

Reducing Child Mortality in India

Keeping up the Pace

Mariam Claeson, Eduard Bos and Indra Pathmanathan

November 1999



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Foreword

The reduction in child mortality globally has been a development success story, as rates have been halved over the last few decades. Progress has, however, been very uneven and some countries have experienced increases in mortality rates in recent years. Better access to basic health services, such as immunization, oral rehydration therapy and antibiotics for pneumonia, improved living standards, and smaller families, have been important factors in improving child survival.

This study was undertaken in response to a question raised by state level health managers in India: *why are the declines in child mortality slowing down?* Infant and child mortality rates in India have barely changed in the past few years, making it unlikely that India will achieve its child survival goals by the year 2000.

This study documents the stagnation in child mortality rates, showing the increasing departure of current rates from longer-term trends. It reviews some of major causes of child mortality and addresses factors responsible for the high number of child deaths. Most importantly, the paper proposes that different strategic approaches may be needed in different states of India depending on mortality levels and the rate of progress made. It also suggests health policy options for reducing barriers to child survival.

Improving child survival remains a major development task in India. The slowing down in India's child mortality reduction rates calls for new approaches to child mortality that goes beyond disease-, program-, and sector-specific approaches. We hope that this paper will provide some answers to the questions raised by health policymakers and implementers, and provide useful input in the current health policy debates, leading to enhanced actions that will result in a resumption, and hopefully an acceleration, of declines in child mortality.

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Key Terms and Acronyms

Child mortality: the probability of dying between the first and fifth birthday
Infant mortality: the probability of dying before the first birthday
Neonatal mortality: the probability of dying in the first month of life
Perinatal mortality: the probability of dying between 28 weeks of gestation and the first week of life
Post-neonatal mortality: the difference between infant and neonatal mortality
Under-five mortality: the probability of dying before the fifth birthday

ADB	Asian Development Bank
ANM	Assistant nurse midwife
ARI	Acute respiratory infection
CDC	Centers for Disease Control and Prevention
CDD	Control of diarrheal diseases
CI	Confidence interval
CMR	Child mortality rate
CSSM	Child Survival Safe Motherhood (program)
DHS	Demographic and health survey
DPT3	Diphtheria, pertussis and tetanus three doses
EPI	Expanded Program of Immunization
GOI	Government of India
ICDS	Integrated Child Development Scheme
ICMR	Indian Council of Medical Research
IMCI	Integrated Management of Childhood Illness
IMR	Infant mortality rate
LBW	Low birth weight
MOHFW	Ministry of Health and Family Welfare
MICS	Multi-Indicator Cluster Survey
NFHS	National Family Health Survey
NGO	Non-governmental organization
NNMB	National Nutrition Monitoring Bureau
NNMR	Neonatal mortality rate
ORS	Oral rehydration solution
ORT	Oral rehydration therapy
PMR	Perinatal mortality rate
SD	Standard deviation
SRS	Sample Registration System
TFR	Total fertility rate
U5MR	Under-five mortality rate
UP	Uttar Pradesh
WHO	World Health Organization

Summary of key findings and major recommendations

Key findings of this study

- Infant and child mortality in India has declined substantially over the past fifteen to twenty years. According to Sample Registration System data, infant mortality declined by 35 percent during the past fifteen years. According to the National Family Health Survey, under-five mortality declined by about 25 percent between 1978-83 and 1988-93. India's decline in infant mortality has been slightly more rapid than the average in other low-income countries.
- This record of continued success in reducing infant and child mortality appears to be in jeopardy. Periods of two to three years of stagnation in the decline in the infant mortality rate have in the past been preceded and followed by years of very rapid declines. The current period of slow decline has lasted four years, however, and indicates a true period of stagnation in the rate of decline as the infant mortality rate has dropped by only 3 per 1,000. As a result, the infant mortality rate is increasingly departing from the longer-term trend. This will make it difficult to achieve the national child mortality goals by 2000.
- Non-income factors have played a significant role in lowering IMR and U5M in recent years, and available data suggest that maternal and child health interventions have contributed to a reduction in child mortality rates in India. Program data are insufficient to directly attribute mortality decline to program efforts, however.
- The decline in child mortality in urban areas has been slower than in rural areas. As a result, urban-rural mortality differentials have become smaller. The difference between urban and rural areas in under-five mortality rates has been reduced from 65 to 45 per 1,000 births between the 1978-83 and 1988-93 periods.
- Under-five mortality has declined because of declines in the neonatal, post-neonatal, and child mortality rates. Proportionately, post-neonatal mortality has declined more than neonatal mortality, increasing the relative importance of perinatal and neonatal mortality. Effective interventions could result in a rapid reduction in the perinatal and neonatal mortality rates and therefore in the overall IMR and U5M.
- Social, cultural, and health conditions related to the low status of women in India have a negative impact on child survival. Improving female education and nutrition, and increasing the use of health services during pregnancy and delivery would further lower child mortality.
- Girls experience a higher level of child morbidity and mortality than do boys from the age of one month to five years, and they receive less health care. Eliminating gender differences in mortality rates would significantly reduce infant and child mortality overall.
- Malnutrition among Indian children is very prevalent and is an underlying and contributing factor to mortality from many causes.
- Future child health policies and strategies should build on the lessons learned from child health programs in India, sustain the achievements that have already been made, enhance quality and efficiency, and address specific gaps in neonatal care and referral services.

Major recommendations

- The slowing down in India’s child mortality reduction rate calls for new approaches to the problem of child mortality. First, an *updated strategic framework for childhood illness, health, and development* is needed. The government of India needs to reassess the country’s current child mortality reduction goals and go forward with enhanced integrated approaches for child health and nutrition. Existing child health programs and strategies, including initiatives for the eradication and elimination of vaccine-preventable childhood diseases, and specific health and nutrition interventions need to be examined in the context of a broader child health framework that goes beyond disease-, program-, and sector-specific approaches.
- Second, central to more effective and efficient strategies for child survival, health, and development, is a *better understanding of the maternal and child health and nutrition cycle* and its main determinants. The “maternal and child health and nutrition cycle” approach recognizes that:
 - ⇒ maternal health and nutrition outcomes are key determinants to birth outcomes;
 - ⇒ birth outcomes are key determinants for child mortality, health, and development outcomes;
 - ⇒ (early) childhood health, nutrition and development outcomes are key determinants for adolescent health, nutrition, and development;
 - ⇒ adolescent health influences maternal mortality, health, and nutrition outcomes; and,
 - ⇒ the cycle continues.

Socioeconomic, environmental, behavioral, health, and nutrition factors influence this cycle. The challenges for the child health and development community in the next decade will be to jointly address the most important determinants and gaps with affordable, cost-effective, feasible, and culturally appropriate interventions that take into account both demand and supply factors, and to involve local communities in the identification of needs and priorities.

- Third, considering the differences in infant and child mortality performance between states, stratified child health policies are needed that take into account state-specific epidemiological and demographic patterns and key determinants. Policy options are provided (Section 3) for states with remaining high U5M/IMR levels and slow rates of decline, for states that have reached lower levels of U5M/IMR but are experiencing a slowdown in U5M/IMR reduction, and for states with large proportion of urban poor. A summary of some of the gaps and barriers identified in this study, and suggested policy options to address them are also provided. While neither comprehensive nor state specific, the matrix summarizing gaps and policy options (Box 3.1, Section 3) is meant to serve as an input to further discussions, and to facilitate design and planning for child mortality reduction at the state level.

Introduction

In 1999, about 10 million children under the age of five will die throughout the world. Of these, 2.1 million deaths will occur in India alone, the highest total of any one country. In India, one out of every four deaths is a child under age five; a high proportion of these children could have been saved with basic health interventions such as immunizations and oral rehydration solution (ORS). Improving child survival remains a major development task in India.

India's goals for the year 2000 include reducing the national mortality rate for children under age five to less than 100 per 1,000 live births, the infant mortality rate to less than 60 per 1,000 live births, and the perinatal mortality rate to less than 85 per 1,000 births. During the second half of the 1980s and early part of the 1990s, significant progress was made toward these goals. At that time, the national targets appeared to be within reach, despite large disparities among India's states in terms of mortality levels, rates of decline, and child health determinants.

In recent years, however, data indicate that the decline of key child mortality measures is slowing down, making it unlikely that India will achieve its child survival goals by the year 2000. This study was undertaken to inform the current debate on child mortality trends and to suggest possible contributing factors that might make a difference in child health policy formulation over the next decade.

Objectives

This study is written primarily for national and state-level health policy makers in India. It seeks to answer the following three questions:

- Is the apparent stagnation in India's child mortality rate real or simply due to irregularities in the data? (Section 1)
- If the stagnation is taking place, what factors are behind it? (Section 2)
- What are the policy options that will help sustain progress, address remaining gaps, and maximize the impact on child survival in India? (Section 3)

The first section examines demographic information to establish trends in child mortality rates. The second section reviews the literature and program reports to better explain the factors at work behind the trends and examine the key determinants that influence child health and survival. The third section puts forth conclusions and provides a matrix of policy options to sustain achievements, accelerate efforts, and ensure continuing declines in child mortality.

A significant body of literature and demographic data already exists on India's child health and survival trends, performance studies, nutrition analysis, and child health program reviews and surveys. This study synthesizes and analyzes this existing body of information to reach its conclusions and recommendations. The major articles and reports used in this study are listed in Section 5.

1. Has the Decline in Child Mortality in India Slowed Down?

1.1 Overview

This section seeks to establish whether recent speculation about a slowing down in the decline of India's infant and child mortality rates is in fact supported by the available data. To find the answer, short- and long-term national trends in infant and child mortality are analyzed. Data for some individual Indian states are provided, but not analyzed in detail.

This analysis is based mainly on two sets of data from India: **The National Family Health Survey (NFHS)** conducted in 1992-93 and annual data from the **Sample Registration System (SRS)**. Each of these datasets has strengths and weaknesses. The NFHS is a DHS-type survey conducted at the national and state level. It uses a questionnaire designed to produce internationally comparable indicators. The SRS collects data through continuous registration systems as well as by using surveys. Appendix 1 contains further information on these two sampling systems.

1.2 Long-term trends: A steady drop

Figure 1.1 shows the decline in India's annual infant mortality rates for the period from 1981 to 1997, the last year for which SRS data have been published. This trend line is compared with the estimated trend for other low-income countries (excluding China) for the same period, and indicates that the decline in infant mortality in India has been slightly more rapid than the average decline in other low-income countries.

**Figure 1.1 Trends in IMR, 1981-1997
India and Low-Income Countries**

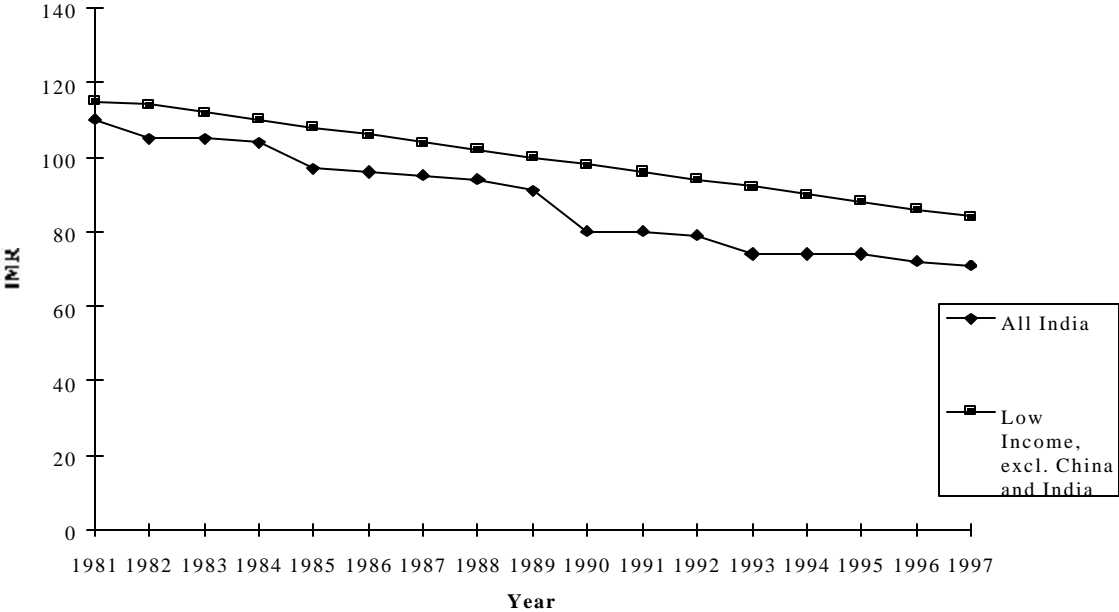


Figure 1.2 Trends in Child Mortality Indicators

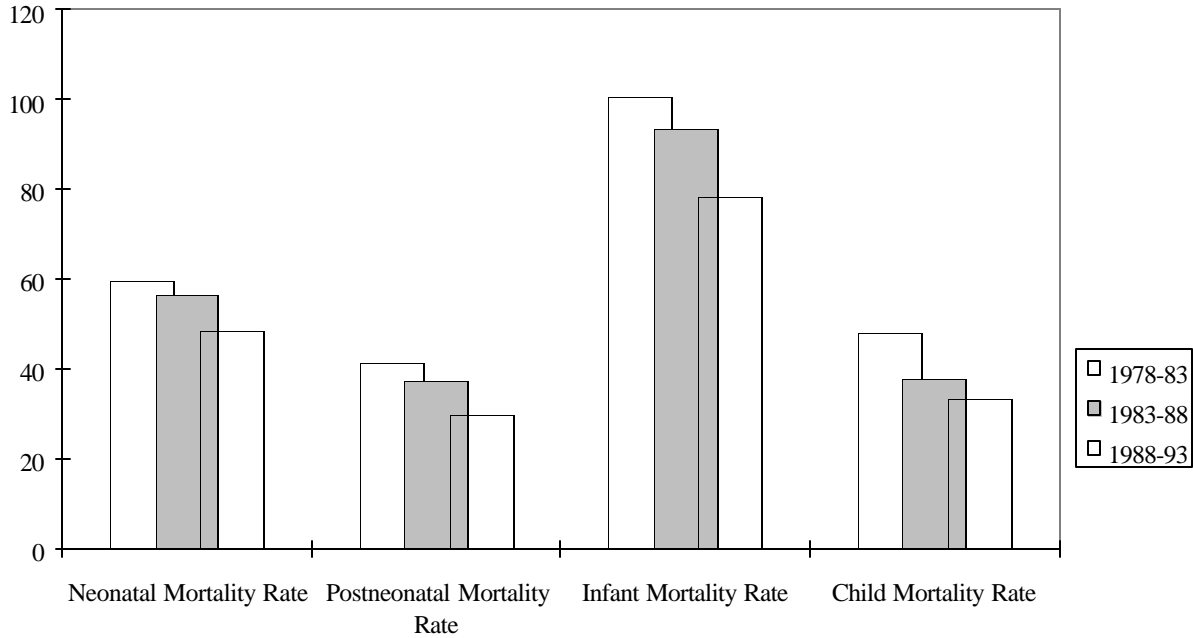
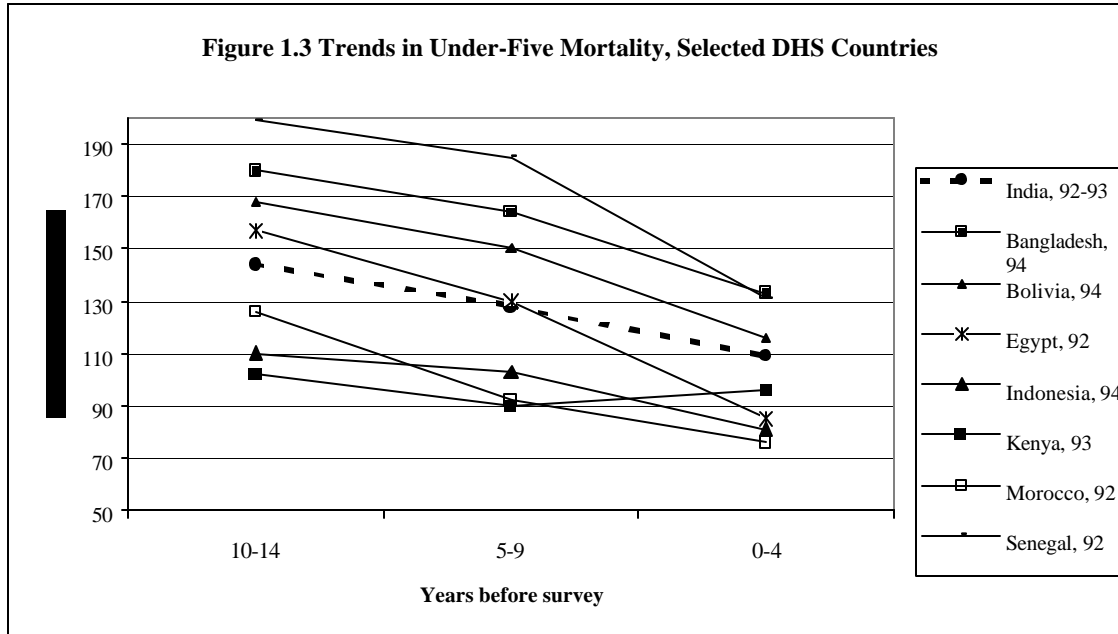


Figure 1.2 shows the decline in several child mortality indicators for India based on NFHS data, presented as average rates for five-year periods from 1978 through 1993. Each indicator shows substantial declines over the fifteen-year period.

It is difficult to compare India to individual countries at similar levels of economic development, since other low-income countries do not have a vital registration system as complete and reliable as the SRS in India. Figure 1.3 compares the under-five mortality rates in India and seven other countries that conduct demographic and health surveys, indicating that India's rate of decline has been about average in that group.

The data presented in these figures confirm the fact that India's infant and child mortality rates have declined substantially over the past fifteen to twenty years. According to the SRS data, infant mortality declined by 35 percent during the past fifteen years. According to the NFHS, under-five mortality declined by about 25 percent between the periods from 1978-83 and 1988-93. The decline in infant mortality has been slightly more rapid than that in other low-income countries.



1.3 Recent trends: A period of stagnation

The long-term trends described in Section 1.2 provide the standard against which India's recent declines in child mortality can be compared. The following analysis of trends in recent years relies on SRS data through 1997, since the mortality data from the NFHS survey end with the 1988-93 period and thus cannot shed light on more recent developments.

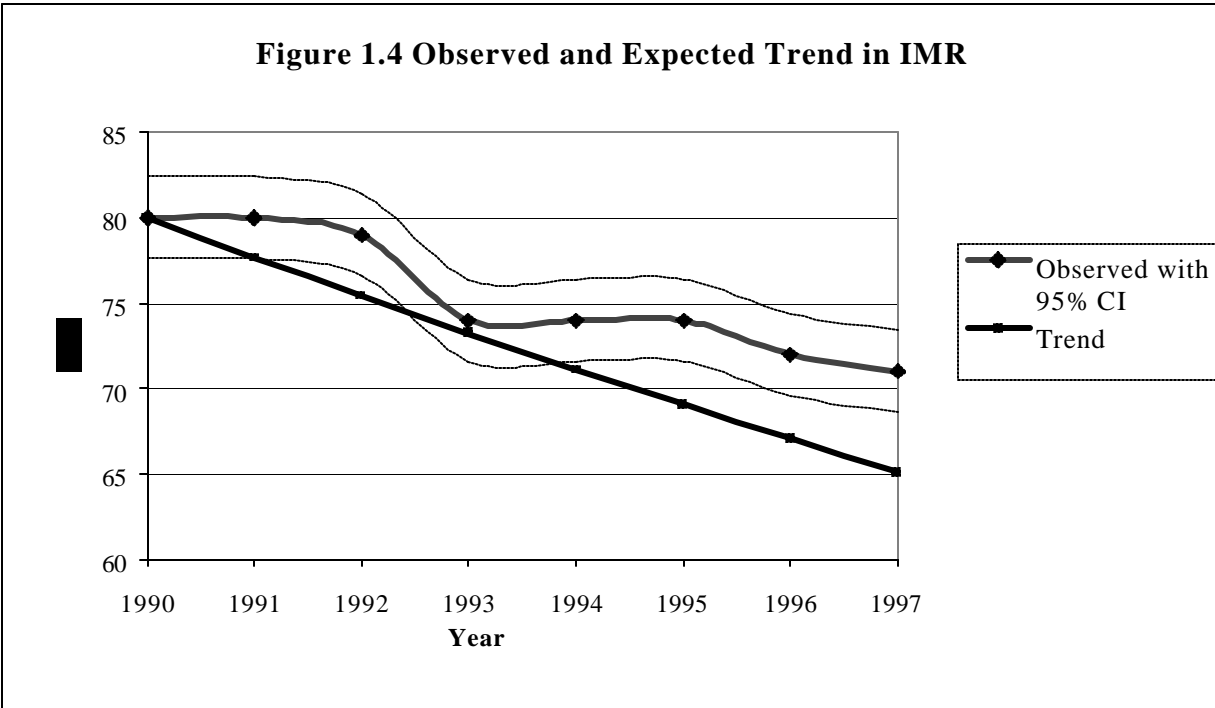
The 16-year SRS series, which covers 1981-1997, reveals a pattern in which large year-to-year declines in the IMR are followed by two or three years of smaller-than-average yearly declines, as summarized in Box 1.1. Thus, the annual data (as shown in Table 4.1) do not offer a good basis for conclusions about trends.

Box 1.1 Trends in IMR Decline

Year	IMR Decline	Decline in subsequent year
1981-82	5 (per 1,000 births)	0 (per 1,000 births)
1984-85	7	1
1989-90	11	0
1992-93	5	0

Source: SRS data, see Table 4.1

One way to deal with fluctuations in annual data is to use moving averages, but this method smoothes out real fluctuations and is somewhat crude. Another way to evaluate whether a large change is significant (or whether no change indicates stagnation) is to consider the annual estimates and their confidence intervals over a period of a few years. Figure 1.4 shows the annual estimates from 1990 onwards, with 95 percent confidence intervals, and the decline that would have occurred if the trend, based on the average annual decline for the period 1980-1990, had continued.



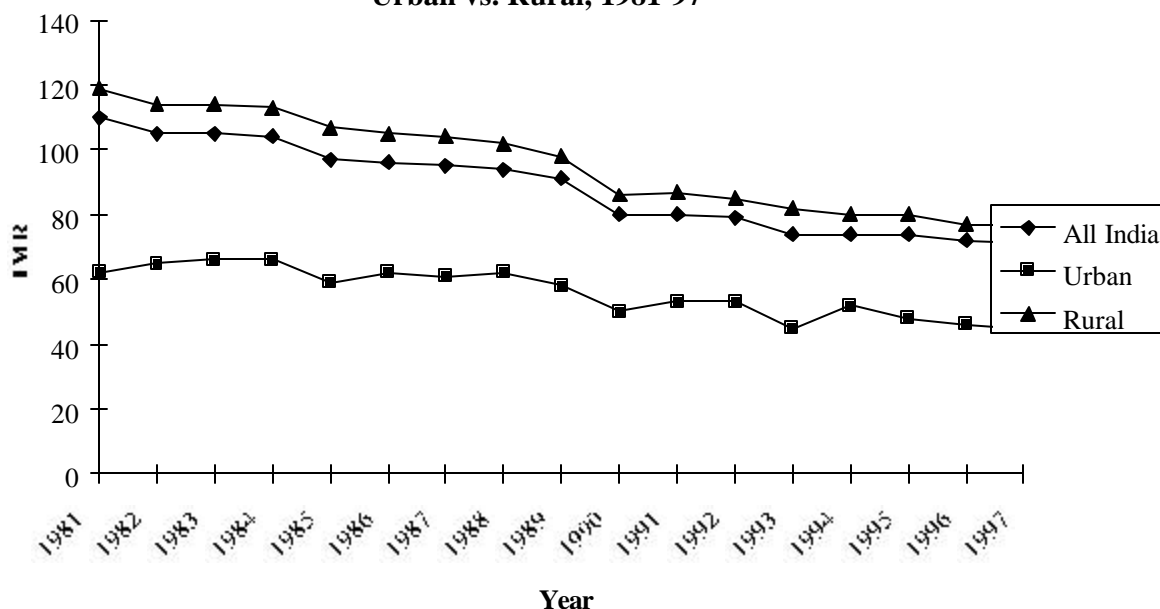
As shown in Figure 1.4, the rate of decline in India's IMR slowed during 1990-92, but then recovered to the long-term trend estimate by 1993. Since 1994, however, the infant mortality rate has increasingly departed from the long-term trend. Given the sampling errors associated with the data, the decline from 1993 to 1997 should be viewed as a drop from the 72-76 range to the 69-73 range. The most optimistic interpretation of these numbers would mean a decline of 7 per 1,000 during this four-year period, well below the longer-term average annual decline. In the most pessimistic interpretation, however, a small increase in the infant mortality rate during this period cannot be ruled out.

The long-term data clearly indicate that periods of two to three years of stagnation in the decline in the infant mortality rate have been preceded and followed by years of very rapid declines. The most recent data, however, departs from this pattern. The current period of slow decline has lasted four years, and seems to indicate a period of true stagnation. One can therefore conclude that the rate of decline in the IMR is indeed slowing down. This finding will make it difficult for India to achieve its national child mortality goals by the year 2000.

1.4 Other findings

Figure 1.5 (based on the SRS data in Table 4.1) compares infant mortality rate trends for urban and rural areas of India. Table 4.2, based on NFHS data, also shows long term trends in these infant and child mortality rates for urban and rural areas. According to both sets of data, the decline in child mortality in urban areas has been slower than in rural areas. As a result, urban-rural mortality differentials have become smaller. According to NFHS data, the difference in under-five mortality rates between urban and rural areas became smaller between the late 1970s/early 1980s and the late 1980s/early 1990s, with the gap narrowing from approximately 65 to 45 deaths per 1000 births.

**Figure 1.5 Trends in Infant Mortality for India
Urban vs. Rural, 1981-97**



The decline in urban areas has been slower both in terms of absolute deaths per 1,000 and in percentage terms. While mortality decline would be expected to slow down at low levels, urban mortality rates for India are still quite high. The urban trend in some of the states with the lowest mortality is evidence that mortality declines can continue to be strong even at these relatively low levels.

The rate of decline in India's infant and child mortality shows a great deal of variation among major states. Tables 4.1 and 4.2 also contain data for individual states included in the SRS and NFHS datasets. Large differences exist among states, with under-five mortality falling rapidly in Kerala, Karnataka, and Tamil Nadu and very slowly in Rajasthan, Gujarat, and Assam. Table 4.3 ranks the SRS data from states with the largest to the smallest overall IMR decline between 1981 and 1997. Improvements in data collection methods probably did not occur evenly among the states, however, so small differences in the percentage change among states may not be meaningful. It is beyond the scope of this paper to look in detail at trends in individual states.

Table 4.4 breaks infant mortality into its neonatal and post-neonatal mortality components, indicating that post-neonatal mortality has declined more than neonatal mortality. According to SRS data, neonatal mortality declined by 33 percent from 1972 to 1995, whereas post-neonatal mortality declined by 62 percent during the same period. The NFHS data show a similar pattern. While child mortality rates could certainly decline more by further reductions in post-neonatal mortality, neonatal mortality will become an increasing proportion of child mortality. To achieve future declines in U5MR, neonatal mortality needs greater attention.

2. Why is the Decline in Child Mortality Slowing Down?

2.1. Overview

Section 1 of this study concludes that the decline in India's child mortality rates is indeed leveling off. This section explores the possible reasons for this trend. In doing so, it reviews the literature on determinants of child mortality, including information from the government of India on maternal and child health programs and the recent NFHS report on infant and child mortality (Pandey et al., 1998). Some important determinants of child health lie beyond the scope of this literature review, however, including educational, social, and environmental factors such as access to water and sanitation.

The absence of routine data collection and systematic analysis of the determinants of child health poses a challenge for attributing trends in child mortality to program inputs. Another challenge is the extent to which it is possible to generalize from selected studies to India as a whole. Most of the available data are from four states: Uttar Pradesh, Madya Pradesh, Kerala, and Tamil Nadu. Routine data at the district and sub-district level, and from sub-populations, are lacking except in special studies, often conducted by NGOs. The interpretation of reported program indicators, surveys, and reviews are affected by the reliability of data, comparability between different data sources, and representativeness of samples.

2.2 Determinants of child mortality in India

Child mortality trends, differentials, and determinants are important statistics for national and state health policy makers in India and have been the subject of many reviews, studies, and consultations. These studies include Zachariah and Patel (1982); Philip (1985); Puffer (1985); Sandell et al. (1985); Visaria (1985); Tilak (1991); Anilkumar and Asharaf (1993); Khan (1993); Goyal (1994); and Measham et al. (1999).

The report *Infant Mortality in India: Differentials and Determinants* (Jain and Visaria, 1988) sought to explain the pace of IMR decline from 1968 to 1978 and developed a framework for analysis of factors contributing to the observed decline in IMR. These included proximate factors (such as non-medical factors and medical care during the prenatal period, care at birth, preventive and curative care in the postnatal period); maternal factors (age, parity, and birth intervals); and household- and community-level factors (water, sanitation, and housing).

Then, as now, opinions differed as to the relative importance of socioeconomic development and health services in reducing IMR. Jain and Visaria concluded that, although data was lacking to adequately assess the relative importance of various determinants, a substantial decline in IMR is possible without significant improvement in economic development. They made a case for a minimum package of essential services: reproductive health services, perinatal care, improved breastfeeding practices, immunization, home-based treatment of diarrhea, and timely introduction of supplementary foods. Consistent with many other studies and recommendations, they predicted that increased access to such a package of essential maternal and child health services would significantly reduce high infant mortality rates. Several other reports laid out intervention strategies and directions based on similar analysis and assumptions including Ghai (1985); Kumar and Datta (1985); Pratinthi

et al. (1987); and Bhargava (1991). IMR studies at the district level have yielded similar findings regarding the importance of access to essential health services (Sandell et al., 1985).

The report *Mortality Change in India Since Independence* (Anilkumar and Asharaf, 1993) noted that the observed change in India's IMR in the 1980s was heavily influenced by its fast decline in a few states that began with higher IMR than others and contained a large share of the overall population. These states are Bihar, Madhya Pradesh, Orissa, Rajasthan, and Uttar Pradesh. The authors concluded that further reduction of IMR in these five states would largely determine the decline at the national level.

2.3 *Income as a determinant of child mortality*

IMR often serves as a key development indicator, reflecting the combined effects of economic development, health interventions, technological change, and the sociocultural environment. Several studies have attempted to break out the impact of these various determinants on IMR. Studies of IMR and child mortality trends in Kerala done by Zachariah and Patel (1982) and Philip (1985) show that socioeconomic factors explain only a small percentage of IMR differentials at the household level. The role of other socioeconomic determinants of child mortality, such as availability of flush or pit toilets, clean cooking utensils, fuel, and ownership of household goods, are reported on in the NFHS report *Infant and Child Mortality in India* (Pandey et al., 1998), but not reviewed in more detail here.

A recent World Bank report on *Performance of Indian States in Reducing Infant Mortality and Fertility from 1975 – 1990* (Measham et al., 1999) supports the previously documented inverse relationship between per capita income and IMR. Increases in income have reduced IMR, although the income effect is stronger on total fertility rates (TFRs).

Non-income factors play an even more significant role than income in lowering the IMR. The effect of technological progress (including access to preventive and curative health services) on lowering IMR was found to have been the strongest between 1985 and 1990. Technological change caused IMR to decline 20 percent between 1975 and 1990. However, public health expenditures did not have a significant influence on lowering the IMR. They noted that although the poorest states performed worst in terms of IMR and TFR, the richest states did not perform best. The best state performers in the country had relatively low per capita income levels, but achieved relatively good results for those levels. The percent difference between the expected IMR for a given level of income and time period and the actual IMR gives the "relative performance rate." According to these estimates, Kerala, Tamil Nadu, and Karnataka are the best performers in the country and, significantly, Kerala and Karnataka are also among the poorest in economic terms. The worst performers are the poorest states: Uttar Pradesh and Orissa. However, Andhra Pradesh, Punjab, Bihar, and Gujarat have higher-than-expected IMRs for their income levels. Notably, some of the weak performers are the relatively rich states of Haryana, Gujarat, and Maharashtra.

Box 2.1 IMR Decline, IMR Relative Performance and Under-five Mortality Rates for Selected States

State	IMR decline 1980-1990 (percent)	IMR Relative Performance (percent)*	Under-five Mortality 1992
Kerala	45	103	32
Karnataka	38	22	87
Tamil Nadu	32	7	86
Haryana	27	-16	98
Bihar	20	5	127
West Bengal	19	5	99
Orissa	19	-34	131
Punjab	18	-5	68
Assam	7	-11	142
Gujarat	7	-23	104
Rajasthan	2	-16	102

Sources: IMR decline: see Section 1; IMR Relative performance (Measham et al., 1999).

*IMR Relative Performance rate = the percent difference between expected IMR for a given level of income and time period and the actual IMR.

Note: This table includes only those states for which information is available on all three indicators.

As shown in Box 2.1, Indian states vary significantly in their rates of IMR decline, IMR relative performance, and U5M levels. For example:

- As expected, states that have the lowest rates of decline in IMR are poor performers and their U5M rates remain high (Assam, Gujarat, and Rajasthan).
- States that have shown the highest rate of decline in IMR are at the lower levels of U5M rates, and their performance ranges from the best (Kerala) to good (Karnataka and Tamil Nadu).
- Some states remain at very high U5M levels, although their rates of IMR decline have been quite high (Bihar and Orissa). Orissa shows the poorest performance and can do much better for its level of income.
- Haryana has a high rate of decline in IMR and its U5M is in the lower range. Haryana's relative performance is poor, however, and it can do much better for its level of income.

To fully explain the profile for each state, additional information on program inputs and recent trends is needed. Several countries in demographic and epidemiological transition are finding it difficult to prevent or reverse a slowdown in U5M/IMR decline. One possible reason why IMR declines are slowing down in some states in India and in some other countries is that current child survival interventions are more effective at reducing high under-five mortality levels (with a relatively large proportion of post-neonatal mortality) than in achieving a significant declines in places that have already achieved relatively lower levels. Another possible reason in some places is a decline or leveling off in actual coverage rates of preventive and curative child health services. To continue to be effective, new approaches and interventions are needed to specifically influence the neonatal phase or address gaps such as nutrition and reproductive health interventions, in addition to sustaining and improving the efficacy of existing child health programs.

2.4 *Child health programs and child mortality reduction*

A full understanding of child survival trends in India is hampered by the lack of useful program data for routine monitoring or intermittent evaluation purposes. Only a few indicators related to implementation of child health programs are readily available to assess state progress over time: immunization rates, institutional deliveries, acute respiratory infection (ARI) prevalence rates and mothers' knowledge about ARI symptoms, oral rehydration solution (ORS) rates, and care-seeking indicators.

Most of these indicators have limited value in assessing outcomes and outputs, and are not proximate determinants for child and infant mortality. While some of these indicators measure program inputs over time, those inputs need to be linked to outputs and outcomes to better evaluate progress. Although immunization programs have received much attention, immunization coverage rates by state for at least two points in time are not readily available. Furthermore, immunization rates may be overstated. For example, the reported DPT3 rate for India as a whole has hovered around 90 percent throughout the 1990s (WHO, 1999) but the 1992-93 NFHS measured DPT3 coverage at only 52 percent. Similarly, the percentage of children immunized against measles was measured by the NFHS at only 42 percent – less than half the previously reported figure. Improving the quality of the data is essential to assessing the contribution of child health program activities and specific services to the reduction of child mortality.

Standard indicators that reflect quality of care and service utilization (such as use of oral rehydration therapy) can serve as proxies for child mortality and enable a comparison between states and countries, but such indicators were not available for trend analysis. The upcoming NFHS (1998-99) survey report will make it possible to compare current rates with the NFHS 1992-93 rates. The recent Multi-Indicator Cluster Survey (MICS) gives a good cross-sectional overview of the current status of child health and nutrition, but is less useful for trend analysis.

Tables 4.4 – 4.6 summarize available data on selected child health program indicators from different data sources. Table 4.5 groups the data in Table 4.4 by clusters of states with similar U5MR levels, and indicates a positive relationship between coverage of key child health interventions (such as ORT, ARI, and immunization rates) and the reduction in under-five mortality. When the 1998-99 NFHS data become available, this relationship can be further analyzed and validated. Table 4.6 suggests that similar relationships exist between immunization and feeding rates and U5M rates, although it is based on less conclusive MICS data and does not include states with U5MR of less than 50.

In short, the available data show that non-income factors have played a significant role in lowering IMR and U5M in recent years. Data from the NHFS suggest that maternal and child health program interventions have contributed to a reduction in child mortality rates in India. Program data are insufficient to directly attribute program efforts to mortality decline, however.

2.5 *Urban/rural differentials*

As described in Section 1.4, the recent IMR decline in urban areas has been slower than in rural areas, resulting in a narrowing of the urban/rural gap. Most studies of infant deaths have been conducted in rural areas. However, reports by the Integrated Child Development Scheme (ICDS) document the problems of urban slums and recommend multidisciplinary action: family planning education, adequate antenatal care services including tetanus immunization, training of front-line

health workers, recognition of high risk pregnancies, and neonatal services (Singhal et al., 1986). The recommended health interventions for the urban poor are similar to those for the rural poor, although implementation strategies might differ in order to effectively reach the urban poor. A recent study documents the inability of many urban poor to discriminate among the various sources of health care available to them, as well as their preference for local private practitioners (many of whom may be unqualified), and frequent discontinuation of treatment and changing of practitioners (de Soyza et al., 1998). The study recommends a more concerted effort to improve primary health care services in the private sector and develop more practical approaches for the standard management of childhood illnesses, emphasizing the management of young infants with low weight.

Many other studies have focused on differences in urban/rural determinants in infant and child mortality including Gupta (1981); Reddiah et al. (1988); Singhal et al. (1990); Reddaiah and Kapoor (1992); Biswas et al. (1993); Khalique et al. (1993); and Pandey et al. (1998). A study by Bhardwaj and Hasan (1993) identified the main factors in perinatal and neonatal mortality in rural India as poor utilization and low demand for health services, illiteracy, low rates of tetanus toxoid immunization, and poor hygiene. The authors concluded that most deaths were preventable and that only 10 percent of the deaths were unavoidable at the rural level. The recent NFHS report on *Infant and Child Mortality in India* (Pandey et al, 1998) found that most of the large urban/rural differences in infant and child mortality rates (unadjusted child mortality is nearly twice as high in rural as in urban areas) disappear when controlling for the effects of other variables. The findings suggest that most urban/rural differences in infant and child mortality are due to factors *related to* residence rather than to residence itself. Women who live in urban areas are more likely to be literate, use clean cooking fuel, and have access to better sanitation, for example. These characteristics tend to be correlated with each other and related to residence. Urban vs. rural residence seemed to have a greater effect on infant and child mortality (after adjusting for other factors) in states where mortality levels were high.

2.6 *Perinatal and neonatal mortality determinants*

Concerted global and national efforts have been made to improve child mortality, especially in the postneonatal phase, through implementation of readily available, affordable, cost-effective, and feasible child health interventions such as oral rehydration therapy and immunization. Less attention has been given to defining, prioritizing, and influencing the multiple determinants to perinatal and neonatal mortality. As shown in Table 4.7, for the period 1972 – 1995, neonatal mortality has gradually increased as a percentage of total child mortality due to a faster decline in the post-neonatal mortality rate. The SRS and NFHS data presented in Section 1 show a similar pattern. As expected, the decline in perinatal mortality rates (PMR) also lags behind the overall decline in child mortality.

Much of the child mortality literature has documented problems in the perinatal and neonatal phases, including Bhatia et al. (1984A and B); Gupta and Gupta (1985); Agarwal and Agarwal (1987); Chakraborty (1987); Tandon et al. (1987); Bhave (1989); Puffer et al. (1985); Singhal et al. (1990); Bhargava et al. (1991); Sachdev et al. (1991); Suguna Bai et al. (1991); Chavan et al. (1992); and Soudarssanane et al. (1992). Despite this large body of literature, little progress has been made toward implementing large-scale solutions to perinatal and neonatal phase problems. The relative importance of perinatal/neonatal determinants of child survival is increasing and must be addressed to achieve significant further declines in child mortality. Effective interventions are available and their implementation could result in a rapid reduction of the PMR and NMR.

The Indian Council of Medical Research (ICMR) issued a report in 1989 that supported this conclusion and identified gaps that need to be addressed (ICMR, 1989). In 1971 the perinatal mortality

rate for rural areas was 57/1000; 14 years later, the rural PMR had only declined to 52/1000 (SRS data). In 1971, the urban PMR was 36/1000, and in 1985 the rate was still 30/1000. The report presented an approach based on identifying risk factors with a direct relationship to the outcome of perinatal deaths: illiteracy, birth interval of less than 24 months, previous stillbirth(s), previous pre-term birth(s), untrained birth attendant, and low birth weight (LBW). From 1988-1990, the ICMR conducted a national collaborative study in three rural and three urban slum communities, involving approximately 30,000 participants in thirty-one sub-populations. The baseline survey to identify families and women at risk revealed higher PMR rates than the SRS data had shown, with a rural PMR of 62/1000 and an urban PMR of 52/1000 (ICMR, 1990).

Several studies have shown that addressing the risk factors identified by the ICMR can result in rapid reduction in PMR. A six-year effectiveness study in Bihar (Gupta and Gupta, 1985) showed a reduction in PMR from 79/1000 in 1978 to 58/1000 in 1983. The Bihar study took place in a controlled environment, using health education to promote better utilization of antenatal care services and other services offered by the Mines Hospital in the Indian Copper Complex. This is one of many studies that have yielded good results for program inputs in controlled contexts.

Neonatal health has recently been taken up as priority agenda by the WHO South East Asian Regional Office (SEARO), and an expert group reported in 1998 on the status of newborn health in India and neighboring countries and identified priorities for newborn care delivery, training, research and advocacy (Paul and Deorari, 1999). Priorities and strategies for the expansion of essential newborn care at district and sub-district levels are outlined by the All India Institute of Medical Sciences (Paul, 1999).

2.7 *Maternal determinants*

As noted above, perinatal mortality studies point to the link between the health of the mother and the birth outcome. The high PMR in India reflects the poor status of women, including poor nutritional status (malnutrition and anemia), low rates of literacy, lack of autonomy, and early age of marriage and childbirth. In addition, low rates of antenatal care, low utilization of obstetric and other health services, and large numbers of deliveries attended by untrained personnel result in poor maternal health and poor birth outcomes such as low birth weight and prematurity (World Bank, 1996). Toxemia and infection are other important contributing factors to the high rate of prematurity, perinatal mortality, and growth retardation (Raman, 1980). The effects of maternal characteristics are not limited to the perinatal period. As Table 4.8 shows, mortality from ages one to four also differs significantly by maternal background characteristics.

The educational level of mothers tends to have a strong effect on the mortality of young children, as discussed in the NFHS report by Pandey et al. (1998). Educated mothers usually are healthier themselves, give birth to healthier babies, provide a healthier environment, and are more likely to have information about care options and actively seek care. In this study, a mother's literacy level emerges as an important factor in the child's first five years, especially after the first month. Children of illiterate mothers in India have rates of infant mortality 40 percent higher than rates for children of literate mothers, for example.

Contrary to expectations, however, another recent NFHS report (Kishor and Parasuraman, 1998) identified an association between mothers' employment outside the home and an elevated risk of infant and child mortality. Mothers' employment influenced infant mortality in urban areas, with a

stronger association for boys than for girls. These findings indicate that multiple social, cultural, and economic factors determine these complex relationships

Social, cultural, and health conditions related to the low status of women in India clearly have a negative impact on child survival. Improving female education, female nutrition, and increasing the use of health services during pregnancy and delivery are essential to achieving a reduction in child mortality.

2.8 Gender differentials

The level of gender disparities in health and education is higher in South Asia, including India, than anywhere else in the world, and has been the subject of many studies, including Ware (1984); Chatterjee (1990); Murthi et al. (1995); Arnold et al. (1996); and Filmer et al. (1998). It has also been the subject of several World Bank reports, including *A New Agenda for Women's Health and Nutrition* (1993) and *Improving Women's Health in India* (1996). Overall, a girl in India is 30 to 50 percent more likely to die between her first and fifth birthdays than is a boy. Pandey et al. (1998) reports that females are at the greatest disadvantage from ages one to four, when their risk of dying exceeds that of males by 40 percent. Eliminating gender gaps in mortality rates would significantly reduce infant and child mortality overall.

Approximately 12 million girls are born in India every year. Of each cohort, nearly one million will not survive their first year of life; of those who do survive, another half million will die in the next four years of life. According to age-sex specific mortality rates for 1971 to 1987, although mortality rates have been falling for the population overall, the rate for females remained consistently higher during the 1970s and 1980s. More recent NFHS data show that mortality at every age below five was higher for girls than for boys--except for the first month of life, when congenital and other causes increase boys' mortality. Data from the 1992/93 NFHS on age-sex specific mortality rates indicate that the infant mortality rate would drop by four per thousand, and the child mortality rate by 20 percent, if girls had the same mortality rate as boys between the ages one month and five years.

Son preference is one explanatory factor for these gender differences in child mortality. The pressure to have a boy has led an increasing number of women to practice sex-selective abortions according to UNICEF (1995) and Arnold et al. (1996) -- although this does not affect the child mortality rates. After the first month of life, environmental and behavioral factors, including care-seeking practices, come into play. Girls are often brought to health facilities in more advanced stages of illness than boys, and taken to less qualified doctors when they are ill, while less money is spent on medicines for them compared with boys (Chatterjee, 1990). A recent analysis of the NFHS data by Filmer et al. (1998) confirmed that girls are less likely to receive treatment than boys. A study conducted in the state of Punjab showed that during the first two years of life (the peak years for child mortality), expenditure on health care was 2.3 times higher for sons than for daughters (Das Gupta, 1987).

Pandey et al. (1998) concluded that although "it will be difficult to eliminate son preference and associated excess female child mortality quickly...maternal and child health programs that provide supplemental nutrition and basic health care to all children, regardless of sex, may help reduce excess child mortality ...family health programs should pay particular attention to providing basic health care and supplemental nutrition to girls." The report on *Improving Women's Health in India* (World Bank, 1996) similarly recommends identification of at-risk female children, especially those under three years of age, and to directly intervene with nutritional supplements and health care services.

2.9 Nutritional determinants

Malnutrition is a factor in an estimated 54 percent of all childhood deaths globally (Pelletier et al., 1993). Despite significant progress, more than half of the children in India under age four are still moderately or severely malnourished, 30 percent of newborns are significantly underweight, and 60 percent of Indian women are anemic (Subbarao, 1989). The report entitled *Wasting Away: The Crisis of Malnutrition in India* (World Bank, 1998) points to malnutrition as the main factor retarding improvements in human development and hindering further reduction in infant mortality. According to a malnutrition study by the government of India (Asian Development Bank and UNICEF, 1997), 53 percent of preschool children in India are malnourished; this translates into 60 million malnourished children. Significant differences between states exist, however, and the proportion of malnourished children among scheduled castes and tribes is consistently higher than the average in most places, whether urban or rural (Subbarao, 1989).

While some studies conclude that there are no gender differentials in terms of childhood malnutrition (Subbarao, 1989), others point conclusively to gender biases in malnutrition (Sen and Sengupta, 1983), as discussed in section 2.8. Subbarao's review of National Nutrition Monitoring Bureau (NNMB) data shows that both sexes suffer to about the same extent from caloric inadequacy; in fact, the figures were slightly less for females. The data concludes that the incidence of protein energy malnutrition is not due to lower food intake but probably due to general neglect of the health of girls. However, Sen and Sengupta measured malnutrition in children in two villages in West Bengal and found a systematic sex bias against girl children.

Malnutrition among Indian children clearly presents a major obstacle to improving child survival rates. Children age three and below in almost all states have the highest rates of acute malnutrition, and scheduled castes and tribes have the highest proportion malnourished. *India Wasting Away; the Crisis of Malnutrition in India* (World Bank, 1998) outlines policy options for addressing the nutrition crisis, including actions to ensure commitment to nutrition, actions to be taken by the health sector, and actions to increase the impact on vulnerable groups.

2.10 Low birth weight

Low birth weight is a key predictor of malnutrition and an important determinant of child mortality. WHO, on the basis of worldwide data, recommends that newborns with a birth weight of less than 2500 grams be classified in the LBW category, carrying relatively greater risks of perinatal and neonatal morbidity and mortality as well as substandard growth and development in later life (UNICEF, 1997). Birth weight below 2500 grams has been closely associated with poor growth throughout childhood.

National efforts have been made to collect representative estimates of birth weights from institutional and community deliveries, but the findings vary greatly. In a study of fifteen centers across the country, the National Neonatology Forum found a LBW prevalence of 33 percent, of which 32 percent of the infants were pre-term. The Child Survival Safe Motherhood (CSSM) Program collected district data on 27,069 births and estimated the LBW prevalence to be 18.4 percent, (ranging from 2.7 percent to 40 percent). The low figures reported from some states are questionable, and illustrate the need for improved nutrition data.

The 1992-93 NFHS found that small birth size – a proxy for birth weight – carries a risk of infant death 2.5 times higher than the risk for average or large birth size. LBW has also been

identified as a factor in retardation of motor, adaptive, social, and language development as well as in adult diseases. One of the most significant detrimental outcomes of LBW is growth retardation in young girls, perpetuating a vicious cycle of female malnutrition through adulthood and into the next generation (UNICEF, 1997). Studies in other parts of the world have shown that women who receive energy-rich food supplements during pregnancy have fewer low birth weight babies, resulting in lower perinatal mortality rates than their counterparts who do not receive supplements (UNICEF, 1998). Reducing low birth weight babies through maternal nutritional supplements might reduce India's child mortality substantially.

2.11 *Micronutrient deficiencies*

Nutritional deficiencies are underlying factors in child and infant mortality throughout India, despite varying sociocultural practices and lifestyles between and within states. The major nutritional disorders are deficiencies of iron, vitamin A, and iodine. Micronutrient deficiencies influence child survival as well as the health and development of surviving children, including effects on cognitive development and disabilities.

Nutritional anemia. The data on childhood anemia prevalence is very limited. Studies in India place the prevalence rate between 48 and 95 percent. Iron stores in infants are adequate to last only the first four to six months of life – or even less in many infants due to the high prevalence of maternal anemia in India. The high incidences of low birth weight children and their lower levels of iron stores makes the situation critical (UNICEF, 1997).

Vitamin A deficiency. Vitamin A deficiency is still a major public health concern in India. It is an important factor in terms of childhood development, long-term disability, and child survival. Lack of vitamin A contributes to high mortality from other causes. Approximately 30,000 preschool children go blind every year due to severe vitamin A deficiency. The prevalence of vitamin A deficiency is noted in school children irrespective of income levels (ADB and UNICEF, 1997).

Iodine deficiency disorders. Estimates attribute 90,000 stillbirths and neonatal deaths every year to iodine deficiency. The prevalence of goiter in endemic regions ranges from 1.5 percent in Assam to 68.7 percent in Mizoram; the prevalence of cretinism is also high (UNICEF, 1997).

Although potentially cost-effective and affordable interventions are available, existing food supplementation and micronutrient programs in India have not yet been able to achieve significant reductions in nutritional deficiencies at the state and national level. The problems that beset micronutrient programs include shortages in supplies, logistical problems, and the lack of community motivation and education (World Bank, 1998). These shortcomings need to be addressed in order to affect infant and under-five morbidity and mortality rates.

3. Conclusions and Policy Recommendations

The slowing down in India's child mortality reduction rate calls for new approaches to the problem of child mortality. First, an *updated strategic framework for childhood illness, health, and development* is needed. The government of India needs to reassess the country's current child mortality reduction goals and go forward with enhanced integrated approaches for child health and nutrition. Existing child health programs and strategies, including initiatives for the eradication and elimination of vaccine-preventable childhood diseases, and specific health and nutrition interventions need to be examined in the context of a broader child health framework that goes beyond disease-, program-, and sector-specific approaches.

Second, central to more effective and efficient strategies for child survival, health, and development, is a *better understanding of the maternal and child health and nutrition cycle* and its main determinants. The "maternal and child health and nutrition cycle" approach recognizes that:

- ⇒ maternal health and nutrition outcomes are key determinants to birth outcomes;
- ⇒ birth outcomes are key determinants for child mortality, health, and development outcomes;
- ⇒ (early) childhood health, nutrition and development outcomes are key determinants for adolescent health, nutrition, and development;
- ⇒ adolescent health influences maternal mortality, health, and nutrition outcomes; and,
- ⇒ the cycle continues.

Socioeconomic, environmental, behavioral, health, and nutrition factors influence this cycle (Simon, 1999). The challenges for the child health and development community in the next decade will be to jointly address the most important determinants and gaps with affordable, cost-effective, feasible, and culturally appropriate interventions that take into account both demand and supply factors, and to involve local communities in the identification of needs and priorities.

Third, considering the differences in infant and child mortality performance between states, *stratified child health policies are needed that take into account state-specific epidemiological and demographic patterns and key determinants*. Such policies might include the following.

States with high U5M/IMR levels and slow rates of decline need to:

- address priority maternal and child health problems through strengthening of health systems (including availability of drugs, monitoring and surveillance);
- prioritize the essential elements of child health and nutrition services, including strengthening of the immunization program and other preventive measures, as well as integrated approaches to clinical management: ARI, malnutrition, diarrhea, and fever;
- develop and expand community prevention and treatment of childhood illnesses (including strengthening of care seeking, compliance and preventive behaviors at household level).

States that have reached lower levels of U5M/IMR but are also experiencing a slowdown in U5M/IMR reduction, need to:

- sustain all of the programs outlined above;
- emphasize improved referral services (including obstetric emergencies);
- emphasize effective strategies for perinatal/neonatal mortality reduction (including comprehensive reproductive health services and improving women's nutritional status);

- implement early child development programs.

States with large proportion of urban poor need to:

- include policy options for innovative approaches to health services delivery, including increased access and use of quality services provided by private providers and NGOs.

The matrix in Box 3.1 summarizes some of the gaps and barriers identified in this study, and suggests policy options to address them. While neither comprehensive nor state specific, this matrix is meant to serve as an input to further discussions, and to facilitate design and planning for child mortality reduction at the state level.

Box 3.1 Options for Reducing Barriers to Child Survival

Gaps & barriers in child survival:	Possible policy options:
1. The IMR performance gaps	<ul style="list-style-type: none"> • Focus attention on states with high U5M levels and/or poor relative performance and/or a reduction in IMR declines. Develop state-specific strategies (including advocacy, incentives strategies, and increased commitment among stakeholders). • Apply managerial approaches at the state level to identify the main implementation bottlenecks in the health system and the most critical and feasible solutions. • Introduce more efficient, integrated strategies for prevention and management of childhood illness at the community and facility levels.
2. The neonatal/perinatal determinants	<ul style="list-style-type: none"> • Introduce or enhance integrated approaches to childhood illness with emphasis on neonatal care and referral services. • Introduce or expand a standard approach to the management of pregnancy and safe delivery; develop strategies for how to increase demand for and use of antenatal services and access to safe deliveries.
3. The maternal determinants	<ul style="list-style-type: none"> • Improve female education and nutrition and increase use of health services before, during and after pregnancy and delivery. • Expand successful reproductive health initiatives and develop feasible strategies for increasing antenatal and delivery services.
4. The gender gap	<ul style="list-style-type: none"> • Provide supplemental feeding and basic health services to all children, with particular attention to young girls.

	<ul style="list-style-type: none"> • Target at-risk girls with health services and supplemental feeding.
5. The nutrition determinants	<ul style="list-style-type: none"> • Develop a LBW strategy for wide-scale implementation, identifying the most influential factors and cost-effective, feasible interventions, including expansion of supplementary feeding and reduction of maternal anemia. • Review and revise strategies for micronutrient programs. Address known constraints such as availability of supplies, and motivating/educating communities. • Include nutrition in integrated strategies for prevention and care of children, including breast feeding counseling, provision of micronutrients, and feeding advice.
6. The urban poor	<ul style="list-style-type: none"> • Design and expand multisectoral approaches for prevention and care in slum areas. • Improve involvement of private sector to increase the reach of quality healthcare services for the urban poor. • Review and revise protocols and procedures to allow more practical and feasible approaches for private healthcare providers.

4. Supporting Tables

Table 4.1 Infant Mortality Rates, 1981-97 (SRS)

	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
URBAN																	
Andhra Pradesh	52	50	54	66	57	59	58	63	53	56	56	42	46	52	43	38	37
Assam	76	72	70	77	96	69	69	66	63	39	42	50	60	76	59	37	37
Bihar	60	60	65	79	62	68	72	70	63	46	46	49	441	61	57	54	53
Gujarat	89	89	71	56	64	66	59	64	70	54	57	53	42	51	47	46	46
Haryana	52	62	64	64	58	58	61	72	58	53	49	56	53	68	65	60	59
Karnataka	45	47	41	43	41	47	41	46	53	39	47	41	42	50	43	25	24
Kerala	24	24	26	27	30	20	25	22	15	15	16	13	8	14	13	16	15
Madhya Pradesh	80	79	76	76	79	82	81	83	78	61	74	74	67	57	61	61	57
Maharashtra	49	55	54	59	49	44	47	50	44	44	38	40	32	38	34	31	31
Orissa	68	64	73	84	84	75	75	69	78	68	71	80	69	65	65	65	65
Punjab	51	53	69	35	51	55	63	59	44	45	40	41	39	36	39	40	38
Rajasthan	53	60	82	69	76	71	69	66	58	59	50	65	54	62	62	60	61
Tamil Nadu	55	51	59	53	53	54	54	51	43	37	42	42	38	48	43	39	40
Uttar Pradesh	97	99	100	99	78	88	80	81	75	67	74	78	67	65	66	67	66
West Bengal	44	52	48	55	46	55	43	43	53	41	47	38	33	52	45	44	43
India total urban	62	65	66	66	59	62	61	62	58	50	53	53	45	52	48	46	45
RURAL																	
Andhra Pradesh	93	86	83	81	90	87	84	89	88	73	77	78	70	69	74	73	70
Assam	107	103	95	100	112	111	104	101	93	78	83	77	84	78	77	79	79
Bihar	124	116	102	97	109	104	104	99	93	77	71	74	73	68	74	73	73
Gujarat	123	120	120	126	112	124	113	101	92	79	73	72	65	70	68	68	69
Haryana	108	100	97	110	92	91	93	94	88	73	73	79	70	70	70	70	70
Karnataka	77	71	80	84	80	82	86	83	89	80	87	82	79	73	69	65	63
Kerala	40	32	35	29	32	28	29	29	23	17	17	17	15	16	16	13	11
Madhya Pradesh	152	145	135	130	131	124	128	128	125	120	125	109	113	105	104	102	99
Maharashtra	90	77	91	85	78	73	76	76	66	64	69	67	63	68	66	58	56
Orissa	140	139	131	135	137	127	131	126	125	127	129	118	115	108	107	99	100
Punjab	88	82	84	77	78	72	62	63	71	66	58	61	60	59	58	54	54
Rajasthan	118	105	115	133	114	113	108	109	103	88	84	94	88	87	90	90	89
Tamil Nadu	104	97	100	90	95	93	86	84	80	70	65	66	66	64	61	60	58
Uttar Pradesh	157	156	166	166	154	140	136	132	126	105	102	102	98	91	89	88	89
West Bengal	98	93	93	88	80	75	77	76	83	68	76	71	64	64	61	58	58
India total rural	119	114	114	113	107	105	104	102	98	86	87	85	82	80	80	77	77

TOTAL																	
Andhra Pradesh	86	79	77	78	83	82	79	83	81	70	73	71	64	65	67	66	63
Assam	106	102	94	99	111	109	102	99	91	76	81	76	81	78	77	74	76
Bihar	118	112	99	95	106	101	101	97	91	75	69	73	70	67	73	71	71
Gujarat	116	111	106	106	98	107	97	90	86	72	69	67	58	64	62	62	62
Haryana	101	93	91	101	85	85	87	90	82	69	68	75	66	70	69	68	68
Karnataka	69	65	71	74	69	73	75	74	80	70	77	73	67	67	62	53	53
Kerala	37	30	33	29	31	27	28	28	21	17	16	17	13	16	15	14	12
Madhya Pradesh	142	134	125	121	122	118	120	121	117	111	117	104	106	98	99	97	94
Maharashtra	79	70	79	76	68	63	66	68	59	58	60	59	50	55	55	48	47
Orissa	135	132	126	131	132	123	126	122	121	122	124	115	110	103	103	95	96
Punjab	81	75	80	66	71	68	62	62	64	61	53	56	55	53	54	52	51
Rajasthan	108	97	109	122	108	107	102	103	96	84	79	90	82	84	86	86	85
Tamil Nadu	91	83	87	78	81	80	76	74	68	59	57	58	56	59	54	54	53
Uttar Pradesh	150	147	155	155	142	132	127	124	118	99	97	98	94	88	86	85	85
West Bengal	91	86	84	82	74	71	71	69	77	63	71	65	58	62	58	55	55
INDIA	110	105	105	104	97	96	95	94	91	80	80	79	74	74	74	72	71

Source: Sample Registration System (SRS), 1981-1997

Table 4.2 Infant and Child Mortality Rates, 1978-93 (NFHS)

		Neonatal Mort.			Postneonatal Mort.			Infant Mortality			Child Mortality			Under-five Mort.		
		Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural
Assam	1978-83	64	50	66	34	26	35	98	76	101	60	37	63	153	110	158
	1983-88	60	60	60	37	41	36	96	100	96	54	27	57	145	124	147
	1988-93	51	49	51	38	18	40	89	67	91	59	37	61	142	101	146
Bihar	1978-83	59	39	63	49	33	52	108	72	115	57	38	61	159	107	169
	1983-88	59	31	63	45	34	46	104	65	110	46	21	50	145	84	154
	1988-93	55	35	58	34	25	36	89	59	94	42	36	43	128	93	133
Gujarat	1978-83	53	41	59	31	19	37	84	60	96	30	24	33	111	83	126
	1983-88	50	39	55	28	19	33	78	58	88	28	22	31	104	78	116
	1988-93	42	39	44	26	26	27	69	65	70	38	31	41	104	94	108
Haryana	1978-83	60	42	67	35	42	67	95	78	102	43	18	52	134	94	148
	1983-88	47	33	52	39	33	52	86	66	93	34	25	37	117	90	127
	1988-93	38	19	44	35	19	44	73	52	80	27	20	30	99	71	107
Jammu	1978-83	43	22	46	27	7	31	70	29	76	29	11	32	97	40	106
	1983-88	32	29	33	23	13	24	55	42	57	24	18	25	78	59	80
	1988-93	32	30	32	14	9	14	45	39	47	14	8	15	59	47	61
Karnataka	1978-83	56	55	56	38	24	44	94	79	99	52	40	57	141	116	151
	1983-88	54	38	61	29	18	34	84	56	95	35	27	39	116	81	130
	1988-93	45	39	48	20	21	20	65	60	68	24	11	29	87	71	94
Kerala	1978-83	28	30	27	13	10	14	40	40	40	19	11	22	58	50	61
	1983-88	28	31	27	9	10	9	38	41	36	11	9	12	48	50	47
	1988-93	16	6	19	8	4	10	24	10	29	8	4	10	32	13	39
Orissa	1978-83	70	58	72	75	59	78	144	117	149	21	15	22	162	130	168
	1983-88	64	38	68	63	47	66	126	85	134	18	10	20	142	95	151
	1988-93	65	42	69	47	42	48	112	85	117	21	25	21	131	107	135
Punjab	1978-83	36	29	39	25	22	26	61	50	66	22	28	21	83	76	85
	1983-88	29	17	34	22	15	25	52	32	59	20	9	24	70	41	82
	1988-93	31	21	34	23	22	23	54	42	57	15	14	15	68	56	72
Rajasthan	1978-83	36	34	36	34	15	39	70	49	75	38	17	43	105	65	115
	1983-88	46	39	48	33	25	35	79	64	83	35	19	39	112	81	119
	1988-93	37	45	36	35	24	38	73	69	73	32	10	37	103	78	108
Tamil Nadu	1978-83	50	29	60	29	31	29	79	60	89	51	40	57	126	97	140
	1983-88	47	30	54	27	28	27	74	59	81	32	27	35	103	84	113
	1988-93	46	41	49	22	20	22	68	61	71	20	4	29	87	65	98
West Bengal	1978-83	60	51	63	28	21	31	89	72	94	38	21	44	123	92	134
	1983-88	58	48	61	28	30	28	86	78	89	31	18	36	115	95	121
	1988-93	52	42	55	24	26	23	75	68	77	26	16	29	99	83	104
INDIA	1978-83	60	43	65	41	26	46	101	69	111	48	29	55	144	96	160
	1983-88	56	37	62	37	26	41	94	62	103	38	21	43	128	82	142
	1988-93	49	34	53	30	22	32	79	56	85	33	20	38	109	75	119

Source: National Family Health Survey (NFHS), 1992-1993

Table 4.3 Decline in Infant Mortality Rates by State, 1981-97*States Ranked by Total Decline in IMR*

	Infant Mortality, 1981			Infant Mortality, 1997			Decline (%) in Infant Mortality, 1981-97		
	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural
1 Kerala	37	24	40	12	15	11	68	38	73
2 Gujarat	116	89	123	62	46	69	47	48	44
3 Uttar Pradesh	150	97	157	85	66	89	43	32	43
4 Tamil Nadu	91	55	104	53	40	58	42	27	44
5 Maharashtra	79	49	90	47	31	56	41	37	38
6 Bihar	118	60	124	71	53	73	40	12	41
7 West Bengal	91	44	98	55	43	58	40	2	41
8 Punjab	81	51	88	51	38	54	37	25	39
9 Madhya Pradesh	142	80	152	94	57	99	34	29	35
10 Haryana	101	52	108	68	59	70	33	-13	35
11 Orissa	135	68	140	96	65	100	29	4	29
12 Assam	106	76	107	76	37	79	28	51	26
13 Andhra Pradesh	86	52	93	63	37	70	27	29	25
14 Karnataka	69	45	77	53	24	63	23	47	18
15 Rajasthan	108	53	118	85	61	89	21	-15	25

Source: SRS

Table 4.4 Child Health Program Indicators, 1992-93

<i>STATES</i>	<i>U5M</i>	<i>EPI rates</i>	<i>ORT use</i>	<i>ARI rates</i>
All India	109.3	35.4	30.6	66.3
Assam	142.2	19.4	35.2	40.7
Orissa	131.0	36.1	41.1	56.4
UP	141.3	19.8	22.7	68.3
Bihar	127.5	10.7	23.0	72.9
Tripura	104.6	19.0	NA	59.6
Gujarat	104	49.8	20.7	73.3
Rajasthan	102.6	21.1	22.7	54.3
Maharashtra	70.3	64.1	41.7	72.6
West Bengal	99.3	34.2	74.7	61.7
Haryana	98.7	53.5	19.5	77.7
Karnataka	87.3	52.2	34.0	74.0
Meghalaya	86.9	9.7	40.7	86.8
Tamil Nadu	86.5	64.9	27.1	67.4
Arunachal Pradesh	72.0	22.5	33.3	50.0
Punjab	68.0	61.9	32.7	88.1
Manipur	61.7	29.1	63.1	39.5
Jammu	59.1	65.7	44.4	77.6
Goa	38.9	74.9	41.4	82.3
Kerala	32.0	54.4	37.8	81.3
Mizoram	29.3	56.4	24.5	NA
Nagaland	20.7	3.8	24.6	31.6

Source: NFHS, 1992-93

EPI rates = % fully immunized

ORT use rates = % children with diarrhea given ORS or recommended home fluid

ARI rates = % of children with cough and fast breathing taken to health facility/provider

**Table 4.5 Selected Child Health Program Indicators, 1992-93
(by clusters of states according to U5M levels)**

<i>Cluster of states</i>	<i>U5M range</i>	<i>Median EPI rates</i>	<i>Median ORT use rates</i>	<i>Median ARI rates</i>
All India	109.3	35.4	30.6	66.3
Assam, Orissa, UP, Bihar, Gujarat, Rajasthan	>100	20.2 [10.7-49.8]	22.9 [20-41]	62.3 [54.3-73.3]
Maharashtra, West Bengal, Haryana, Karnataka, Tamil Nadu, Punjab	100- 50	57.7 [34.2-64.9]	33.3 [19.5-74.7]	73.3 [67.4-88.1]
Goa, Kerala	<50	64.6 [54.4-74.9]	39.6 [37.8-41.4]	81.8 [81.3-82.3]

Source: NFHS, 1992-93

EPI rates = % fully immunized; ORT use rates = % children with diarrhea given ORS or recommended home fluid

ARI rates = % of children with cough and fast breathing taken to health facility/provider

Table 4.6 States Ranked by U5M Levels and Median Rates of Key Indicators

<i>State</i>	<i>U5M</i>	<i>ORT (%)</i>	<i>Continued feeding (%)</i>	<i>ARI knowledge (%)</i>	<i>Fully immunized (%)</i>
CLUSTER: U5M >100		63	40	24	54
(All India)	109.3	54	40	33	64
Assam	142.2	64	49	19	41
UP	141.3	53	38	41	58
Orissa	131.0	14	8	24	61
Bihar	127.5	69	NA	NA	40
Rajasthan	102.6	63	43	NA	54
CLUSTER: U5M 50-100		56	52	26	72
Maharashtra	70.3	25	NA	30	82
West Bengal	99.3	91	59	35	51
Tamil Nadu	86.5	24	NA	NA	NA
Andra Pradesh	72.0	59	53	26	72
Punjab	68.0	66	27	11	84
Manipur	61.7	56	52	23	70
< 50					
CLUSTER: U5M <50		NA	NA	NA	NA
Goa	38.9				
Kerala	32.0				
Mizoram	29.3				
Nagaland	20.7				

Source: MICS 1995-97 – National report (DRAFT)

Table 4.7 Neonatal and Post-Neonatal Mortality Rates, 1972-92

	Neonatal Mortality Rate	Post-Neonatal Mortality Rate	Percent NNMR
1972	72	68	51
1973	68	66	51
1974	70	56	56
1975	78	62	56
1976	77	52	60
1977	80	50	62
1978	77	50	61
1979	77	52	60
1980	76	48	61
1981	70	41	63
1982	67	38	64
1983	67	38	64
1984	66	38	63
1985	60	37	62
1986	60	37	62
1987	58	38	60
1988	57	38	60
1989	56	35	62
1990	53	27	66
1991	51	29	64
1992	50	29	63
1994	48	26	65
1995	48	26	65

Source: Registrar General India

	<u>IMR</u>	<u>CMR</u>	<u>UMR</u>
Mother's education			
Illiterate	101	44	141
Literate, < middle complete	63	23	84
Middle school complete	56	9	65
High school and above	37	6	43
Medical maternity care			
No antenatal care	97	54	146
Either antenatal or delivery care	64	23	85
Both antenatal and delivery care	44	13	57
Place of delivery			
Public health facility	59	19	77
Private health facility	39	4	42
Home	78	40	114
Mother's age at birth			
Less than 20	107	38	141
20-29	76	35	108
30-39	91	34	122
40-49	112	58	163
Previous birth interval			
Less than 24 months	130	55	178
24-47 months	68	35	3
More than 48 months	42	16	57
Birth order			
1	93	26	117
2	77	32	106
3	72	37	107
6	98	40	134
7	120	54	168

Source: NFHS 1992-93

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Appendix 1

Key Data Sources

A. The National Family Health Survey

The NFHS was carried out between April 1992 and September 1993 in 24 states and in Delhi, covering 99 percent of India's total population. Almost 90,000 women between the ages of 13 and 49 were included in the sample. This analysis uses the results for India as a whole, and also results of those individual states for which reliable survey reports were available.¹ (When data become available from the NFHS 1998-99 survey, it will allow comparison of current rates with the NFHS 1992-93 rates.)

To measure infant and child mortality, the NFHS administered a questionnaire in which eligible respondents provided a complete birth history. The birth history included the date of birth of each child, survival status, sex, the age of each child at the time of the survey or the age at the time of death for children who had not survived. Information on survival times was aggregated, and probabilities of dying were calculated using standard life table methods.

The resulting infant and child mortality rates are subject to both sampling and reporting errors. Sampling errors occur because the NFHS sample size and design produce one of many possible samples from a given population, each of which would yield somewhat different results. Sampling error is measured by the standard errors for each indicator, which can be used to show the confidence interval within which the true value for the population may be expected to fall.

Due to these sampling errors, caution must be used in interpreting the mortality results. Many of the trends in the mortality indicators are not, in a strict statistical interpretation, evidence of a change over time or of differences among states. Standard errors tend to be particularly large for indicators that separate urban and rural areas, and for less common events. The trends in this study are therefore to be interpreted as suggestive, rather than conclusive. Table A.1 shows the sampling errors for three mortality indicators for India and for two states, illustrating typical standard errors and confidence intervals.

Nonsampling errors relate to the validity of the birth history data, the most serious of which are underreporting of infant and child deaths and the misreporting of the timing of deaths. Of particular concern for analyzing trends in mortality rates is the common pattern of underreporting information on children born longer ago, which leads to understatement of any decline in mortality. Various analyses of the NFHS indicate that underreporting of child deaths has not been substantial (IIPS, 1995).

¹ These states are Assam, Bihar, Goa, Gujarat, Haryana, Jammu, Karnataka, Kerala, Orissa, Punjab, Rajasthan, Tamil Nadu, West Bengal. Excluded were the northeastern states (Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, and Tripura), for which data were of doubtful quality.

B. The Sample Registration System

The Sample Registration System (SRS) tracks births and deaths through continuous enumeration by resident enumerators, as well as through biannual surveys. The system was first started in a few states in 1965, with coverage extended in 1970 to all states and union territories. Infant mortality rates and child deaths are published each year, but not child mortality rates. Occasionally, SRS reports have included neonatal and perinatal mortality rates. The analysis in this study is limited to the larger states.

The continuous registration and survey results are matched and verified in the field to minimize duplication and omission of vital events. The results are generally believed to be quite accurate. Improvement in the accuracy of the data is likely to have occurred in some states over time, which may result in a slightly underestimated pace of mortality decline. However, this is not likely to have had a major impact on the estimation of trends. A 1980 inquiry into omissions of vital events found that death rates were underestimated by about 3 percent nationally; by 1985, this had improved to 2.5 percent, indicating limited room for improvement.

As with any sample, estimates of fertility and mortality rates are accompanied by standard errors. Because the SRS samples are larger than those of the NFHS, sampling errors tend to be smaller. Table A.2 shows the 95 percent confidence intervals for infant mortality rates reported in 1996. As with the NFHS data, the SRS data are merely suggestive of trends, and require a cautious interpretation, as they frequently lack statistical significance.

Table A.1 Sampling Errors for Mortality Indicators, India and Selected States (NFHS)

	<u>Value</u>	<u>Standard Error</u>	<u>95% C.I.</u>
INDIA			
Neo-natal mortality rate			
Urban	34.1	1.9	30.3 - 38.0
Rural	52.9	1.5	49.9 - 55.8
Total	48.6	1.2	46.1 - 51.1
Infant mortality rate			
Urban	56.1	2.5	51.1 - 61.2
Rural	85.0	1.8	81.4 - 88.7
Total	78.5	1.6	75.4 - 81.6
Child mortality rate			
Urban	19.6	1.7	16.2 - 22.9
Rural	37.6	1.3	35.1 - 40.1
Total	33.4	1.0	31.3 - 35.5
Tamil Nadu			
Neo-natal mortality rate			
Urban	41.4	8.1	25.3 - 57.5
Rural	48.9	6.2	36.5 - 61.3
Total	46.2	4.9	36.4 - 56.0
Infant mortality rate			
Urban	61.2	10.5	40.1 - 82.3
Rural	71.4	6.9	57.6 - 85.1
Total	67.7	5.8	56.2 - 79.3
Child mortality rate			
Urban	3.7	2.1	0 - 7.9
Rural	28.7	4.7	19.4 - 38.0
Total	20.1	3.3	13.6 - 26.6
Rajasthan			
Neo-natal mortality rate			
Urban	44.7	9.1	26.6 - 62.9
Rural	35.7	4.3	27.1 - 44.4
Total	37.2	3.9	29.4 - 45.0
Infant mortality rate			
Urban	68.6	12.0	44.6 - 92.5
Rural	73.4	6.4	60.6 - 86.1
Total	72.6	5.7	29.4 - 45.0
Child mortality rate			
Urban	9.8	4.0	1.7 - 17.8
Rural	36.8	3.8	29.2 - 44.5
Total	32.3	3.3	25.7 - 38.9

Source: NFHS 1992-93

Table A.2 Sampling Errors for IMR, India and Selected States, 1996 (SRS)

	<u>Value</u>	<u>Standard Error</u>	<u>95% C.I.</u>
INDIA			
Urban	46	1.6	42.7 - 49.1
Rural	77	1.1	75.1 - 79.4
Total	72	1.0	69.7 - 73.4
Andhra Pradesh			
Urban	38	6.3	25.8 - 50.7
Rural	73	4.1	64.4 - 80.6
Total	65	3.5	58.2 - 71.9
Bihar			
Urban	54	6.7	40.7 - 67.5
Rural	73	2.7	67.3 - 77.8
Total	71	2.5	66.1 - 76.0
Gujarat			
Urban	46	6.2	34.0 - 58.5
Rural	68	3.3	61.1 - 74.1
Total	61	2.9	55.6 - 67.2
Karnataka			
Urban	25	3.7	18.2 - 32.8
Rural	63	3.6	56.3 - 70.5
Total	53	2.8	47.6 - 58.7
Kerala			
Urban	16	4.4	7.8 - 25.2
Rural	13	1.8	9.3 - 16.3
Total	14	1.7	10.3 - 17.1
Madhya Pradesh			
Urban	61	6.6	48.0 - 74.2
Rural	102	3.7	94.3 - 108.9
Total	97	3.6	89.6 - 104.0
Maharashtra			
Urban	31	3.9	23.1 - 38.5
Rural	58	4.0	50.1 - 66.0
Total	48	3.0	42.5 - 54.4
Orissa			
Urban	65	6.8	51.7 - 78.8
Rural	99	5.0	89.0 - 108.8
Total	96	4.6	86.6 - 104.8
Punjab			
Urban	40	6.4	27.1 - 52.6
Rural	54	4.8	44.7 - 64.0
Total	51	4.0	43.3 - 59.4
Rajasthan			
Urban	60	6.6	46.9 - 73.4
Rural	90	4.1	81.3 - 97.8
Total	85	3.7	78.0 - 92.7
Tamil Nadu			
Urban	39	4.5	29.5 - 47.6
Rural	60	3.9	52.1 - 67.6
Total	53	3.0	47.2 - 59.3
Uttar Pradesh			
Urban	67	5.5	55.6 - 77.4
Rural	88	2.8	82.1 - 93.4
Total	85	2.5	79.8 - 89.9
West Bengal			
Urban	44	5.6	32.8 - 55.1
Rural	58	3.3	51.3 - 64.5
Total	55	2.9	49.6 - 61.1

Source: SRS

Annex 2

Child Health Programs in India

Future child health policies and strategies need to build on the lessons learned from past and current child health programs in India. They should sustain the achievements made to date, further improve quality, and increase efficiencies through cost-effective and affordable integrated approaches to prevention and treatment of childhood illnesses. Future programs need to address specific gaps in neonatal care and referral services. Several of the most important child health programs in India are briefly described below:

The **Child Survival and Safe Motherhood (CSSM)** program was launched in 1990 to provide integrated services for mothers and children. This program was taken a step further in 1994 with the development of the Reproductive and Child Health Services program, following the recommendations of the Cairo Conference. The original national CSSM program focused on infant feeding, Vitamin A deficiency, ARI and diarrhea management, with a reliance on assistant nurse-midwives (ANMs) as the key service providers (CSSM/MCH Division MOHFW, 1994). An evaluation of the CSSM in 1995 noted that the clinical aspects of ARI had been more difficult to implement than the other components, and that there were evident gaps in case management practices (Swedish International Development Agency (SIDA), 1995). The SIDA report strongly recommended a move forward in reproductive health by endorsing the inclusion of emergency obstetrics and neonatal care as well as continued capacity building. An assessment carried out by the U.S. Agency for International Development in 1994 also highlighted the need for a comprehensive approach to reproductive and child health services (Expanded Technical Needs Assessment 1995). In 1998, SIDA supported an evaluation in Tamil Nadu, which included a review of routine data gathered directly from blocks without central and district involvement in the data management. The most interesting finding is the documented effectiveness of the Integrated Child Development Scheme's (ICDS') nutrition program (including growth monitoring and deworming of children and the promotion of micronutrients and supplemental feeding for women and children) on nutritional status with a consistent gradual decrease in the proportion of moderate and severe malnutrition over the period 1988-97.

The **Expanded Program of Immunization (EPI)** was established in 1979 to provide tetanus toxoid (TT) vaccine to pregnant women, as well as BCG, polio, DPT, and measles. In 1985, the **Universal Immunization Program** was initiated, aiming at 85 percent coverage with BCG, DPT and polio immunizations. The coverage rates are still generally far from this goal, however, with pockets of the polio virus continuing to surface across the country. According to the Union Health Ministry, the disappointing polio coverage rates achieved by the program (73 percent nationally, ranging from 5 percent in eastern Bihar to over 95 percent in western Maharashtra and southern Tamil Nadu) are due to a lack of faith among urban families in the polio pulse immunization strategy and the lack of access or awareness of the strategy in rural areas. (CDC/World News, December 7, 1998). Sustainability, maintenance of quality, and extending services will remain challenges for India in the next decade.

The **National Control of Diarrheal Diseases Program** was established in 1985 with a focus on oral rehydration therapy for the reduction of diarrhea-specific child mortality. A health facility survey was conducted in 1992 (85 health facilities in Maharashtra and Orissa) to assess quality of case management of diarrhea in children, availability of ORS and antibiotics, performance in relation to training status, and drug use. The survey showed a significant discrepancy between knowledge and

practice. The **National Acute Respiratory Infection (ARI)** program, begun in 1990, has been implemented in only twenty-four districts in the country, and focuses on training of health workers.

The CSSM program integrated some elements of various disease-specific programs, immunization, and nutrition in its training activities and service provision for women and children. Recently, revised treatment and prevention protocols for the major causes of childhood death (including ARI, malnutrition, diarrhea, and measles and malaria in some areas) are being considered to improve efficiencies, cost-effectiveness, and quality of training and services. In this context, the WHO/UNICEF approach to **Integrated Management of Childhood Illness (IMCI)** is being reviewed and considered for adaptation by the MOHFW and expert pediatricians in India. A National Consultation on IMCI, organized by the MOHFW in January 1999, reviewed the new WHO/UNICEF approach to IMCI and stressed the need for neonatal and referral care to be included in the development of IMCI in India and for state-specific adaptation (Shah, 1999, Costello 1999). Introducing IMCI is viewed as an opportunity to increase the efficiencies of integrated preventive and case management services and to enhance hands-on clinical skills. It includes counseling on nutrition for all sick children and breast feeding counseling for mothers with infants. Following the orientation meeting in early 1999, a model demonstration course on IMCI for pediatricians was conducted in mid-1999 to assess its relevance in the Indian context.



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