478	127283
15-59	2166	196	546	138	576	3146	273319
60-69	14549	1159	1623	320	1117	4258	24335
70+	20421	2970	1569	245	1818	3912	14384
<b>Sex</b>							
Male	2346	399	564	147	776	3363	257438
Female	2839	433	365	91	494	3283	243055
<b>Total</b>	<b>2585</b>	<b>416</b>	<b>467</b>	<b>120</b>	<b>639</b>	<b>3324</b>	<b>500492</b>

Note: Table excludes persons with missing information on sex.

## Malaria

In the NFHS, more than 3 percent of the population was reported to have malaria in the three months before the survey. It should be noted that the NFHS was not undertaken at the same time of the year in all states and, hence, the calendar dates of the reference period (three months prior to the survey) for the assessment of the prevalence of malaria vary from state to state. Since there is seasonal variation in the incidence of malaria, the prevalence rates of malaria for any state cannot be assumed to reflect the situation throughout the year in that state. However, the data collection was conducted in three phases throughout the year, and hence the

prevalence rate for total India may be taken as more representative of the situation throughout the year.

The prevalence of malaria is more than twice as high in rural areas (3,896 per 100,000) than in urban areas (1,729 per 100,000), and is slightly higher for males than for females (3,363 per 100,000 compared with 3,283 per 100,000). The sex differential is very small in both urban and rural areas. Differences in prevalence among age groups are modest but suggest that prevalence is higher for those age 60 and over than for those below age 60 for India as a whole. This is also true for rural areas, which constitute the bulk of India's population, but in urban areas the prevalence of malaria is highest among children age 0-4.

### **Partial and Complete Blindness**

The overall prevalence of partial blindness is 2,585 per 100,000 population, with slightly lower prevalence in urban than in rural areas (2,306 compared with 2,686 per 100,000). Prevalence rates range from 192 per 100,000 for persons age 0-4 to 20,421 per 100,000 for persons age 70 and over. The much higher prevalence among older persons is striking and probably reflects a combination of historical improvements in the prevention of blindness and the tendency for blindness to increase with age at all periods in history. In both urban and rural areas, females are more prone to partial blindness than are males. In the country as a whole, the prevalence of partial blindness is 2,839 per 100,000 for females and 2,346 per 100,000 for males.

The overall prevalence of complete blindness is 416 per 100,000 population. The NFHS estimate of total blindness is considerably higher than the 1981 Census estimate of 73 per 100,000 (Office of the Registrar General and Census Commissioner, 1983). This is probably indicative of relatively high underenumeration in the census rather than a substantial increase in blindness between 1981 and 1992-93.

The prevalence of complete blindness is slightly higher in rural areas (430 per 100,000) than in urban areas (375 per 100,000). Females are more prone than males to total blindness in both urban and rural areas, although the differences between the sexes are small. As expected, complete blindness is also far more prevalent among the old than among the young or middle-aged.

### **Physical Impairment of the Limbs**

The overall prevalence of persons with physically impaired limbs is 639 per 100,000, with a slightly higher prevalence in rural areas than in urban areas. Physical impairment of the limbs is more common among males (776 per 100,000) than among females (494 per 100,000). The sex differential is similar in urban and rural areas. As with blindness, impairment of the limbs is much more prevalent among those age 60 and over than among younger people: 440 to 645 per 100,000 at ages 0-4 and 5-14 compared with 1,818 per 100,000 at age 70 and over.

## **Tuberculosis**

Tuberculosis, which is becoming an increasing problem worldwide has an overall prevalence of 467 per 100,000, with rural areas once again having a higher prevalence than urban areas (512 per 100,000 compared with 314 per 100,000). The prevalence of tuberculosis is higher among males (564 per 100,000) than among females (365 per 100,000). Age differences are marked, ranging from 95 per 100,000 at age 0-4 to about 1,600 per 100,000 at ages 60 and over.

## **Leprosy**

The reported prevalence of leprosy is only 120 per 100,000. The observed sex difference is small, with higher prevalence for males than for females in both urban and rural areas. The prevalence of leprosy tends to rise with age, but is slightly lower at age 70 and over than at age 60-69. This pattern prevails in both urban and rural areas. It is not clear why prevalence falls off after age 70, but it could be due to lower probabilities of survival for persons who contracted leprosy further in the past.

## **Comparisons by State**

Table 8.2 shows comparisons of prevalence rates for morbidity and physical impairments by state. The prevalence of partial blindness varies considerably by state, from a low of 557 per 100,000 in Meghalaya to a high of 5,142 per 100,000 in Andhra Pradesh. The states with prevalence rates below 1,000 per 100,000 are Meghalaya, Jammu, Tamil Nadu, Punjab, Haryana, Arunachal Pradesh, West Bengal, Assam and Himachal Pradesh. The states with prevalence rates above 2,500 per 100,000 are Andhra Pradesh, Karnataka, Rajasthan, Madhya Pradesh, Maharashtra, Orissa, Gujarat and Uttar Pradesh.

Variation in the prevalence rate for complete blindness is also large. In this case the prevalence rate ranges from 115 per 100,000 in Mizoram to 842 per 100,000 in Andhra Pradesh. The states with prevalence rates below 200 per 100,000 are Mizoram, Manipur, Nagaland, Haryana, West Bengal, Assam and Punjab. The states with prevalence rates above 400 per 100,000 include Andhra Pradesh, Uttar Pradesh, Rajasthan, Bihar, Madhya Pradesh, Himachal Pradesh and Gujarat. The prevalence of partial blindness and the prevalence of complete blindness are positively correlated at 0.75; in most cases, the higher the prevalence of partial blindness, the higher the incidence of complete blindness.

State differentials are also substantial for the other conditions examined. Physical impairment of the limbs is most common in Nagaland but it is also a substantial problem in Punjab and the southern states of Andhra Pradesh, Karnataka and Tamil Nadu. Levels of tuberculosis are particularly high in Manipur, Arunachal Pradesh and Rajasthan and leprosy is reported to be relatively high in Uttar Pradesh and Manipur. The prevalence of malaria varies widely across the states, at least partly because of seasonal variations in the timing of the survey fieldwork. Malaria was most often reported in the belt extending from Rajasthan through Uttar Pradesh and Madhya Pradesh to Orissa. On the other hand, there were very few reports of malaria in Kerala, Goa and Delhi. No state is worse than the national average for all of the

**Table 8.2 Morbidity and physical impairments by state**

Number of persons per 100,000 household population suffering from blindness, tuberculosis, leprosy, physical impairment of the limbs, and malaria by state, India, 1992-93

State	Number of persons per 100,000 suffering from:					
	Blindness		Tuberculosis	Leprosy	Physical impairment of limbs	Malaria during the last three months
	Partial	Complete				
<b>India</b>	2585	416	467	120	639	3324
<b>North</b>						
Delhi	1269	208	192	101	240	554
Haryana	679	145	327	14	681	933
Himachal Pradesh	929	455	242	56	562	1141
Jammu Region of J & K	620	249	245	18	663	853
Punjab	664	199	238	28	841	2546
Rajasthan	4182	479	724	128	593	5103
<b>Central</b>						
Madhya Pradesh	3353	478	435	136	733	4728
Uttar Pradesh	2557	544	560	222	632	7395
<b>East</b>						
Bihar	2270	479	595	123	712	1428
Orissa	2842	319	555	96	583	5148
West Bengal	753	161	357	47	386	678
<b>Northeast</b>						
Arunachal Pradesh	718	294	938	110	460	4213
Assam	914	192	638	36	406	2707
Manipur	1319	123	951	199	460	1641
Meghalaya	557	202	321	17	590	4723
Mizoram	1409	115	311	33	459	4636
Nagaland	1237	136	491	153	1101	2778
Tripura	1141	289	289	0	482	2619
<b>West</b>						
Goa	2456	258	179	16	532	243
Gujarat	2819	447	308	29	539	3228
Maharashtra	3214	320	293	72	573	3742
<b>South</b>						
Andhra Pradesh	5142	842	407	118	785	1944
Karnataka	4517	383	136	132	795	457
Kerala	1104	300	586	18	662	112
Tamil Nadu	632	204	703	209	759	576

diseases or medical conditions, but three states (West Bengal, Tripura and Goa) consistently have lower prevalence than the national average.

## 8.2 Crude Death Rates and Age-Sex-Specific Death Rates

Table 8.3 shows crude death rates (CDRs) and age-sex-specific death rates by residence for the usual resident population of India, as estimated from both the NFHS and the Sample Registration System (SRS), which is maintained by the Office of the Registrar General. The death rates from the NFHS are based on deaths occurring to usual residents of the household

**Table 8.3 Crude death rates and age-sex specific death rates**

Crude death rates (CDR) and age-sex specific death rates from the NFHS and the SRS, by residence, India, 1991-92

Age	NFHS (1991-92)			SRS (1991-92)		
	Male	Female	Total	Male	Female	Total
<b>URBAN</b>						
0 - 4	14.4	15.8	15.1	15.4	16.3	15.8
5 - 9	1.6	1.9	1.7	1.4	1.6	1.5
10-14	1.6	0.3	1.0	0.8	0.9	0.9
15-19	1.3	1.7	1.5	1.3	1.6	1.4
20-24	1.8	1.4	1.6	1.8	2.1	2.0
25-29	2.5	2.4	2.5	2.2	2.2	2.3
30-34	2.3	2.8	2.5	2.5	2.1	2.3
35-39	4.0	2.1	3.1	3.5	2.9	3.3
40-44	4.5	2.3	3.5	4.9	3.2	4.1
45-49	5.7	4.9	5.4	8.3	4.2	6.4
50-54	11.7	5.4	8.9	12.6	7.9	10.5
55-59	16.5	10.1	13.2	20.2	13.7	17.1
60-64	33.6	15.5	24.3	31.4	20.6	26.0
65-69	41.2	22.9	32.3	41.2	34.3	37.6
70+	95.8	94.1	95.0	88.7	78.2	83.1
CDR	8.3	6.9	7.6	7.4	6.8	7.1
<b>RURAL</b>						
0 - 4	25.4	25.9	25.7	27.7	30.7	29.1
5 - 9	2.3	2.6	2.5	2.8	3.5	3.2
10-14	1.6	2.2	1.9	1.5	1.8	1.6
15-19	2.2	3.4	2.8	2.0	2.8	2.4
20-24	2.9	3.2	3.0	2.6	3.6	3.1
25-29	2.4	3.1	2.8	2.8	3.5	3.1
30-34	2.7	3.4	3.0	3.5	3.4	3.4
35-39	4.0	3.3	3.7	4.3	3.9	4.1
40-44	5.3	3.9	4.7	5.9	4.7	5.3
45-49	8.2	4.6	6.5	9.5	6.1	7.8
50-54	10.1	10.9	10.5	13.5	9.8	11.7
55-59	14.0	9.8	11.7	20.8	14.9	17.9
60-64	24.2	20.3	22.3	33.1	25.3	29.2
65-69	30.8	29.7	30.3	48.0	40.1	44.0
70+	91.0	99.9	94.9	98.1	89.7	93.7
CDR	10.6	10.3	10.4	10.7	10.8	10.8
<b>TOTAL</b>						
0 - 4	23.0	23.6	23.3	25.3	27.9	26.5
5 - 9	2.1	2.5	2.3	2.5	3.1	2.8
10-14	1.6	1.7	1.6	1.4	1.6	1.5
15-19	2.0	2.9	2.5	1.9	2.6	2.2
20-24	2.5	2.7	2.6	2.4	3.2	2.8
25-29	2.4	2.9	2.7	2.7	3.2	2.9
30-34	2.6	3.2	2.9	3.3	3.1	3.2
35-39	4.0	3.0	3.5	4.1	3.6	3.9
40-44	5.1	3.4	4.3	5.4	4.2	5.0
45-49	7.5	4.7	6.2	9.2	5.7	7.5
50-54	10.6	9.4	10.0	13.3	9.4	11.4
55-59	14.7	9.9	12.1	20.7	14.6	17.7
60-64	26.2	19.1	22.8	32.7	24.3	28.6
65-69	33.2	28.0	30.8	46.7	39.0	42.7
70+	92.1	98.5	95.0	96.1	87.3	91.5
CDR	10.0	9.4	9.7	10.0	10.0	10.0

Note: Crude death rates and age-sex specific death rates from the NFHS are based on the annual number of deaths reported for the *de jure* population during the two years prior to the survey. The SRS rates are the average rates for 1991-92, based on the *de jure* population. Source for the SRS: Office of the Registrar General (1993a, 1994)

during the two years preceding the survey (approximately 1991-92) as obtained from the Household Questionnaire, and the death rates from the SRS are the average rates for 1991-92. The death rates from the NFHS are calculated as the annual number of deaths in each age group in the two-year period before the date of interview per 1,000 usual residents. The denominator of this measure is calculated by projecting the number of usual residents at the time of the survey back to the mid-point of the time period on the basis of the intercensal population growth rate in the state. The urban intercensal growth rate is assumed to be the same for all age and sex groups in urban areas. Similarly, the rural intercensal growth rate is applied to all rural age and sex groups and the total intercensal growth rate is applied to the total population in each age and sex group.

Questions on the number of deaths occurring to usual residents in each household during a particular time period have been included in demographic surveys in many countries, and have generally resulted in a substantial understatement of deaths. We, therefore, begin by considering the evidence on the completeness of reporting of deaths. The Sample Registration System (SRS) provides a useful comparison.

Table 8.3 shows an estimated CDR for India of 9.7 per 1,000 in the NFHS, compared with 10.0 per 1,000 from the SRS. Therefore, overall estimates from the two sources agree quite well. The rural estimates are also quite similar (10.4 per 1,000 in the NFHS and 10.8 per 1,000 in the SRS). The NFHS estimate for urban areas (7.6 per 1,000) is slightly higher than the SRS estimate (7.1 per 1,000). The urban CDR estimated by the NFHS is 27 percent lower than the rural CDR. The NFHS estimate of the CDR may be subtracted from the earlier NFHS estimate of the crude birth rate from the household birth record (Table 5.1 in Chapter 5) to calculate the rate of natural increase of the population of India. The rate of natural increase so estimated is 18.3 per 1,000 population per year for the two-year period before the survey. These estimates imply a doubling time of 38 years for India's population in the absence of net international migration. At this rate of growth, India's population will reach one billion in the year 2000 and 1.5 billion in 2022.

By sex, the male CDR (10.0 in both the NFHS and the SRS) is slightly higher than the female CDR in the NFHS (9.4) and the same as the female CDR in the SRS (10.0). Table 8.3 also compares age-sex-specific death rates by residence from the NFHS and the SRS. On the whole, the two sets of estimates agree rather well, with a tendency for age-specific death rates from the NFHS to be slightly lower than corresponding rates from the SRS. In both cases, death rates are relatively high for the youngest children (age 0-4), uniformly low at ages 5-44, and rapidly increasing at ages 45 and above.

In most countries, male death rates are higher than female death rates at nearly all ages. South Asia generally has been an exception in this respect, with higher death rates for females over much of the age span (Preston, 1990; Ghosh, 1987). In the NFHS, females have higher age-specific death rates up to age 35, after which males generally have higher rates.

Comparisons among the NFHS estimates of the CDR by state (Table 8.4) show that the CDR ranges from 1.9 per 1,000 in Nagaland to 11.9 per 1,000 in Uttar Pradesh, with most estimates falling in the range of 8-12 per 1,000. The estimates for Nagaland and Mizoram seem implausibly low, as does the estimate for urban residents of Arunachal Pradesh. It should be



**Table 8.4 Crude death rates by state**

Crude death rates from the NFHS and the SRS, by state and residence, India, 1991-92

State	NFHS (1991-92)			SRS (1991-92)		
	Urban	Rural	Total	Urban	Rural	Total
<b>India</b>	7.6	10.4	9.7	7.1	10.8	10.0
<b>North</b>						
Delhi	8.0	4.1	7.8	6.2 <sup>a</sup>	7.9 <sup>a</sup>	6.3 <sup>a</sup>
Haryana	8.1	9.3	9.0	6.9	8.9	8.5
Himachal Pradesh	6.5	8.6	8.4	6.5 <sup>b</sup>	8.7 <sup>b</sup>	8.6 <sup>b</sup>
Jammu Region of J & K	8.9	8.6	8.7	U	U	U
Punjab	7.2	7.0	7.1	6.1	8.7	8.0
Rajasthan	7.2	7.9	7.8	7.7	10.6	10.1
<b>Central</b>						
Madhya Pradesh	9.1	10.7	10.3	9.2 <sup>b</sup>	14.9 <sup>b</sup>	13.8 <sup>b</sup>
Uttar Pradesh	7.7	13.0	11.9	8.3	12.0	11.3
<b>East</b>						
Bihar	9.0	12.0	11.5	6.3	10.2	9.8
Orissa	7.4	11.6	11.0	6.5	13.5	12.8
West Bengal	8.6	10.2	9.7	6.7 <sup>b</sup>	8.9 <sup>b</sup>	8.3 <sup>b</sup>
<b>Northeast</b>						
Arunachal Pradesh	0.8	9.1	8.2	3.3 <sup>a</sup>	12.8 <sup>a</sup>	9.3 <sup>a</sup>
Assam	7.0	11.9	11.3	6.9	11.8	11.5
Manipur	5.3	6.1	5.8	6.1 <sup>a</sup>	5.5 <sup>a</sup>	5.6 <sup>a</sup>
Meghalaya	6.6	6.1	6.2	3.4 <sup>a</sup>	9.4 <sup>a</sup>	8.4 <sup>a</sup>
Mizoram	4.2	2.7	3.4	U	U	U
Nagaland	1.7	2.0	1.9	0.8 <sup>a</sup>	4.4 <sup>a</sup>	3.7 <sup>a</sup>
Tripura	13.0	11.6	11.8	5.3 <sup>a</sup>	7.6 <sup>a</sup>	7.4 <sup>a</sup>
<b>West</b>						
Goa	5.9	7.1	6.5	6.0 <sup>a</sup>	7.8 <sup>a</sup>	7.2 <sup>a</sup>
Gujarat	7.2	10.2	9.1	7.9	8.8	8.5
Maharashtra	7.3	8.1	7.7	6.2	9.3	8.2
<b>South</b>						
Andhra Pradesh	7.4	9.2	8.7	6.7 <sup>b</sup>	10.5 <sup>b</sup>	9.7 <sup>b</sup>
Karnataka	6.2	8.1	7.5	6.9	9.8	9.0
Kerala	6.1	6.3	6.2	5.3	6.2	6.0
Tamil Nadu	7.3	11.0	9.7	7.6 <sup>b</sup>	9.5 <sup>b</sup>	8.8 <sup>b</sup>

Note: Crude death rates from the NFHS are based on the annual number of deaths reported for the *de jure* population during the two years prior to the survey. The SRS rates are the average rates for 1991-92, based on the *de jure* population.

U: Not available

<sup>a</sup>Three years moving average, 1990-92

<sup>b</sup>Average rates for 1990-91

Source for the SRS: Office of the Registrar General (1993a, 1993b, 1994)

pointed out, however, that the sampling errors are relatively large in these areas due to the small size of the samples. Delhi, Jammu, Punjab, Meghalaya, Mizoram and Tripura are the only exceptions to the general tendency of the rural CDR to exceed the urban CDR.

Table 8.4 also shows the average CDRs for the year 1991-92 from the SRS for 23 states for which the SRS has published estimates. The NFHS and SRS estimates differ by less than 1 per 1,000 in 9 of the 17 major states. In the remaining major states, the NFHS estimates are

higher than the SRS estimates for Delhi, Bihar and West Bengal and lower than the SRS estimates for Rajasthan, Madhya Pradesh, Orissa, Andhra Pradesh and Karnataka. In the six small states for which comparisons can be made, two states have estimates that differ by less than 1 per 1,000 and the SRS estimates are higher in three of the four remaining states.

### 8.3 Infant and Child Mortality

#### Definitions of Infant and Child Mortality

All respondents in the NFHS were asked to provide a complete birth history, including sex, date of birth, survival status, and age at the time of the survey or age at death for each live birth. For children who had died, age at death was recorded in days for children dying in the first month of life, in months for children dying before their second birthday, and in years for children dying at later ages. This information was used to calculate the following direct estimates of infant and child mortality<sup>1</sup>:

<b>Neonatal mortality:</b>	the probability of dying in the first month of life;
<b>Postneonatal mortality:</b>	the difference between infant and neonatal mortality;
<b>Infant mortality (<math>{}_1q_0</math>):</b>	the probability of dying before the first birthday;
<b>Child mortality (<math>{}_5q_1</math>):</b>	the probability of dying between the first and fifth birthday;
<b>Under-five mortality (<math>{}_5q_0</math>):</b>	the probability of dying before the fifth birthday.

#### Assessment of Data Quality

The reliability of mortality estimates calculated from retrospective birth histories depends upon the completeness with which deaths of children are reported and the extent to which birth dates and ages at deaths are accurately reported and recorded. Estimated rates of infant and child mortality are subject to both sampling and nonsampling errors. Sampling errors for various mortality estimates are provided in Appendix C. This section describes the results of various checks for nonsampling errors - in particular, underreporting of deaths in early childhood (which would result in an underestimate of mortality) and misreporting of the date of birth or age at death (which could distort the age pattern of under-five mortality). Both problems are likely to be more pronounced for children born long before the survey than for children born recently. Failure to report deaths will result in mortality figures that are too low. If underreporting is more severe for children born longer ago, the estimates will tend to

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<sup>1</sup> A detailed description of the method for calculating the probabilities presented here is given in Rutstein (1984). The mortality estimates are not rates, but are probabilities, calculated according to the conventional life table approach. For any calendar period, deaths and exposure in that period are first tabulated for the age intervals 0, 1-2, 3-5, 6-11, 12-23, 24-35, 36-47, and 48-59 months. Then age interval-specific probabilities of survival are calculated. Finally, probabilities of mortality for larger age segments are produced by multiplying the relevant age interval survival probabilities together and subtracting the product from 1.00:

$${}_nq_x = 1 - \prod_i (1 - q_i)$$

understate any decline in mortality that has occurred.

Underreporting of infant deaths, in particular, is usually most severe for deaths which occur very early in infancy. If deaths in the early neonatal period are selectively underreported, then there will be an abnormally low ratio of deaths under seven days to all neonatal deaths and an abnormally low ratio of neonatal to infant mortality. Changes in these ratios over time can be examined to test the hypothesis that underreporting of early infant deaths is more common for births that occurred longer before the survey. Results from Table D.5 (see Appendix D) suggest that early infant deaths have *not* been severely underreported in India as a whole in the NFHS, since the ratios of deaths under seven days to all neonatal deaths are quite high (a ratio of less than 25 percent is often used as a guideline to indicate underreporting of early neonatal deaths). The ratios decline slightly over time, from 70 in the five years preceding the survey to 66 in the period 10-14 years preceding the survey, indicating that some early infant deaths may not have been reported by older women. The ratios of infant deaths that occurred during the neonatal period (see Appendix Table D.6) are also quite high, and again they increase slightly over time.

One problem that is inherent in most retrospective surveys is heaping of ages at death on certain digits, e.g., 6, 12 and 18 months. Misreporting of the age at death will bias estimates of the age pattern of mortality if the net result of misreporting is the transference of deaths between age segments for which the rates are calculated; for example, an overestimate of child mortality relative to infant mortality may result if children dying during the first year of life are reported as having died at age one or older. Thus, heaping at 12 months can bias the mortality estimates because a certain fraction of these deaths, which are reported to have occurred after infancy (i.e., at ages 12-23 months), may have actually occurred during infancy (i.e., at ages 0-11 months). In this case, heaping would bias the infant mortality rate ( ${}_1q_0$ ) downward and child mortality ( ${}_4q_1$ ) upward.

In the NFHS, there was some misreporting of age at death due to a preference for reporting age at death at 3, 6, 8, 10, 12, 15, 20 and 25 days (see Table D.5 in Appendix D). Examination of the distribution of deaths under age two years during the 15 years prior to the survey by month of death (Table D.6 in Appendix D) indicates that the calculated infant mortality rates for India as a whole are not likely to be understated by more than 1-2 percent because of age heaping. There was some heaping on 12 months of death, but due to strong emphasis during interviewer training<sup>2</sup>, there were few deaths reported to have occurred at age one year. This brief check on internal consistency of the NFHS childhood mortality data for all India suggests that although there is some evidence of heaping in age at death at certain ages, the bias in infant and child mortality rates arising from this heaping is negligible.

However, an examination of the distribution of births and deaths since 1982 (Table D.4 in Appendix D) suggests that there may be some underreporting of deaths in the most recent five-year period. The proportion of deaths to births decreases from 13 percent in 1982-87 to 9 percent since 1987. Some of this decrease undoubtedly reflects a real reduction in mortality

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<sup>2</sup> Interviewers in the NFHS were instructed to probe for the exact number of months lived by the child if the age at death was reported as "1 year".

during that period and some reflects the fact that younger children have had less exposure to the risk of mortality. However, the sharp disjuncture in the proportion of deaths between 1987 and 1988 may be due partly to underreporting of deaths relative to births during the most recent period.

It is seldom possible to establish, with confidence, mortality levels for a period more than 15 years before a survey. Even within the recent 15-year period considered here, apparent trends in mortality rates should be interpreted with caution for several reasons. First, there may be differences in the completeness of death reporting related to the length of time before the survey. Second, the accuracy of reports of age at death and of date of birth may deteriorate systematically with time. Third, sampling variability for mortality rates is relatively high especially for groups with relatively few births. The fourth reason relates to truncation of mortality rates further back in time, because women currently age 50 and over who were bearing children during these periods were not included in the survey. This truncation particularly affects mortality trends. For example, for the period 10-14 years before the survey, the rates do not include any births for women age 40-49 since these women were over age 50 at the time of the survey and not eligible to be interviewed. Since these excluded births to older women were likely to be at a somewhat greater risk of dying than births to younger women, the mortality levels for the period may be slightly underestimated. However, the estimates for later periods are less affected by the truncation bias since fewer older women are excluded. The extent of this bias depends on the proportion of births omitted, however, and Table 8.9 shows that among children born in the five years before the survey, only 5 percent were born to women over age 34 years. Given this small proportion of births excluded, selection bias for infant and child mortality statistics as far back as 15 years before the survey should be negligible.

### **Levels and Trends in Infant and Child Mortality**

Table 8.5 and Figure 8.1 show various measures of infant and child mortality by residence group for the three quinquennial periods preceding the survey. Infant mortality rates in India declined by 22 percent during the 15 years prior to the NFHS. The infant mortality rate for the total population declined from 101 per 1,000 births 10-14 years prior to the survey (approximately 1978-82) to 79 per 1,000 births 0-4 years prior (approximately 1988-92), an average rate of decline of 2 infant deaths per 1,000 live births per year. There was a steady decline in all of the mortality measures over the three 5-year periods preceding the survey. The percentage decline in mortality was not the same for all five measures of mortality. The largest proportionate decline is observed for child mortality (31 percent) and the smallest for neonatal mortality (18 percent). Postneonatal mortality fell by 27 percent and under-five mortality by 24 percent. Most of the decline in child mortality occurred between the periods 10-14 years and 5-9 years preceding the survey, but for neonatal and postneonatal mortality, the rate of decline accelerated between the two most recent periods.

In all instances, urban mortality rates are lower than rural mortality rates. In the five-year period preceding the survey, infant mortality was 52 percent higher in rural areas than in urban areas and child mortality was nearly twice as high in rural areas. Urban-rural differences in the rate of decline of mortality depend on the mortality measure examined. Postneonatal mortality and infant mortality declined by a larger percentage in rural areas than in urban areas,

**Table 8.5 Infant and child mortality**

Neonatal, postneonatal, infant, child and under-five mortality for five-year periods preceding the survey, by residence, India, 1992-93

Years prior to survey	Neonatal mortality (NN)	Postneonatal mortality <sup>1</sup> (PNN)	Infant mortality ( ${}_1q_0$ )	Child mortality ( ${}_4q_1$ )	Under-five mortality ( ${}_5q_0$ )
<b>URBAN</b>					
0-4 years	34.1	22.0	56.1	19.6	74.6
5-9 years	36.8	25.7	62.4	20.6	81.8
10-14 years	42.5	26.1	68.7	29.0	95.7
<b>RURAL</b>					
0-4 years	52.9	32.2	85.0	37.6	119.4
5-9 years	62.2	40.7	102.9	43.3	141.8
10-14 years	65.1	46.2	111.3	55.0	160.2
<b>TOTAL</b>					
0-4 years	48.6	29.9	78.5	33.4	109.3
5-9 years	56.4	37.2	93.6	37.7	127.8
10-14 years	59.5	41.2	100.7	48.2	144.0

<sup>1</sup>Computed as the difference between the infant and neonatal mortality rates

whereas neonatal mortality and child mortality fell by about the same percentage in the two areas. Overall, under-five mortality fell slightly faster in rural areas (25 percent) than in urban areas (22 percent).

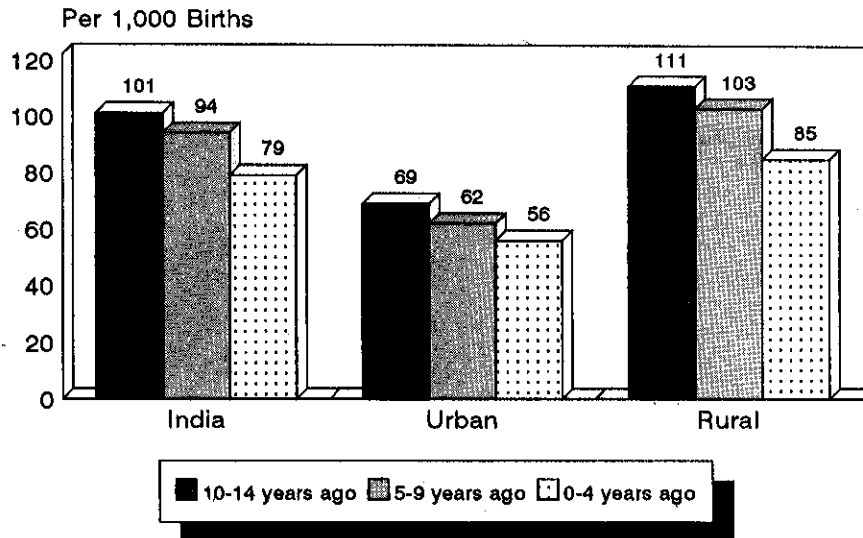
Despite the improvements in infant and child mortality, 1 in every 13 children still dies in the first year of life, and 1 in 9 dies before reaching age five. Clearly child survival programmes in India need to be intensified to produce further reductions in the level of infant and child mortality.

The estimated NFHS infant mortality rate of 79 in 1988-92 is virtually identical to the 1990 SRS value of 80 infant deaths per 1,000 live births, but slightly lower than the average SRS infant mortality rate of 85 for the period 1988-92 (Office of the Registrar General, 1993b, 1994). In rural areas, the NFHS estimate (85) is lower than the average SRS estimate of 92 for 1988-92, but in urban areas the NFHS rate of 56 is almost identical to the SRS rate of 55. For earlier periods also, the overall NFHS estimates of infant mortality are somewhat lower than the SRS estimates - 5 percent lower in 1983-87 (94 compared with 99) and 12 percent lower in 1978-82 (101 compared with 115).

### Socioeconomic Differentials in Infant and Child Mortality

Table 8.6 and Figure 8.2 show infant and child mortality statistics for the 10-year period preceding the survey, by selected background characteristics. As one would expect, infant mortality declines sharply with increasing education of mothers, from a high of 101 per 1,000 for illiterate mothers to a low of 37 for mothers with at least a high school education. The other mortality indicators vary by education in a similar fashion. Scheduled castes have higher levels

**Figure 8.1**  
**Infant Mortality Rates for Five-Year**  
**Periods by Residence**



Note: Rates are for 5-year periods preceding the survey

NFHS, India, 1992-93

of infant mortality than scheduled tribes, who in turn have higher levels than non-SC/ST women. Hindus have higher infant and child mortality than Muslims, and other religious groups (Christians, Sikhs, Jains and Buddhists) have substantially lower rates.

Antenatal or delivery care by a trained health professional is associated with greatly reduced infant and child mortality risks. Infant mortality rates range from 97 per 1,000 for births with neither antenatal or delivery care, to 64 per 1,000 for births with either type of care, and 44 per 1,000 for births with both types of care. One might expect the effect of antenatal and delivery care to be most pronounced for mortality risks immediately following birth (neonatal mortality), but this is not the case. The impact of antenatal and delivery care is considerably greater for child mortality (with a 76 percent reduction if both types of care are received, relative to neither type of care) than for neonatal mortality (48 percent reduction). It seems unlikely that the presence of antenatal or delivery care can explain fully its apparent impact. Utilization of antenatal and delivery care services is undoubtedly associated with other circumstances favourable to child survival, which might explain the apparently large effect of antenatal and delivery care on child mortality.

The impact of antenatal and delivery care on survival during the first month of life is nonetheless very large. Children of mothers who received no such care have a neonatal mortality rate that is almost twice that experienced by children whose mothers received both antenatal and delivery care, 58 compared with 30 per 1,000 live births. The differential is all the more impressive because women who have pregnancy-related complications (whose babies

**Table 8.6 Infant and child mortality by background characteristics**

Neonatal, postneonatal, infant, child and under-five mortality by selected background characteristics for the 10-year period preceding the survey, India, 1992-93

Background characteristic	Neonatal mortality (NN)	Postneonatal mortality <sup>1</sup> (PNN)	Infant mortality (Iq)	Child mortality (Cq)	Under-five mortality (Uq)
<b>URBAN</b>					
<b>Mother's education</b>					
Illiterate	46.2	34.4	80.6	31.0	109.1
Literate, < middle complete	29.0	20.6	49.7	18.7	67.4
Middle school complete	33.6	19.7	53.4	8.8	61.7
High school and above	22.3	8.8	31.1	5.2	36.2
<b>Religion</b>					
Hindu	38.6	25.4	64.0	20.6	83.2
Muslim	28.4	22.9	51.3	19.9	70.2
Christian	28.3	9.4	37.8	10.3	47.7
Sikh	14.1	22.0	36.0	6.0	41.8
Jain	(25.9)	(4.0)	(29.8)	(6.4)	(36.1)
Buddhist	(36.1)	(12.3)	(48.4)	*	(94.2)
<b>Caste/tribe</b>					
Scheduled caste	45.0	35.7	80.6	33.2	111.2
Scheduled tribe	43.9	11.7	55.5	25.2	79.3
Other	34.1	23.0	57.1	18.4	74.4
<b>Medical maternity care<sup>2</sup></b>					
No antenatal or delivery care	55.9	35.1	90.9	57.9	143.6
Either antenatal or delivery care	27.5	22.3	49.8	9.7	59.0
Both antenatal and delivery care	25.8	13.1	38.8	8.3	46.8
<b>Place of delivery<sup>3</sup></b>					
Public health facility	31.3	16.6	47.9	13.6	60.9
Private health facility	21.7	8.4	30.1	1.5	31.5
Home	34.1	27.1	61.2	30.9	90.2
<b>Total</b>	<b>35.5</b>	<b>23.9</b>	<b>59.4</b>	<b>20.1</b>	<b>78.3</b>
<b>RURAL</b>					
<b>Mother's education</b>					
Illiterate	63.1	40.9	104.0	46.7	145.9
Literate, < middle complete	43.0	25.0	68.0	24.8	91.1
Middle school complete	40.5	17.6	58.1	9.5	67.0
High school and above	30.4	17.2	47.6	8.0	55.2
<b>Religion</b>					
Hindu	59.1	38.0	97.1	41.3	134.4
Muslim	56.6	33.0	89.6	38.8	124.9
Christian	34.3	20.5	54.8	23.1	76.6
Sikh	31.9	18.7	50.6	22.7	72.2
Buddhist	(37.1)	(26.7)	(63.8)	(42.8)	(103.8)
Other	58.4	34.5	92.9	53.7	141.6
<b>Caste/tribe</b>					
Scheduled caste	66.9	46.0	112.9	50.0	157.2
Scheduled tribe	55.6	38.1	93.7	51.5	140.5
Other	56.3	34.5	90.8	36.9	124.4
<b>Medical maternity care<sup>2</sup></b>					
No antenatal or delivery care	57.7	39.7	97.4	54.0	146.1
Either antenatal or delivery care	44.4	22.6	67.0	26.2	91.4
Both antenatal and delivery care	33.9	15.9	49.8	18.8	67.7
<b>Place of delivery<sup>3</sup></b>					
Public health facility	48.4	20.7	69.1	25.2	92.5
Private health facility	35.3	14.6	49.8	7.4	56.8
Home	48.4	31.5	79.9	41.3	117.9
<b>Total</b>	<b>57.7</b>	<b>36.6</b>	<b>94.3</b>	<b>40.4</b>	<b>130.9</b>

**Table 8.6 Infant and child mortality by background characteristics (Contd.)**

Neonatal, postneonatal, infant, child and under-five mortality by selected background characteristics for the 10-year period preceding the survey, India, 1992-93

Background characteristic	Neonatal mortality (NN)	Postneonatal mortality <sup>1</sup> (PNN)	Infant mortality (I <sub>0</sub> )	Child mortality (C <sub>0</sub> )	Under-five mortality (U <sub>0</sub> )
<b>TOTAL</b>					
<b>Mother's education</b>					
Illiterate	60.6	40.0	100.6	44.3	140.5
Literate, < middle complete	38.8	23.7	62.5	22.8	83.9
Middle school complete	37.6	18.5	56.1	9.2	64.8
High school and above	25.3	11.9	37.2	6.2	43.2
<b>Religion</b>					
Hindu	55.0	35.4	90.4	36.9	124.0
Muslim	47.1	29.6	76.6	32.2	106.3
Christian	32.6	17.3	49.9	19.4	68.4
Sikh	27.7	19.5	47.2	18.5	64.8
Jain	(20.7)	(2.8)	(23.5)	(13.8)	(37.0)
Buddhist	36.6	19.8	56.4	45.4	99.3
Other	57.3	28.6	85.9	46.4	128.3
<b>Caste/tribe</b>					
Scheduled caste	63.1	44.2	107.3	46.9	149.1
Scheduled tribe	54.6	35.9	90.5	49.1	135.2
Other	50.6	31.6	82.2	32.0	111.5
<b>Medical maternity care<sup>2</sup></b>					
No antenatal or delivery care	57.5	39.3	96.8	54.3	145.8
Either antenatal or delivery care	41.2	22.5	63.7	22.9	85.1
Both antenatal and delivery care	29.8	14.5	44.2	13.2	56.8
<b>Place of delivery<sup>3</sup></b>					
Public health facility	40.3	18.7	59.1	19.3	77.2
Private health facility	27.5	11.0	38.5	3.9	42.3
Home	46.5	30.9	77.5	39.9	114.3
<b>Total</b>	<b>52.7</b>	<b>33.7</b>	<b>86.3</b>	<b>35.5</b>	<b>118.8</b>

Note: Total includes the mortality experience of "other" religious groups in urban areas and Jains in rural areas, which is not shown separately.

( ) Based on 250-499 unweighted children surviving to the beginning of the age interval

\* Rate not shown; based on fewer than 250 unweighted children surviving to the beginning of the age interval

<sup>1</sup>Computed as the difference between the infant and neonatal mortality rates

<sup>2</sup>Rates for the four-year period preceding the survey. Medical care is that given by a doctor, nurse, trained midwife, or other health professional in a hospital, clinic, or health centre or care received at home from a health worker.

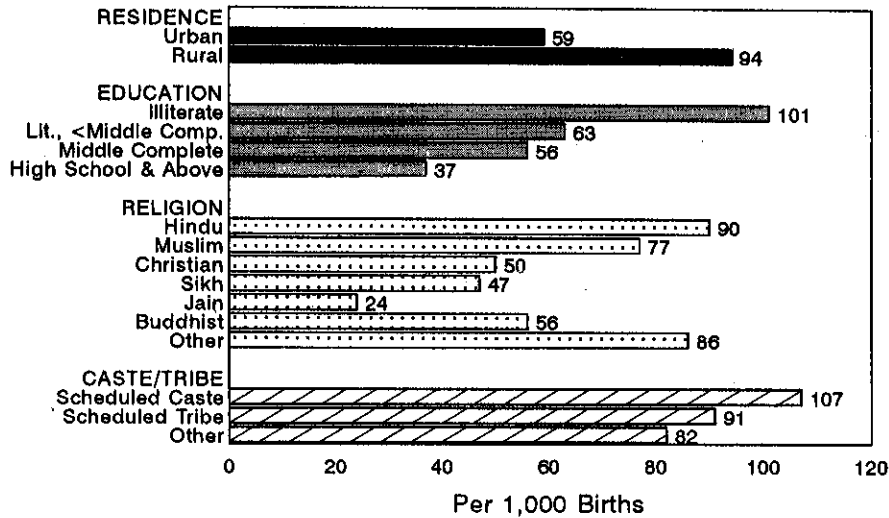
<sup>3</sup>Rates for the four-year period preceding the survey

have a relatively high risk of dying) are usually more likely to seek antenatal and delivery care in the first place (see Table 9.9 in Chapter 9).

Table 8.6 also shows that the place of delivery is associated with substantial differences in infant and child mortality. Births delivered at home have the highest infant and child mortality rates, followed by births delivered in public facilities. Births delivered in private facilities have considerably lower mortality rates. Again, these differences undoubtedly reflect socioeconomic differences as well as the direct effects of place of delivery. For example, those who give birth in private facilities tend to come from higher socioeconomic groups.



**Figure 8.2**  
**Infant Mortality Rates by Selected**  
**Background Characteristics**



Note: Based on births in the 10 years preceding the survey

NFHS, India, 1992-93

The pattern of socioeconomic differentials in infant and child mortality just described typifies both urban and rural areas as well as the whole country. However, absolute levels of infant and child mortality are considerably lower in urban areas than in rural areas.

### Demographic Differentials in Infant and Child Mortality

This section examines differentials in infant and child mortality by demographic characteristics of both the child and the mother. Table 8.7 and Figure 8.3 present mortality rates for the 10 years preceding the survey by sex of the child, age of the mother at the time of the child's birth, birth order, length of the previous birth interval and size of the child at birth.

The data on death rates in Table 8.3 indicated that the female death rate for the age group 0-4 exceeds the male rate by 3 percent. Table 8.7 suggests that, within this age group, excess female mortality occurs only after the neonatal period. During the neonatal period, males have a higher risk of dying than females (57 compared with 48 deaths per 1,000 births). Higher neonatal mortality among boys than girls is found in most populations and reflects greater underlying male frailty. Postneonatal mortality, however, is 13 percent higher for females than for males, and child mortality (ages 1-4) is 43 percent higher for females than for males. This reversal of sex differentials in mortality after the age of weaning has been observed in other studies conducted in South Asia and is thought to reflect the relative nutritional and medical neglect of girls after breastfeeding has ceased. In fact, child mortality is somewhat higher for females than males in most less developed countries, but the differentials are much larger in

**Table 8.7 Infant and child mortality by demographic characteristics**

Neonatal, postneonatal, infant, child and under-five mortality by selected demographic characteristics for the 10-year period preceding the survey, India, 1992-93

Demographic characteristic	Neonatal mortality (NN)	Postneonatal mortality <sup>1</sup> (PNN)	Infant mortality ( <sub>1</sub> q <sub>0</sub> )	Child mortality ( <sub>4</sub> q <sub>1</sub> )	Under-five mortality ( <sub>5</sub> q <sub>0</sub> )
<b>URBAN</b>					
<b>Sex of child</b>					
Male	39.7	23.4	63.1	15.3	77.5
Female	31.1	24.4	55.5	25.2	79.3
<b>Mother's age at birth</b>					
< 20	48.1	31.0	79.1	23.3	100.5
20-29	31.4	20.7	52.1	19.6	70.7
30-39	36.4	27.6	64.0	17.3	80.2
<b>Birth order</b>					
1	40.9	19.5	60.3	12.7	72.2
2	31.0	23.5	54.4	19.2	72.6
3	29.1	21.9	51.0	19.6	69.5
4	36.9	25.2	62.2	27.1	87.6
5	33.6	35.5	69.1	29.4	96.5
6	36.6	35.0	71.6	27.5	97.2
7+	49.5	32.6	82.1	33.5	112.9
<b>Previous birth interval</b>					
< 24	45.5	40.4	86.0	30.7	114.0
24-47	27.4	20.8	48.2	21.3	68.5
48+	23.0	11.3	34.2	12.5	46.3
<b>Birth size<sup>2</sup></b>					
Large	26.9	15.8	42.7	13.9	56.0
Average	19.5	15.9	35.5	18.1	52.9
Small	61.5	30.6	92.1	18.7	109.1
<b>Total</b>	<b>35.5</b>	<b>23.9</b>	<b>59.4</b>	<b>20.1</b>	<b>78.3</b>
<b>RURAL</b>					
<b>Sex of child</b>					
Male	62.1	34.1	96.2	33.9	126.8
Female	53.1	39.2	92.2	47.3	135.1
<b>Mother's age at birth</b>					
< 20	76.0	37.8	113.8	41.2	150.3
20-29	49.3	34.5	83.8	40.0	120.4
30-39	58.4	40.1	98.5	39.2	133.8
40-49	53.5	63.9	117.4	62.5	172.5
<b>Birth order</b>					
1	71.3	33.2	104.5	31.0	132.3
2	52.3	31.9	84.2	36.7	117.8
3	46.5	32.1	78.7	42.7	118.0
4	49.5	38.9	88.5	42.8	127.5
5	53.0	43.0	96.0	49.7	140.9
6	58.6	44.2	102.8	42.4	140.9
7+	73.4	53.9	127.3	58.7	178.6
<b>Previous birth interval</b>					
< 24	84.8	57.4	142.2	62.7	196.0
24-47	41.3	31.4	72.7	39.1	109.0
48+	27.2	17.3	44.5	16.9	60.7
<b>Birth size<sup>2</sup></b>					
Large	40.0	19.1	59.1	37.8	94.7
Average	32.2	25.5	57.8	35.7	91.4
Small	94.5	48.5	143.0	44.3	181.0
<b>Total</b>	<b>57.7</b>	<b>36.6</b>	<b>94.3</b>	<b>40.4</b>	<b>130.9</b>

**Table 8.7 Infant and child mortality by demographic characteristics (Contd.)**

Neonatal, postneonatal, infant, child and under-five mortality by selected demographic characteristics for the 10-year period preceding the survey, India, 1992-93

Demographic characteristic	Neonatal mortality (NN)	Postneonatal mortality <sup>1</sup> (PNN)	Infant mortality (I <sub>10</sub> )	Child mortality (C <sub>49</sub> )	Under-five mortality (U <sub>5</sub> )
<b>TOTAL</b>					
<b>Sex of child</b>					
Male	57.0	31.7	88.6	29.4	115.4
Female	48.1	35.8	83.9	42.0	122.4
<b>Mother's age at birth</b>					
< 20	70.8	36.5	107.3	37.6	140.9
20-29	44.8	31.0	75.8	34.6	107.8
30-39	53.7	37.4	91.1	34.3	122.3
40-49	51.0	60.8	111.8	57.5	162.9
<b>Birth order</b>					
1	63.4	29.6	93.0	26.0	116.6
2	46.9	29.7	76.6	32.0	106.2
3	42.6	29.8	72.4	37.1	106.7
4	46.9	36.1	83.0	39.4	119.1
5	49.4	41.6	90.9	45.7	132.5
6	55.0	42.7	97.7	39.8	133.6
7+	69.8	50.5	120.3	54.3	168.1
<b>Previous birth interval</b>					
< 24	76.0	53.6	129.6	55.0	177.5
24-47	38.4	29.2	67.6	35.2	100.5
48+	26.2	15.9	42.1	15.8	57.2
<b>Birth size<sup>2</sup></b>					
Large	36.8	18.2	55.0	31.7	84.9
Average	29.3	23.3	52.7	31.7	82.7
Small	87.4	44.6	132.1	38.8	165.7
<b>Total</b>	<b>52.7</b>	<b>33.7</b>	<b>86.3</b>	<b>35.5</b>	<b>118.8</b>

Note: Total includes the mortality experience of children whose size at birth is unknown and urban children whose mothers were age 40-49 at the time of birth, which is not shown separately.

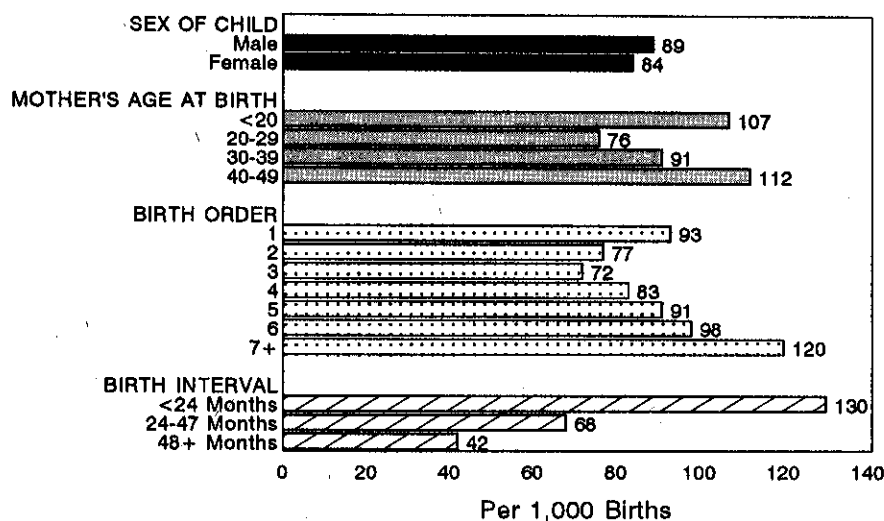
<sup>1</sup>Computed as the difference between the infant and neonatal mortality rates

<sup>2</sup>Rates for the four-year period preceding the survey

India than elsewhere (United Nations Secretariat, 1988; Arnold, 1992). In fact, the maximum extent to which female child mortality exceeded male child mortality in any of the 28 Demographic and Health Surveys examined in a recent study was 23 percent (Sullivan et al., 1994).

For both social and biological reasons, infant and child mortality often exhibit a U-shaped pattern with respect to mother's age at childbirth, with children of both very young and very old mothers at higher risk of dying than children whose mothers are in the prime reproductive ages. This pattern is also seen in India. As Table 8.7 shows, infant mortality is higher for children of mothers under age 20 (107 per 1,000) or age 40-49 (112 per 1,000) and is lowest for children of mothers age 20-29 (76 per 1,000). A similar age pattern is also observed for the other infant and child mortality rates. It should be noted that infants born to young mothers are more likely to be of low birth weight, which is probably an important factor contributing to their higher neonatal mortality rate. Similarly, children born to mothers above age 30 are at higher risk of

**Figure 8.3**  
**Infant Mortality Rates by Selected**  
**Demographic Characteristics**



Note: Based on births in the 10 years preceding the survey

NFHS, India, 1992-93

experiencing congenital malformations.

Birth order also has a U-shaped relationship to infant deaths. Neonatal mortality rates are relatively high for first births and high order births. However, postneonatal mortality and child mortality (ages 1-4) do not show a U-shaped pattern; for these measures, mortality tends to increase with birth order. The steady increase in child mortality with birth order may reflect the more intense competition for nutritious food faced by higher birth order children once they are weaned. It is also likely that higher birth order children are disproportionately from lower socioeconomic groups, in which mortality is higher.

Childspacing patterns have a powerful effect on the survival chances of children in India. Infant and child mortality risks increase sharply as the length of the preceding birth interval decreases. Infant mortality is more than three times as high for children with a preceding birth interval of less than 24 months as for children with a preceding interval of 48 months or more (130 compared with 42 per 1,000). Lengthening the birth interval from less than 24 months to 24-47 months has a much stronger association with child survival than does lengthening the interval from 24-47 months to 48 months or more. Note, however, that although the length of the preceding birth interval is likely to affect mortality risks directly, a substantial portion of the total association between birth intervals and mortality risks may reflect other risk factors that are correlated with birth intervals. For example, shorter intervals are likely to occur in larger families, and larger families tend to come from lower socioeconomic groups and also are more likely to reside in rural areas where medical facilities and other survival-enhancing resources are

less readily available. Nevertheless, multivariate analyses of birth intervals and child survival that control for socioeconomic background commonly find short intervals (less than 24 months) to be damaging to a child's survival chances.

Another important determinant of the survival chances of children is the baby's weight at the time of birth. Many studies have found that low birth weight babies (under 2,500 grams) have a substantially increased risk of mortality. Because most babies in India are not weighed at the time of birth, mothers were asked whether babies born during the four years preceding the interview were "large, average, or small" at birth. The last panel of Table 8.7 shows infant and child mortality statistics for births classified in this way. Children who are perceived by their mothers to be smaller than average at birth experience much higher mortality risks than children perceived to be average or larger. Once again, the pattern of demographic differentials in infant and child mortality just described typifies urban and rural areas as well as the whole country.

Infant mortality rates vary dramatically from one state to another, ranging from 15 in Mizoram to 112 in Orissa (Table 8.8 and Figure 8.4). Orissa also recorded the highest infant mortality rate in the SRS in every year between 1988 and 1992. Other large states with infant mortality rates above the national average are Uttar Pradesh (100), Bihar and Assam (89 each), and Madhya Pradesh (85). These same states have the highest under-five mortality rates in India. The infant mortality rates seem implausibly low in Nagaland and Mizoram (17 and 15, respectively), but the NFHS rate for Nagaland is consistent with the SRS estimate of 18 for 1989-91 (the SRS did not report an infant mortality rate for Mizoram for those years). All of the mortality rates are also relatively low in Kerala and Goa, the two states with the lowest levels of fertility.

#### **8.4 High-Risk Fertility Behaviour**

In theory, the mother's age at the time of birth, the interval between births, and the order of a birth (all factors with a high risk of mortality for the children) can be controlled by the parents if they want to increase the probability of survival of their children. Understanding the prevalence of high-risk births in India is, therefore, of interest for health and family planning policymakers and programme managers. Table 8.9 shows the percentages of births in the five years preceding the interview that fall into different child survival risk categories, as well as the distribution of all currently married women across these categories. It also shows the relative risks of children dying across the different risk categories. The purpose of this table is to identify areas in which changed reproductive behaviour would be likely to effect a reduction in infant and child mortality. Mortality risks are represented here by the proportion of children born during the five years prior to the survey who had died by the time of the survey. The "risk ratio" is the ratio of the proportion of deceased children in a given high-risk category to the proportion of deceased children not in any high-risk category.

The numbers in Table 8.9 may be considered either from the point of view of a prospective parent or from the point of view of the health and family planning policymaker. For the prospective parent, the critical issue is the magnitude of each relative risk, since parents will presumably want to avoid having births under circumstances that are more likely to result in the child's death. For policymakers, not only is the magnitude of each risk important; so, too, is

**Table 8.8 Infant and child mortality by state**

Neonatal, postneonatal, infant, child and under-five mortality by state for the 5-year period preceding the survey, India, 1992-93

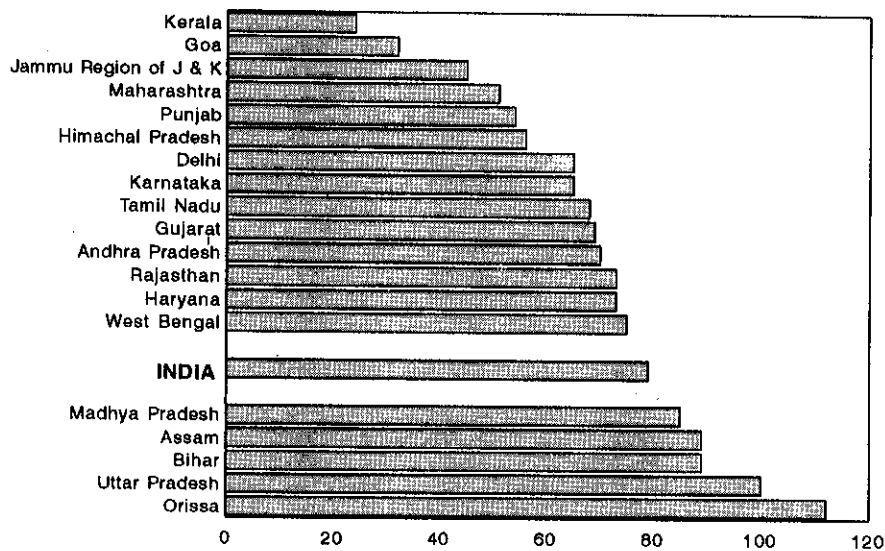
State	Neonatal mortality (NN)	Postneonatal mortality <sup>1</sup> (PNN)	Infant mortality (I <sub>q</sub> )	Child mortality (C <sub>q</sub> )	Under-five mortality (U <sub>q</sub> )
<b>India</b>	48.6	29.9	78.5	33.4	109.3
<b>North</b>					
Delhi	34.9	30.5	65.4	19.0	83.1
Haryana	38.4	34.9	73.3	27.4	98.7
Himachal Pradesh	34.2	21.7	55.8	14.1	69.1
Jammu Region of J & K	31.9	13.5	45.4	14.3	59.1
Punjab	31.2	22.5	53.7	15.0	68.0
Rajasthan	37.2	35.4	72.6	32.3	102.6
<b>Central</b>					
Madhya Pradesh	53.2	32.0	85.2	49.3	130.3
Uttar Pradesh	59.9	40.0	99.9	46.0	141.3
<b>East</b>					
Bihar	54.8	34.4	89.2	42.0	127.5
Orissa	64.7	47.4	112.1	21.3	131.0
West Bengal	51.8	23.5	75.3	26.0	99.3
<b>Northeast</b>					
Arunachal Pradesh	17.5	22.5	40.0	33.3	72.0
Assam	50.9	37.8	88.7	58.7	142.2
Manipur	25.1	17.3	42.4	20.2	61.7
Meghalaya	37.8	26.3	64.2	24.3	86.9
Mizoram	8.3	6.3	14.6	14.9	29.3
Nagaland	10.0	7.2	17.2	3.6	20.7
Tripura	43.6	32.3	75.8	31.2	104.6
<b>West</b>					
Goa	20.6	11.3	31.9	7.2	38.9
Gujarat	42.3	26.4	68.7	37.9	104.0
Maharashtra	36.4	14.0	50.5	20.9	70.3
<b>South</b>					
Andhra Pradesh	45.3	25.0	70.4	22.4	91.2
Karnataka	45.3	20.2	65.4	23.5	87.3
Kerala	15.5	8.2	23.8	8.4	32.0
Tamil Nadu	46.2	21.5	67.7	20.1	86.5

<sup>1</sup>Computed as the difference between the infant and neonatal mortality rates

the percentage of births or women in each of the high-risk categories. The latter is important because it determines whether particular types of high-risk births are likely to occur frequently or only rarely; presumably, policymakers will want to target their efforts toward the types of high-risk births that occur most frequently.

In terms of the magnitudes of the risks associated with each risk factor, Table 8.9 suggests that the most vulnerable births are high order births that occur to older women within 24 months of a previous birth (risk ratio of 3.16). However, less than 1 percent of all births occur to women in this group. Although the risk ratio is smaller for women under 18 years of age, 9 percent of all births occur to women with this single risk factor. In the aggregate, therefore, infant mortality rates would undoubtedly decline if early childbearing could be

Figure 8.4  
Infant Mortality Rates by State



\* Note: Rates are for the 5-year period preceding the survey; excludes 6 small northeastern states

NFHS, India, 1992-93

curtailed. In addition, individual couples would be well advised to avoid having children until the wife reaches age 18, as the risks of a child dying if the mother is younger are relatively high. Short birth intervals should also be discouraged (based on a consideration of both the risk ratios and the percentage of births in each category).

Although mortality risks to children can be reduced by changing women's childbearing behaviour, the risk ratios shown in Table 8.9 almost certainly overstate the magnitude of the potential effect. This is because a mother's demographic characteristics are not the only causal factors influencing the risks of mortality experienced by her children. Women who have many children at short birth intervals almost certainly tend, for example, to live in rural areas, which will raise mortality risks to their children independently of their childbearing behaviour. However, a multivariate analysis designed to assess the effects of the demographic factors, while controlling for the potentially confounding effects of residence, education, and other correlated socioeconomic factors, is beyond the scope of this report.

Table 8.10 shows how high-risk fertility behaviour varies by state. For India as a whole, 52 percent of children born during the last five years are in at least one elevated risk category. The percentage tends to be higher in high-fertility states, such as Uttar Pradesh (59 percent) and Bihar (58 percent). The low-fertility state of Kerala has the lowest percentage in any risk category (27 percent). The percentage of children born to mothers less than 18 years of age (10

**Table 8.9 High-risk fertility behaviour**

Percentage of children born in the last five years at elevated risk of mortality and percentage of currently married women at risk of conceiving a child with an elevated risk of mortality, according to category of increased risk and residence, India, 1992-93

High-risk category	Births in last 5 years		Percentage of currently married women <sup>a</sup>
	Percent of births	Risk ratio	
<b>URBAN</b>			
<b>Not in any high-risk category</b>	55.8	1.00	56.1 <sup>b</sup>
<b>Single high-risk category</b>			
Age<18: Age under 18 years at birth	5.9	2.08	1.0
Age>34: Age over 34 years at birth	0.6	0.69	7.5
BI<24 : Birth interval under 24 months	12.2	1.48	8.7
BO>3 : Birth order higher than 3	15.0	1.17	7.7
Subtotal	33.8	1.43	25.0
<b>Multiple high-risk category</b>			
Age<18 & BI<24 <sup>a</sup>	0.8	2.86	0.3
Age>34 & BI<24	--	*	0.1
Age>34 & BO>3	2.9	1.37	13.4
Age>34 & BI<24 & BO>3	0.4	1.57	0.8
BI<24 & BO>3	6.3	2.54	4.4
Subtotal	10.4	2.20	19.0
<b>In any high-risk category</b>	44.2	1.61	43.9
Total percent	100.0	NA	100.0
Number	13872	NA	22075
<b>RURAL</b>			
<b>Not in any high-risk category</b>	45.3	1.00	49.5 <sup>b</sup>
<b>Single high-risk category</b>			
Age<18: Age under 18 years at birth	9.9	1.65	2.9
Age>34: Age over 34 years at birth	0.3	0.80	3.3
BI<24 : Birth interval under 24 months	9.6	1.74	8.6
BO>3 : Birth order higher than 3	20.5	1.07	10.6
Subtotal	40.3	1.37	25.3
<b>Multiple high-risk category</b>			
Age<18 & BI<24 <sup>a</sup>	1.4	2.57	0.7
Age>34 & BI<24	--	*	--
Age>34 & BO>3	4.5	1.40	15.6
Age>34 & BI<24 & BO>3	0.7	3.17	1.4
BI<24 & BO>3	7.7	2.17	7.5
Subtotal	14.4	2.02	25.2
<b>In any high-risk category</b>	54.7	1.54	50.5
Total percent	100.0	NA	100.0
Number	47239	NA	62603



**Table 8.9 High-risk fertility behaviour (Contd.)**

Percentage of children born in the last five years at elevated risk of mortality and percentage of currently married women at risk of conceiving a child with an elevated risk of mortality, according to category of increased risk and residence, India, 1992-93

High-risk category	Births in last 5 years		Percentage of currently married women <sup>a</sup>
	Percent of births	Risk ratio	
<b>TOTAL</b>			
<b>Not in any high-risk category</b>	47.7	1.00	51.2 <sup>b</sup>
<b>Single high-risk category</b>			
Age<18: Age under 18 years at birth	9.0	1.78	2.4
Age>34: Age over 34 years at birth	0.4	0.73	4.4
BI<24 : Birth interval under 24 months	10.2	1.68	8.6
BO>3 : Birth order higher than 3	19.2	1.12	9.9
Subtotal	38.9	1.42	25.2
<b>Multiple high-risk category</b>			
Age<18 & BI<24 <sup>c</sup>	1.3	2.72	0.6
Age>34 & BI<24	--	*	0.1
Age>34 & BO>3	4.1	1.45	15.0
Age>34 & BI<24 & BO>3	0.6	3.16	1.2
BI<24 & BO>3	7.4	2.28	6.7
Subtotal	13.5	2.11	23.5
<b>In any high-risk category</b>	52.3	1.59	48.8
Total percent	100.0	NA	100.0
Number	61111	NA	84678

Note: Risk ratio is the ratio of the proportion dead of births in a specific high-risk category to the proportion dead of births in the "not in any high-risk" category.

NA: Not applicable

\* Risk ratio not shown; denominator of the upper proportion in the risk ratio is fewer than 50 unweighted births.

-- Less than 0.05 percent

<sup>a</sup>Women are placed into the categories according to the status they would have at the birth of a child if they were to conceive at the current time: current age less than 17 years and 3 months or older than 34 years and 2 months, last birth occurred less than 15 months ago, or last birth was order 3 or higher.

<sup>b</sup>Includes sterilized women and women whose husbands are sterilized

<sup>c</sup>Also includes category age under 18 and birth order greater than 3

percent for India as a whole)<sup>3</sup> reflects patterns in the age at marriage. The proportion exceeds 15 percent in Maharashtra, Andhra Pradesh and Karnataka, which are states with relatively low median ages at first marriage. The percentage born to mothers older than 34 is 5 percent for India and is highest in Meghalaya (12 percent). The percentage born with a previous birth interval less than 24 months is 20 percent for India and the percentage with a birth order higher than three is 31 percent. Overall, there is substantial scope in all states for improving child survival by avoiding high-risk births.

<sup>3</sup> The percentage born to mothers less than 18 years of age is calculated by adding together the percentages in the two columns that include women in this age group. A similar procedure is used to calculate the percentage of women in the other risk groups.

Table 8.10 High-risk fertility behaviour by state

Percentage of children born in the last five years at elevated risk of mortality, according to category of increased risk and state, India, 1992-93

State	High-risk category											In any high-risk category	Total Percent
	Not in any high-risk category					Multiple high-risk category							
	Single high-risk category		Sub-total			Age<18 & BI<24*	Age>34 & BI<24 & BO>3	Age>34 & BI<24 & BO>3	Age>34 & BI<24 & BO>3	Age>34 & BI<24 & BO>3	Sub-total		
Age<18	Age>34	BI<24	BO>3	Sub-total	Age<18 & BI<24*	Age>34 & BI<24 & BO>3	Age>34 & BI<24 & BO>3	Age>34 & BI<24 & BO>3	Age>34 & BI<24 & BO>3	Sub-total			
India	9.0	0.4	10.2	19.2	38.9	1.3	--	4.1	0.6	7.4	13.5	52.3	100.0
<b>North</b>													
Delhi	3.2	0.4	13.3	14.9	31.8	0.6	--	2.5	0.5	7.4	11.0	42.9	100.0
Haryana	8.0	0.3	15.2	17.3	40.9	0.6	--	3.2	0.3	8.3	12.5	53.3	100.0
Himachal Pradesh	2.7	0.4	16.9	12.3	32.3	0.4	0.1	2.7	0.4	5.8	9.4	41.7	100.0
Jammu Region of J & K	3.3	0.4	14.0	16.6	34.4	0.3	--	3.6	0.3	5.5	9.7	44.2	100.0
Punjab	3.4	0.7	16.8	12.9	33.7	0.2	0.1	2.2	0.2	6.2	8.8	42.5	100.0
Rajasthan	8.1	0.5	9.1	21.4	39.0	1.0	--	4.5	0.8	6.9	13.2	52.2	100.0
<b>Central</b>													
Madhya Pradesh	10.6	0.2	8.8	20.7	40.4	0.9	--	4.0	0.6	8.0	13.5	53.9	100.0
Uttar Pradesh	6.0	0.3	9.7	23.6	39.6	0.7	--	7.4	1.2	9.9	19.2	58.7	100.0
<b>East</b>													
Bihar	8.6	0.4	9.0	25.2	43.1	1.1	--	5.6	0.6	7.9	15.2	58.3	100.0
Orissa	7.7	0.4	9.7	18.1	36.0	1.5	--	3.0	0.5	6.8	11.7	47.7	100.0
West Bengal	13.0	0.2	8.4	18.6	40.2	1.6	--	3.3	0.4	6.9	12.2	52.4	100.0
<b>Northeast</b>													
Arunachal Pradesh	7.4	1.1	10.9	21.1	40.5	1.0	--	5.5	2.4	7.7	16.6	57.1	100.0
Assam	11.7	0.3	8.2	24.1	44.3	2.4	--	4.5	1.0	11.9	19.8	64.0	100.0
Manipur	1.9	1.0	10.0	20.7	33.6	--	0.3	4.6	0.7	8.2	13.8	47.3	100.0
Meghalaya	5.3	0.2	12.9	16.9	35.3	0.9	0.1	8.3	3.0	9.3	21.6	56.9	100.0
Mizoram	3.1	0.5	18.1	14.4	36.2	--	0.2	4.2	0.7	5.7	10.8	47.0	100.0
Nagaland	4.1	0.8	13.0	17.4	35.3	0.3	0.3	5.0	2.2	8.2	15.9	51.2	100.0
Tripura	10.7	0.9	8.2	18.6	38.4	1.3	0.1	5.5	0.6	5.6	13.1	51.5	100.0
<b>West</b>													
Goa	2.3	3.4	11.2	10.3	27.2	0.4	0.1	2.7	0.8	2.2	6.3	33.4	100.0
Gujarat	4.6	0.1	12.9	15.8	33.4	0.6	--	2.7	0.4	6.2	10.0	43.4	100.0
Maharashtra	12.4	0.4	11.7	14.5	39.0	2.8	--	1.3	0.5	6.7	11.3	50.3	100.0
<b>South</b>													
Andhra Pradesh	17.0	0.3	8.5	15.9	41.7	2.5	--	1.9	0.1	4.7	9.2	50.9	100.0
Karnataka	13.1	0.6	10.3	17.2	41.1	2.1	0.1	1.9	0.4	7.2	11.7	52.9	100.0
Kerala	3.0	1.2	11.2	7.3	22.8	0.3	0.1	2.0	0.1	2.1	4.6	27.3	100.0
Tamil Nadu	7.6	0.6	12.9	10.3	31.4	0.9	0.2	2.1	0.2	2.9	6.3	37.7	100.0

BI: Birth interval, BO: Birth order

-- Less than 0.05 percent

\*Also includes category age under 18 and birth order greater than 3.

## 8.5 Maternal Mortality

It has been estimated by the World Health Organization that worldwide at least one-half million women die every year from causes related to pregnancy and childbirth and 99 percent of these deaths occur in developing countries (World Health Organization, 1991). Although reliable national estimates of maternal mortality are not available for most countries, South Asia is thought to have among the highest maternal mortality rates in the world. Most demographic surveys do not have samples which are large enough to produce reliable estimates of maternal mortality. The NFHS sample, however, is sufficiently large to estimate maternal mortality at the national level for the two-year period preceding the survey. The NFHS estimates are based on a series of questions in the Household Questionnaire about deaths occurring to usual residents of the household and visitors since January (or since *Pongal* or *Makar Sankranti*) of the second calendar year preceding the start of the survey in each state. In the case of deaths to women age 13-49, a series of follow-up questions was asked about whether the woman was pregnant when she died, whether the death occurred during childbirth, whether she died within two months after the end of a pregnancy or childbirth, and whether the death was due to a complication of the pregnancy or childbirth.

On the basis of this information, it is possible to calculate the *maternal mortality rate* (MMR), which is defined here as the number of maternal deaths per 100,000 live births. This measure is based on the annual number of female deaths to usual residents of the sample households that occurred during childbirth or within two months after the end of a pregnancy or childbirth. The average maternal mortality rate at the national level for the 2-year period preceding the NFHS is 437 deaths per 100,000 live births. The rural MMR (448) is 13 percent higher than the urban MMR (397). There is no way to assess the completeness and accuracy of these estimates, but it should be pointed out that direct survey estimates of this type often underenumerate maternal deaths. It should also be noted that despite the large size of the NFHS sample, sampling errors for the maternal mortality estimates are quite large. The 95 percent confidence interval for the maternal mortality rate ranges from 334 to 540 per 100,000 live births and the confidence intervals are even wider for the urban and rural estimates. Because of the large sampling errors, reliable maternal mortality rates can not be calculated for individual states or population subgroups.

The maternal mortality rate of 437 deaths per 100,000 live births implies that more than 100,000 women in India die every year from causes related to pregnancy and childbirth. This finding reinforces the urgency of insuring that all pregnant women receive adequate antenatal care during pregnancy and that deliveries take place under hygienic conditions with the assistance of a trained medical practitioner.