Original Research Article

A cross sectional study on out born neonate referral pattern and factors influencing the neonatal outcomes among the out born neonates admitted to sick newborn care units of a government teaching hospital

Poornima Basavraj Khot[1], Thejeshwari H. L.[1]*, Kumar[2], M. Sundar[1], Prasanna Kumar[2]

[1]Department of Community Medicine, [2]Department of Paediatrics, Hassan Institute of Medical Sciences, Hassan, Karnataka, India

*Correspondence:
Dr. Thejeshwari H. L.,
E-mail: hltejas2014@gmail.com

ABSTRACT

Background: Neonatal mortality rate (NMR) is one of the major contributors to infant mortality rate. The neonatal mortality depends on many factors birth weight, gestational age, post-natal care; it also depends on maternal social and environmental conditions which contribute to the social determinants of maternal health. This study was taken up to identify maternal social determinants contributing to outcome among outborn neonates in order to reduce neonatal deaths. The present was conducted to assess the outcome among the outborn neonates and assess the maternal social determinants of health affecting the outcome.

Methods: A cross sectional study conducted in sick newborn care units (SNCU), Hassan Institute of Medical Sciences, Hassan among all out born neonates. After taking prior written consent, all mothers/bystanders of outborn neonates were interviewed using predesigned, pretested semi-structured proforma. Social factors, environmental conditions and antenatal care affecting the maternal health were collected. Neonatal outcome data was collected from SNCU register. The mothers/bystanders of outborn neonates not willing to give consent and re-admitted neonates were excluded from the study. Data analysis was done using SPSS V20.0.

Results: Of 353 outborn neonates admitted, 16.1% was mortality rate. Number of antenatal care visits, consumption of iron tablets, gestational age, high risk mother, staff attending delivery, birth weight, referral time (at $p \leq 0.5$) and distance from hospital, passive smoking exposure, maternal services utilization (at p-value <0.1) were significantly associated with poor outcome among outborn neonates.

Conclusions: There is need for establishment of SNCUs at sub-divisional levels.

Keywords: Outborn neonates, Social determinants, SNCU, Neonatal outcomes

INTRODUCTION

Neonatal mortality rate (NMR) is probability of dying during the first 28 days of life, expressed per 1,000 live births.[1] Neonatal mortality constitutes two-thirds of infant mortality in India; 45% of the deaths occur within the first two days of life while 75% deaths occur within first week of life.[2] According to the World Bank statistics-2017, NMR in India is 24 per 1000 live births.[1] The proposed SDG target aims to reduce neonatal mortality to 12/1,000 live births.

Sick newborn care units (SNCU) are special newborn units in a large hospital generally at district level meant to reduce the case fatality among sick neonates, either born within the hospital or outside including home delivery.[3] According to care of small and sick newborn in SNCU

report (2013-15) states out-born admissions account to 39% of total SNCU admissions.[4] Mortality is higher among the out born (12.6%) compared to inborn admissions (8.3%).[4] Out-born neonates are the major contributors to the mortality rates, and the mortality depends on many factors like nutrition, general condition of the mother, antenatal care and services provided to the mother during her antenatal period, care at the time of delivery, birth weight, gestational age; it also depends on maternal social and environmental conditions which contribute to the social determinants of maternal health.

An out-born neonate is defined as neonate born at home, on the way to hospital or in another hospital and transferred post-natal to the hospital with the level 3 nurseries. This also included horizontal transfer between level 3 nurseries. Level I facilities are the nurseries that provide a basic level of care to neonates who are low risk along with the neonatal resuscitation if necessary and also the routine postnatal care. Level II facilities are reserved for stable or moderately ill newborn infants who are born at ≥32 weeks' gestation or who weigh ≥1500 g at birth with problems that are expected to resolve rapidly. Level III is the NICUs defined by having continuously available personnel (neonatologists, neonatal nurses, respiratory therapists) and equipment to provide life support for as long as necessary. Facilities should have advanced respiratory support and physiologic monitoring equipment, laboratory and imaging facilities, nutrition and pharmacy support with paediatric expertise. Level IV units include the capabilities of level III with additional capabilities for surgical repair of complex conditions and considerable experience in the care of the most complex and critically ill newborn infants and should have paediatric medical and paediatric surgical specialty consultants continuously available 24 hours a day.[5]

The high mortality among the out born could be attributed to delay at three levels, which include– (i) delay in recognition of severity of illness, (ii) delay in transport of the neonate and (iii) delay in delivery of appropriate health-care.[6] Effective transports of neonate and its effect on mortality depends on the mode of transport, health care staff accompanying during the transport, adequate equipment, appropriate drugs and effective communication from the referral centre.[7]

Accurate documentation of the prevailing pattern of morbidity and mortality in the out born newborn population is required for the planning, implementation, and monitoring of the healthcare programmes. Also identifying the trends in the morbidity and mortality among the neonates over time will help in assessing the impact of existing strategies and help in identifying areas in which more effort or reorientation of approaches is required.

METHODS

A hospital based cross sectional study was conducted in the SNCU of Hassan Institute of Medical Sciences which is a tertiary care teaching hospital that caters to the needs of more than 10 lakh populations of Hassan district and also neighboring districts, with an average of 200-250 neonatal admissions per month of which out born neonates constitute 30.6%. The study was conducted over a period of 6 months from December 2018 to May 2019. The mothers of the out-born neonates were interviewed using predesigned, pretested semi-structured proforma. The details regarding outcome of the out born neonates were collected from the SNCU register.

Inclusion criteria

All out born admissions to SNCU during the study period.

Exclusion criteria

Mothers and bystanders of out born neonates not willing to give consent and mothers of re-admitted neonates.

Sampling procedure

The study was conducted after obtaining institutional ethical clearance approval. After taking prior permission from the medical superintendent of the hospital and written informed consent of the mothers, the mothers of out born neonates fulfilling the inclusion and exclusion criteria were interviewed after a brief explanation about the study. The mothers were interviewed regarding address, educational status, occupation, annual income, the environmental factors like overcrowding, availability of water and sanitation facility, fuel used for cooking, exposure to passive smoking during the pregnancy, intimate partner violence, knowledge about empowerment services and their utilization. About antenatal care mothers were interviewed regarding antenatal care (ANC) registration, Total no. of ANC visits, health personnel providing antenatal care, high risk pregnancy, hospitalizations, Total weight gain, Awareness regarding maternal services like Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA), Janani Suraksha Yojana (JSY), Pradhan Mantri Matru Vandana Yojana and their utilization, iron and calcium tablets initiation and consumption. Regarding intra-natal care, they were interviewed regarding total duration of labor, complications during delivery, time of the day at delivery; health personnel conducting delivery, place and mode of delivery and regarding postnatal care mothers were interviewed for birth weight, gestational age, complications after delivery, time taken for referral to the SNCU, care provided during transport, health personnel accompanying during referral, mode of transport used, difficulty faced during referral, information regarding referral to SNCU, referral letter, Out of pocket expenditure for transport and medications.

Statistical analysis

Data was entered in microsoft excel spread sheet and analyzed using SPSS 20.0. Data was analyzed for descriptive statistics, bivariate and multivariate logistic regression.

RESULTS

Pattern and outcome of the out born neonates admitted to SNCU

Of the total 353 out born neonatal admissions, mean age at admission was 2.2 days, with average birth weight of 2.34 kg. The sex ratio of admissions in our study was 877 girls per 1000 boys i.e., 53% were males. The referral from within district was 249 (70.5%) and outside the district was 104 (29.5%); from a mean distance of 48.3 kms (SD) with the distance ranging from 1-93 kms. The community-based referrals were 217 (61.4%) and facility-based referrals were 136 (38.6%) (Table 1).

One hundred and eighty four (52.1%) neonates were low birth weight and 33.7% were preterm deliveries. 74 (21%) neonates were admitted with multiple morbid conditions.

Among 353 out born admissions, 4 (1.1%) were home delivery, 1 ambulance delivery and rest being institutional delivery. 47% of the neonates were admitted before 24 hours of birth and rest were admitted between 2-15 days of birth. The most common cause of referral was preterm with low birth weight (LBW) and the most common diagnosis was birth related complication like obstructed labor, cord related complication etc.) which accounted to 24%, followed by Jaundice (16%), respiratory distress syndrome (12%). Mean duration of stay was 6.8 days with a maximum duration of stay of 21 days. 21.1% of out-born admissions were associated with out of pocket expenditure (spent for transport and health care). The common causes of mortality were prematurity (34%) followed by birth related complications (18%), sepsis (14%).

Among 353 neonates, mortality was 57 (16.1%). Of the 296 alive neonates, 13 (4.4%) babies were referred, 18 (6.1%) left against medical advice (LAMA), 265 (89.5%) were discharged with satisfactory recovery.

Social determinants of the maternal health and neonatal outcome

Literacy of the mother shows that 231 (65.4%) of the mothers had attended secondary school and 80 (22.6%) had attended primary school. 257 (72.8%) mothers were home makers. 236 (66.8%) families of the out born neonates were below poverty level card holders (Table 2).

Table 1: Association between neonatal factors and out born neonatal mortality.

Neonatal factors	Expired (n=57)	Improved (n=296)	Odd ratio (95%CI)	Chi square test (p value)
	N (%)	N (%)		
Referral place				
Within district	38 (10.7)	211 (59.7)	0.805 (0.44-1.47)	0.49 (0.483)
Outside the district	19 (5.4)	85 (24.1)		
Referral after delivery (1st delay) (hrs)				
<24	33 (57.9)	134 (37.9)	1.66 (0.93-2.95)	3.358 (0.326)
24-48	10 (17.5)	57 (16.1)		
48-72	6 (10.5)	50 (14.1)		
>72	8 (14)	55 (15.6)		
Distance from hospital (2nd delay) (km)				
>50	30 (8.5)	119 (33.7)	1.38 (0.61-1.94)	3.027 (0.08)
≤50	27 (7.6)	117 (33.1)		
Referral time (2nd delay) (hr)				
<1	30 (8.4)	232 (65.7)	3.26 (1.81-5.88)	21.88 (0.00018)*
1-2	20 (5.6)	34 (9.6)		
>2	7 (1.9)	30 (8.5)		
Time of day during referral				
8 am-2 pm	17 (4.8)	63 (17.8)	-	2.2 (0.331)
2 pm-8 pm	10 (2.8)	67 (18.9)		
8 pm-8 am	30 (8.4)	166 (47)		
Gestational age				
Preterm	26 (7.3)	93 (26.3)	1.83 (1.03-3.25)	4.309 (0.0378)*
Term	31 (8.7)	203 (57.5)		
Birth weight				
VLBW (<1500 gms)	18 (5)	38 (10.7)	2.48 (1.34-4.58)	15.31 (0.00047)
LBW (1500-2500 gms)	22 (6.2)	106 (30)		
Normal BW (≥2500 gms)	17 (4.8)	152 (43)		

*p value significant (p value <0.05).

Table 2: Association between social determinants of health and out born neonatal mortality.

Social determinants	Neonatal outcome		Odd ratio (95%CI)	Chi square test (p value)
	Expired (n=57)	Improved (n=296)		
	N (%)	N (%)		
Education of mother				
Primary	8 (2.2)	17 (4.8)	-	5.101 (0.121)
Secondary	36 (10.2)	196 (55.5)		
PUC	12 (3.4)	69 (19.5)		
DEG	1 (0.2)	14 (3.9)		
Caste				
SC/ST	16 (4.5)	95 (26.9)	0.825 (0.44-1.54)	0.359 (0.549)
Non-SC/ST	41 (11.6)	201 (56.9)		
Passive smoking exposure				
Yes	20 (5.6)	40 (11.3)	3.46 (1.83-6.54)	3.29 (0.069)
No	37 (10.4)	256 (72.5)		
Tobacco use during pregnancy				
Yes	5 (1.4)	17 (4.8)	1.57 (0.55-4.46)	0.139 (0.709)
No	52 (14.7)	279 (79)		
Housing condition				
Kutcha	29 (8.2)	119 (33.7)	1.54 (0.87-2.72)	2.237 (0.135)
Pucca	28 (7.9)	177 (50.1)		
Water facility (mts)				
Public (>600)	18 (5.1)	119 (33.7)	0.68 (0.37-1.257)	1.49 (0.221)
Private (<600)	39 (11)	177 (50.1)		
Empowerment				
Yes	13 (3.6)	78 (22)	0.82 (0.4-1.6)	0.3138 (0.575)
No	44 (12.4)	218 (61.7)		
ANC visit				
<6visit	39 (11)	108 (30.5)	3.08 (1.74-5.47)	12.313 (0.0004)*
≥6 visit	22 (6.2)	188 (53.2)		
High risk mother				
Yes	34 (9.6)	132 (37.4)	4.34 (1.03-3.27)	4.348 (0.037)*
No	23 (6.5)	164 (46.4)		
No. of gestation				
G1	25 (7.0)	105 (29.7)	0.86 (0.35-2.11)	3.1774 (0.608)
G2	24 (6.7)	162 (45.8)	0.53 (0.22-1.31)	
G≥3	8 (2.2)	29 (8.2)		
Iron tablets consumption				
Regular	24 (6.7)	160 (45.3)	0.55 (0.312- 0.98)	4.572 (0.0438)*
Irregular	33 (9.3)	136 (38.5)		
Intimate partner violence				
Yes	8 (2.2)	15 (4.2)	3.058 (1.23-7.59)	6.31 (0.012)*
No	49 (13.9)	281 (79.6)		
Maternal services utilization				
Yes	52 (14.7)	286 (81)	0.4 (0.133-1.99)	2.846 (0.092)
No	5 (1.4)	11 (3.1)		
Matruvandana utilization				
Regular	16 (4.5)	101 (28.6)	0.66 (0.28-1.58)	0.9599 (0.618)
Irregular	31 (8.7)	153 (48.3)	0.85 (0.38-1.87)	
Nil	10 (2.8)	42 (11.8)		
Delivery done by				
SBA (ANM's, S/N)	35 (9.9)	132 (37.3)	1.97 (1.10-3.53)	5.42 (0.02)*
Doctor (obstetrician)	22 (6.2)	164 (46.4)		

*p value significant (p value <0.05).

Table 3: Overall health status of the out born neonate mothers admitted to SNCU.

	Average	Average among expired
Average number of visits	5.84	5.86
1st ANC visit	1.87	1.87
Total weight gain during pregnancy	7.5	7.1
Initiation of iron tablets	3.8	4.1

Among 353 neonatal mothers, tobacco exposure was seen among 21 (5.9%) mothers, exposure to passive smoking was seen in 60 mothers (17%), and alcohol consumption was seen among 4 mothers (1.1%). The maternal environmental conditions showed that 146 (41.3%) had Kutcha housing condition, 246 (69.7%) of the families were nuclear. Overcrowding was seen in 78 mothers (22%). 301 mothers (85.2%) were using LPG as cooking fuel, 317 (89.8%) had sanitation facilities at home and 167 mothers (47.3%) had to fetch water from public water supply with maximum distance of 4 kms. 286 (81%) were aware of the various government services; of which 183 (64%) had availed the services. 91 (25.8%) mothers were empowered.

Seventeen (4.8%) mothers were <18years. Prenatally 28 (7.9%) mothers had availed Integrated Child Development Services (ICDS), 14 (3.9%) mothers had taken nutritional supplements. 167 (47.2%) deliveries were conducted by skilled birth attendant (staff nurse and trained dai), 196 (55.4%) deliveries were between 8 pm to 8 am. 119 (33.7%) deliveries were preterm. 56 (15.7%) neonates belonged to the category of very low birth weight (<1500 gms) and 128 (36.2%) belonged to low birth weight (i.e., 1500 to 2500 gms). 74 out born (21%) were admitted to SNCU with multiple morbid conditions. The neonates who were accompanied by health personnel at the time of referral were 81 (22.9%) and 34 (9.6%) referrals used private mode of transport to reach SNCU. Prior intimation regarding the referrals to the SNCU was given in 31 (8.8%) cases.

The neonatal factors significantly associated with higher mortality were birth weight <1.5 kg [OR-4.23 (95%CI: 1.99-8.98)], preterm delivery [OR-1.83 (95%CI: 1.03-3.25)], number of morbid conditions at admission [OR-8.56 (95%CI: 4.34-15.08)], referral time >1hr [OR-3.26 (95%CI: 1.81-5.88)]. Of this birth weight, preterm delivery and referral time were significant in multivariate analysis (Table 1). The social determinants of maternal health which were found to be significantly associated with neonatal mortality were number of ANC visits, iron tablets consumption, high risk mother, intimate partner violence and staff conducting delivery (Table 2).

In our study, the delay in identification of the health problem (i.e., referral after 24 hrs of birth were 52.7%) and the second delay that is reaching the health facility were seen. There was significantly high association observed between the referral time, travel distance and neonatal mortality (p=0.0018).

DISCUSSION

There are many studies which are being conducted among the neonates as well as the maternal health, but there is less evidence of effect of social determinants of maternal health affecting the outcome and the effect of various delays on neonatal outcomes. Hence this study provides information regarding the effects of social determinants and delays in transport.

The SNCU at Hassan is tertiary care centre catering to the needs of >4,000 neonates/year from the same district and also neighbouring district. Of which out born neonatal admissions constitute 31%. The case fatality rate of 16.1% at the time of discharge is slightly higher than the Ministry of Health and Family Welfare (MoHFW) report which shows 15% among out-born neonates.[4] And also higher as compared to the study done in Eritrea in which the mortality was 8.1% and the mortality was higher among neonates admitted within 1hr of birth.[7] But in our study the mortality was higher among neonates after 1hr of birth. When compared to the state findings of the report on SNCUs from the Ministry of Health and Family Welfare which showed 60% discharge rate, the proportion of neonates who had satisfactory recovery and were discharged well from Hassan SNCU is higher (75.1%).[4]

In this study the main causes of out born admissions were low birth weight (32%), birth related complications (24%) and jaundice (16%). Many recent studies have shown prematurity and birth asphyxia as the major causes of neonatal mortality, similarly in this study it was observed that prematurity (34%) and birth related complication (24%) were the main causes of mortality.[4,9] The higher amount of birth related complications and birth asphyxia at the time of out-born admissions shows the improper intra-partum monitoring.

The proportion of LAMAs was 18% higher in this study as compared to the MoHFW report which was 12% (State report).[4] There are many studies which show the disparity between admission of males and females, however in our study there was no such disparity seen.[10,11] The out of pocket expenditure was incurred by 22% of the families of out-born neonates, which might be a contributing factor in access to health facility similar to the study findings in North Bihar where out-of-pocket expenditure is a significant barrier to access basic health care for newborns.[12]

In this study, the neonatal factors affecting the neonatal outcomes associated were birth weight, term, referral time >1 hr, travel distance >50 km which were similar to a study conducted by Narang et al on predictors of mortality among the neonates transported to referral centre in Delhi,

India among 300 consecutive neonates who were transferred to the centre. The study showed that birth weight <1 kg (OR 0.04; 95% CI: 0.006-0.295, p<0.01) and transportation time >1 hour (OR 5.58; 95% CI: 1.41-22.01, p=0.01) were significant predictors for mortality among the transported neonate.[13] The various social determinants of maternal health like caste, educational status of mother, passive smoking exposure, tobacco use during pregnancy, cooking facility, housing condition, empowerment services, maternal services utilization lacked statistical significant association with neonatal mortality. The referrals from outside the district were mainly from adjacent border taluks of Chikkamagalur district (15.3%), due to the feasibility and easy availability of the transport facilities. As observed only 22.9% referrals were accompanied by medical staff, similar to the study conducted by Kailash et al where the referrals were not accompanied and not intimated to the SNCU priorly.[14]

CONCLUSION

The deliveries should be attended by experienced doctor (obstetrician) so that there is early detection of complications during intra partum phase, and possibly the mother can be referred before delivery to a tertiary care centre. There should be a staff always accompanying the neonate while referral. And the ambulance used for referral used at time of referral should be equipped. Higher Mortality was seen among the neonates referred after 24 hrs of birth, transportation time >1 hr, travel distance >50 km. Hence there is need for establishment of SNCUs at sub-divisional levels.

ACKNOWLEDGEMENTS

REFERENCES

1. United Nations Inter-agency Group for Child Mortality Estimation (UNIGME). Available at: https://data.unicef.org/topic/child-survival/neonatal-mortality/. Accessed on 9 December 2018.
2. Neogi SB. Assessment of Special Care Newborn Units in India. J Health Population Nutrition. 2011;29(5):500-9.
3. Norway India Partnership Initiative. Sick Newborn Care Units; 2015: 1-4.
4. Child Health Division, Ministry of Health and Family Welfare, Government of India. Two Year Progress Report of Special Newborn Care Units in India. Child Health Division, Ministry of Health and Family Welfare, Government of India; 2013. Accessed on 9 December 2018.
5. Barfield WD, Papile LA, Baley JE, Benitz W, Cummings J, Carlo WA, et al. Levels of neonatal care. Pediatrics. 2012;130(3):587-97.
6. Ramji S. Transport in community. J Neonatology. 2005;19:328-31.
7. Babinard J, Roberts P. Maternal and child developmental goals: What can transport sector do? The World Bank group. Transport paper. Available at: http://www.siteresources.worldbank.org/inttransport/tp12maternalhelath.pdf. Accessed on 17 December 2018.
8. Shah S, Zemichael O, Meng HD. Factors associated with mortality and length of stay in hospitalized neonates in Eritrea, Africa: a cross-sectional study. BMJ Open. 2012; 2(5):e000792.
9. Sankar MJ, Neogi SB, Sharma J, Chauhan M, Srivastava R, Prabhakar PK, et al. State of newborn health in India. J Perinatol. 2016;36:38.
10. Shah HD, Shah B, Dave PV, Katariya JB, Vats KP. A step toward healthy newborn: An assessment of 2 years' admission pattern and treatment outcomes of neonates admitted in special newborn care units of Gujarat. Indian J Community Med. 2018;43:14.
11. Neogi SB, Khanna R, Chauhan M, Sharma J, Gupta G, Srivastava R, et al. Inpatient care of small and sick newborns in healthcare facilities. J Perinatol. 2016;36:18-23.
12. Kumar GA, Dandona R, Chaman P, Singh P, Dandona L. A population based study of neonatal mortality and maternal care utilization in the Indian state of Bihar. BMC Pregnancy Childbirth. 2014;14:357.
13. Narang M, Kaushik JS, Sharma AK, Faridi MM. Predictors of mortality among the neonates transported to referral centre in Delhi, India. Indian J Public Health. 2013;57(2):100.
14. Aggarwal KC, Gupta R, Sharma S, Sehgal R, Roy MP. Mortality in newborns referred to tertiary hospital: An introspection. J Family Med Primary Care. 2015;4(3):435.