"Development" is not essential to reduce infant mortality rate in India: experience from the Ballabgarh project

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Abstract

***Background*—India aims to reduce the infant mortality rate (IMR) to below 60 per 1000 live births by 2000. IMR is higher in northern India as compared with south Indian states like Kerala. Any further reduction in IMR needs identification of new strategies. The Ballabgarh project with an IMR of 36 in 1997 can help identify such strategies.**

***Objective*—To see the trend in reduction of neonatal mortality rate (NNMR) and IMR at the Ballabgarh project, compare it with Kerala and rural India's trend and look at the causes of neonatal and infant mortality.**

***Design*—The Comprehensive Rural Health Services Project, Ballabgarh, run by the All India Institute of Medical Sciences, covered an estimated population of 70 079 in 1997. The health care delivery system is on the national pattern. All the deaths are identified during the house visits by the male workers. The cause of death is ascertained by the health assistant based on the symptomatology at the time of death.**

***Results*—The trends in reduction of IMR for Ballabgarh, Kerala and rural India are roughly parallel with the IMR of Ballabgarh lying somewhere in between the two. However, the NNMR of Ballabgarh (10.6 in 1996) was comparable to Kerala's NNMR (10.9 in 1992). The proportion of infant deaths occurring during the neonatal period had fallen from 50% in the early seventies to 30% during 1996–97. In 1992–1994, 33.8% of all neonatal deaths were attributable to low birth weight and 37.3% to infective causes. Acute respiratory infection and diarrhoea continue to be the chief cause of postneonatal mortality.**

***Conclusion*—It is possible to bring down neonatal mortality before postneonatal mortality. The Kerala model, which focuses on social development, may not apply to northern India for sociocultural reasons.**

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Infant mortality rate (IMR) is considered as one of the most sensitive indicators of health status of a community. India's IMR was 72 per 1000 live births in 1996.[1] However, there is a wide variation among different states. IMR ranges from 13 in the state of Kerala to 97 for Madhya Pradesh.[1] India has set the goal to reduce IMR to less than 60 per 1000 by the year 2000.[2] However, most developed nations have an IMR in the range of 5 to 10.[3] Kerala, a southern state in India has achieved IMR comparable to that of developed nations. The strategies and factors that contributed to Kerala's achievement have been well researched and documented.[4 5] However, the applicability of this approach outside Kerala has not been studied adequately.

India is a vast country with widely varying sociocultural regions. It is possible that a single approach may not be applicable to the rest of the country. There is a need to compare experiences of other areas where IMR has been brought down to see whether more than one approach is needed in India to bring down IMR to a level similar to developed countries.

Ballabgarh is a rural area in a northern state of India, Haryana. Over the years, the IMR in this area has come down from 101 per 1000 live births in 1972 to 37 per 1000 live births in 1997. Though this area has an IMR that is well below the national average for rural areas, it is still higher than that of Kerala. In this paper, we present the trend in decline of IMR during the past 25 years, compare the trend with that of rural India and Kerala and look at the causes of infant mortality and neonatal mortality during these years. The first objective of this study was to compare the pattern of decline of IMR in Ballabgarh and Kerala and relate it to the identified factors and strategies. Secondly, we wanted to identify measures that would help us to reduce IMR in the study area to approximately 20 per 1000 live births in the next five to 10 years.

Methods

The Comprehensive Rural Health Services Project (CRHSP), Ballabgarh is situated in the state of Haryana in northern India. It is run by All India Institute of Medical Sciences, New Delhi in active collaboration with the state government of Haryana. This project was started in 1965 with the objective of demonstrating a model health care delivery system and for training of nursing students, undergraduates, interns and postgraduate medical students.

In 1972, the estimated population of the 28 villages under the project was around 40 000. In 1997, the population had increased to 70 079. The health care in these villages is provided along the national pattern. At present there are two Primary Health Centres (PHCs) each catering for about 35 000 population. Each PHC has four subcentres, each staffed by a male and female multipurpose workers. Thus each team of male and female multipurpose workers caters for a population of about 8500. All the houses are visited alternately by the male and female worker every fortnight for the delivery of health care services including maternal and child health activities. These workers are supervised by one health assistant and one medical officer at each of the PHCs.

Birth and death registration are a part of the job responsibilities of male worker. Female workers register the women in antenatal period and follow them up till delivery. Births are registered by male workers during their domiciliary visits. Subsequently the newborn is followed up for immunisation. As per the records as well as field verifications, the antenatal registration in the study area is around 95% and immunisation coverage more than 90% for the past 10 years. Some births (around 5%) are registered late as sometimes pregnant mothers go to their parents' house for the delivery and return to the study area in about three months after the delivery.

All the deaths are identified during the house visits by the male workers. This is supplemented by information provided by the female worker and the village chowkidar (guard). Under the Birth and Death Registration Act, the village guard is expected to provide information on births and deaths in the village to the local administration. A death card that contains the demographic details of the patient is filled in by the male worker. This card is submitted to the health assistant at the end of the month along with the monthly activity report. During the subsequent month, the health assistant visits these families and inquires about the death from the available adult member in the family. The symptoms preceding the death are detailed by the health assistant. The period between death and interview is usually between one to two months. These assistants have been trained in conducting these inquiries. Based on the symptoms recorded by the health assistant, the medical officer of the PHC makes a probable diagnosis. In about 20% of the deaths, this inquiry is verified by interns or medical officer by re-interviewing the family member. All these cards are sent to the project head quarters at Ballabgarh. Here at least two faculty members review the death cards to see whether the cause mentioned in the card is compatible with the history provided.

In addition to routine continuous collection of demographic information, a yearly census is also conducted in the months of May and June by the male workers. Information in about 20% of randomly selected households, is cross checked by the health assistant and in another 5% of the households by the medical officer in charge of the two PHCs for completeness and accuracy. This opportunity is used for confirming reported deaths and identifying any deaths missed during the routine domiciliary visits.

All the demographic data of the community were initially maintained manually in family demographic registers that had separate pages for each family. These data were computerised in 1987. At present all births and deaths are entered into an electronic database on a monthly basis. Every year, as a part of the annual report, vital statistics including various death rates are collated from this database and sent to AIIMS. The rates used in this article are based on these reports. The information on causes of deaths for the period 1972–74 and 1982–84 have been taken from a previous paper by Reddaiah *et al*.[6] For the period 1992–94, the information was collected from death cards of infants during this period. The system of collection of information has remained same during the entire study period.

The infant and neonatal mortality rates from the study area for the period 1972–97 was compared with the national rates for rural India and for Kerala. The information was collected from published literature.[7–9] The source for these data is the sample registration system (SRS). SRS is a miniature registration system in a random sample of villages or segments of villages or urban blocks of different states in India for generation of indicators of mortality and fertility. An enumerator keeps a record of births and deaths in the selected units. Simultaneously and independently, a supervisor conducts six monthly surveys in these units. The two data are then matched.[10] This system has remained unchanged for past many decades including the study period. SRS is the best available system in the country for collection of vital statistics.

Information on the both the neonatal and infant mortality rate for the three areas were plotted on a graph using a logarithmic scale, as the objective was to compare the trend in these areas. The 95% confidence intervals were calculated for IMR and NNMR using the standard error of proportions. The change in the cause of death during the three points in time was tested using the χ^2 test.

Results

During the study period (1972–97), the IMR in the study area had declined from 100.9 to 36.8 in 1997 (table 1). This is shown graphically in figure 1. Though there is a declining trend, the graph shows an uneven pattern. Until the late seventies IMR remained in the range of 100 and NNMR in the range of 40. In 1978 both IMR and NNMR fell sharply. Thereafter the IMR and NNMR again stabilised around 60 and 25 respectively. The next important decrease occurred in the early nineties. Since 1995, IMR is around 35 and NNMR is around 10. The proportion of infant deaths occuring during the neonatal period has fallen somewhat from around 40% in the early seventies to around 30% during 1996–97. The proportion of neonatal deaths occurring during early neonatal period (<7 days) has remained around 50% during the 25 year period.

We then analysed the causes of infant deaths in the study area at three different points with 10 year intervals during the 25 year period. The causes of mortality have changed significantly during the past three decades. Prematurity and low birth weight continue to be the most important cause of neonatal mortality in the study area (table 2). Even in 1992–1994,

Table 1 Trends in neonatal and infant mortality rates per 1000 live births in Ballabgarh

Year	*Births*	*Deaths*	*Infant mortality rate (95% CI)*	*Neonatal mortality rate (95% CI)*	*Contribution of NNMR to IMR (%)*
1972	1844	186	100.9 (114.9,86.9)	42.3 (51.7,32.9)	42
1973	1807	147	81.2 (94.0,68.3)	29.3 (37.2,21.3)	36
1974	1975	199	100.9 (114.5,87.3)	42.4 (51.5,33.3)	42
1975	1985	191	96.2 (109.4,83.0)	51.4 (61.3,41.4)	53
1976	1744	170	97.5 (111.7,83.3)	36.1 (45.0,27.2)	37
1977	1834	174	94.9 (108.6,81.2)	39.3 (48.4,30.2)	41
1978	1381	142	102.8 (119.1,86.4)	50.7 (62.5,38.9)	49
1979	1732	108	62.4 (74.0,50.77)	32.9 (41.4,24.3)	53
1980	1919	128	66.7 (78.1,55.3)	27.6 (35.1,20.1)	41
1981	1887	154	80 (92.5,67.5)	37.1 (45.8,28.3)	46
1982	1958	114	58.2 (68.8,47.6)	22.9 (29.7,16.1)	39
1983	1851	129	69 (80.8,57.2)	24.8 (32.0,17.6)	36
1984	1879	135	71.3 (83.1,59.4)	33.5 (41.8,25.2)	47
1985	1885	121	64.2 (75.5,52.9)	29.7 (37.5,21.9)	46
1986	1976	139	70.2 (81.7,58.7)	29.2 (36.8,21.6)	42
1987	1944	122	63 (74.0,60.0)	18 (24.0,11.9)	29
1988	1940	135	69.6 (81.1,58.0)	21.9 (28.5,15.2)	31
1989	2040	132	64.7 (75.6,53.8)	22.4 (28.9,15.8)	32
1990	2138	131	61.4 (71.8,51.0)	23.4 (29.9,16.9)	38
1991	1949	130	66.6 (77.9,55.3)	22.5 (29.2,15.8)	34
1992	1936	79	40.8 (49.8,31.8)	14.1 (19.4,8.7)	35
1993	1848	129	70 (81.9,58.1)	15.3 (21.0,9.5)	22
1994	1919	97	50.4 (60.4,40.4)	21 (27.5,14.4)	42
1995	2065	138	66.6 (77.6,55.6)	22.5 (29.0,16.0)	33
1996	1981	77	38.7 (47.4,30.0)	10.6 (15.2,6.0)	27
1997	1939	71	36.8 (45.3,28.2)	11.5 (16.3,6.6)	31

33.8% of all neonatal deaths were attributable to this cause. Infective causes (septicaemia, acute respiratory infection and diarrhoea) have shown an increase. Compared with 1972–74, when they accounted for 18.7% of the deaths, in 1992–94 they were responsible for 37.3% of all neonatal deaths. Tetanus neonatorum showed a significant decline from 25.7% in 1972–74 to 1.7% in 1992–94. In fact, there was only one case of tetanus neonatorum in the study area during 1992–94. This child was born to a mother who had refused to be immunised against tetanus during the antenatal period. Other causes, which chiefly include congenital abnormalities, have shown a slight increase. The commonest congenital abnormalities was meningomyelocele, cleft lip/palate and imperforate anus in decreasing order of frequency.

KEY POINTS

- Conventional wisdom that IMR is an indicator of social development and that with the decline in IMR the proportionate contribution of neonatal mortality to IMR increases, needs to be reviewed.
- Health based interventions, irrespective of social development, can bring down IMR at least to a level of 35 per 1000 live births.
- Consequently, health interventions should focus on improving the birth weight and the accessibility and quality of neonatal care.

Acute respiratory infections (ARI) and diarrhoea continue to be the chief causes of postneonatal mortality (table 3). They have contributed to roughly half of all post neonatal infant deaths throughout the study period. Malnutrition as a cause of death has shown a decline. Deaths attributable to prematurity have showed an increase. Other causes of death include congenital abnormalities, accidents and unclassifiable causes. Two deaths were attributable to complication of measles.

From 1972 the IMR of Ballabgarh lied somewhere in between the national rural and Kerala's rate (fig 2). However, since the late eighties Kerala's rate shows a much steeper decline until the early nineties after which it has been stable. This has increased the gap between Ballabgarh and Kerala's IMR. There seems to be a decrease in the IMR of Ballabgarh as well since 1995. The NNMR of rural India is very high compared with the other two areas (fig 3). Despite the fact that Ballabgarh's IMR is higher than that of Kerala, the difference in the neonatal mortality is narrow. In fact, the neonatal mortality of Ballabgarh in 1996 (10.6) was equal to Kerala's

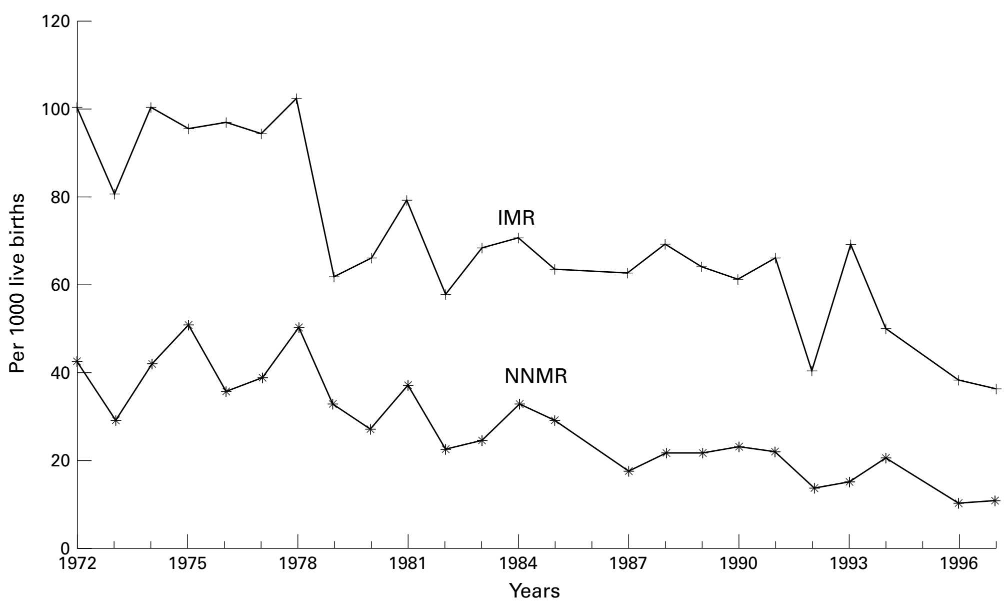

Figure 1 Infant and neonatal mortality rates in BalIabgarh (1972–1997).

Table 2 Trends in causes of neonatal mortality in Ballabgarh

Causes	*1972–74 (n=214)*	*1982–84* (n=154)*	*1992–94†‡ (n=59)*
Prematurity/low birth weight	41.6	50.7	33.8
Birth asphyxia	3.7	5.8	10.2
Tetanus neonatorum	25.7	6.5	1.7
Septicaemia	—	9.1	20.3
Acute respiratory infection	13.6	17.5	15.3
Diarrhoea	5.1	2.6	1.7
Others including congenital abnormalities	10.3	7.8	16.9

*p value <0.00001 1972–74 *v* 1982–84. †p value <0.00001 1972–74 *v* 1992–94. ‡p value <0.00001 1982–84 *v* 1992–94.

Table 3 Trends in causes of postneonatal mortality in Ballabgarh

Causes	*1972–74 (n=315)*	*1982–84* (n=231)*	*1992–94†‡ (n=162)*
Acute respiratory infection	30.2	23.4	27.8
Diarrhoea	24.4	32	22.2
Malnutrition	24.1	18.2	11.7
Prematurity	2.2	4.8	8
Tetanus	1	0.4	—
Septicaemia	—	4.8	6.8
Meningitis	—	4.8	3.1
Others	17.1	11.7	20.3

*p value <0.00001 1972–74 *v* 1982–84. †p value <0.00001 1972–74 *v* 1992–94. ‡p value <0.00001 1982–82 *v* 1992–94.

(10.9) in 1992. We could not get more recent estimates of neonatal mortality of Kerala.

Discussion

IMR in the study area had decreased from 100.9 in 1972 to 36.8 in 1997. A sharp decline in IMR had occurred in 1978 and then again in 1994. Because of a coercive birth control policy in 1976, there were less deliveries during the period 1976–78. This could have resulted in a higher fluctuation because of smaller sample size. It is also possible that fearing future forcible sterilisation, these children could have been well cared for to ensure their survival. The IMR in the study area was consistently lower than the national average for rural areas. In the early seventies neonatal mortality accounted for about 40%–50% of all infant deaths. This proportion has decreased to about 30% in 1997.

Even in 1992–94, prematurity and low birth weight continue to be important causes of neonatal mortality. In the study area, seven (12%) of the 60 neonatal deaths attributable to prematurity were in twins. As other causes of death like infections are prevented, proportion of deaths because of low birth weight is likely to increase. This does not, therefore mean that prevalence of low birth weight is increasing. In fact, an increase in the contribution of prematurity and low birth weight to postneonatal deaths could be because of an increase in the survival of preterm and low birthweight babies resulting in postponement of possible neonatal deaths to postneonatal period. Tetanus neonatorum has been eliminated because of high coverage with tetanus toxoid in antenatal women and adoption of safe delivery practices.

The methodology used for classification of cause of death needs improvement as the present system of diagnosis may result in misclassification. This is more so for neonatal deaths, where most diseases manifest in a very limited symptom complex. We have started using a more detailed verbal necropsy schedule for classification of the deaths of infants under 5 in the study area since 1996. This was following a pilot study in 1993–94,[11] which compared a more detailed verbal necropsy system with the existing system used in this study. A total of 35 neonatal deaths were compared. The agreement between the two methods was 73% for low birth weight, 80%–90% for prematurity and infections and 100% for congenital malformations. However, in the verbal necropsy, more than one cause of death could be identified. Of these 35 neonatal deaths, 19 (55%) were primarily or secondarily attributed to low birth weight or prematurity by verbal necropsy.

ARI and diarrhoea continue to contribute to about half of all postneonatal deaths. However, in absolute numbers 172 children died of ARI and diarrhoea in 1972–74 compared with 81 children in 1992–94. Adjusting for the

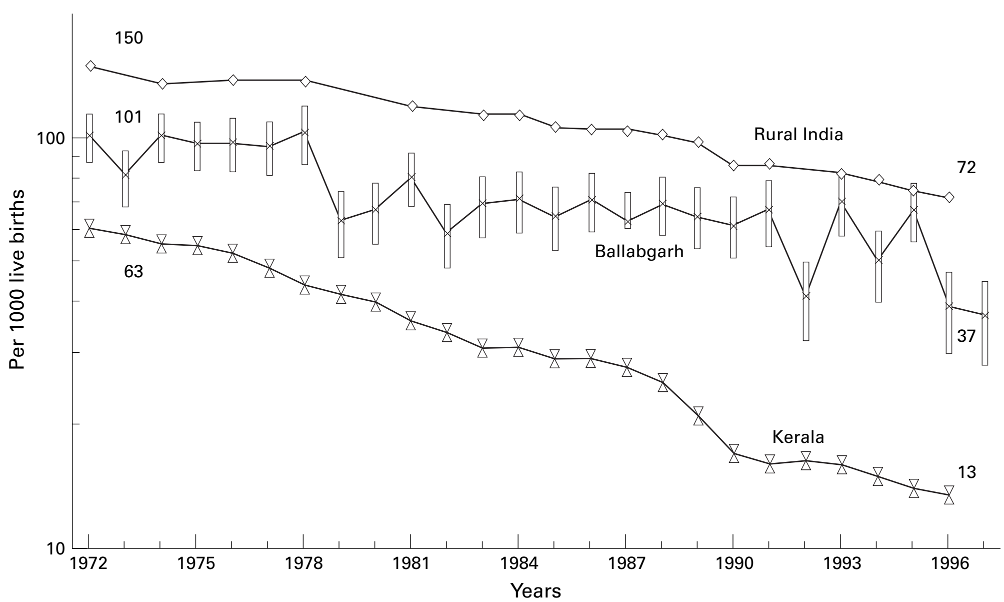

Figure 2 Trends in IMR in rural India, Ballabgarh and Kerala (1972–97).

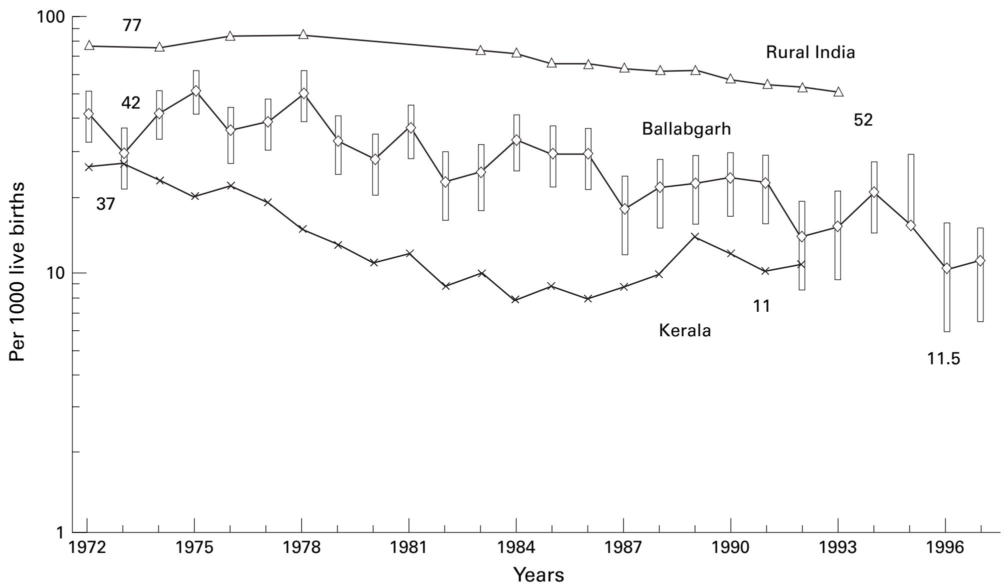

Figure 3 Trends in neonatal mortality rate in rural India, BalIabgarh and Kerala.

population size, which has increased by 1.75 times during this period, it means that about 220 deaths were prevented. Thus, about two thirds of deaths attributable to diarrhoea and ARI are being prevented now compared with 1972. It has been our experience that fluid supplementation in the form of any home available fluid (not necessarily WHO formulated ORS) in children with diarrhoea is near universal in the study area. Similarly recognition of pneumonia by mothers on the basis of chest indrawing and tachypnoea ("Pasli chalna" in the local dialect) results in seeking early treatment from either private medical practitioners or government health agencies.[12] Thus, any further decrease in the postneonatal mortality attributable to ARI and diarrhoea may be difficult unless the incidence of the disease is brought down.

The causes of infant death at all India level showed that 49.6% of deaths in 1990 were attributable to prematurity followed by ARI (13.2%) and diarrhoea (9%). No break up of neonatal and postneonatal mortality was available.[7]

The comparison of IMR and neonatal mortality between the three areas, Ballabgarh, rural India and Kerala, has certain methodological limitations.

(1) The sources of data and their methods of collection are different. Whereas, the source of information for Kerala and India is from SRS, our data are from a community kept under continuous surveillance. Therefore there is a possibility of differences in the quality of data. However, SRS is the most reliable method of data collection in the country. As per the National Family Health Survey, conducted at national level by an independent agency, the estimated IMR for the country (79) was virtually identical to the 1990 SRS value (80). A similar concordance has been reported for Kerala as well.[13] We therefore feel that the figures reported by SRS are reliable.

(2) In the study area, approximately 2000 births occur in a year. Therefore, the calculation of rates in such a small sample size is prone to larger fluctuations. A small sample size also increases the possibility of the result occurring because of chance. However, as the trend was maintained for the entire study period, chance is unlikely to account for the differences/similarities in the results.

Conventionally, it is believed that about half of infant deaths occur in neonatal period, half of which, in turn, occur in early neonatal period. It is also generally believed that most health interventions help in bringing down the postneonatal mortality rates This is because the common causes of postneonatal deaths are "exogenous" like infections whereas the neonatal deaths are caused by "endogenous" factors. This includes low birth weight, congenital abnormalities, etc. Therefore, as the IMR goes down, the contribution of neonatal mortality to IMR goes up. This has been the experience in most countries worldwide.[14]

This has been described as the Bourgeois-Pichat model.[15] However, in a review article, Leela Visaria[16] articulated the need to examine data on the causes of infant deaths to assess the continuing relevance of the Bourgeois-Pichat framework. She argues that prima facie, there is a case for reviewing the approach as based on the experiences reported, one is led to the hypothesise that control of pathogens responsible for lowering postneonatal mortality also extends to neonatal mortality. This would mean that both could be simultaneously reduced. To confirm this, she emphasised the need for good quality data from well designed surveys both on rates and causes of neonatal and postneonatal mortality. We believe, for the reasons mentioned before, our study satisfies these criteria.

For rural India in 1990, NNMR accounted for about 65% of the IMR. In the mid-seventies in Bangladesh,[17] neonatal mortality (65.3) accounted for about 65% of the infant mortality rate (102.9). Sri Lanka, is another neighbouring country that has brought down its IMR comparable to many developed countries.[18] In 1981, the neonatal mortality accounted for 60%–70% of the infant mortality rate (around 27) in Sri Lanka. In Kerala, in the early seventies neonatal mortality accounted for 60%–70% of infant mortality. This has roughly remained the same even in the early nineties.[4]

However, in the study area, the proportion of neonatal mortality in infant mortality is decreasing. A similar report has also been reported by Abel from their experience at the RUHSA's health and development programme.[19] In their community based project in the southern state of Tamil Nadu, the share of neonatal mortality decreased from 52.6% in 1970–72 when IMR was 114 to 41% in 1982–84 when IMR was reduced to 77. The author attributed this to better antenatal care, which resulted in decreased neonatal tetanus and improved birth weight.

To the best of our knowledge, this experience has not been reported from any other area. If similar results are reported from other north Indian states, it may result in rethinking on the current strategies of reduction in IMR in these states. However, the reason for this difference is not clear.

One reason could be the misclassification of neonatal deaths as postneonatal deaths. This could occur because of improper ascertainment of date of birth or date of death. In the study area, the workers visit each village at least once a week and usually come to know, through informal channels of communication, of any death or birth within few days of their occurrence. Thus, ascertainment of dates of these events is likely to be correct. The existing high levels of coverage with antenatal care and immunisation indicate that there are repeated contacts of the workers with the community. We, therefore, feel that the misclassification of neonatal deaths into postneonatal deaths is unlikely to be an important reason for low neonatal mortality in the study area.

The most important determinant of neonatal mortality is birth weight.[20] One of the possible reasons for a lower neonatal mortality in the study area could be the low prevalence of underweight births in the area. A recent study done in some villages of this area by us (unpublished data), found the prevalence of low birth weight (<2500 g) as only 10.2%. The national average for the prevalence of low birth weight is 33%.[3] The prevalence of low birth weight among hospital deliveries in Kerala[21] has been reported to be between 12% to 18% in 1992–93. As 90% of deliveries in Kerala take place in hospitals, this may be assumed to be representative of all deliveries in Kerala. As we do not have any data on birth weight in Ballabgarh from the past, it is not possible to say whether this low prevalence of low birth weight represents an improvement from the past or this difference existed before as well. As neonatal mortality in the study area was similar to that reported for Kerala (fig 3) for the past 20 five years, it is possible that prevalence of low birth weight was low throughout the study period.

It is also possible that some other unidentified factor is responsible for the low neonatal mortality; for example; availability of good quality antenatal and neonatal care. The high coverage with tetanus toxoid and iron supplements and identification of high risk pregnancies at the village level is well supported at the secondary level by the Ballabgarh project hospital. All the villages are within 20 km of this hospital and are connected to it by metalled road. This hospital functions as a First Referral Unit (FRU) for this area. The hospital is fully equipped to handle any antenatal and neonatal emergencies except for the availability of a blood bank and ventilatory support. Ballabgarh hospital, because it is attached to a medical college is likely to provide much better care than in any other FRU.

The pattern of government health care delivery system is similar for the country. However, state to state or even PHC to PHC variations do exist. In the state of Kerala, the accessibility of health services is very good because most villages are large villages (more than 10 000) and are well connected by roads. Even good quality private health care is available in Kerala. These are a reflection of its overall development. However, in most rural areas, especially in north India, the accessibility of both government health service and good quality private health services is poor.

Based on our study, the following areas would need to be resolved if IMR is to be brought down further in the project area:

(1) Reduction of deaths attributable to ARI and diarrhoea: these cases are likely to be serious or complicated cases who would need admission. These are unlikely to be manageable at domiciliary level. Further reduction of these deaths would need early admissions especially for diarrhoea, better facilities (for example, S electrolytes measurement) and better medical skills of doctors. However, even then all deaths would not be prevented. The scope for further reduction in these deaths is limited.

(2) Prevention of congenital abnormalities: provision of periconceptional folic acid could help prevent meningomyelocles, which are the most common congenital abnormality.

(3) Decreasing early neonatal deaths: this would need early identification of high risk pregnancies especially twins during the antenatal period and referral to the hospital for delivery. Similarly early identification of sick neonates by mothers, primary level care providers including doctors and good management skills at the headquarter hospital is also needed.

The success of Kerala state in reducing IMR has been attributed to its overall development characterised by (a) high female literacy, (b) higher status of women in the society, (c) good accessibility of health services even in rural areas, (d) equitable distribution of wealth resulting from land reforms. This is despite the lack of any industrial or agricultural development in the state.[22] Kerala had made important advances in the social sector even before independence. The per capita national income of Kerala is lower than the national average and that of the state of Haryana where this study area is situated. Almost 90% of deliveries occur in hospitals and there are hardly any rural and urban differences. Compared to this, the study area is characterised by good agricultural and industrial production with only modest achievements in the fields of education, health or land reforms. The female literacy in Kerala was 86%[23] in 1991 compared with 34% in the study area. In Ballabgarh, only 10%–20% of deliveries occur in hospitals. Most north Indian areas would be similar to the study area rather than Kerala. This difference in the sociocultural context, and, the findings of this study where the pattern of reduction of IMR is different to Kerala's lead us to believe that the Kerala model of bringing down of IMR may not be applicable to northern India.

The current focus at national level is on controlling the postneonatal mortality that is attributable to infections by increasing coverage with immunisation, promoting ORS use in diarrhoeas and case management of ARIs.[24] Our study shows that simultaneously there is a need to identify strategies to bring down neonatal mortality. As the most important determinant of neonatal mortality is birth weight, there is a need to tackle this issue immediately. Strategies to improve birth weight by administration of iron folic acid supplements, improving maternal nutrition should receive higher priority than they are getting now if the IMR is to be brought down further. There is also a need to strengthen the neonatal services at peripheral levels in the country. A beginning has been made in the Child Survival and Safe Motherhood (CSSM) programme wherein for the first time essential new born care was included in the package of primary health care services.[24]

An estimated 8 million infant deaths occurred worldwide in 1997, of which 5 million were neonatal deaths. A total of 98% of these neonatal deaths occurred in developing countries.[13] Our study has demonstrated that bringing down the IMR need not wait for the overall development of the community. Environmental, social and educational improvement in the developing countries is likely to be a slow process. Bringing down IMR cannot wait for that long. Developmental issues like literacy campaigns, land reforms, etc, are outside the scope of the health sector. Therefore, without in any way reducing the emphasis on these developmental programmes, we feel that IMR could be brought down faster by more specifically aimed health interventions.

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