Original Research Article

DOI: http://dx.doi.org/10.18203/2394-6040.ijcmph20175322

Analysis of neonatal deaths in Maharashtra: policy implications

S. Saunik¹, C. Jaiswal², R. Nair³, A. Radkar⁴, A. Patil⁵, S. Irani², M. Phadke*⁶

Received: 09 May 2017 Revised: 21 June 2017 Accepted: 22 June 2017

*Correspondence: Dr. M. Phadke,

E-mail: drmapaa@yahoo.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: As per statistics on infant mortality, the State of Maharashtra has done well in bringing down IMR from 33 to 21 per 1000 live births. However a lot needs to be achieved still. Various child health programs like home based new born care and others have improved child survival. But the analysis of cases will throw light on actionable points for policy change.

Methods: Keeping in mind mortality statistics of the State, an analysis was done on causes of neonatal deaths and social determinants. A retrospective study was done on causes of death from birth to 28 days during 2015-2016 in the State of Maharashtra. 6 deaths per block were reviewed by a committee that included a pediatrician. Verbal autopsy was done and all factors like social, cultural, behavioral as well as factors that resulted in delay in deciding to take the baby to health facility, delay in transport and delay at health facility were studied in details.

Results: Latur circle had the highest deaths i.e. 70%, Nashik and Gadchiroli had 62 and 63% respectively. Males were more than females (55.7%). ^0.6% of deaths occurred in babies weighing less than 2500 gms. Delay in deciding to take the baby to the health facility and getting treatment was important (41.4% cases). In 40.8% cases delay in receiving treatment at health facility was observed. Major causes were infections, prematurity and asphyxia.

Conclusions: Various causes of neonatal deaths are studied. Delay in deciding to take the baby to the health facility was one of the major factors. Majority of deaths were due to infection prematurity and asphyxia.

Keywords: Neonatal deaths, infection, prematurity, asphyxia

INTRODUCTION

Maharashtra is one of the most developed and progressive states of India as far as health parameters are concerned. In the recent past child mortality scenario has seen a lot of progress. Under-5 mortality rate (U_5MR) has reduced from 41 in 2008 to 23 in 2015, infant mortality rate (IMR) from 33 to 21 and neonatal mortality rate (NMR) from 24 to 16 during the same period. Reduction in U_5MR , IMR and NMR is 15%, 30% and 42% respectively. Though a large decline is seen in NMR, a lot needs to be achieved because share of neonatal deaths

to infant deaths as per sample registration system (SRS) 2014 is 74.8%. 1-3

As per SRS 2015, IMR for Maharashtra is 21 with 26 for rural and 14 per 1000 live births for urban areas. NMR for Maharashtra is reported as 15 with percentage of neonatal deaths to infant deaths is 71.3. Similarly percentage of early neonatal deaths to infant deaths is 52. (SRS bulletin 2015 chapter 4 mortality indicators). This huge share of neonatal deaths needs attention; because if these deaths are restricted, child mortality would drop further to show remarkable results.

¹Principal Secretary, Public Health, ⁵Addl. Director, DHS, Government of Maharashtra, Mumbai

²Consultant, ³Nutrition Specialist, ⁶Sr. Adv. NHM, UNICEF, Mumbai

⁴Associate Professor, Gokhale Institute of Politics and Economics, Maharashtra, Pune

As per national family health survey - 3 (NFHS-3), conducted during 2005-06, NMR for Maharashtra was 35.6 and for rural areas it was as high as 47.2. Among the determinants of NMR, the highest NMR is reported in the categories like, no education of mother—55.3, Other backward class - 39.4, lowest wealth quintile—71.6, male child—37.9, mother's age at birth less than 20 years—49.8, birth order 4 or more-48.2 and previous birth interval less than 2 years—60.7 (IIPS and Macro International, 2008). This highlights the fact that if mother is very young, poor, not educated belonging to backward class NMR is high. It is also high when previous birth interval is small and birth order is large.

Considering the factors listed above, various child health programs are planned under the National Health Mission (NHM) like facility and home based newborn care, use of antenatal corticosteroids in premature delivery, prophylactic use of vitamin K in all newborns etc. that comprehensively integrates interventions at both facility and community level that improves child survivals and addresses factors contributing to infant and child mortality (Child health programs in India GOI. www.nrhm.gov.in)

The states having IMR less than Maharashtra are Kerala and Tamil Nadu (SRS, 2016). Kerala is way ahead with IMR 12. For Maharashtra to reach closer to Kerala some definite, concerted action is required.

It was therefore decided to analyze neonatal deaths in the state to assess the causes and social determinants so that relevant policy planning could be brought about. Very few such studies are available in Indian literature.²⁻⁴ Analysis of data on death reviews could shed the light on the areas that need more efforts and try to articulate action strategies for the same.

METHODS

This is an attempt to explore about neonatal mortality and come out with some action strategies. It is a retrospective study, basically a review and analysis of the data on neonatal deaths that occurred and were reported in the state of Maharashtra. It comprised of 'Child death review of neonates' based on the neonatal deaths that were registered during the year 2015-2016 in rural areas of the state. All live born babies who died from birth to 28 days were included in the report. After the death was notified by Accredited Social Health Activist (ASHA) / Auxiliary Nurse Midwife (ANM), the medical officer at Primary Health Centre (PHC) maintained the line list in this area. Then 6 deaths per block were reviewed by the Committee under Chief Executive Officer of Zilla Parishad (local Government at block level) which included a Pediatrician. This was the procedure followed for the community based reviews of neonatal deaths. The medical officer undertook the detailed verbal and social autopsy within one month of the notification of the neonatal death. Verbal autopsy was a systematic

retrospective enquiry from the caregiver close to the deceased neonate about the signs and symptoms of illness prior to death. The investigation for verbal autopsy included investigation of chain of events, circumstances, signs of illness and social autopsy included social, cultural, behavioural and health system contributors to neonatal deaths. Verbal autopsy forms issued by Government of India for neonatal deaths (Form 1-3) with social factors like literacy, religion, place of death, medical factors like details of pregnancy and delivery, delay in transfer with complications, conduct of delivery, sickness, feeding, cord care etc. were recorded. Details about the baby when transferred to facility were noted. Verbal autopsy also captured three delays to take action at one or more of the links in the chain of events that results in death. Delay 1 refers to the delay by the relatives in taking the decision and getting the baby to the health facility, thereby giving an idea about the health seeking behaviour of the community; delay 2 is the delay due to transportation of the baby from home to health facility or from one facility to another (referral) and delay 3 is the delay that occurred after the baby was brought to the health facility and the care that was given, reflecting services at facility.

RESULTS

Data on the child deaths occurred in the rural areas of Maharashtra during 2015-16 are analyzed here using statistical tests like chi square test and percentages. Information is available on 4584 deaths of children under five years. Share of the infant deaths to under-five deaths is 81%. So under-five mortality can be controlled by controlling infant deaths. Similarly share of neonatal deaths to infant deaths is 65.8%. That showed two-thirds of the infants deaths are actually neonatal deaths. Share of neonatal deaths among child deaths is 59.3%, which translates into need to control neonatal deaths to restrict under-five mortality.

For the administrative convenience, Maharashtra has been divided into eight health circles. In Pune and Latur circles share of neonatal deaths to infant deaths is more than 70%. In circles like Nashik and Gadchiroli it is less than 63%. Share of neonatal deaths is highest in the regions Latur, Gadchiroli and Pune, that directs towards the tangible action. Lesser share of neonatal deaths also reflects more deaths in later ages, means more can be done. Some intervention can reduce the overall child mortality (Table 1).

Distribution of neonates by death indicates that more male children (55.7%) are dying as neonate compared to female children (44.3%) (Table 2).

60.6% of Neonatal deaths had low birth weight (<2.5 kg) and 40% had Normal weight (\ge 2.5 kg) at time of birth. On analysis of place of birth in Neonatal deaths 86% were born in Health Facility and 12.6% were born at Home and 1% during transport.

Table 1: Distribution of child deaths by regions, Rural Maharashtra, 2015-16.

Region	Neonatal deaths	Infant deaths	Child deaths	Share of neonatal deaths in infant deaths (%)	Share of neonatal deaths in child deaths (%)
Thane	135	211	274	64.0	49.3
Nashik	547	879	1075	62.2	50.9
Pune	361	511	622	70.6	58.0
Kolhapur	289	456	548	63.4	52.7
Aurangabad	218	325	404	67.1	54.0
Latur	187	262	317	71.4	59.0
Akola	405	588	720	68.9	56.2
Gadchiroli	303	481	624	63.0	58.6
Total	2445	3713	4584	65.8	53.3

Table 2: Distribution of neonatal deaths by background characteristics of the neonate, Rural Maharashtra, 2015-16.

Background characteristics of the neonate	Number	Percentage (%)
Sex		
Male	1362	55.7
Female	1082	44.3
Not reported	1	-
Birth weight		
Less than 2500 gms.	1451	60.6
2500 gms.	312	13.0
More than 2500 gms.	630	26.4
Not reported	52	-
Place of birth		
Home	305	12.6
Public	1303	53.8
Private	791	32.6
Transit	25	1.0
Not reported	21	-
Place of death		
Home	909	38.0
Public	720	30.1
Private	661	37.6
Transit	104	4.3
Not reported	51	-
Delay		
Delay 1	966	41.4
Delay 2	294	12.6
Delay 3	953	40.8
Multiple delays	122	5.2
Not reported	159	-
Total	2445	100.0

As regards place of death 38% children died at home whereas 4.3% died during transit. More than two-thirds, i.e. 68% deaths occurred in the health facility with 30.1% in public and 37.6% in private health facility. Among the major determinants, delay in making the decision to reach the health facility and getting the treatment after reaching the facility played important role. In case of 5.2% deaths multiple delays are reported, whereas in case of 41.4% deaths, type of the delay was 1, i.e. making the decision

to take the child to the health facility whereas in case of 40.8% deaths, delay 3 that is receiving treatment in health facility is reported.

The major causes of neonatal deaths are Infections (33%) such as Pneumonia, Septicaemia and Umbilical Cord infection; Prematurity (35%) i.e. birth of new-born before 37 weeks of gestation and Asphyxia (20%) i.e. inability to breathe immediately after birth and leads to lack of oxygen (NHM, 2017) (Table 3).

Table 3: Distribution of neonatal deaths by cause of death, Rural Maharashtra, 2015-16.

Cause of neonatal death	Number	Percentage (%)
Septicemia, sepsis	403	16.5
Pneumonia	97	4.0
Asphyxia	498	20.4
LBW	412	16.9
Premature birth	640	26.2
Congenital malformation	116	4.7
Congenital heart disease, CHD, PDA, VSD	99	4.0
Other	180	7.4
Total	2445	100.0

Table 4: Percent distribution of neonatal deaths by cause of death and place of birth, rural Maharashtra, 2015-16.

Cause of neonatal death	Place of birth				Total
Cause of neonatal death	Home	Public	Private	Transit	Total
Sepsis	20.9	21.5	18.4	20.0	20.5
Asphyxia	13.8	22.6	19.7	16.0	20.5
LBW	29.2	16.3	13.3	12.0	16.9
Premature birth	21.6	24.4	30.5	32.0	26.1
Congenital malformations	6.9	8.2	10.3	8.0	8.7
Other	7.5	7.1	7.7	12.0	7.4
Total	305	1303	791	25	2424

Table 5: Percent distribution of neonatal deaths by cause of death and birth weight, Rural Maharashtra, 2015-16.

	Birth weight			
Cause of neonatal death	Less than 2500 gms.	2500 gms.	More than 2500 gms.	Total
Septicaemia, Sepsis	11.2	33.0	34.6	20.3
Asphyxia	8.9	36.5	38.4	20.3
LBW	27.4	2.9	0.0	17.0
Premature birth	43.2	.6	1.0	26.5
Congenital malformation	5.0	14.4	14.6	8.8
Other	4.3	11.9	11.4	7.1
Total	1451	312	630	2393
	60.6	13.0	26.3	

Table 6: Percent distribution of neonatal deaths by cause of death and place of death, Rural Maharashtra, 2015-16.

Cause of neonatal death	Place of death				■ Total
Cause of neonatal death	Home	Public	Private	Transit	Total
Septicaemia, Sepsis	24.4	15.3	18.6	27.9	20.2
Asphyxia	18.3	23.3	20.9	18.3	20.5
LBW	20.2	15.1	14.2	12.5	16.7
Premature birth	17.6	33.2	31.0	24.0	26.3
Congenital malformation	5.5	3.9	5.1	3.8	4.8
Congenital heart disease, CHD, PDA, VSD	3.9	4.2	4.5	2.9	4.1
Other	10.1	5.0	5.6	10.6	7.4
Total	909	720	661	104	2394

Among the various causes of death, around 84% deaths occurred either because of prematurity, low birth weight, asphyxia or septicemia. These are difficult conditions for the child to survive because they are difficult to restrict

once seen. 5% of deaths were contributed each by congenital malformations and congenital heart diseases. 7.4% of deaths were contributed by other cause which

included bites, diarrhea, accidents, nervous system disorders etc. (Table 3).

Place of birth of the children matters in case of neonatal deaths. Among those who delivered at home, 29.2% died because of low birth weight and 21.6% because of prematurity. Corresponding percentages for the births in public health facility are 16.3 and 24.4 whereas that in case of private, they are 13.3 and 30.5 respectively. Septicemia, sepsis is more in case of home deliveries as well as in the deliveries (17.0%) conducted in public health facilities (17.4%). They are marginally less in the births in private health facility (14.5%). However, Asphyxia is the cause of death of neonates in case of 13.8% home deliveries, 22.6% deliveries in public and 19.7% deliveries in private health facility (Table 4).

This data set shows that birth weight of 61% children was less than 2500 gms, 13% children were weighed exactly 2500 gms and 26.3% children were more than 2500 gms when they born. Birth weight is significantly associated with cause of neonatal death (p=0.000) (Table 5).

Among the deaths when child was born with weight exactly 2500 gms 26.0% deaths were because of Septicemia, Sepsis and 36.5% were because of asphyxia. Corresponding percentages for the children born with the weight more than 2500 gms are 29.2 and 38.4. The deaths that have occurred when the child was born with the weight less than 2500 gms, 27.4% died of low birth weight and 43.2% died because they were born premature. Low birth weight in itself is a major cause of

death and premature births lead to low birth weight. So More than 70% deaths among the children born with weight less than 2500 gms die just because of the low birth weight. Other 8.9% children with low birth weight die of asphyxia (Table 5).

Among the neonatal deaths, 38% occurred at home, 30.1% in public health facility and 27.6% in private; whereas 4.3% occurred in the transit. Compared to births in the transit, deaths in the transit are much more.

Place of death sheds light on the fact that whether the child received at least some medical aid before the death, depending on the cause of death. Among those who died at home, major cause of death was low birth weight (20.2%) followed by septicaemia (18.7%) asphyxia (18.3%) and premature birth (17.6%). The picture is slightly different if the child dies in the health facility. Major causes of death in the public and private health facility respectively are premature birth (33.2% and 31.0%), asphyxia (23.3% and 20.9%), septicaemia (13.2% and 15.7%) followed by low birth weight (15.1% and 14.2%). Though just 4.3% children have died in the transit, the pattern is the same, premature birth, septicaemia, asphyxia and low birth weight. In case of deaths occurred at home and in transit, share of other causes is more than 10%. Association between place of death and cause of death is statistically significant (p=0.000) (Table 6).

Table 7: Percent distribution of neonatal deaths by cause of death and 3 delays, rural Maharashtra, 2015-16.

Cause of neonatal death	Delay				
Cause of neonatal death	Delay 1	Delay 2	Delay 3	Multiple delays	Total
Septicaemia, sepsis	17.2	18.7	15.5	9.8	16.3
Pneumonia	5.6	5.4	2.2	3.3	4.1
Asphyxia	15.3	20.4	25.9	14.8	20.3
LBW	21.6	15.0	13.2	17.2	17.1
Premature birth	21.8	22.4	31.6	32.0	26.4
Congenital malformation	4.5	6.5	4.2	4.9	4.6
Congenital heart disease, CHD, PDA, VSD	3.2	4.1	3.9	9.8	3.9
Other	10.8	7.5	3.5	8.2	7.2
Total	966	294	953	122	2335
	41.4	12.6	40.8	5.2	

If delays are controlled, deaths can be controlled. The data shows that 41.4% deaths occurred because of delay 1, 12.6% because of delay 2 and huge 40.8% because of delay 3. In 5.2% cases number of delays were multiple. Though all the delays are to be reduced, delay 3 needs an immediate action not only because of its share but also it reflects the child health services implemented in the facilities. In case of neonatal deaths, delayed treatment increases probability of death.

In all the delays the major causes of death are prematurity, low birth weight, asphyxia, and septicaemia.

However, other causes of death are more in case of delay 1 and multiple delays (Table 7).

DISCUSSION

As per SRS report, it was seen that of all the deaths occurring in infants, 78% of the deaths occurred in neonatal period, which calls for a neonatal death review in Maharashtra. The data used for this study is for the year 2015-2016. Methodology includes observed was reporting and notifying of the death in first 28 days of life

(stillbirth excluded), followed by verbal and social autopsy.

Analysis highlights that more male neonates died in the first 28 days (male:female-1:25). As regards birth weight it was seen that 60.6% of babies had birth weight below 2500 gms, 13% had birth weight 2500 gms and 26.3% weighed more than 2500 gms. Obviously, maximum number of deaths occurred in neonates who weighed less than 2500 gms. The fact has direct implication on policy signifying more attention to be given to adolescent health, maternal nutrition and anemia during pregnancy, so that share of low birth weight (LBW) babies could be restricted. Nevertheless, care provided to LBW and premature babies both at facility and community level needs improvement.⁴⁻⁶

It is observed that in case of neonatal death, 86.4% births are institutional, out of which 53.8% births occurred in public hospital. Though institutional births are getting common, 38% deaths have occurred at home. It reflects the health seeking behaviour of the community as far as their neonates are concerned. Neonates are either denied required care or the death occurred so quickly that the neonate could not even reach the health facility for the necessary treatment. Some action is required which would ensure better involvement of the community. Further, mother of the child and other decision makers in the family need to be educated on the subject of danger signals. The role of ASHAs regarding counseling of care takers and community about essential newborn care practices and danger signals. ASHAs also should monitor and review the newborn so that the babies would be brought to health facility early.

As regards delay in seeking treatment it was seen that 41.4% of the babies belonged to the category of 'Delay 1' which meant that the baby was brought late to the health facility, implying once again the need to have better education to the community to take the newborn to the health facility as also to improve confidence in the health systems rather than the traditional faith healers or others. 12.6% of the babies belonged to the category of 'Delay 2' which showed that more time was wasted in transport while shifting the baby from home to the health facility. 40.8% babies had 'level 3 Delay' which was due to the lack or delay in the care and treatment started in the health facility. As a policy implication, it only points out to the need of upgrading the services and manpower in the health facilities in Govt. and private sector. 5.2% of the babies had multiple delays. Though this study sheds light on type of delays in neonatal death, causes of delay have not been reported by many workers. In fact there are no Indian studies highlighting causes of delays, in Pediatric age group especially in Neonates.

Highest number of deaths 26.2% is due to prematurity followed by low birth weight 16.9% and septicemia 16.4%. Septicemia is probably easily avoidable. Reports from Indian studies have shown that the major causes of

neonatal deaths in India are sepsis and pneumonia (30.4% CI 23.7-37.0%) followed by birth asphyxia (19.5% CI 12.6-26.3%), prematurity (16.8% CI 3.3-30.3%). ⁵⁻⁸ Pooled analysis suggests that cumulatively 35.4%, 51.0% and 71.5% of all deaths occur by day 1, day 3 and day 7 of life respectively which support the findings of this study.

When causes of deaths were studied in relation to place of birth. It was seen that share of deaths by septicemia is 20% if the birth has occurred during transit. Sepsis occurred in 21.4% cases when birth has taken place in public health facility compared to 18.4% in private. Care in public hospital with special attention to asepsis is highly required. Asphyxia was highest (22.6%) when babies were delivered in public hospitals, thereby meaning the need for improving intrapartum care in the facilities.

The neonatal period appears to be a period of highest risk of child deaths in India. 9,10 We estimated as per the method described earlier that the children in the country have 68 times higher risk of dying in neonatal period, than that in the rest of the childhood (1-59 months). This risk is 183 times higher in early neonatal period than in the rest of the childhood.

Policy implications/action strategies

This study has brought out likely policy implications for public health department. It is now well recognized that child survival cannot be addressed in isolation as it is intricately linked to the health of the mother which is further determined by her health and development as an adolescent. Therefore, the concept of continuum of care that emphasizes on care during critical life Stages in order to improve child survival should be monitored. Linkages between Home Based care and facility Based care should be developed which incorporated following actions. Knowledge attitude practices of ASHAs should be monitored in HBNC which is one of the important flagship programs in child survival. Every Newborn house should have quality scheduled visits by ASHAs and implement the package of essential newborn care in HBNC. Timely referral of newborn by caretaker and ASHAs should be monitored. IEC regarding danger signals should be developed so that community awareness is strengthened and this with improve Health seeking behavior. Since majority of the deliveries are taking place in the facilities they have to be strengthened with respect to service delivery. Human resources should develop the skills and practices in child survival interventions. These should be monitored meticulously and necessary action should be taken by mid-level managers and policy maker. FRU wise monitoring has to be developed. It also has to be stressed that whatever the case may be all the institutional deliveries should be conducted in aseptic conditions so as to circumvent neonatal mortality.

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the

Institutional Ethics Committee

REFERENCES

- 1. SRS Bulletin, 2008-2015.
- 2. Child Death Review –Operational Guidelines August 2014, Ministry of Health and Family Welfare, Government of India.
- 3. Lahariya C, Paul V. Burdens, Differential, and causes of child deaths in India. Indian J Pediatrics. 2010;77:1312-21.
- Rajaratnam JK, Marcus JR, Flaxman AD, Wang H, Levin-Rector A, Dwyer L, et al. Neonatal, postneonatal, childhood and under-5 mortality for 187 countries, 1970–2010: a systematic analysis of progress towards Millennium Development Goal 4. Lancet. 2010;375:1988–2008.
- 5. Baqui AH, Darmstadt GL, Williams EK, Kumar V, Kiran TU, Panwar D, et al. Rates, timing and causes of neonatal deaths in rural India: implications for neonatal health programs. Bull World Health Organ. 2006;84:706–13.
- 6. Sankar MJ, Neogi SB. State of newborn health in India. J Perinatol. 2016;36:3–8.

- Upadhyay RP, Chinnakali P. High Neonatal Mortality Rates in Rural India: What Options to Explore? International Scholarly Research Network ISRN Pediatrics. 2012;968921:10.
- Rubayet S, Shahidullah M. Newborn survival in Bangladesh: a decade of change and future implications, Published by Oxford University Press in association with The London School Hygiene Trop Med, Health Policy Planning. 2012;27:40–56.
- Sankar MJ, Natarajan CK. When do newborns die?
 A systematic review of timing of overall and cause-specific neonatal deaths in developing countries. J Perinatol. 2016;36:1–11.
- NRHM, 2017, http://nrhm.gov.in/nrhm-components/rmnch-a/child-health-immunization.html, SRS Bulletin, Sample Registration System, Registrar General, India, Vital Statistics Division, West Block 1, Wing 1, 2nd Floor, R. K. Puram, New Delhi-110 066, 2016. Accessed on 15 March 2017.

Cite this article as: Saunik S, Jaiswal C, Nair R, Radkar A, Patil A, Irani S, et al. Analysis of neonatal deaths in Maharashtra: policy implications. Int J Community Med Public Health 2017;4:4513-9.