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Infant Mortality in an Urban Slum

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Abstract

Objective—Infant and child mortality are important indicators of the level of development of a society, but are usually collected by governmental agencies on a region wide scale, with little local stratification. In order to formulate appropriate local policies for intervention, it is important to know the patterns of morbidity and mortality in children in the local setting.

Methods—This retrospective study collected and analyzed data on infant mortality for the period 1995 to 2003 in an urban slum area in Vellore, southern India from government health records maintained at the urban health clinic.

Results—The infant mortality rate over this period was 37.9 per 1000 live births. Over half (54.3%) of the deaths occurred in the neonatal period. Neonatal deaths were mainly due to perinatal asphyxia (31.9%), pre-maturity (16.8%) and aspiration pneumonia or acute respiratory distress (16.8%), while infant deaths occurring after the first mth of life were mainly due to diarrheal disease (43%) and respiratory infections (21%).

Conclusion—These results emphasize the need to improved antenatal and perinatal care to improve survival in the neonatal period. The strikingly high death rate due to diarrheal illness highlights the requirements for better sanitation and water quality.

Keywords

Infant mortality; Gastroenteritis; India

The level of infant and child mortality is a basic indicator of the quality of life in a society. Multiple factors related to social and economic conditions, health care and environment have a significant effect on childhood mortality, and improving child survival is a national priority in health care. The World Health Organization is working with national/ governments to improve neonatal and child survival, most recently with the development of the Integrated Management of Childhood Illness (IMCI) scheme, with the addition of a neonatal component in some areas.

In India, health care for children in rural and urban areas is provided through different organizational structures. Particularly in poorer urban communities or slums, the pressure of large and increasing numbers in the population to be served can result in stretching of infrastructure and resources. This is evidenced by data that shows that the urban population of India increased 31.2% between 1991 and 2001, at nearly twice the rate of the rural population.¹ Of the urban population in India, 38% was living in poverty in 1990, mostly in slums. The rapid changes in these populations support the need for periodical assessment of the standards of health care delivery in these areas. The infant mortality rate (IMR) recorded

for poorer urban communities in India during the National Family Health Survey (NFHS) 1 in 1992 for the preceding 5 yr period was 76 per 1000 live births.² However, the overall rate for Tamil Nadu by the NFHS 2 for the 5 yr period preceding 1998-1999 was 48 per 1000 live births and by the Sample Registration System (SRS) for 1994-1997 was 53 to 59 per 1000 live births.^{3,4}

Studies from India which examined causes of mortality have shown that in the neonatal period, the common causes of death are perinatal asphyxia, prematurity and sepsis, while in older children, infections are the commonest causes of death.⁵⁻¹² Infant mortality rates vary from state to state and over time, and are expected to change after the introduction of the IMCI. The authors therefore decided to carry out a retrospective study to determine the cause specific infant mortality during the period 1995 to 2003 in an urban slum near Vellore, which would provide both data on mortality in slum areas as well as a baseline to permit assessment of the effect of interventions.

MATERIALS AND METHODS

Study Area

Vellore is the sixth largest town in Tamil Nadu with an urban and peri-urban population of approximately 350,000. The municipality area is divided into 49 wards. There are five urban health centres, but the areas covered by the urban health centres are not divided by ward. There are 4 health workers at each health centre, responsible for maintaining and updating records, and they report to the medical officer at the urban health centre who collates information and submits it as scheduled to the municipal health officer. In 1999, each health post conducted a new census of households. The census registers give information by street, all members of the household including name, date of birth and antenatal history for women. Each health worker is responsible for maintenance of data for a list of streets with a population of 8000 individuals or 1500 households, approximately. The Kaspas Urban Health Centre, which was studied in this report, covers four main areas, Kaspas, Ramnaickapalayam, Vasanthapuram and Ditter Line. The 1999 census recorded a population of 38,328 with 4746 houses and 7448 families. The population is approximately 50% Muslims, 45% Hindus and 5% Christians.

Data collection

The birth history, immunization records and infant mortality data of all the infants in the population under study are recorded and maintained by health workers at the Urban Health Clinic. Each report of a death of a child under one yr of age is investigated by the medical officer, who conducts a verbal autopsy, using a modified WHO/UNICEF best judgement format,¹³ at the house and then records cause of death. A single medical officer was responsible for all the autopsies, and ensured that all information was recorded within two weeks of the death report. The more structured WHO verbal autopsy format was not available in 1995, but was reviewed subsequently to ensure that misclassification was kept to a minimum.¹⁴

We abstracted the cause-specific infant mortality data and the birth history of these infants from the records maintained between January of 1995 and December of 2003 for the purpose of this retrospective study. Still births and intra-uterine deaths were not included in this study.

Analysis of data

The data collected were divided into the age-specific categories, less than 2 wk, 2 wk to 1 mth, and 1 mth to 1 yr. Proportional and cause-specific mortality in these categories and the

birth history versus cause-specific mortality were also studied. The most common causes of death in each age group were determined and compared with the causes of infant deaths in other parts of the subcontinent. Predisposing factors such as the gestational age, birth weight, mode of delivery and whether they contributed to infant deaths were also examined.

RESULTS

Between 1995 and 2003, there were 5765 live births and 219 infant deaths, giving an average infant mortality rate of 37.9 (range, 31.3 to 46.4) per 1000 live births for this period.

The birth history of the 219 infants showed that 6.8% had instrumental or operative deliveries in a hospital or nursing home, while among the remaining births with no delivery related complications, 44.3% were born in a hospital, 34.3% were born in a nursing home and 14.6% were born at home. No significant association was found between mode and place of delivery and any cause of death.

The majority (119/219, 54.3%) of the deaths occurred in the neonatal period. Of these, 97 (81.5% of neonatal deaths) occurred in the first two wk and 22 (18.5% of neonatal deaths) in the second two wk. Most infant deaths occurred in the first six mth, with only 18 (8.2% of deaths) occurring in the second six mth of infancy. Of the 219 deaths, 120 (54.7%) were male and 99 (45.3%) were female infants. Based on the religion of the family, 129 (58.9%) of deaths occurred in Muslim households, 88 (40.2%) in Hindus and 2 (0.9%) in Christian families.

In the age group less than 2 wk, the most common cause of infant deaths was perinatal asphyxia (39.2%, Fig. 1). Of those infant deaths due to perinatal asphyxia, 42.1% were born preterm and with a birth weight less than 2.5 Kg. Prematurity was also related to another 20.6% of the infant deaths that occurred in the first 2 wk. Aspiration and aspiration pneumonia were the most important respiratory related causes of mortality (14/97, 14.4%) in the early neonatal period, although two children were also recorded to have had acute respiratory distress syndrome. Congenital anomalies were recorded as cause of death in 9 neonates, of whom 6 had cardiac defects. Rh incompatibility contributed to 2 deaths. Jaundice was seen in 2 children and one neonate had gastroenteritis. Other causes shown as miscellaneous cause in Fig. 1 included hypocalcaemia, seizures, acute renal failure, pleural effusion and unknown causes. In the age group 2 wk- to 1 mth, the most common causes of death were found to be aspiration (27.3%), acute gastroenteritis (22.7%) and jaundice (13.6%) Fig. 1.

In the age group above 4 wk of age to 1 yr, the most common cause of death was found to be diarrheal illness (43%, 43/100), including both acute gastroenteritis and bacillary dysentery, followed by respiratory infections (21%, 21/100), (Fig. 1). Other causes of mortality were mainly infective, including meningitis, septicaemia, undifferentiated fevers and hepatitis. Congenital anomalies contributed to 10% of deaths in this age group.

Overall, of the 219 infants who died, 28.3% of the infant deaths were recorded to have a birth weight less than 2.5 Kg and 21.9% were premature births. Perinatal asphyxia was seen in 21 neonates who were not premature or low birth weight, and in 19 premature neonates.

Information on whether the infant had died at home or in hospital was available for 182 children. Among the 86 infants, who died at less than 2 wk of age, 18 (20.9%) deaths had occurred at home, 23 (26.7%) in nursing homes and 45 (52.3%) in hospitals. Among the 96 children who were older than 2 wk, 42 (43.8%) had died at home and the remainder in nursing homes (34, 35.4%) and hospitals (20, 20.8%). No documents were available at the time of this study for any investigations regarding cause of death. During the early neonatal

period, perinatal asphyxia, prematurity, aspiration and congenital anomalies were the most common cause of deaths, but overall, during infancy the leading cause of mortality was acute gastroenteritis (Table 1). Infectious diseases contributed to 41% of the deaths, mainly in children over 4 weeks of age.

DISCUSSION

Data from the NHFS 2 covering the period 1994-1999 showed that Tamil Nadu had a neonatal mortality of 35 which contributed to an infant mortality rate of 48 per 1000 live births.³ According to the NHFS, infant mortality rates, but not neonatal mortality have been declining over successive 5 yr periods. However, these data are collected state wide, and do not assess differences in socio-economic indices and place of residence. In the SRS, data from 1995 to 2000 shows that in rural areas infant mortality ranged from 57 to 61 with a mean of 58.8, while in urban areas it ranged from 38 to 40 with a mean of 39.1.⁴ Again, these data include all socio-economic strata and levels of urbanization. In a study that compared urban slums in Calcutta and Raipur, the infant mortality was higher in the metropolis than in the smaller city.⁸ The mean IMR reported here in the study area of 37.9, compares well with national and state data assessed by different methods, although the study area has a low standard of living. It is also possible that the IMR reported here may be biased towards under-reporting because the primary data on deaths is collected by field workers, and although each death is verified by the medical officer, there is no systematic validation of the data collection.

It is interesting to note that there were fewer deaths in girls than in boys in both the neonatal period and later in infancy. This is in contrast to previous reports from other parts of the Sub-continent.^{9,11} The proportional higher mortality rate in Muslims has been reported in another study from central India as well.¹⁰ This may reflect both economic and socio-cultural conditions.

Studies on causes of infant mortality from other parts of the country have shown differing results. In the neonatal period, reports from Lucknow and Dhaka showed that tetanus was an important cause of death in the early neonatal period, as late as the 1990s.^{5,11}

However, no tetanus was reported as a cause of infant mortality in all 9 yr of this study. This is likely because of the high immunization coverage during pregnancy in Tamil Nadu. In this study, the rates of perinatal asphyxia (17.3% of infant mortality, 31.9% of neonatal mortality) are higher than the rates of 16.8% and 20.5% reported elsewhere,¹¹⁻¹⁵ but this may be because in 18 of these deaths, in addition to the asphyxia, the child was also pre-term, and in other studies may have been classified as such. In a total of 30 (13.7%) children, mortality was ascribed to pre-maturity, including the 10 with perinatal asphyxia. This is comparable with previous reports of 11.3% and 12.7%,^{5,15} and less than the 35.2% reported from central India in 1985.¹⁰

In infants over one month of age, the leading cause of death was diarrheal disease. This was responsible for 49 deaths (23.3% of deaths overall). In the largest series studied so far, urban Lucknow was reported to have respiratory infections (23.4%) and diarrhea (20.9%) as leading causes of death in children less than 5 yr of age.⁵ In Dhaka, in infants, the common causes of death were respiratory and diarrhoeal illnesses.¹¹ Similarly in Delhi, beyond the neonatal period, the major causes of deaths were diarrhea, meningitis, sepsis and respiratory illness.⁷ Remarkably, sepsis was not a major cause of mortality in this study, a possible cause for this finding may be the large number of private practitioners in the area who are known to administer parenteral antibiotics widely in children. In contrast to a report from

Delhi where twice as many females as males died of diarrhea,⁹ there was no difference in sex seen in this study.

Differences in interview techniques, cultural aspects and the underlying mix of causes of death in the population affects the accuracy of the verbal autopsy. In this study all interviews were conducted by the same medical officer who is known and respected in the community. Even so, these data are flawed in being retrospective and not validated by a national mechanism as in the current studies being conducted by the Indian Council of Medical Research. However, these data do emphasize that although there has been a decrease in infant mortality over the past few decades; neonatal mortality, which could be decreased by better access to antenatal and perinatal health care, continues to be high. In post-neonatal infants, infectious diseases, particularly diarrhoeal illnesses, continue to cause deaths, despite the promotion of rehydration and the availability of health services. Increased reduction in childhood mortality requires new approaches that go beyond disease- and programme-specific approaches.¹⁶ Enhancement of services in pregnancy and to young children, improvements in sanitation and water supplies are required, but with limited governmental resources, may be achievable only with more widespread community involvement.

CONCLUSION

Neonatal mortality, which is preventable by better antenatal and perinatal care, continues to be high in urban slums in south India. In the post-neonatal period of infancy, infectious disease mortality is high although health care is accessible.

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Fig.

Causes of death in infants of different ages in an urban slum in Vellore, southern India, 1995-2003. The size of the pie diagram is proportional to the number of infant deaths in each age group. Miscellaneous deaths includes seizures, pleural effusion, acute renal failure, injury and unidentified causes.

Table 1
Causes of Death in Infancy in a Urban Slum in Vellore, 1995-2003

Cause of death	Number	Percentage	Rate/1000 live births
Gastroenteritis	49	23.3	8.6
Perinatal asphyxia ¹	38	17.3	6.7
Acute respiratory infections	23	10.5	4.1
Congenital anomalies	21	9.6	3.7
Pre-maturity	20	9.1	3.5
Aspiration pneumonia	18	8.2	3.2
Fever/Septicemia	10	4.6	1.8
Jaundice ²	6	2.7	1.1
Meningitis	5	2.3	0.9
Miscellaneous ³	29	13.2	5.1
Total	219		

¹Includes 18 children in whom pre-maturity was also listed as a cause of death

²Includes one infective hepatitis in late infancy

³Includes seizures, pleural effusion, acute renal failure, injury and unidentified causes