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Inter-state Inequality in Infant Mortality in India, 1981-2000

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ABSTRACT

Based on the estimates of infant mortality rate available through the sample registration system, this paper measures levels and analyses trends in inter-state inequality in the probability of death during infancy in India by rural and urban residence for the period 1981 through 2000. The analysis reveals that with the declining levels of infant mortality, the absolute inter-state inequality in the probability of death during infancy has also decreased for the country and for its rural and urban populations. In terms of relative inter-state inequality, however, the declining trend in inequality could be observed in rural areas only; in urban India, the relative inter-state inequality in infant mortality has tended to increase during the 20 years under reference. There is a need of a community based public health services delivery network in the urban areas to address the increase or stagnation in relative inter-state inequality in urban infant mortality rate in India.

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INTRODUCTION

Inter-state disparity or inequality in all indicators of demographic situation including the probability of death during infancy and early childhood in India is well known. Reducing these inter-state disparities has been an integral component of the official strategy to hasten the pace of demographic transition in the country. At the aggregate level, there has been a consistent improvement in the demographic situation in the country and in its constituent states. The infant mortality rate decreased from 110 infant deaths per 1000 live births around the year 1981 to 68 infant deaths per 1000 live births in 2000 for the country as a whole (*1*). A similar trend has also been observed in other demographic indicators at national and state level. However, there has been little systematic investigation of the observed inter-state inequality in the demographic situation. It is not known, for example, whether a decrease in the probability of death during the first year of life has also resulted in a decrease in inter-state disparity or inequality in this probability. In fact, the problem of demographic or health transition in India is simply the problem of accounting for observed distribution across states and across time in the levels and the rate of change in different demographic and health indicators.

Regional disparities in the risk of death in different age groups have generated considerable discussion and interest in recent years in the context of falling mortality rates. Most of this discussion has however been focussed on inequalities in the risk of death between social classes. This debate has foundered on difficulties in defining and measuring acceptable categories and ensuring consistencies over time (*2*). It has been argued that differences between death rates of different social classes are primarily a reflection of the classificatory scheme itself and bear little resemblance to actual changes in the inequality in the probability of death (*3*).

The probability of death during infancy or infant mortality is universally regarded as one of the most sensitive indicators of demographic and health transition, especially when mortality levels are high and majority of deaths are due to the causes which are avoidable. It is associated with a host of important social and economic indicators related to general standards of living and quality of life such as education and level of nutrition, especially of the mother and such factors as the availability of effective ante-natal care and safe delivery services. It is well established that factors which increase the parental capacity to provide adequate care to infants and young children, when present, increase the chances of the survival of infant and young children, while their absence is expected to increase the probability of premature deaths. Viewed in this context, inter-state inequality in the probability of death in the first year of life is indicative of the inter-state inequality in the level of development, especially in the inter-state disparity in the health status and living standards of the people.

The purpose of this paper is to present an analytical description of the manner in which the Indian states have behaved over the period 1981 through 2000 in terms of the probability of death in the first year of life in the context of falling infant mortality rates. The period 1981 through 2000 is of particular importance to the analysis of inequality in the probability of death during infancy in India. During this period, special efforts were launched in the country, first through Universal Immunization Programme and subsequently through Child Survival and Safe Motherhood and Reproductive and Child Health Programmes for an accelerated improvement in the probability of survival during infancy and in early childhood. These programmes appear to have yielded benefits in terms of improvements in infant and child survival. The impact of these programmes in terms of reducing the disparity or inequality in the probability of death during infancy across the constituent states of the country, however, is yet to be analysed.

Measurement and analysis of inequality in the probability of death during infancy or, equivalently, the probability of survival in the first year of life is important in the quest for Health for All for at least two reasons. First, inequality in the probability of death in the first year of life, almost always implies both absolute and relative deprivation in matters related to health and well being to a specific section of the community. Second, unequal distribution of the probability of death among individuals or among population groups, on average, hampers the pace of demographic and health transition. There is also a strong, and universally accepted, ethical basis for being concerned that there is a reasonable equality in the probability of survival among individuals as well as among population groups. Because of these considerations, inequalities in the probability of death or, equivalently, in the probability of survival are now getting increased attention at the policy level (*4-19*). Average levels of health are not sufficient; distribution of health is also important in measuring the state of health.

DATA SOURCE

Estimates of infant mortality rate for India and for its constituent states are prepared by the Registrar General of India separately for total, rural and urban areas on the basis of the information collected through the sample registration system. The sample registration system is a dual reporting system. The system was introduced on a pilot basis in the country in 1964-65 and now covers the entire country (*20*). Annual estimates of infant mortality rate based on the sample registration system are available for the year 1970 onwards for the country and for its constituent states (*21*). Sample registration system is the only source which provides unbroken series of the estimates of annual infant mortality rate for India and for its major states now lasting for 30 years.

A review of the coverage of sample registration system suggests that it is nearly complete (*22*). An evaluation of the sample registration system during the year 1980-81 had revealed that the extent of under enumeration in the reporting of births and deaths in the system was of the order of 3 per cent at the national level (*23*). Subsequent to this evaluation, the sample on which the sample registration system was based was revised and expanded with the result that a similar evaluation study in 1985 revealed an improvement in completeness of birth and death reporting through the system (*24*). A direct check of coverage of registration in 1986 showed that the coverage in births and deaths registration was 98 per cent (*25*).

Estimates of demographic indicators prepared on the basis of the sample registration system have also been found to be associated with year-to-year random fluctuations. Use of the estimates of infant mortality rate, generated through the sample registration system, therefore, requires elimination of these random fluctuations through appropriate smoothing process. The procedure advocated by the Registrar General of India is to use three years moving averages instead of annual estimates generated through the sample registration system for the purpose of analysing trends and making inferences. The underlying assumption is that the average infant mortality rate for the three-year period is located at the mid-point of the reference period. In other words, we assume that the average infant mortality rate for the period 1981-83, actually refers to the infant mortality rate for the year 1982, etc.

In addition to sample registration system, estimates of the probability of death during the first year of life are also available through a number of other sources. Using the information on children ever born and children surviving collected during the decennial population census; the Registrar General of India has prepared estimates the probability of death during infancy and early childhood for 1981 and 1991 through the application of indirect techniques (*26*). Estimates of the probability of death during infancy based on the information on children ever born and children surviving from the 2001 population census are yet to be made available by the Registrar General of India. Estimates of infant mortality are also available through the National Family Health Survey which was carried out throughout the country in

1992-93 and 1998-99 (*27-28*). These estimates are based on the analysis of birth history data collected from a sample of women in their reproductive age group.

Because of different methodologies used in the collection of information and in estimation, the estimates of the probability of death in the first year of life obtained from different sources are not strictly comparable. However, the level of the probability of death during infancy as indicated by different sources, specially, the annual estimates of infant mortality rate from sample registration system are consistent with those of National Family Health Survey (*29*).

METHOD

We follow the approach developed and proposed by the World Health Organization for measuring and analysing health inequalities (*30*). The World Health Organization defines health inequality to be variations in the health status across individuals in a population (*31*). It advocates measuring health inequality as a distinct dimension of the performance of health systems (*32*). The health status of an individual is proposed to be measured through individual's health lifespan which is different from the set of health risks individuals are exposed to at each stage of their life (*33*). Currently, it is not possible to measure health risks at the individual level but these risks can be measured at population group level. In any case, a healthy lifespan may be considered the realization of a set of health risks. Similarly, when the risk of being in a state less than full health is combined for all ages for an individual, it is possible to estimate the expected number of years lived by that individual in full health, given a set of health risks.

There has been considerable debate on the approach of measuring health inequality proposed by the World Health Organization. The centre stage of this debate is the question 'equality of what?' There are two options: equality of outcomes or equality of opportunities. The healthy lifespan is an outcome. Two individuals having different health risks or health expectancy may have same health lifespan. The probabilities of death, disability and incidence of diseases, on the other hand, are opportunities. Two individuals having same health lifespan does not mean that they have same probabilities of death, disability and incidence of diseases. It is argued that we should want individuals to have equality of capabilities and not equality of the realization of their capability (*34*).

If the focus of discussion is the healthy lifespan then equality of the healthy lifespan of two populations is possible only when the probabilities of death, disability and incidence of diseases are either zero or one for the entire population. This cannot be an achievable goal for any population. What is more realistic, therefore, is to achieve equality in the distribution of health risks among individuals and among population groups and comparing these distributions across populations and over time in the same population.

In view of the above considerations, the present paper focuses on the opportunities, not outcomes as regards death in the first year of life. The paper is devoted to the measurement and analysis of the inequality in the probability of death in the first year of life across 15 major constituent states of India; states with a population of at least 20 million and more at the time of 2001 population census. These states accounted for more than 95 per cent of the population of India enumerated at the time of 2001 population census (*35*). Moreover, the analysis is restricted to the average probability of death during infancy as measured through the annual infant mortality rate, treating the state as a single entity. The analysis does not focus on the inequality in the probability of death across districts within each state. According to the Constitution of India, India is a Republic, constituted by federal states and Union Territories. Although the centre sets policies and develops guidelines for health improvement programmes and activities, the implementation of these programmes and activities is entirely the responsibility of the state; the states are also free to evolve their own policies and programmes addressing the health needs of the people within the overall policy framework laid down by the centre.

The constituent states of India also vary widely in terms of social and economic development and quality of life of the people. Disparities or inequalities in health opportunities across the states, therefore, constitute an important element in the formulation of health policies and programmes at the national level. Disparities or inequalities in health opportunities within the states such as across districts a state are no doubt important but primarily for the state government. At the national level, it is the disparity or the inequality in health opportunities across states that is important from a policy point of view.

The method of analysis comprises of computing indexes of state-mean differences (SMD) and inter-state differences (ISD) in infant mortality rate across states. The individual-mean difference compares the infant mortality rate of a state with the average infant mortality rate of the 15 major states which are focus of attention in this analysis. The index of state-mean differences (SMD) is defined as

$$SMD(\forall, \exists) = \frac{\sum_{i=1}^{n} * y_i - \Phi *^{\forall}}{n\Phi^{\exists}}$$

where y_i is the infant mortality rate for state i, Φ is the un-weighted average of the infant mortality rates of the 15 states under consideration and n is the number of states included in analysis. The parameter "changes the significance attached to differences in infant mortality rate observed at the end of the distribution compared to difference observed near the mean of the distribution of infant mortality rate across states. When $\forall$=1, equal weights are given to all differences from the mean. When $\forall$>1, bigger weights are given to differences farther from the mean. The parameter $\exists$ controls the extent to which differences from mean are assessed in absolute units or in units relative to the mean value. When $\exists$=1, the differences are assessed strictly relative to the mean value and when $\exists$=0, the index measures absolute deviations from the mean. Any value of $\exists$ between 0 and 1 results in a measure with a mix of absolute and relative inequality.

The index of inter-state differences, on the other hand, has the general form

$$ISD(\forall, \exists) = \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} |y_i - y_j|^{\forall}}{2n^2\Phi^{\exists}}$$

where $\forall$ and $\exists$ have same interpretations as in case of individual-mean differences.

We calculate the two indexes for three different values of $\forall$ ($\forall$ = 1, 2 and 3) and for three values of $\exists$ ($\exists$ = 0, 0.5 and 1). Note that when $\forall$=1 and $\exists$=1, the index of inter-state differences in infant mortality is nothing but the Gini coefficient which is very widely used to measure inequalities in income distribution. Note that for $\forall$=2, the two indexes are identical. Similarly, the index of inequality used by the World Health Organization in its World Health Report 2000 is a special case of the index of inter-individual differences with $\forall$=3 and $\exists$=0.5. On the other hand, when $\forall$=2 and $\exists$=1, the index of individual-mean differences is the square of the coefficient of variation, a commonly used index of measuring inequality in economics.

There exists a wide variety of alternative summary measures of a distribution that are not part of the two families of summary measures described above - the individual-mean differences and the inter-individual differences. These measures have primarily been used by economists in the measurement of income inequality within and across population groups. Some of these commonly used summary measures of distribution include standard deviation of logarithms, Dalton's measure, Atkinson's measure and concentration index. The concentration index has been used in the literature as a summary measure on income-related inequalities in health. It is a summary measure of a bivariate distribution. It measures the covariance between the income ranks of individuals (states) and their health status (infant mortality rate). The concentration index, however, is not a conventional measure of inequality. It has been observed that the income distribution can worsen significantly with no effect on the concentration index as long as the relative ranks of individuals (states) remain the same. Similarly, the univariate health (infant mortality rate) distribution can worsen significantly with no effect on concentration index as long as the covariance between income ranks and health status (infant mortality rate) of individuals (states) remains the same (*36*).

INFANT MORTALITY IN INDIA

According to the sample registration system, the infant mortality rate for the country as a whole decreased from 110 in the year 1981 to 68 in 2000 - a reduction of 42 points over two decades. Decrease in the infant mortality rate has been faster in rural than in urban areas. The rural infant mortality rate decreased by 45 absolute points - from 119 to 74 between 1981 and 2000 - compared to a decrease of only 18 absolute points in the urban areas - from 62 to 44. As the result, the rural-urban gap in the infant mortality rate which was 57 in 1981 decreased to 30 in the year 2000.

The decline in infant mortality rate in India has however not been uniform; the rate of decline in infant mortality rate tended to stagnate for brief periods, and was normally followed by a subsequent rapid decline. This pattern of trend in infant mortality rate is more marked during the 1980s than during the 1990s and in rural than in urban population. Moreover, the decline in infant mortality rate during the 1990s appears to have slowed down as compared to the decline during the 1980s (Figure 1). For the year 2000, the infant mortality rate for the country was estimated to be 68; this level is same as the predicted infant mortality rate based on the trend during the period 1991-2001 but is well above the target of less than 60 infant deaths for every 1000 live births that was set to be reached, among others, to achieve the goal of Health for All (*37*). It is well known that with the decrease in infant mortality, further gains in the probability survival in the first year of life become more difficult to achieve. However, infant mortality rate in India tend to plateau at a level which is significantly higher that accepted. Reasons for the slowdown in infant mortality rate decline in India during the 1990s are difficult to be explained on the basis of the available evidence (*38*).

The average levels of infant mortality rate and its trend over time, however, mask some very strong and persistent inter-state variations in the risk of death during infancy (Figure 2). During 1981-83, the infant mortality rate was highest in Uttar Pradesh which is the largest state of India with a population of more than 166 million at the 2001 population census and was lowest in Kerala. The infant mortality rate in Uttar Pradesh, during 1981-83, was nearly five times higher than the infant mortality rate in Kerala. Kerala continues to have lowest infant mortality rate amongst the major states of the country. However, highest infant mortality rate, in 2001, has been estimated in Orissa; Uttar Pradesh having the third highest infant mortality rate among the major states of the country but the gap between highest and lowest infant mortality rate in the country has increased. Infant mortality rate in Orissa, the state with highest infant mortality rate during 1998-2000 is more than six times the infant mortality rate in Kerala, the state with lowest infant mortality (*39*).

Despite reduction in average levels wide inter-state disparity in infant mortality rate in India continues to persist (Figures 3 to 5). During 1981-83, the range of infant mortality rate across the states was 117 -

ranging from a maximum of 151 to a minimum of 34. This range shrunk to 82 during 1998-2000 - ranging from 97 to just 15. Latest data released by the Registrar general of India suggests that only seven of the 15 major states have been able to reduce the infant mortality rate to below 60 infant deaths per 1000 live births by the year 2000 - the goal set to achieve Health for All by 2000 (*40*).

Infant mortality rate in India has been subject to intensive enquiry in terms of trends, regional differentials and determinants (*41-45*). Dyson and Moore grouped the major states of India into two basic demographic regions: the north and the south including states in the east (*46*). Nag, on the other hand, compared the state of Kerala in the south with the state of West Bengal in the east (*47*). Based on the survey of infant and child mortality carried out in 1979, Jain has demonstrated the importance of maternal education and poverty level in explaining regional difference in infant mortality (*48*). A recent World Bank report has also focussed on social class differentials in infant mortality rate in India (*49*). Another study carried out by the World Bank has also highlighted the role played by maternal and child health interventions in lowering infant mortality rate although the data do not permit directly attributing infant mortality decline to official programme efforts (*50*). There are numerous studies which have explored the correlated and determinants of infant mortality at the local level (*51-56*). All these studies have attempted to explain differentials in infant mortality in India across states and within states in terms of a number of social, economic, cultural and behavioural factors. Findings of these studies have contributed substantially in developing strategies and programmes for enhancing infant and child survival probability at national, state and local levels. Inter-state inequality or disparity in the probability of death in the first year of life and changes in this inequality over time have, however, not been the focus of research on regional disparities in infant and child survival in India despite the fact that reduction in inter-state disparity or inequality in the health status is an important component of health transition efforts in the country. The recently announced National Health Policy of the Government of India highlights the wide disparity between better performing and poor performing states in terms of key health related indicators. One of the principal objectives of India's National Health Policy 2002 is to evolve a policy structure which reduces inequities in health status across states and across different population groups and allows the disadvantaged sections of society a fairer access to public health services (*57*). Obviously, analysing the trends in the inter-state inequality in health status (infant mortality rate) is important in the context of the health equity goals and objectives as recognized in the National Health Policy 2002.

INTER-STATE INEQUALITY IN INFANT MORTALITY

Estimates of the index of individual mean differences and the index of inter-individual differences in infant mortality in India are presented in tables 4 and 5 respectively for total, rural and urban populations and for different combinations of parameters " and $. In order to assess the trends in inter-state inequality in infant mortality rate over time, we fitted an ARIMA(1,0,0) model to state-mean differences and inter-state differences for different values of " and $. An analysis of autocorrelations in the time series of inequality indexes revealed that regression residuals are those of a first-order autoregressive process and so ARIMA(1,0,0) was applied *(58)*. Results of the time series analysis in terms of regression coefficient of the index of inequality on time are given in table 5. The analysis reveals that 47 out of 54 regression coefficient of the index of inequality on time are negative while 40 of the possible 54 regression coefficients are statistically significant. This indicates that, in general, inter-state inequality in infant mortality rate in India has decreased over time. Of the 7 regression coefficients which have been found to be positive, 6 are related to urban population - three related to state-mean differences and three related to inter-state differences - and only 2 are statistically significant.

Salient findings of the time series analysis of inter-state inequality in infant mortality rate in India may be summarized as under:

- The absolute inter-state inequality in infant mortality rate in India has decreased over time for the total as well as separately in rural and urban populations. The regression coefficients of all indices of state-mean differences and inter-state differences on time are negative for $\exists \neq 0$ and irrespective of the value of $\forall$. Moreover, all but two of these values are statistically significant; the two indices which are not found to be statistically significant are SMD(1,0) and ISD(1,0) for the urban areas.

- The same cannot be said about the relative inter-state inequality in infant mortality rate. There is a clear indication that for the total and for rural population, relative inter-state inequality in infant mortality has decreased but in the urban population, the time series analysis suggests an increase in this inequality when equal weights are allocated to all differences from mean ($\forall=1$). The relative inter-state inequality in urban infant mortality rate turns negative only when very high weights are given to differences farthest from the mean ($\forall=3$) but the regression of the inequality index, either measured through state-mean differences or through inter-state differences, remains statistically insignificant.

- When equal importance is given to absolute and relative inequality ($\exists=0.5$), the inter-state inequality in infant mortality rate shows a statistically significant declining trend in total and rural population in terms of both state-mean differences and inter-state differences. By contrast, the inter-state inequality in urban infant mortality rate shows an increasing but statistically insignificant trend.

- The trend in inter-state inequality in infant mortality rate reflected either through the state-mean differences or through the inter-state differences is more or less similar.

- The time series analysis suggests that Indian states have exhibited a tendency of convergence during the last two decades as regards the probability of death during the first year of life is concerned. This convergence has coexisted with the decrease in the levels of probability of death during infancy. This is an encouraging feature of transition in child survival in India as measured by the infant mortality rate. This transition also reflects the effectiveness of child survival strategies and programmes adopted by India in not only reducing the infant mortality levels but also in narrowing the inter-state differentials in the total and in rural population as regards the probability of death in the first year of life. However, trends in inter-state inequality in infant mortality in the urban areas are not so encouraging. Unlike the rural infant mortality rate, the Indian states have shown a tendency to diverge in terms of urban infant mortality rate during the last 20 years.

The decrease in the inter-state inequality in infant mortality rate in India, however, appears to have slowed down after 1993-95 in total and rural populations as may be seen in almost all indices presented in tables 4 and 5. This stagnation in the decrease in inter-state inequality again coexists with a slowdown in infant mortality rate decline in the country (*59*). Although, slowdown in the decrease in either infant mortality rate or in inter-state inequality in infant mortality rate is not a welcome feature of transition in child survival in India, yet it again confirms a close association between decrease in infant mortality levels and the decrease in inter-state inequality in infant mortality. The urban India, however, does not conform to this pattern. There are clear indications to suggest that inter-state inequality in urban infant mortality rate in India has either increased during the last twenty years or has remained unchanged despite falling urban infant mortality rates.

DETERMINANTS OF INEQUALITY IN INFANT MORTALITY

The inter-state inequality in infant mortality increases if the rate of decrease in infant mortality is slower in high infant mortality states as compared to low infant mortality states. On the other hand, inequality decreases if the rate of decrease is faster in high infant mortality states than in low infant mortality states. In order to test this hypothesis, we have estimated the change in the infant mortality rate between 1981-83 and 1998-2000 in five lowest infant mortality states of the country during 1981-83 and five highest infant mortality rate states during the same period and compared the decrease in infant mortality in the two groups (Figure 6). The comparison confirms that, during the period 1981-2000, on average, the decrease in infant mortality rate in five highest infant mortality states in 1981-83 has been faster than the decline in infant mortality in the five lowest infant mortality states for total and rural populations but not for the urban population. In the urban population, decrease in infant mortality has been faster in the five lowest infant mortality states than in five highest infant mortality states with the result that inter-state inequality in urban infant mortality has increased. By contrast, because of the faster decrease in total and rural infant mortality in states with highest infant mortality in 1981-83, the inter-state inequality in the two has decreased during the period under reference. The median decrease in total infant mortality rate in states having lowest infant mortality in 1981-83 was 39.92 per cent whereas the median decrease in states having highest infant mortality in 1981-83 was 54.16 per cent. Similarly, the median decrease in rural infant mortality rate in states with lowest rural infant mortality and in states with highest infant mortality in 1981-83 was 39.96 and 54.73 per cent respectively; the corresponding figures for the urban infant mortality rate being 46.73 and 41.56 per cent respectively. The lowest infant mortality states include Kerala which has quite different behaviour than other states of the country in terms of transition in infant mortality rate. Even if we exclude Kerala from the analysis, the over all situation remains more or less unchanged.

It is well known that the decline in infant mortality rate is not evenly distributed in terms of difficulty in reducing it. It is easier to reduce infant mortality rate when the probability of death is high as compared to when the probability of death is low. With the decline in infant mortality rate, it becomes more and more difficult and needs more and more efforts to ensure a further decline in mortality because more and more mortality is due to biological factors and not due to social and economic factors. At very low levels of infant mortality, an advanced stage of social and economic development appears to be a precondition for further decline in infant mortality rate. Burgeois-Pichat has classified the causes of infant deaths into two broad classes - exogenous and endogenous - and has nicknamed them as ‘soft’ and ‘hard’ rocks of infant mortality respectively (60). He has argued that it is possible to erode the ‘soft’ rock of infant mortality through such public health measures as immunization and oral rehydration therapy but erosion of ‘hard’ rock of infant deaths requires much more concerted and diversified efforts. It has also been observed that the plot of infant mortality rate with health efforts is not a straight line but a S-shaped curve. This means that as the infant mortality declines, more and more efforts are needed to bring down the infant mortality rate further. In other words, it is easier to bring down the infant mortality rate from 100 to 90 infant deaths per 1000 live births then from 50 to 40 infant deaths per 1000 live births. According to this argument, the rate of decline in infant mortality rate should be higher in those states where the level of infant mortality is high as compared to those states where the level of infant mortality is relatively low.

The pattern that emerges in the total and rural populations of India on the basis of the sample registration data conforms to the pattern suggested by Burgeois-Pichat but the patterns that emerges in urban population of the country does not conform to the pattern suggested by Burgeois-Pichat. It appears that low cost appropriate technology based on public health measures of reducing infant mortality have been quite effective in ensuring an accelerated reduction in rural infant mortality rate in states having highest rural infant mortality rate around 1981-83 not strong enough to ensure a similar reduction in the urban infant mortality rate in states having highest urban infant mortality around 1981-83. The five states having the highest rural informality in 1981-83 were Uttar Pradesh, Madhya

Pradesh, Orissa, Bihar, and Gujarat. Four of these five states - Uttar Pradesh, Gujarat, Madhya Pradesh and Orissa - are also amongst the five highest urban infant mortality states in 1981-83. This means that in these four states, the strategies and programmes adopted for reducing infant mortality rate have been effective in rural areas but not in urban areas. Perhaps, the most glaring example of this observation is Orissa where the rural infant mortality rate decreased by more than 30 per cent during 1981-2000 but the urban infant mortality rate decreased by just about 3 per cent during the same period. In Uttar Pradesh also, rural infant mortality rate decreased by more than 59 per cent between 1981-2000 but urban infant mortality rate decreased by just around 42 per cent during the same period. In fact, in 10 of the 15 states of India under review here, the decrease in rural infant mortality rate has been higher than the urban infant mortality during 1981-2000.

The decrease in infant mortality is widely argued to be dependent on at least two groups of factors. The first group of factors is related with the strength and efficiency of child survival efforts which, in a country like India, are almost invariably based on the low cost, appropriate technology based public health measures. which are being promoted to ensure an accelerated reduction in infant mortality. The second group of factors, on the other hand, constitute what is known as the social and economic environment. These factors are often found to be more important in accelerating infant mortality decline than the programme factors. Moreover, it is now well known that a certain threshold of social and economic environment is essential even for the low cost, appropriate technology based public health measures to be effective in preventing infant deaths. If this threshold social and economic environment is missing, the technology alone will have only a limited effect in accelerating infant mortality decline irrespective of the level of infant mortality.

Little is currently known about the strength and the efficiency of low cost, appropriate technology based public health measures directed towards improving child survival in rural and urban areas of different states of the country and how the prevailing levels of the strength and efficiency of these measures contribute to the reduction in infant mortality. It may be pointed out here that in the rural areas in India, a well organized and well defined public health care delivery system has been evolved to provide primary health care services including child survival services. This system is a hierarchal comprising of community health centres, primary health centres and sub-health centres. This rural public health care delivery system is a mix of clinic-based and community-based health care services. The public health care delivery system in the urban areas, however, is primarily clinic based with limited extension activities. no such official public health care delivery system exists in the urban areas. It is also argued that there is a heavy concentration of non-government health care delivery institutions in the urban areas and that these institutions have necessary strength and capacity to meet the primary health care needs of the urban population including the basic child survival services. However, trend in urban infant mortality rate suggests that the neither the urban health care delivery system nor the concentration of non-government health care services delivery facilities in the urban areas have been able to ensure an accelerated decrease in urban infant mortality rate in most of the states of the country. This is so when it is argued that the social and economic environment in the urban areas is relatively more conducive to improvements in child survival probability than the social and economic environment that prevails in the rural areas.

CONCLUSIONS

Infant mortality has been and continues to be one of the key indicators of the well-being in the society, especially in populations where the risk of death during infancy remains high. An encouraging sign of infant mortality transition in India during the 1980s and 1990s is that reduction in the probability of death in the first year of life has been associated with a reduction in absolute inter-state inequality in this probability. This means that the Indian states have tended to converge during the period in question as far as the probability of survival during the first year of life is concerned. Quite interestingly, when the

discussion is focussed on relative inequality, this tendency of convergence of Indian states is confined to rural areas only. In urban areas, the Indian states have tended to diverge during the twenty years under reference primarily because of relatively slower decline in urban infant mortality in states which had the highest urban infant mortality around twenty years ago.

Factors behind differing trends in inter-state inequality in rural infant mortality and urban infant mortality largely remain unexplored. Efforts to improve child survival in India have largely been focussed on the rural areas of the country primarily because the gap between rural and urban infant mortality rates has traditionally been quite large. These efforts definitely appear to have resulted in a decrease in the level as well as a decrease in inter-state inequality in rural infant mortality rate. However, some type of indifference to issues related to urban infant mortality in these efforts appear to have resulted in some increase in inter-state inequality in urban infant mortality in the country despite a decrease in average urban infant mortality levels. It appears that high infant mortality states have not been able to accelerate the urban infant mortality rate decline in the manner in which they have been able to accelerate the rural infant mortality decline during the twenty years under reference. This situation calls for new approaches to address the problem of child survival, especially in the urban areas of high infant mortality states. Probably and so obviously, there is a need of reorganizing urban public health care delivery system so that this system can efficiently address the primary health care needs including basic child survival needs of the rapidly growing urban population of the country. This reorganization becomes all the more important in view of the fact that a growing proportion of urban population is poor, unable to afford the cost of private health care delivery system.

Table 1: Summary measures of the distribution of infant mortality rate across Indian states: 1981-2000

Year	Minimum	Q1	Median	Q3	Maximum
1981-83	34	80	95	111	151
1982-84	31	77	95	109	152
1983-85	31	77	92	108	151
1984-86	29	74	90	110	143
1985-87	29	73	85	107	134
1986-88	28	72	87	104	128
1987-89	26	72	86	99	123
1988-90	22	69	80	92	122
1989-91	18	66	75	84	122
1990-92	17	63	71	81	120
1991-93	15	61	70	82	116
1992-94	15	60	69	82	109
1993-95	15	59	65	81	105
1994-96	15	58	66	81	100
1995-97	14	55	65	81	98
1996-98	14	54	65	80	97
1997-99	14	53	65	80	97
1998-00	15	53	64	78	97

Table 2: Summary measures of distribution of rural and urban infant mortality rates across Indian states: 1981-2000

Year	Rural Infant Mortality Rate					Urban Infant Mortality Rate				
	Minimum	Q1	Median	Q3	Maximum	Minimum	Q1	Median	Q3	Maximum
1981-83	35	87	102	118	159	25	53	60	71	99
1982-84	32	84	99	120	162	26	54	63	73	99
1983-85	32	85	100	120	162	28	53	62	77	92
1984-86	30	82	98	121	153	26	52	61	76	88
1985-87	30	80	92	114	143	25	51	59	75	82
1986-88	29	80	93	112	136	22	50	63	70	83
1987-89	27	81	92	105	131	21	49	64	67	80
1988-90	23	77	85	96	126	17	46	57	62	74
1989-91	19	74	81	88	127	15	45	52	58	72
1990-92	17	70	75	86	124	15	42	47	56	73
1991-93	16	69	74	86	121	12	41	48	55	73
1992-94	16	66	72	85	113	12	41	46	61	72
1993-95	16	65	71	84	110	12	42	47	60	68
1994-96	15	63	70	84	104	13	40	48	60	68
1995-97	13	60	70	84	102	14	39	44	60	66
1996-98	13	58	71	84	102	16	37	43	59	66
1997-99	13	58	70	83	100	16	37	41	57	65
1998-00	14	58	70	82	100	16	36	39	57	66

Table 3: Index of state-mean differences in infant mortality rate in India: 1981-2000.

Year	∀=1			∀=2			∀=3		
	∃=0	∃=0.5	∃=1	∃=0	∃=0.5	∃=1	∃=0	∃=0.5	∃=1
Total Population									
1981-83	0.022107	0.071127	0.228847	0.000794	0.002555	0.008221	0.000037	0.000118	0.000379
1982-84	0.022169	0.072128	0.234674	0.000804	0.002616	0.008512	0.000038	0.000124	0.000402
1983-85	0.022169	0.072487	0.237016	0.000788	0.002576	0.008423	0.000037	0.000120	0.000393
1984-86	0.022791	0.075195	0.248089	0.000771	0.002542	0.008387	0.000034	0.000112	0.000368
1985-87	0.022400	0.074667	0.248889	0.000714	0.002379	0.007930	0.000029	0.000098	0.000327
1986-88	0.021351	0.071866	0.241893	0.000670	0.002255	0.007590	0.000027	0.000091	0.000307
1987-89	0.019804	0.067506	0.230106	0.000630	0.002146	0.007314	0.000026	0.000088	0.000301
1988-90	0.018098	0.063407	0.222149	0.000590	0.002066	0.007237	0.000025	0.000088	0.000307
1989-91	0.016933	0.061023	0.219913	0.000586	0.002113	0.007616	0.000026	0.000094	0.000337
1990-92	0.016400	0.060451	0.222826	0.000554	0.002041	0.007523	0.000024	0.000089	0.000327
1991-93	0.016640	0.062071	0.231540	0.000548	0.002044	0.007625	0.000023	0.000087	0.000325
1992-94	0.015733	0.059466	0.224762	0.000480	0.001813	0.006851	0.000019	0.000072	0.000274
1993-95	0.015600	0.059677	0.228293	0.000449	0.001719	0.006575	0.000017	0.000066	0.000252
1994-96	0.015164	0.058382	0.224769	0.000412	0.001588	0.006112	0.000015	0.000059	0.000226
1995-97	0.015867	0.061761	0.240404	0.000424	0.001651	0.006428	0.000015	0.000059	0.000231
1996-98	0.015884	0.062177	0.243378	0.000422	0.001652	0.006466	0.000015	0.000058	0.000228
1997-99	0.015452	0.060555	0.237315	0.000410	0.001606	0.006295	0.000014	0.000057	0.000222
1998-00	0.014919	0.058767	0.231494	0.000389	0.001531	0.006032	0.000013	0.000053	0.000208
Rural Population									
1981-83	0.022000	0.068329	0.212219	0.000849	0.002638	0.008194	0.000043	0.000132	0.000410
1982-84	0.022089	0.069050	0.215852	0.000879	0.002748	0.008591	0.000046	0.000143	0.000446
1983-85	0.021938	0.069006	0.217062	0.000858	0.002700	0.008494	0.000044	0.000139	0.000438
1984-86	0.022889	0.072624	0.230425	0.000839	0.002663	0.008449	0.000041	0.000129	0.000409
1985-87	0.022382	0.071964	0.231381	0.000763	0.002452	0.007883	0.000035	0.000111	0.000357
1986-88	0.021244	0.069047	0.224413	0.000714	0.002320	0.007540	0.000032	0.000103	0.000335
1987-89	0.019680	0.064813	0.213449	0.000673	0.002218	0.007303	0.000030	0.000100	0.000331
1988-90	0.017671	0.059888	0.202961	0.000622	0.002106	0.007139	0.000029	0.000097	0.000329
1989-91	0.016827	0.058595	0.204042	0.000622	0.002165	0.007541	0.000030	0.000104	0.000360
1990-92	0.016480	0.058732	0.209314	0.000585	0.002084	0.007428	0.000027	0.000098	0.000349
1991-93	0.016667	0.059933	0.215517	0.000568	0.002041	0.007341	0.000026	0.000094	0.000339

Year	∀=1			∀=2			∀=3		
	∃=0	∃=0.5	∃=1	∃=0	∃=0.5	∃=1	∃=0	∃=0.5	∃=1
1992-94	0.015600	0.056963	0.208000	0.000492	0.001796	0.006556	0.000021	0.000078	0.000284
1993-95	0.015004	0.055441	0.204854	0.000466	0.001722	0.006364	0.000020	0.000073	0.000270
1994-96	0.014264	0.053298	0.199152	0.000431	0.001611	0.006021	0.000018	0.000066	0.000248
1995-97	0.015034	0.056617	0.213216	0.000440	0.001658	0.006244	0.000018	0.000067	0.000254
1996-98	0.015090	0.057045	0.215645	0.000442	0.001669	0.006311	0.000018	0.000067	0.000254
1997-99	0.014702	0.055649	0.210634	0.000427	0.001618	0.006124	0.000017	0.000065	0.000244
1998-00	0.014646	0.055631	0.211307	0.000409	0.001553	0.005898	0.000016	0.000060	0.000228
Urban Population									
1981-83	0.012800	0.051545	0.207568	0.000283	0.001141	0.004594	0.000008	0.000033	0.000134
1982-84	0.012764	0.051044	0.204122	0.000265	0.001060	0.004239	0.000008	0.000030	0.000121
1983-85	0.013378	0.053440	0.213475	0.000268	0.001069	0.004272	0.000007	0.000026	0.000105
1984-86	0.013316	0.053592	0.215695	0.000266	0.001069	0.004303	0.000006	0.000026	0.000104
1985-87	0.012649	0.051326	0.208269	0.000240	0.000975	0.003955	0.000006	0.000023	0.000093
1986-88	0.011911	0.048492	0.197422	0.000234	0.000952	0.003876	0.000006	0.000025	0.000101
1987-89	0.011742	0.048397	0.199471	0.000218	0.000898	0.003703	0.000006	0.000023	0.000094
1988-90	0.010960	0.046790	0.199757	0.000199	0.000851	0.003635	0.000005	0.000022	0.000094
1989-91	0.010489	0.046145	0.203011	0.000199	0.000877	0.003857	0.000005	0.000023	0.000099
1990-92	0.011316	0.050740	0.227525	0.000213	0.000954	0.004280	0.000005	0.000024	0.000106
1991-93	0.011591	0.052435	0.237199	0.000234	0.001060	0.004796	0.000006	0.000028	0.000126
1992-94	0.012027	0.054442	0.246448	0.000228	0.001031	0.004667	0.000006	0.000026	0.000116
1993-95	0.011319	0.051424	0.233639	0.000205	0.000931	0.004228	0.000005	0.000023	0.000103
1994-96	0.011319	0.051602	0.235258	0.000196	0.000892	0.004065	0.000004	0.000020	0.000093
1995-97	0.011982	0.055653	0.258485	0.000211	0.000980	0.004552	0.000005	0.000021	0.000098
1996-98	0.012314	0.058020	0.273376	0.000210	0.000991	0.004668	0.000004	0.000020	0.000094
1997-99	0.012101	0.057356	0.271859	0.000204	0.000965	0.004574	0.000004	0.000019	0.000091
1998-00	0.012237	0.058191	0.276717	0.000205	0.000974	0.004632	0.000004	0.000019	0.000093

Table 4: Index of inter-state differences in infant mortality rate in India 1981-2000.

Year	∀=1			∀=2			∀=3		
	∃=0	∃=0.5	∃=1	∃=0	∃=0.5	∃=1	∃=0	∃=0.5	∃=1
Total Population									
1981-83	0.015591	0.050134	0.161399	0.000794	0.002555	0.008221	0.000051	0.000164	0.000527
1982-84	0.015591	0.050727	0.165044	0.000804	0.002616	0.008512	0.000052	0.000170	0.000555
1983-85	0.015396	0.050340	0.164600	0.000788	0.002576	0.008423	0.000051	0.000166	0.000543
1984-86	0.015440	0.050941	0.168070	0.000771	0.002542	0.008387	0.000048	0.000159	0.000524
1985-87	0.014871	0.049570	0.165235	0.000714	0.002379	0.007930	0.000043	0.000142	0.000473
1986-88	0.014409	0.048499	0.163243	0.000670	0.002255	0.007590	0.000039	0.000131	0.000441
1987-89	0.013831	0.047145	0.160702	0.000630	0.002146	0.007314	0.000036	0.000123	0.000420
1988-90	0.013156	0.046091	0.161484	0.000590	0.002066	0.007237	0.000034	0.000118	0.000413
1989-91	0.012800	0.046128	0.166234	0.000586	0.002113	0.007616	0.000034	0.000123	0.000442
1990-92	0.012356	0.045543	0.167874	0.000554	0.002041	0.007523	0.000031	0.000116	0.000427
1991-93	0.012444	0.046421	0.173160	0.000548	0.002044	0.007625	0.000031	0.000115	0.000428
1992-94	0.011671	0.044113	0.166730	0.000480	0.001813	0.006851	0.000025	0.000095	0.000361
1993-95	0.011342	0.043389	0.165984	0.000449	0.001719	0.006575	0.000023	0.000087	0.000334
1994-96	0.010898	0.041956	0.161528	0.000412	0.001588	0.006112	0.000020	0.000078	0.000300
1995-97	0.011173	0.043492	0.169293	0.000424	0.001651	0.006428	0.000021	0.000080	0.000313
1996-98	0.011185	0.043782	0.171377	0.000422	0.001652	0.006466	0.000020	0.000080	0.000311
1997-99	0.011004	0.043126	0.169010	0.000410	0.001606	0.006295	0.000020	0.000077	0.000301
1998-00	0.010729	0.042263	0.166483	0.000389	0.001531	0.006032	0.000018	0.000071	0.000281
Rural Population									
1981-83	0.019511	0.049418	0.153483	0.000849	0.002638	0.008194	0.000058	0.000179	0.000556
1982-84	0.016071	0.050239	0.157047	0.000879	0.002748	0.008951	0.000061	0.000192	0.000599
1983-85	0.015787	0.049658	0.156201	0.000858	0.002700	0.008494	0.000059	0.000187	0.000588
1984-86	0.015929	0.050540	0.160358	0.000839	0.002663	0.008449	0.000056	0.000178	0.000556
1985-87	0.015262	0.049072	0.157776	0.000763	0.002452	0.007883	0.000048	0.000156	0.000500
1986-88	0.014747	0.047929	0.155775	0.000714	0.002320	0.007540	0.000044	0.000143	0.000466
1987-89	0.014116	0.046487	0.153097	0.000673	0.002218	0.007303	0.000041	0.000136	0.000447
1988-90	0.013173	0.044645	0.151302	0.000622	0.002106	0.007139	0.000038	0.000127	0.000431
1989-91	0.012880	0.044851	0.156184	0.000622	0.002165	0.007541	0.000038	0.000133	0.000463
1990-92	0.012418	0.044255	0.157719	0.000585	0.002084	0.007428	0.000035	0.000125	0.000446
1991-93	0.012338	0.044366	0.159540	0.000568	0.002041	0.007341	0.000034	0.000121	0.000434
1992-94	0.011476	0.041903	0.153007	0.000492	0.001796	0.006556	0.000027	0.000100	0.000364
1993-95	0.011156	0.041220	0.152306	0.000466	0.001722	0.006364	0.000025	0.000093	0.000345
1994-96	0.010750	0.040167	0.150088	0.000431	0.001611	0.006021	0.000023	0.000085	0.000316

Year	∀=1			∀=2			∀=3		
	∃=0	∃=0.5	∃=1	∃=0	∃=0.5	∃=1	∃=0	∃=0.5	∃=1
1995-97	0.011034	0.041553	0.156487	0.000440	0.001658	0.006244	0.000023	0.000087	0.000328
1996-98	0.011096	0.041947	0.158569	0.000442	0.001669	0.006311	0.000023	0.000087	0.000330
1997-99	0.010880	0.041181	0.155874	0.000427	0.001618	0.006124	0.000022	0.000084	0.000317
1998-00	0.010708	0.040674	0.154494	0.000409	0.001553	0.005898	0.000021	0.000078	0.000297
Urban Population									
1981-83	0.009191	0.037012	0.149405	0.000283	0.001141	0.004594	0.000011	0.000045	0.000181
1982-84	0.008791	0.035155	0.140583	0.000265	0.001060	0.004239	0.000010	0.000041	0.000163
1983-85	0.009218	0.036822	0.147092	0.000268	0.001069	0.004272	0.000010	0.000038	0.000153
1984-86	0.009182	0.036956	0.148740	0.000266	0.001069	0.004303	0.000009	0.000038	0.000154
1985-87	0.008667	0.035167	0.142700	0.000240	0.000975	0.003955	0.000008	0.000034	0.000136
1986-88	0.008364	0.034053	0.138637	0.000234	0.000952	0.003876	0.000008	0.000034	0.000139
1987-89	0.008018	0.033046	0.136202	0.000218	0.000898	0.003703	0.000008	0.000031	0.000129
1988-90	0.007520	0.032104	0.137060	0.000199	0.000851	0.003635	0.000007	0.000029	0.000126
1989-91	0.007529	0.033123	0.145720	0.000199	0.000877	0.003857	0.000007	0.000030	0.000132
1990-92	0.007813	0.035036	0.157105	0.000213	0.000954	0.004280	0.000007	0.000032	0.000145
1991-93	0.008276	0.037436	0.169350	0.000234	0.001060	0.004796	0.000008	0.000038	0.000171
1992-94	0.008293	0.037542	0.169945	0.000228	0.001031	0.004667	0.000008	0.000036	0.000162
1993-95	0.007769	0.035297	0.160367	0.000205	0.000931	0.004228	0.000007	0.000031	0.000143
1994-96	0.007721	0.035203	0.160493	0.000196	0.000892	0.004065	0.000006	0.000029	0.000131
1995-97	0.008113	0.037680	0.175008	0.000211	0.000980	0.004552	0.000007	0.000031	0.000145
1996-98	0.008210	0.038685	0.182273	0.000210	0.000991	0.004668	0.000007	0.000031	0.000144
1997-99	0.008083	0.038312	0.181594	0.000204	0.000965	0.004574	0.000006	0.000029	0.000139
1998-00	0.008077	0.038409	0.182647	0.000205	0.000974	0.004632	0.000006	0.000030	0.000142

Table 5: Time series ARIMA(1,0,0) analysis of indices of inter-state inequality in infant mortality rate in India: 1981-2000.

	∀=1			∀=2			∀=3		
	∃=0	∃=0.5	∃=1	∃=0	∃=0.5	∃=1	∃=0	∃=0.5	∃=1
Index of State-mean Differences									
Total Population									
Log likelihood	106.615	86.109	64.844	168.843	147.307	123.981	217.297	194.817	171.607
B	-0.0004583	-0.0008369	-0.0000763	-0.0000257	-0.0000670	-0.0001432	-0.0000015	-0.0000041	-0.0000107
SE(B)	0.0000926	0.0002525	0.0006743	0.0000023	0.0000055	0.0000182	0.0000001	0.0000004	0.0000016
't'	-4.949	-3.315	-0.113	-11.286	-12.289	-7.883	-11.268	-9.746	-6.754
Rural Population									
Log likelihood	104.808	85.308	65.533	164.681	144.745	123.824	211.863	190.943	169.656
B	-0.0004857	-0.0009198	-0.0005144	-0.0000284	-0.0000726	-0.0001566	-0.0000017	-0.0000047	-0.0000119
SE(B)	0.0000962	0.0002428	0.0005798	0.0000030	0.0000068	0.0000185	0.0000002	0.0000005	0.0000016
't'	-5.047	-3.788	-0.887	-9.529	-10.646	-8.473	-9.424	-9.317	-7.481

Urban Population									
Log likelihood	112.230	85.962	58.166	178.279	151.229	123.419	234.410	211.500	184.410
B	-0.0000464	0.0003838	0.0004253	-0.0000044	-0.0000076	0.0000162	-0.0000002	-0.0000007	-0.0000017
SE(B)	0.0000582	0.0002420	0.0011311	0.0000013	0.0000058	0.000027	0.0000001	0.0000002	0.0000009
't'	-0.798	1.586	3.760	-3.259	-1.319	0.599	-5.6036	-3.551	-1.8631
Index of Inter-state Differences									
Total Population									
Log likelihood	122.215	102.359	77.442	168.843	147.307	123.981	212.544	191.216	168.567
B	-0.000307	-0.000532	-0.000309	-0.000026	-0.000067	-0.000143	-0.000002	-0.000006	-0.000016
SE(B)	0.000034	0.000063	0.000183	0.000002	0.000005	0.000018	0.0000002	0.0000005	0.000002
't'	-8.994	-8.425	-1.683	-11.289	-12.290	-7.882	-10.991	-11.619	-9.684

Rural Population									
Log likelihood	103.794	100.529	81.339	164.681	144.784	121.452	207.613	186.991	166.621
B	-0.0004667	-0.0006051	-0.0000645	-0.0000284	-0.0000726	-00001636	-0.0000024	-0.0000067	-0.0000183
SE(B)	0.0000730	0.0000870	0.0001719	0.0000030	0.0000068	0.0000183	0.0000003	0.0000007	0.0000018
't'	-6.394	-6.953	-0.376	-9.521	-10.647	-8.947	-8.750	-9.737	-9.404
Urban Population									
Log likelihood	120.517	93.527	65.008	178.279	151.229	123.419	232.507	206.597	179.203
B	-0.0000654	0.0001233	0.0022982	-0.0000044	-0.0000076	0.0000162	-0.0000003	-0.0000007	-0.0000015
SE(B)	0.0000340	0.0001472	0.0007282	0.0000013	0.0000058	0.0000270	0.0000001	0.0000003	0.0000012
't'	-1.923	0.838	3.156	-3.259	-1.319	0.599	-4.848	-2.812	-1.312

Table 6: Comparison of infant mortality rate decline in five lowest infant mortality rate states and five highest infant mortality rate states in India, 1981-2000.

Lowest infant mortality rate states			Highest infant mortality rate states		
Name	Infant mortality rate during 1981-83	Decline in infant mortality rate during 1981-2000 (Per cent)	Name	Infant mortality rate during 1981-83	Decline in infant mortality rate during 1981-2000 (Per cent)
Kerala	34	84.07	Uttar Pradesh	151	58.56
Karnataka	68	16.48	Madhya Pradesh	134	37.97
Maharashtra	76	45.26	Orissa	131	30.39
Punjab	79	39.92	Gujrat	111	56.64
Andhra Pradesh	81	20.99	Bihar	110	54.16
Rural Population					
Kerala	35	89.28	Uttar Pradesh	159	59.16
Karnataka	76	9.66	Madhya Pradesh	144	38.33
Punjab	85	39.96	Orissa	136	30.75
Maharashtra	86	40.55	Gujrat	121	54.73
Andhra Pradesh	87	15.29	Bihar	114	56.18
Urban Population					
Kerala	25	46.73	Uttar Pradesh	99	41.56
Karnataka	45	61.48	Gujarat	82	59.27
West Bengal	50	24.00	Madhya Pradesh	78	34.94
Andhra Pradesh	52	34.03	Assam	73	71.62
Maharashtra	53	50.46	Orissa	68	3.49

Figure 1: Infant mortality rate in India: 1981-2001

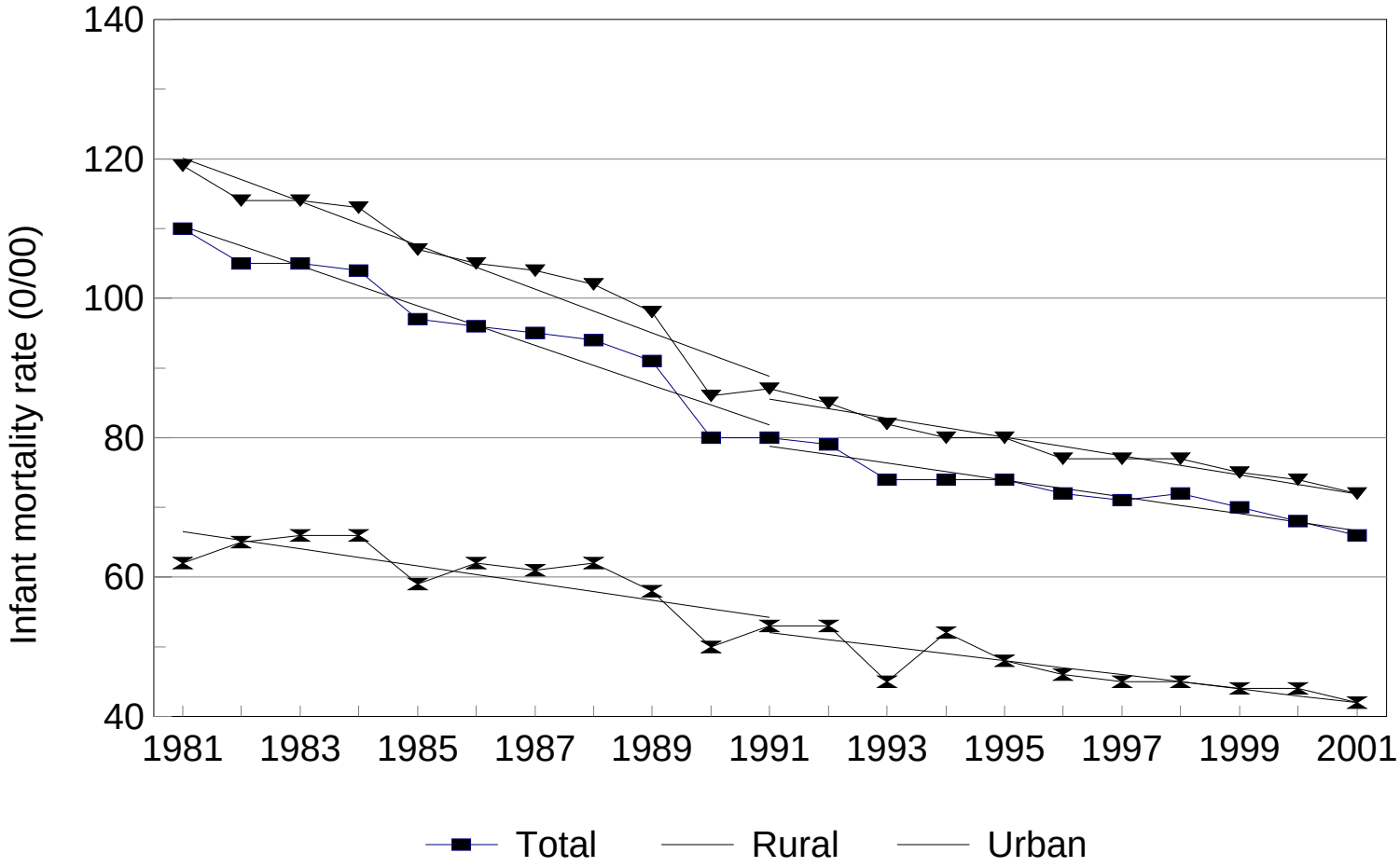
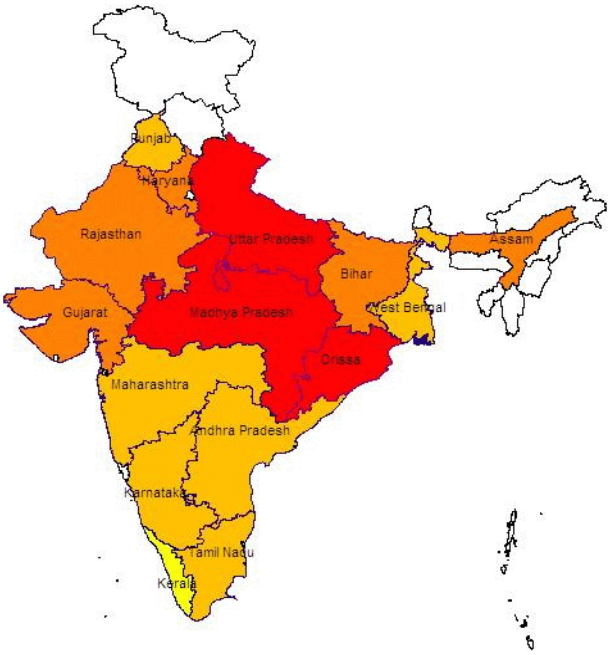


Figure 2: Regional Variations in Infant Mortality Rate in India

1998—2000



1981—83

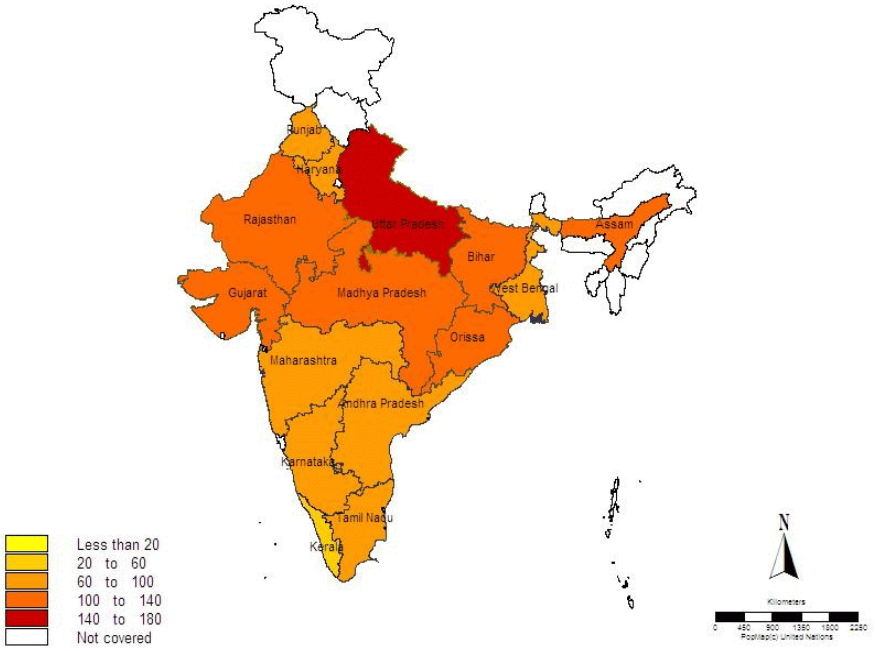


Figure 3: Inter-state variations in infant mortality rate in India: 1981-2000

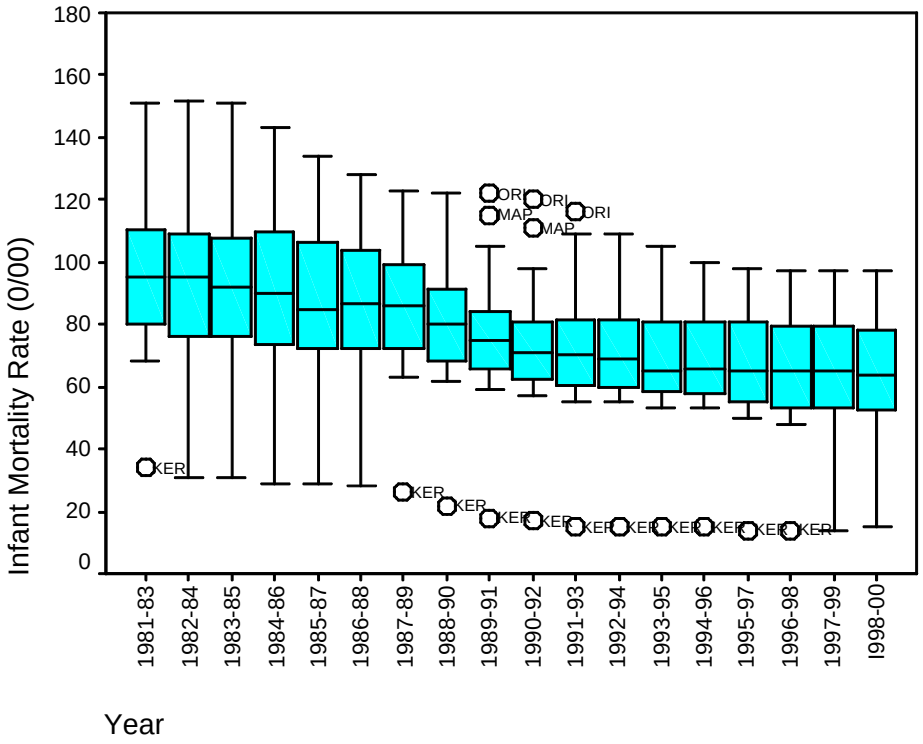


Figure 4: Inter-state variations in rural infant mortality rate in India: 1981-2000

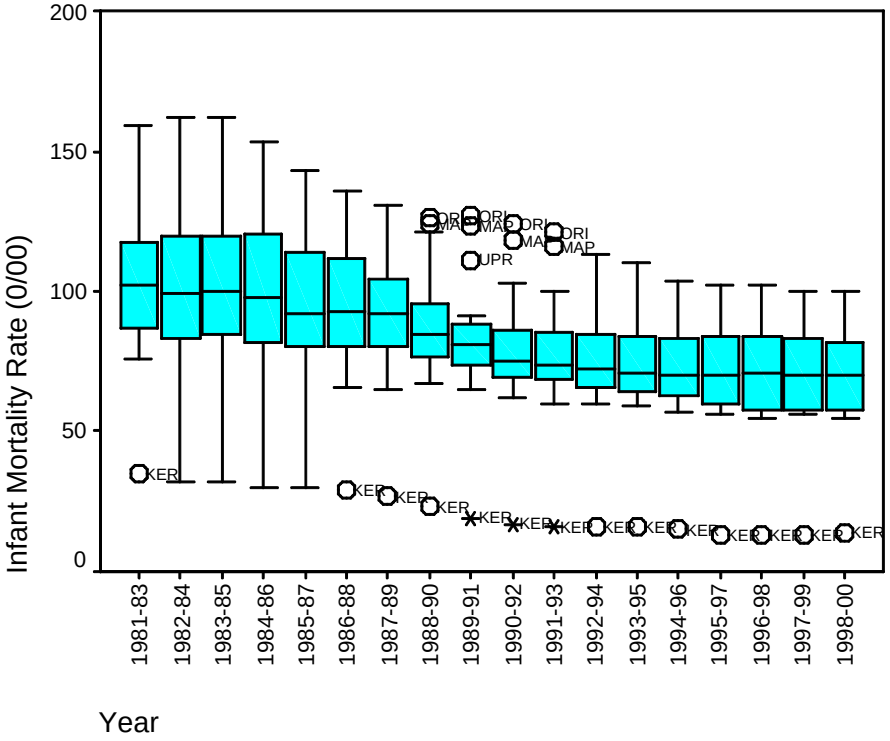


Figure 5: Inter-state variations in urban infant mortality rate in India: 1981-2000

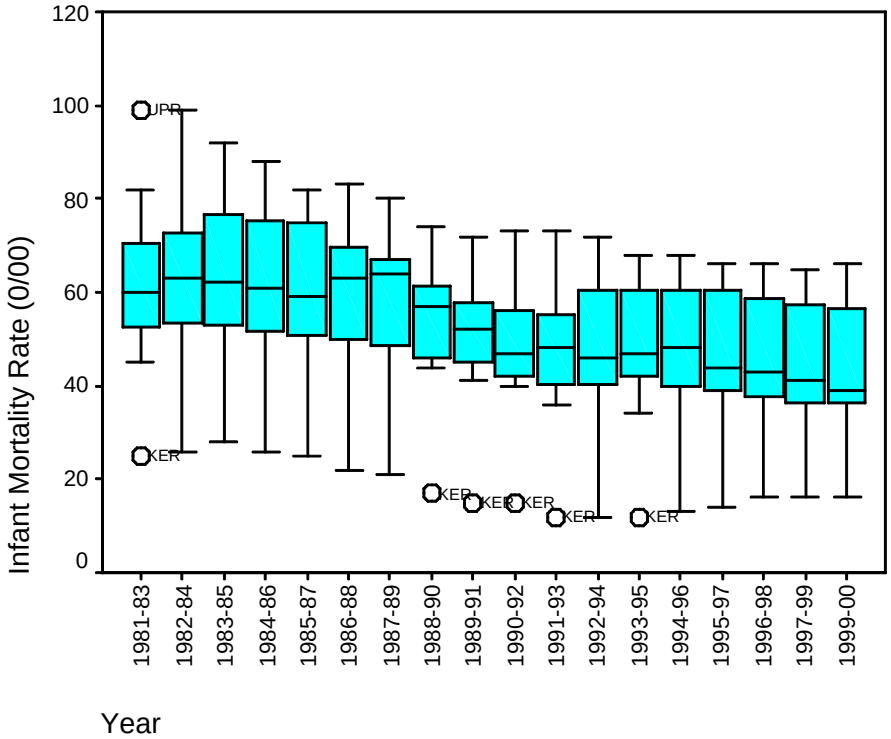
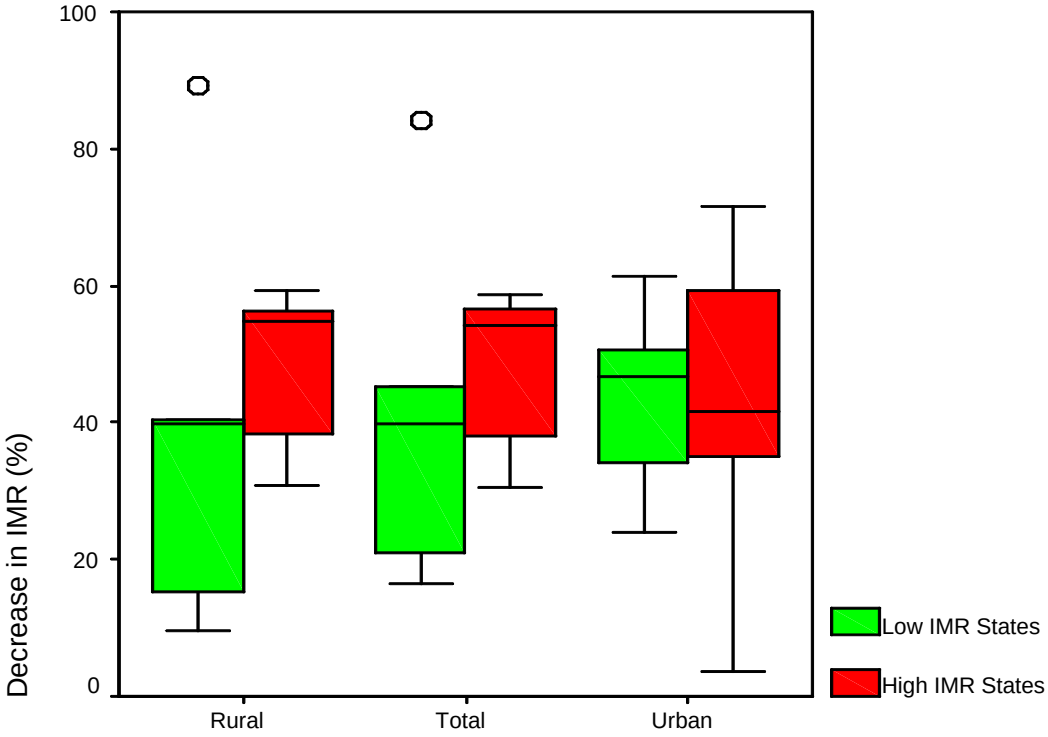


Figure 6: Infant mortality rate decline by the level of base year infant mortality



Appendix Table 1: Estimates of Infant Mortality Rate for Different States: 1981-2000.

Period	India	Andhra Pradesh	Assam	Bihar	Gujarat	Haryana	Karnataka	Kerala	Madhya Pradesh	Maharashtra	Orissa	Punjab	Rajasthan	Tamil Nadu	Uttar Pradesh	West Bengal
1981-83	107	81	100	110	111	95	68	34	134	76	131	79	105	87	151	87
1982-84	105	78	98	102	108	95	70	31	127	75	130	74	110	83	152	84
1983-85	102	79	101	100	103	92	71	31	123	74	130	73	113	82	151	80
1984-86	99	81	106	100	104	90	72	29	120	69	128	68	113	80	143	75
1985-87	96	81	107	103	101	85	73	29	120	66	127	67	106	79	134	72
1986-88	95	81	104	100	98	87	74	28	120	66	124	64	104	76	128	70
1987-88	93	81	98	97	91	86	76	26	119	64	123	63	100	72	123	72
1988-90	88	78	89	88	83	80	75	22	116	62	122	62	94	67	114	70
1989-91	84	74	82	79	75	73	76	18	115	59	122	59	86	62	105	70
1990-92	80	71	78	72	69	71	73	17	111	59	120	57	84	58	98	66
1991-93	78	69	79	71	64	70	72	15	109	56	116	55	84	57	96	65
1992-94	76	66	78	70	63	70	69	15	103	55	109	55	85	58	93	61
1993-95	74	65	78	70	61	68	65	15	101	53	105	54	84	57	89	60
1994-96	73	66	77	71	63	69	61	15	98	53	100	53	85	56	86	59
1995-97	72	65	76	72	62	68	56	14	97	50	98	52	85	54	85	56
1996-98	72	65	75	70	62	69	55	14	96	48	97	52	84	53	85	54
1997-99	71	65	76	68	63	69	56	14	94	48	97	53	83	53	85	53
1998-00	70	66	76	64	63	68	58	15	92	48	97	53	81	52	84	51

Source: Sample Registration System

Appendix Table 2: Estimates of Rural Infant Mortality Rate in India and states: 1981-2000

Period	India	Andhra Pradesh	Assam	Bihar	Gujarat	Haryana	Karnataka	Kerala	Madhya Pradesh	Maharashtra	Orissa	Punjab	Rajasthan	Tamil Nadu	Uttar Pradesh	West Bengal
1981-83	116	87	102	114	121	102	76	35	144	86	136	85	113	100	159	95
1982-84	114	83	99	105	122	103	79	32	137	84	135	81	118	96	162	99
1983-85	111	84	102	102	119	100	81	32	132	85	134	80	121	95	162	87
1984-86	108	86	108	103	121	98	82	30	129	78	133	75	120	93	153	81
1985-87	105	87	109	106	116	92	82	30	128	75	131	71	112	91	143	78
1986-88	104	87	106	102	113	93	84	29	127	75	128	66	110	88	136	76
1987-88	101	87	100	99	102	92	86	27	127	72	127	65	107	83	131	78
1988-90	95	83	91	90	90	85	84	23	124	69	126	67	100	78	121	75
1989-91	90	79	84	81	81	78	85	19	123	66	127	65	91	72	111	75
1990-92	86	76	79	74	75	75	83	17	118	67	124	62	89	67	103	72
1991-93	85	75	81	73	70	74	83	16	116	67	121	60	88	66	100	70
1992-94	82	72	80	71	69	73	78	16	109	66	113	60	90	65	97	66
1993-95	81	71	80	72	68	70	74	16	107	65	110	59	88	64	93	63
1994-96	79	72	78	72	69	70	69	15	104	64	104	57	89	62	89	61
1995-97	78	72	79	74	68	70	66	13	102	60	102	56	90	60	89	59
1996-98	77	73	79	71	69	71	65	13	102	57	100	55	89	59	89	57
1997-99	76	73	79	69	70	71	67	13	100	57	100	56	87	58	88	56
1998-00	75	75	79	65	70	70	69	14	98	57	100	57	85	58	88	55

Source: Sample Registration System

Appendix Table 3: Estimates of Urban Infant Mortality Rate in India and states: 1981-2000.

Period	India	Andhra Pradesh	Assam	Bihar	Gujarat	Haryana	Karnataka	Kerala	Madhya Pradesh	Maharashtra	Orissa	Punjab	Rajasthan	Tamil Nadu	Uttar Pradesh	West Bengal
1981-83	64	52	73	61	82	60	45	25	78	53	68	58	66	55	99	50
1982-84	66	57	73	68	72	63	44	26	77	56	73	53	71	54	99	52
1983-85	64	59	81	69	64	62	41	28	77	54	80	52	76	55	92	50
1984-86	62	61	80	70	62	60	43	26	79	51	81	47	72	54	88	52
1985-87	61	58	78	67	63	59	43	25	80	47	78	57	72	54	82	48
1986-88	62	60	68	70	63	64	45	22	82	47	73	59	69	53	83	47
1987-88	60	58	66	68	64	64	47	21	80	47	74	55	64	50	79	46
1988-90	57	57	56	60	62	61	46	17	74	46	71	49	61	44	74	45
1989-91	54	55	48	52	60	54	47	15	71	42	72	43	56	41	72	47
1990-92	52	52	44	47	54	53	42	15	70	41	73	42	58	40	73	42
1991-93	50	48	54	45	50	53	43	12	71	36	72	40	56	41	73	39
1992-94	50	46	61	46	48	55	43	12	65	35	70	38	60	42	72	39
1993-95	48	46	62	49	47	58	43	12	62	34	66	38	59	42	68	42
1994-96	49	43	54	53	48	61	36	13	60	34	65	38	61	42	68	46
1995-97	46	40	44	55	46	61	29	14	60	32	65	39	61	39	66	44
1996-98	45	38	37	53	46	59	25	16	58	31	65	39	60	40	66	43
1997-99	45	37	36	52	46	59	24	16	56	31	65	39	60	40	65	41
1998-00	44	37	36	53	45	58	24	16	55	32	66	39	59	39	65	39

Source: Sample Registration System

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