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Reducing Neonatal Mortality in Jhagadia Block, Gujarat: We Need to go Beyond Promoting Hospital Deliveries

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Summary

Background and Methods: We examined data from a cohort of births that occurred in the period 2004–08 in the SEWA-Rural project area, covering a population of ~175 000, in Gujarat, India, to assess the trends and risk factors for neonatal mortality.
Results: In this population living in 168 villages, there has been a significant declining trend in infant and neonatal mortality, more marked in the tribal population, in whom this paralleled a rise in the proportion of women delivering in hospitals. The more important risk factors for neonatal mortality risk to emerge from multivariate analysis are low birth weight, prematurity, young age of mother, older mother and high birth order.
Conclusion: Although community based interventions along with promotion of hospital birth has an impact in reducing neonatal deaths in this community, sustaining this momentum may demand more long-term policy interventions to promote better living standards and better reproductive health.

Key words: neonatal mortality, infant mortality, Gujarat, India, Janani Suraksha Yoajana.

Introduction

Of the newborn deaths reported worldwide, 99% occur in low- and middle-income countries; two-thirds of these occur in the African and South-east Asian regions of World Health Organization [1]. Preterm births, infections and asphyxia are the major causes, with low birth weight (LBW) contributing as a major indirect cause. In southern Asia, more than half of all newborn deaths take place in the first 28 days of life [2].

Infant mortality trends in India, analysed from Sample Registration System data, show a slowing down of the fall in mortality rate by the late 90s [3]. The pace of improvement has been slow and falls short of millennium development goals; the reasons for this include poor coverage of existing programmes and poor quality of implementation [4]. However, reduction in neonatal mortality risk (NMR) can be achieved even in remote rural villages by appropriate interventions, as has been shown by Bang *et al*. [5] in Gadchiroli, where it was done by concerted community action without using high technology.

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Policy initiatives to curb infant and maternal mortality in India have tended to two approaches. The first involves encouraging childbirth in hospitals instead of homes. The alternative approach is to train rural birth attendants in proper birthing practices so that home deliveries become safer. In recent years, various state governments have used conditional cash transfers as a policy of inducing women to come to hospital for delivery. In a scheme called the Janani Suraksha Yojana, government provides €1400 (about US $28) to women choosing to deliver in public facilities or accredited private facilities in rural areas of relatively poor performing states and €700 (about US $14) to women doing the same in other states [6]. The scheme also covers all women belonging to the most marginalized 'dalit' and tribal communities (scheduled castes and scheduled tribes in official parlance) across the country [6]. It is assumed that hospital delivery will considerably reduce infant mortality, especially neonatal mortality, through reduction of infections and proper care of LBW infants. The experience of the southern Indian state of Kerala, where virtually every delivery takes place in hospital, and which has the best infant mortality statistics in the country, has supported this view [7].

However, most Indian states, including Gujarat, are far from achieving this goal. 'SEWA-Rural' is an organization that has been engaged in an effort to develop a 'Family Centred Safe Motherhood and Newborn Care Project' since 2004 in the Jhagadia block (sub-unit of a district) of Gujarat, with the objective of making it an evidence based model for saving lives of rural poor and tribal mothers and their newborn in the 168 villages covering a population of 171 000 in Bharuch district of Gujarat [8]. The whole programme has the backup of a fully functional base hospital, with 100 beds providing comprehensive emergency obstetric and neonatal care. In the field operational areas of SEWA-Rural, 55% of deliveries are home deliveries, whereas institutional deliveries are 45% for 2007–08. Of the institutional deliveries, 70% are conducted in SEWA-Rural Hospital, which is The United Nations Children's Relief Fund recognized first referral unit providing comprehensive emergency obstetric and newborn care; thus, making the SEWA-Rural hospital the main provider of maternity care services in the community development block, which is a sub-unit of the district.

The availability of records on most of the births and deaths in this population provided a unique opportunity to analyse the trends and causes of NMR in this part of Gujarat in the recent past. Examination of this data, we felt, would yield valuable lessons for the rest of India and the developing world on the effectiveness of the policy of promoting hospital deliveries on bringing down neonatal and thereby infant mortality. The specific objectives of this exercise were:

(i) Estimate the trends in neonatal mortality from 2004–05 to 2007–08 in this population, for which detailed information was available;
(ii) Examine the factors associated with high neonatal mortality and
(iii) Examine the possible impact of recent policy interventions on the above two.

Methods

In the data on births for 2004–08, extracted from the records of the SEWA-Rural hospital and the project in Jhagadia block, 19 600 births were recorded. These included babies born in the hospital and babies born at home, whose birth details were recorded by the health volunteers. As the project covered most of the population in the area, this is a fairly comprehensive record of births in the community development block. We restricted the analysis to live births occurring in mothers ordinarily resident in the project area or those who had migrated from the project area for childbirth. From April 2004 to March 2008, 13 624 births were recorded. Deaths of infants aged <1 year recorded in this birth cohort numbered 674; of these, information on exact time of death was available in 665 infants. We analysed this data to identify the risk factors for mortality in the first 28 days of life. We looked at NMR, defined as probability (incidence proportion) of death in the newborn infant within 28 days of birth. The impact of many policy initiatives, such as the promotion of hospital delivery, would be felt maximally in this group. The proximate explanatory variables we used were tribal identity (whether the mother was a tribal or not), LBW (<2500 g), pre-term delivery (delivery before 36 completed weeks of gestation, as could be assessed from the case records), age of the mother at childbirth, birth order and birth in hospital. Some of the other important variables, such as socio-economic status, education of mother and father, income, standards of living and nutritional status of mother were strongly correlated with these proximate determinants; therefore, we chose not to include them in the multivariate models. Statistical analysis was done using the '*R*' software [9].

Ethical considerations

All analysis was done on records from SEWA-Rural for the corresponding period, and there was no primary data collection involved. All records were analysed in an anonymous, unlinked manner, after obtaining permission from the institutional review board.

Results

Of the mothers whose data we studied, 73% were tribal and 27% were non-tribal. Among 665 deaths

TABLE 1
Distribution of infant deaths by cause of death and period of death (neonatal/post-neonatal)—births outside hospital and hospital births

Age group	Caste	Infection	Trauma/asphyxia	Pre-term	Others	Total
Births outside hospital						
Neonatal	Tribal	69 (28.3)	85 (34.8)	62 (25.4)	28 (11.5)	244 (100.0)
	Non-tribal	07 (17.1)	16 (39.0)	11 (26.8)	07 (17.0)	41 (100.0)
Post neonatal	Tribal	96 (62.7)	22 (14.4)	5 (3.5)	30 (19.6)	153 (100.0)
	Non-tribal	11 (61.1)	01 (5.5)	0 (0)	06 (33.3)	18 (100.0)
Hospital births						
Neonatal	Tribal	16 (19.0)	29 (34.5)	23 (27.4)	16 (19.0)	84 (100.0)
	Non-tribal	08 (12.5)	24 (37.5)	18 (28.1)	14 (21.9)	64 (100.0)
Post neonatal	Tribal	26 (70.3)	02 (05.4)	02 (05.4)	07 (18.9)	37 (100.0)
	Non-tribal	08 (53.3)	04 (26.7)	00 (00.0)	03 (20.0)	15 (100.0)

Figures in brackets indicate percentages.

TABLE 2
NMR (calculated as incidence proportion per 1000 births in 1 year) among tribal subjects and non-tribal subjects

Year	NMR/1000	95% CI	Tribal	Non-tribal
2004–05	38.8	32.7 (45.7)	41.8 (34.4–50.2)	31.1 (21.0–44.0)
2005–06	26.1	21.1 (32.0)	27.6 (21.6–34.8)	22.1 (13.7–33.6)
2006–07	36.2	30.2 (42.8)	36.0 (29.2–43.9)	36.5 (25.4–50.7)
2007–08	25.0	19.7 (31.1)	25.3 (19.2–3 2.7)	24.0 (14.7–36.8)
All years	31.8	28.9 (34.9)	33.0 (29.6–36.7)	28.5 (23.4–33.4)

TABLE 3
NMR by key risk factors

Attribute	NMR/1000	(95% CI)
Sex		
Male	36.7	(32.5–41.3)
Female	26.1	(22.3–30.3)
Place of birth		
Home	31.2	27.7–34.9
SEWA-Rural	27.7	21.3–35.2
Other hospital	38.6	31.0–47.5
Age of mother (years)		
<21	37.8	31.0–45.5
21–25	28.8	25.1–32.9
26–30	28.1	22.0–35.3
31–35	69.8	43.7–104.7
36–40	116.3	38.9–250.8
Ethnicity		
Tribal	33.0	29.6–36.7
Non-tribal	28.5	23.4–34.4
Term/pre-term		
Full term	19.6	17.2–22.2
Pre-term	137.9	120.3–157.0
Birth weight		
LBW (<2500 g)	73.8	65.2–83.1
Normal birth weight	15.2	12.5–18.2

of infants on whom information on time of death was available, 433 (65%) occurred in the neonatal period (within 28 days of birth). Overall, only one-third (33.3%) of all births in the period under study took place in hospitals. Table 1 shows the principal reported causes of death in babies of tribal and non-tribal women.

Overall, average risk of mortality within the first year of birth—the infant mortality rate (IMR)—in 2004–08 is 49.5/1000 [95% confidence interval (CI) = 45.9–53.3], with no major sex difference (boys: 52.7, 95% CI = 47.7–58.1; girls: 45.3, 95% CI = 40.5–50.7). Other results are in Tables 2–4 and Figs 1 and 2.

Discussion

IMR in the whole of rural Gujarat ranged from 65/1000 in 2005 to 60/1000 in 2008 [10]. During the same period, IMR in our study population was lower, and there was a persistent downward trend, declining from 57.7 to 39.1/1000 (Fig. 1). This is a pointer to the success of the community mobilization and awareness efforts through the health workers initiated by SEWA-Rural. This population is predominantly tribal, and it is at greater risk of infant mortality when compared with other rural populations. Infant mortality in all Indian states registered significant declines from 1990s, with southern and western states registering notable declines in neonatal mortality, according to an analysis comparing various Demographic and Health Surveys round the world, including several rounds of the Indian National Family Health Survey [11]. Other studies from India have emphasized the importance of

TABLE 4
Logistic regression analysis of factors influencing neonatal mortality

Risk factor	Reference category	Crude OR (95% CI)	Adjusted OR (95% CI)
Non-tribal	Tribal	1.31 (1.02–1.69)	1.60 (1.23–2.09)
Pre-term (before 37 weeks)	Full term (≥37 weeks)	8.71 (6.98–10.88)	6.38 (5.06–8.06)
LBW (<2500 g)	Birth weight ≥2500 g	5.09 (4.03–6.41)	3.79 (2.97–4.83)
Mother's age: <21 or >30 years	21–30	1.56 (1.23–1.96)	1.34 (1.03–1.73)
Male	Female	1.43 (1.14–1.78)	1.45 (1.16–1.83)
Birth-order: >2	1 or 2	0.95 (0.76–1.19)	1.20 (0.94–1.53)
Birth in SEWA-Rural hospital	Other hospitals and home	1.15 (0.87–1.53)	1.28 (0.95–1.72)

Nagelkerke $R^2 = 0.175$.
Analysis was done on 10 274 births on which complete data were available.
OR, odds ratio.

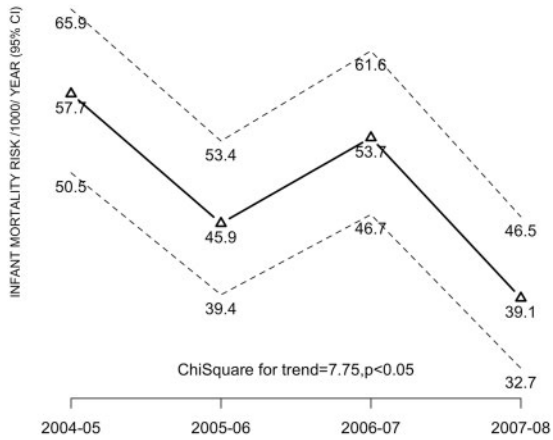

FIG. 1. Trend in IMR in the project area with 95% CI, 2004–05 to 2007–08.

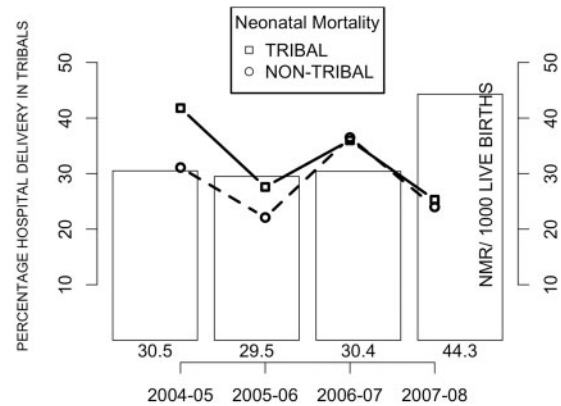

FIG. 2. Trend in NMR among tribal and non-tribal mothers, along with proportion of births in hospital among tribal mothers, 2004–05 to 2007–08.

understanding local specific risk factors and their contribution to infant and child mortality to develop effective policy [12].

The tribal population in India, despite sustained government initiatives, still lags behind the general population in almost all health indicators. This can be attributed to a variety of reasons, including poverty, lack of education and often, customs and traditions that contribute to ill health. They are also traditionally reluctant to use modern health services. In this project area, however, there is no perceptible difference between the tribal and non-tribal populations in the proportion of hospital deliveries, as a result of continuous effort at promoting hospital birth among the tribes by the SEWA-Rural team. Our data indicate that the proportion of tribal mothers giving birth in hospitals has increased in the latter part of the period under observation (Fig. 2). Institutional birth brings down the proportion of neonatal deaths because of infections (Table 1) in both tribal and non-tribal populations. LBW is associated with a large proportion (attributable fraction: >45%) of infant deaths in both non-tribal and tribal populations; this does not vary much between them. LBW is compounded by prematurity, as there is a strong association between prematurity and LBW. Prematurity continues to be an important contributor to NMR even in societies with access to advanced health care, such as the USA [13]. Although LBW is a significant contributor to NMR, analysis of data from the USA shows that NMR can be substantially reduced despite uneven success in reducing LBW, by proper care of babies under different weight categories [14]; as a higher proportion of lower birth weight infants started surviving, the relationship between LBW and NMR also weakened. The authors emphasize that interventions to reduce the proportion of LBW babies are likely to be ineffective, as has been the experience in the recent past.

There are a high proportion of deaths because of infection in the post-neonatal period, which can not

in any case be prevented by hospital births. From Table 3, we see that the risk factors for NMR are: LBW (<2500 g), prematurity, age of mother (<21 or >30 years), birth order (>2) and being a tribal mother. Unfavourable age of mother (<21 or >30 years), tribal identity, poor social and economic status (type of house), premature birth and birth order are all risk factors for LBW. LBW may also be associated with poor nutritional status of mothers; analysis of data from National Family Health Survey II has brought out the strong predictive power of low height of the mother on mortality as well as stunting and wasting in the child [15]. This may introduce a generational effect, as malnourished children may grow up into women with short stature, thus, perpetuating the disadvantage. As we did not have information on good indicators of nutritional status, we could not look at the association, although we expect this to be important in tribal women.

Hospital birth, tribal identity and socio-economic status are no longer predictors of mortality risk, once we have accounted for birth weight, prematurity, birth order and age of mother (Table 4). Non-tribal mothers have a higher risk for neonatal mortality after adjusting for these proximate variables; however, we consider this partly a result of a bias. The information on tribal mothers, especially those whose infants have died, is more likely to be incomplete, and they may be over-represented in the subjects whose data were not available for analysis.

This analysis confirms that controlling neonatal mortality remains the major challenge in containing infant mortality in rural and tribal populations in India. Many risk factors for mortality in the early period of life can only be controlled by addressing fundamental issues like nutritional status of mothers, early marriage, too frequent childbirth and lack of access to health care facilities. Promoting more hospital deliveries and training village health workers in safe birthing practices may help to reduce neonatal mortality to a large extent; however, because of the high proportion of premature and LBW babies born, the effect of these policy initiatives can soon reach a plateau.

Limitation

The main limitation of this study has been the use of available data, which were not collected for research using a pre-designed protocol. There may be selective omissions that may have affected the analysis.

Conclusion

The policy emphasis on promoting hospital delivery and training birth attendants has been effective in this population, as evidenced by the declining trend in neonatal mortality. In isolation, however, these two measures may not be completely successful in meeting developmental goals. This needs sustained long-term interventions focused on promoting women's education and nutrition, raising the age of marriage and childbirth and reducing fertility. Along with this, we also need to improve substantially the neonatal care facilities for LBW and premature infants.

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