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The NFHS BULLETIN summarizes findings from the 1992–93 National Family Health Survey. The NFHS collected information from nearly 90,000 Indian women on a range of demographic and health topics. The survey was conducted under the auspices of the Indian Ministry of Health and Family Welfare to provide national and state-level estimates of fertility, infant and child mortality, family planning practice, maternal and child health, and the utilization of services available to mothers and children.

The International Institute for Population Sciences (IIPS), Mumbai, conducted the NFHS in cooperation with various consulting organizations and 18 population research centres throughout India and with the East-West Center in Honolulu, Hawaii, and Macro International in Calverton, Maryland. The U.S. Agency for International Development provided funding for the NFHS and for this publication.

Identifying Children with High Mortality Risk

Child survival has long been a major concern of India's Ministry of Health and Family Welfare. Specific programmes for enhancing maternal and child health have been in place since 1951, and infant and child mortality rates have declined considerably over the years. They are still comparatively high, however, by international standards.

Understanding how various socioeconomic and demographic factors affect infant and child mortality can help policymakers formulate family health programmes aimed at improving child survival. This issue of the *NFHS Bulletin* reports selected results from a comprehensive study of infant and child mortality based on NFHS data (Pandey et al. 1998). Because mortality and its causes vary considerably among children of different ages, the analysis distinguishes between neonatal (first month), postneonatal (1–11 months), infant (first year), and child (1–4 years) mortality. Because the factors that affect infant and child mortality tend to be correlated with each other, the results reported here use hazard regression analysis to estimate the effects of each individual variable while controlling for the effects of all other, potentially confounding, variables.

Mortality is declining

Among all children born in India during the 12 years before the NFHS, 88 out of 1,000 died before their first birthday, and 121 out of 1,000 died before reaching age five. Although still high, mortality levels declined over the period. Between 1981 and 1990, neonatal mortality fell by 18%, and postneonatal mortality fell by 31%, resulting in a drop in infant mortality (which combines neonatal and postneonatal mortality) of 24%. During the same period, child mortality fell by 34%. These mortality declines primarily reflect improvements in public health infrastructure and medical services.

There are large variations in infant and child mortality among India's regions and states. Among children born during the 12 years before the NFHS, infant mortality ranges from less than 40 per 1,000 in Kerala and Goa to 120 or more per 1,000 in Orissa and Uttar Pradesh. Child mortality ranges from less than 10 per 1,000 in Goa to more than 50 per 1,000 in Assam, Uttar Pradesh, and Madhya Pradesh. State-level mortality patterns are discussed in more detail in the recent NFHS Subject Report on infant and child mortality (Pandey et al. 1998).

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Socioeconomic factors affect mortality

The analysis estimates the effects of several socioeconomic variables on infant and child mortality. These are:

- Household head's religion and caste/tribe membership (Hindu and scheduled caste or scheduled tribe (SC/ST),¹ Hindu but not SC/ST, Muslim, other religion)
- Mother's literacy (literate, illiterate)
- Residence (urban, rural)
- Household economic status (a continuous variable based on a composite score for ownership of goods)
- Access to a flush or pit toilet (yes, no)
- Mother's exposure to mass media (does, does not listen to radio or watch television at least once a week)
- Type of cooking fuel used in household (wood or dung, other)

All of these variables have large unadjusted effects on infant and child mortality when considered singly, but their adjusted effects, estimated from hazard models that control for the other socioeconomic variables and some demographic variables, are much smaller.

Table 1 shows that household head's religion and caste/tribe membership, mother's literacy, household economic status, and access to a flush or pit toilet tend to have large and statistically significant effects on infant and child mortality. The adjusted effects of residence, mother's exposure to mass media, and type of cooking fuel used are small (not shown).

The effect of household head's religion and caste/tribe membership is complex. Adjusted neonatal mortality varies widely by religion but little by caste/tribe membership, whereas postneonatal and child

Table 1. Adjusted effects of selected socioeconomic and demographic characteristics on neonatal, postneonatal, infant, and child mortality for children born during the 12 years before the NFHS (deaths per 1,000 births)

Variables	Mortality			
	Neonatal	Postneonatal	Infant	Child
Religion and caste/tribe				
Hindu-non SC/ST [†]	55	35	90	35
Hindu-SC/ST	56	39*	95*	42*
Muslim	50*	30*	80*	33
Other	40*	25*	65*	32
Mother's literacy				
Illiterate [†]	58	40	98	42
Literate	45*	25*	70*	24*
Household economic level: ownership of goods score				
0	56*	39*	95*	47*
5	53*	34*	87*	34*
10	50*	29*	80*	24*
15	48*	25*	73*	18*
Access to flush or pit toilet				
No [†]	57	36	93	36
Yes	44*	31*	75*	34
Previous birth interval				
<24 months	79*	56*	135*	60*
≥24 months [†]	37	27	64	36
Death of an older sibling				
Yes	72*	44*	116*	51*
No [†]	39	30	68	39

Notes: Adjusted effects of religion and caste/tribe, mother's literacy, household economic level, and access to a flush or pit toilet are estimated from hazard models that include these variables plus child's year of birth, urban/rural residence, mother's exposure to mass media and age at childbirth, and use of a clean cooking fuel. Adjusted effects of previous birth interval and death of an older sibling are estimated from hazard models that also include these variables plus birth order. [†]Reference category in the underlying hazard regression. *Variable coefficient in the underlying hazard regression is statistically significant at the 5% level.

mortality also vary considerably by caste/tribe. Adjusted postneonatal and child mortality (but not neonatal mortality) are much higher in Hindu households whose head belongs to a scheduled caste or tribe than in other Hindu households.

The effect of mother's literacy increases with child's age. Among children born to illiterate mothers, neonatal mortality is 29% higher than among children whose mothers are literate, postneonatal mortality is 60% higher, and child mortality is 75% higher.

The effect of household economic status also increases with child's age. With a rise in the ownership-of-goods score from 0 to 15, neonatal mortality declines by 14%, postneonatal mortality by 36%, and child mortality by 62%. In contrast, the effect of access to a flush or pit toilet decreases with child's age.

Demographic variables have an even greater effect

Many Indian women have their children closely spaced. NFHS results indicate that

1. Scheduled castes (SC) and scheduled tribes (ST) are those castes and tribes identified by the Government of India as socially and economically disadvantaged and in need of protection from social injustice and exploitation.

about one-third of all second- and higher-order births are born within 24 months of a previous birth. These short birth intervals have by far the largest effect on infant and child mortality of all the predictor variables considered in this analysis.

Table 1 shows that neonatal and postneonatal mortality are more than twice as high among children born within 24 months of a previous birth as among other children. A previous birth interval of less than 24 months increases child mortality by about 67%. Because so many children in India are born less than 24 months after a previous birth, a programme intervention that increases birth intervals—such as the provision of temporary family planning methods—could reduce infant and child mortality substantially.

Children in families where an older sibling has already died have a heightened risk of mortality themselves. They may face adverse biological conditions that affected the older sibling or a family environment associated with high mortality risk. Infant mortality is 71% higher for children with an older sibling who died than for other children, and child mortality is 31% higher (Table 1).

Women in India begin and end childbearing at young ages. In the 12 years before the NFHS, 34 percent of first births were to mothers under age 18. Sixty percent of first-born children and 13% of all other children were born to mothers under age 20.

Mortality, particularly neonatal mortality, is highest among children of these very young mothers. Both infant and child mortality decrease as mother's age at childbirth increases up to the early 20s. The effect is particularly striking among first-born children (Figure 1). Because so many children are born to very young mothers in India, programmes that encourage women to delay childbearing until at least age 20 would substantially reduce infant and child mortality.

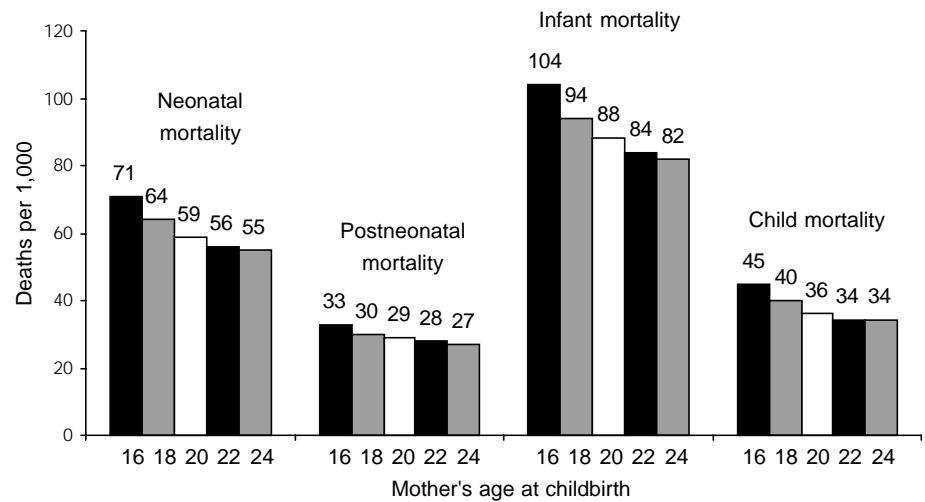


Figure 1. Adjusted neonatal, postneonatal, infant, and child mortality for first births during the 12 years before the NFHS, by mother's age at childbirth (deaths per 1,000)

Note: The hazard models underlying this figure include the following predictor variables: child's year of birth and sex; mother's age at childbirth, literacy status, and exposure to mass media; urban/rural residence; household head's religion and caste/tribe membership; and household's access to flush or pit toilet, use of a clean cooking fuel, and economic level as indicated by ownership-of-goods score.

During the first month of life, mortality risks are much higher for first- and second-born children than for children of higher birth orders (Figure 2). When the effects of other variables are controlled—such as socioeconomic factors and mother's age at childbirth—adjusted neonatal mortality decreases with increasing birth order.

By contrast, adjusted postneonatal mortality tends to increase with birth order. The combination of neonatal mortality and postneonatal mortality results in a U-shaped relationship between birth order and infant mortality, with elevated mortality for low- and high-order births. Adjusted child mortality increases steeply with birth order.

The results shown in Figure 2 suggest that when fertility declines child mortality will decline. This is because there will be fewer of the high-order births that face the greatest mortality risks during childhood. Neonatal mortality, and thus infant mortality, may decrease comparatively slowly because a larger proportion of all births will be high-risk first births.

Girls face high risks

Because of biological differences between the sexes, male mortality is generally higher than female mortality at all ages. In India, male mortality is 14% higher than female mortality during the neonatal period, as would be expected. As children grow older, however, mortality is increasingly determined by the care they receive rather than by biological factors alone. Most likely because parents in India take better care of sons than they do of daughters, postneonatal mortality is 19% higher for girls than for boys. Combining neonatal and postneonatal mortality, infant mortality shows little difference by sex. Child mortality is 40% higher for girls.

Sex differentials in infant and child mortality vary widely by state. Neonatal mortality is higher for boys than for girls in all states. Postneonatal mortality is higher for girls than for boys in all states except Orissa, West Bengal, Tamil Nadu, Kerala, and Goa. Child mortality is higher for girls in all states except Tamil Nadu, Kerala, and Goa. Girls tend to be most

disadvantaged in the northern states, especially Haryana, reflecting a particularly high level of son preference in that region (Mutharayappa et al. 1997).

Programme implications

This analysis has identified seven groups of children who are especially vulnerable to infant and child mortality:

- Children born less than 24 months after a previous birth
- Children in families where an older sibling has died
- Children born to mothers less than 20 years old
- Children of illiterate mothers
- Children in very poor households
- Children in households whose head is Hindu and belongs to a scheduled caste or scheduled tribe
- Children in households without access to a flush or pit toilet

Intervention programmes—such as efforts to provide supplemental nutrition and basic immunization to pregnant mothers, infants, and young children—should focus on these high-risk groups.

The results for many states also show elevated mortality rates for girls after the neonatal period. Family health programmes aimed at overall improvement in mortality levels should pay particular attention to providing basic health care and supplemental nutrition to girls.

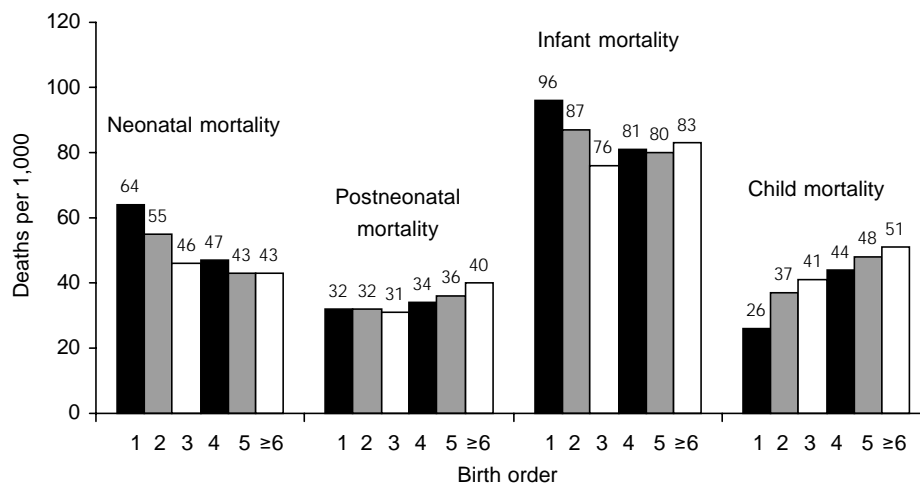


Figure 2. Adjusted neonatal, postneonatal, infant, and child mortality for all births during the 12 years before the NFHS, by birth order (deaths per 1,000)

Note: The hazard models that underlie this figure include all the predictor variables mentioned in the footnote to Figure 1 plus birth order, previous birth interval, and mortality of older siblings.

India's family planning programme can also make a major contribution to improving child survival. The provision of temporary contraceptive methods to help ensure that births are spaced at least 24 months apart would greatly improve the survival chances of children. In addition, family planning programmes aimed at reducing the number of births to very young mothers would substantially reduce infant and child mortality.

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