






ORIGINAL PAPER

Morbidity profile and outcome of new-born admitted in sick newborn care units of Uttar Pradesh, India

Satya Prakash Singh ¹, Harish Chandra Paliwal ², Saket Shekhar ¹,
Poonam Kushwaha ¹

¹ Community Medicine, Rama Medical College Hospital & Research Center, Kanpur, India

² Dr. B S Kushwaha Institute of Medical Sciences, Kanpur, India

ABSTRACT

Introduction and aim. Reduction in child morbidity and mortality is result of upgradation of infrastructure and quality of public health care services. India alone accounts for 30% of the global neonatal deaths occur in India that occurs due to preventable cause. So, the aim of this study was to assess the pattern and status of neonatal mortality observed in SNCUs of Uttar Pradesh, India.

Material and methods. Descriptive study was conducted based on secondary data obtained from sick new born care units (SNCU) online database from 89 Government-supported SNCUs of Uttar Pradesh, from April 2014 to March 2016. Data obtained included age, weight, sex, diagnosis, and outcome.

Results. 22933 neonates admitted in SNCU were included in study with 14269 (62.2%) were males and 8664 (37.8%) females. Majority of the subject (20070; 87%) were in 0-5 days old age group. Most (72.5%) of admitted new-born improved and discharged. Low birth weight was significantly ($\chi^2 = 1334.2$, $p < 0.001$) related with outcome. Birth asphyxia contributed to maximum (36.11%) number of deaths, followed by respiratory distress syndrome (25.21%), sepsis (15.38%), prematurity and extremely low birth weight (5.8%).

Conclusion. Improved antenatal care, improved access to health facility, timely referral of high-risk cases, capacity building, intensive interventional management can reduce neonatal mortality and its complications. Study also warrants, in-depth community-based qualitative study to identify gender-specific, equity issues.

Keywords. low birth weight, morbidity profile, mortality profile, respiratory distress

Introduction

An estimated 130 million babies are born worldwide each year from which about 4 million die in the neonatal period. About 30% of the global neonatal deaths occur in India and little progress has been made in reducing it in the last decade. Universal outreach and family-community care intervention like essential new-born care, resuscitation of the new-born, emergency new-born care, family care of the new-born, and care for low-birth-weight babies at 90% coverage has been estimated to avert Neo Natal mortality from 18 to 37%.¹⁻⁵

Facility based newborn care (FBNC) has a significant potential for improving newborn survival. Provision of newborn care facilities at various levels of health facilities will not only increase the confidence in the health care delivery system but also increase the coverage of services at the time of greatest risk i.e., birth and the first few days of life and thus address the challenge of bringing down neonatal mortality in the country. New-born care corner (NBCC), newborn stabilization unit (NBSU) and sick newborn care unit (SNCU) are new-born care facilities at MCH level I (PHC/SC), MCH lev-

Corresponding author: Saket Shekhar, e-mail: drsaketshekhar@gmail.com

Received: 1.06.2023 / Revised: 14.07.2023 / Accepted: 17.07.2023 / Published: 30.09.2023

Singh SP, Paliwal HC, Shekhar S, Kushwaha P. *Morbidity profile and outcome of newborn admitted in sick new born care units of Uttar Pradesh, India.* *Eur J Clin Exp Med.* 2023;21(3):590–594. doi: 10.15584/ejcem.2023.3.27.



el II (CHC/FRU) and MCH level III (district hospital/medical college/tertiary care hospital) respectively.⁵⁻¹¹ Traditional practices like applying something on the umbilical stump, oil instillation into the nose, etc. also contribute to the newborn risk of morbidity and mortality.² FBNC at various levels is critical to strengthen the care of sick, premature, and low birth weight newborns.

Aim

The current study aimed to assess the pattern of neonate mortality observed in SNCUs of Uttar Pradesh and medical college-attached hospitals.

Material and methods

Study design and settings

A cross-sectional descriptive study was conducted based on secondary data collected from SNCUs of Uttar Pradesh. The study includes all Government-supported 89 designated SNCUs during the year April 2014–March 2016. SNCU is a neonatal unit nearby labour room which provides special care (all care except assisted ventilation and major surgery) for sick newborns. As per government guidelines, any facility with more than 3000 deliveries per year should have an SNCU. Most district and few sub-district hospitals fulfilled this criterion. In our study, we have included SNCU data from 75 district hospitals and 14 Subdistrict Hospitals. Approval from the Institutional Ethics Committee (IEC) was taken prior to starting the study (IEC/Rama medical college/2023/5678).

Study population

Neonates admitted in SNCUs were considered as study participants. These were categorized into two sections: 1) Inborn - who have delivered in same facility, and 2) Out born - who have referred to the facility from peripheral health facilities.

Study period

January 2022 to March 2022 was the study period and aggregated yearly data were taken for the study.

Data collection

The source of information was SNCU monthly reports generated from admitted neonates (Indoor cases only). In SNCUs, neonates are referred from MCH level facilities 1-2, private health facilities and from community by direct contact admission or by frontline health workers: Accredited Social Health Activist, Auxiliary Nurse Midwife, or Multi-Purpose Worker. The primary data have been recorded in predefined registers and case sheets of SNCUs filled up by paediatricians and staff nurses.

Inclusion criteria

The study included all neonates, who had ≤ 28 days of life admitted in SNCUs.

The SNCU monthly report is predefined format from Ministry of Health and Family Welfare, Government of India, which includes data on admission information, reasons of admission, course of admission, and mortality reasons (if any) with treatment outcomes. It also includes information on gender, birth weights, gestation age, and duration of stay. Ethical permission was sought from the concerned authority of State Health and Family Welfare Department, Government of Gujarat. The aggregated data of SNCU reports were analyzed and due efforts were made to conceal identity of hospitals and patients.

Data analysis

Statistical analysis was done analyzing the percentages, proportions, and Chi-square using Statistical Package for the Social Sciences (SPSS) version 17 (SPSS-Inc., IBM, USA). After analysis, the efforts were made to share the analysis with concerned SNCU in charge to take corrective actions in consultation with State officials.

Limitation of analysis

Detailed information of each neonate had not been collected. The aggregated data of indicators was taken into the study. Only Government-supported SNCUs were studied. Data pertaining to gestational age of neonates was not available. The follow-up on discharged, leaving against medical advice (LAMA), and referred neonates were not done during the study.

Results

Total 22933 neonates admitted in SNCU were included in study. We can depict age and sex distribution of study subjects from Table 1. 14269 (62.2%) were males and 8664 (37.8%) were females. Majority of the subject (20070; 87%) were in 0-5 days old age group, among these 12469 were (62.1%) male and 7601 (37.9%) females.

Table 1. Age and gender wise distribution of neonates admitted in SNCU (n=22933)

Age Group (days) (0.0%)	Sex	
	Male	Female
0-5 (20070; 87.5%)	12469 (62.1%)	7601 (37.9%)
6-10 (1356; 5.9%)	832 (61.4%)	524 (38.6%)
11-20 (929; 4.1%)	593 (63.8%)	336 (36.2%)
>20 (578; 2.5%)	375 (64.9%)	203 (35.1%)
Total	14269 (62.2%)	8664 (37.8%)

Outcome of neonates admitted in SNCU among different birth weight groups is described in Table 2 and Figure 1. Most of them 16628 (72.5%) improved and discharged in satisfactory condition, 2790 (12.2%) referred to higher centres, 1983 (8.6%) expired and 1503 (6.6%) left against medical advice. This relationship between birth weight group of newborn and outcome was found statistically significant ($\chi^2=1334.2$, $df=15$,

p<0.001). Figure 2 describes causes of neonatal death, maximum death 36.1% occurred due to HIE/moderate-severe birth asphyxia.

Table 2. Outcome of neonates admitted in SNCU among different birth weight groups (n=22904)

Weight (kg)	Outcome				Total
	Discharged	Expired	LAMA	Referred	
0–1.5	1246 (50%)	654 (26.3%)	244 (9.8%)	340 (13.7%)	2484 (100%)
1.6–2	2696 (72.3%)	359 (9.6%)	243 (6.5%)	426 (11.4%)	3724 (100%)
2.1–2.5	4332 (76.4%)	389 (6.9%)	315 (5.6%)	631 (11.1%)	5667 (100%)
≥ 2.5	8354 (75.6%)	581 (5.3%)	701 (6.3%)	1393 (12.6%)	11029 (100%)
Total	16628 (72.5%)	1983 (8.6%)	1503 (6.6%)	2790 (12.2%)	22904 (100%)

$\chi^2 = 1334.2, df = 15, p < 0.001$

Causes of neonatal death admitted in SNCU among different birth weight groups. Out of total 1983 (8.6%) neonatal deaths, most of the neonatal deaths 716 were occurred due to HIE/moderate-severe birth asphyxia, of which maximum 323 (45.1%) occurred among birth weight group >2.5 kg followed by 201 (28.1%) among birth weight group 2.1–2.5 kg, 104 (14.5%) among birth weight group 1.6–2 kg weight group and rest 88 (12.3%) were amongst birth weight group 0–1.5 kg. Total 500 deaths due to respiratory distress syndrome maximum 186 (37.2%) were among birth weight group 0–1.5 kg, 125 (25.0%) among birth weight group 1.6–2 kg, 106 (21.2%) among >2.5 kg and rest 83 (16.6%) among 2.1–2.5 kg weight group. Out of total 305 deaths were due to sepsis; most of these 108 (35.4%) were among birth weight group 0–1.5 kg, 72 (23.6%) among 1.6–2 kg, 66 (21.6%). Total 151 deaths occurred due to prematurity (<28 weeks of gestation) 118 (78.1%) were among birth weight group 0–1.5, 19 (12.6%) among birth weight group 1.6–2 kg rest 14 (9.3%) among >2 kg birth weight. Total 118 deaths due to extremely low birth weight (ELBW) (weight less than 1000 g) 105 (91.3%) were among birth weight 0–1.5 kg (Table 3).

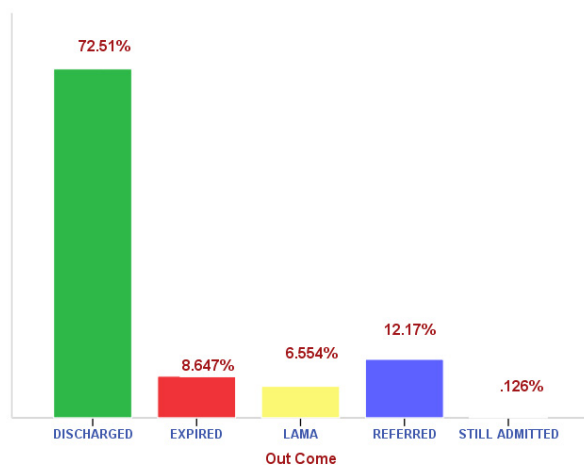


Fig. 1. Outcome of newborns admitted in SNCU

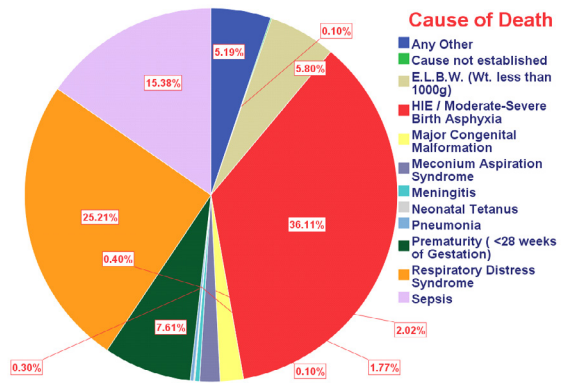


Fig. 2. Causes of death among newborns in SNCU

Table 3. Causes of neonatal death admitted in SNCU among different birth weight groups

Cause of Death	Weight Group (kg)				Total
	0–1.5	1.6–2	2.1–2.5	>2.5	
Cause not established	1 (50%)	0 (0%)	0 (0%)	1 (50%)	2 (100%)
(ELBW, weight<1000g)	105 (91.3%)	10 (8.7%)	0 (0%)	0 (0%)	115 (100%)
HIE/moderate-severe birth asphyxia	88 (12.3%)	104 (14.5%)	201 (28.1%)	323 (45.1%)	716 (100%)
Major congenital malformation	3 (7.5%)	7 (17.5%)	12 (30%)	18 (45.0%)	40 (100%)
Meconium aspiration syndrome	5 (14.3%)	6 (17.1%)	9 (25.7%)	15 (42.9%)	35 (100%)
Meningitis	4 (50.0%)	1 (12.5%)	2 (25.0%)	1 (12.5%)	8 (100%)
Neonatal tetanus	1 (50.0%)	0 (0.0%)	0 (0.0%)	1 (50.0%)	2 (100%)
Pneumonia	0 (0.0%)	1 (16.7%)	2 (33.3%)	3 (50.0%)	6 (100%)
Prematurity (<28 weeks of gestation)	118 (78.1%)	19 (12.6%)	1 (0.7%)	13 (8.6%)	151 (100%)
Respiratory distress Syndrome (RDS)	186 (37.2%)	125 (25.0%)	83 (16.6%)	106 (21.2%)	500 (100%)
Sepsis	108 (35.4%)	66 (21.6%)	59 (19.3%)	72 (23.6%)	305 (100%)
Any other	35 (34%)	20 (19.4%)	20 (19.4%)	28 (27.2%)	103 (100%)
Total	654 (33%)	359 (18.1%)	389 (19.6%)	581 (29.3%)	1983 (100%)

Discussion

This study aimed at understanding morbidity pattern, causes of mortality among newborns admitted across 89 government supported SNCUs across Uttar Pradesh, a northern state in India. Improvement of new-born health outcome aimed at comprehensive continuum of maternal and child health care services with context-specific investment. Maximum reduction in child morbidity and mortality can be met if, high-coverage programme of universal outreach and family-community care becomes an integrated intervention.^{2,3} Reduction in child morbidity and mortality is result of upgradation of infrastructure in public health care facilities, with increased number of SNCUs, which are advanced newborn care centres in tertiary level health care centres.¹²⁻¹⁵

Present study reflects that male admission outnumbered female admission (62.2% vs 32.8%) simulating findings in other studies.^{5,12,16-18} This may be due to gen-

der bias prevalent in India, where male children are given more importance. This societal gender bias is also evident in Sex Ratio at birth in India. National family Health Survey conducted in 2109-20 also reported sex ratio at birth to be 929 females per 1000 males. Biological vulnerability of the male gender could also be the other reason behind male ponderance in SNCU admissions. It warrants in-depth community-based observations to identify gender-specific, equity issues.^{12,16}

SNCU admissions were maximum in early neonate period (0-5 days). Over 90 % admissions were within first 10 days of birth in our study. This is consistent with many previous studies.^{4,5,10} This finding emphasizes that the most vulnerable period is the first week of life. This period must be prioritized to further decrease neonatal mortality and thereby infant mortality. Infant mortality rate have long been used as overall health status indicator of countries.

Most of the admitted new-born (72.5%) improved and discharged in satisfactory condition, 12.2% referred and 8.6% expired. These findings are better than outcome status reported by other studies.^{12,19} This could be due to regional differences and upgradation of infrastructure with time in various facilities. Indian government launched a big initiative with name of India Newborn Action Plan (INAP) in 2014. INAP targets towards the goals of Single Digit Neonatal Mortality Rate and Single digit Stillbirth Rate by 2030. INAP has been implemented under within the existing RMNCH+A framework. It has been guided under principles of integration, equity, gender, quality of care, convergence, accountability and partnerships with six pillars of intervention packages. It focusses on preconception and antenatal care; care during labour and childbirth; immediate newborn care, care of healthy newborn, care of small and sick newborn and care beyond newborn survival.²⁰⁻²³

Low birth weight was significantly related with outcome simulating findings of Mahajan et al.¹³ This findings emphasizes on the fact that to curb neonatal mortality we will have to ensure good preconception and antenatal care prioritizing maternal nutrition. Food related myths are quite prevalent in the Indian society. Raising awareness about them can be big step towards improving maternal nutrition. This can be achieved by periodic training of frontline workers like ASHA, Anganwadi Workers etc.

HIE/moderate-severe birth asphyxia contributed to maximum (36.11%) number of deaths, followed by respiratory distress syndrome (25.21%), sepsis (15.38%), prematurity and ELBW (5.8%) predominant causes of death in our study. Our study present better finding than other previous studies which reported, neonatal jaundice, prematurity, low birth weight, perinatal asphyxia and sepsis as major causes for SNCU admission and also for morbidity and mor-

tality.^{5,13,15-17,19,24,25} This may be due to improved health care system and infrastructure. Moderate-severe birth asphyxia being the top cause of neonatal mortality in SNCUs suggests importance of upscaling of resuscitation at SNCUs and Human resource employment and periodic training.

Conclusion

Neonatal mortality is one of the major contributors to the Infant Mortality. To address the issues of higher neonatal and early neonatal mortality, FBNC services at health facilities have been emphasized by setting up of facilities for care of sick newborn such as SNCU at different levels is a thrust area.

The present study showed that greater number of male infants admitted to SNCU. Male preponderance is still prevalent in spite of various efforts of government to create awareness about female health. Further qualitative studies are required to explore reasons of the male predominance.

The commonest cause for death was birth asphyxia followed by respiratory distress syndrome, sepsis, prematurity and E.L.B.W. All health care personnel involved in new-born care should undergo skill development training on simple immediate newborn care and resuscitation in equipped peripheral institutions. Prevalence of sepsis among new-born born is a matter of grave concern. Proper aseptic procedure, sanitation and hygiene should be maintained to prevent it.

Declarations

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Author contributions

Conceptualization, S.P.S. and H.C.P.; Methodology, P.K.; Software, S.P.S.; Validation, S.S., P.K. and S.P.S.; Formal Analysis, H.C.P.; Investigation, S.P.S.; Resources, P.K.; Data Curation, H.C.P.; Writing – Original Draft Preparation, S.P.S.; Writing – Review & Editing, P.K.; Visualization, S.P.S.; Supervision, S.S.

Conflicts of interest

No conflict of interest has been declared by the authors.

Data availability

Data will be provided on demand from the corresponding author.

Ethics approval

This study was approved by the local ethics committee (IEC/Rama medical college/2023/5678).

References

- Narayanan I, Litch JA, Srinivas GL, Onwona-Agyeman K, Abdul-Mumin A, Ramasetu J. At-Risk Newborns: Overlooked in Expansion From Essential Newborn Care to Small and Sick Newborn Care in Low- and Middle-Income Countries. *Glob Health Sci Pract.* 2023;11(1):e2200099. doi: 10.9745/GHSP-D-22-00099
- Darmstadt GL, Bhutta ZA, Cousens S, Adam T, Walker N, De Bernis L. Evidence-based, cost-effective interventions: how many newborn babies can we save? *Lancet.* 2005;365(9463):977-988. doi: 10.1016/S0140-6736(05)71088-6
- Lassi ZS, Kedzior SG, Bhutta ZA. Community-based maternal and newborn educational care packages for improving neonatal health and survival in low- and middle-income countries. *Cochrane Database Syst Rev.* 2019;2019(11):CD007647. doi: 10.1002/14651858.CD007647.pub2
- Saini N, Chhabra S, Chhabra S, Garg L, Garg N. Pattern of Neonatal Morbidity and Mortality: A Prospective Study in a District Hospital in Urban India. *J Clin Neonatol.* 2016;5(3):183. doi: 10.4103/2249-4847.191258
- Uppal K, Ashwani N, Jeelani K, Prabhakar K, Yadaiah D. Profile of neonatal mortality in SNCU district hospital. *Galore Int J Health Sci Res.* 2019;4(1):6–8.
- Child Health Programmes :: National Health Mission. <https://nhm.gov.in/index1.php?lang=1&level=3&sublinkid=1179&lid=363>. Accessed April 11, 2023.
- Shiras T, Bradley SEK, Johns B, Cogswell H. Sources for and quality of neonatal care in 45 low- and middle-income countries. *PLoS One.* 2022;17(7):e0271490. doi: 10.1371/journal.pone.0271490
- Neogi SB, Khanna R, Chauhan M, et al. Inpatient care of small and sick newborns in healthcare facilities. *J Perinatol.* 2016;36(3):18-23. doi: 10.1038/jp.2016.186
- Gathwala G. Neonatal care in India. *Indian Journal of Community and Family Medicine.* 2015;1(1):17-22. doi: 10.4103/2395-2113.251600
- Kumaravel KS, Ganesh J, Balaji J, Pugalendhiraja KV, Ramesh BB. A study on impact of NRHM on neonatal care and clinical profile of neonates admitted in a SNCU of a Rural Medical College. *J Evol Med Dent Sci.* 2015;4(82):14335-14348. doi: 10.14260/JEMDS/2015/2039
- Venugopal S, Patil RB, Thukral A, et al. Feasibility, Sustainability, and Effectiveness of the Implementation of „Facility-Team-Driven” Approach for Improving the Quality of Newborn Care in South India. *Indian J Pediatr.* 2023;10.1007/s12098-023-04518-8. doi: 10.1007/s12098-023-04518-8
- 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 Off Publ Indian Assoc Prev Soc Med.* 2018;43(1):14.
- Mahajan S, Bajaj M, Vaid A, Thakur A. A one year review of clinical profile and treatment outcomes of neonates admitted to Sick Newborn Care Unit (SNCU) at Regional hospital in Himachal Pradesh draining a rural area. *Journal of Medical Sciences and Clinical Research.* 2019;7(8):235-241. doi: 10.18535/jmscr/v7i8.40
- Kardum D, Serdarušić I, Biljan B, Šantić K, Živković V. Readmission of late preterm and term neonates in the neonatal period. *Clinics (Sao Paulo).* 2022;77:100005. doi: 10.1016/j.clinsp.2022.100005
- Budhiarta KDL, Kardana IM. Neonatal Profile and Outcome in Neonatal Intensive Care Unit Sanglah Hospital. *Am J Pediatr.* 2020;6(3):289-294.
- Rakholia R, Rawat V, Bano M, Singh G. Neonatal morbidity and mortality of sick newborns admitted in a teaching hospital of Uttarakhand. *CHRISMED J Health Res.* 2014;1(4):228.
- Jena D, Tripathy R, Pradhan S, Sethi G. Assessment of socio-clinical profile of neonates admitted in sick neonatal care unit of tertiary care hospital: Odisha. *Int J Res Med Sci.* 2017;5(9):4077-4081. doi: 10.18203/2320-6012.ijrms20173986
- Rohit M, Bhavesh M, PatelJaiminkumar, Punitha KM. Study of the morbidity and the mortality pattern in the neonatal intensive care unit at a tertiary care teaching hospital in Gandhinagar District, Gujarat, India. *J Res Med Dent Sci.* 2015;3(3):208-212.
- Panda PK, Panda PK. Clinical profile and outcome of newborns admitted to a secondary-level neonatal intensive care unit in tribal region of Odisha. *J Clin Neonatol.* 2019;8(3):155.
- Khurmi M, Karpe V, Kaur P. India launches India newborn action plan. *Indian J Child Health.* 2015;2(1):43-44. doi: 10.32677/IJCH.2015.v02.i01.015
- Mohanasundari SK, Padmaja A. National Health Mission (NHM) and India Newborn Action Plan (INAP) Services in Newborn Health -An Overview. *Int J Adv Nurs Manag.* 2019;7(4):366-370. doi: 10.5958/2454-2652.2019.00086.6
- Datta V, Ghosh S, Aquino LD. Progressing towards SDG 2030 goals with system changes: the India Newborn Action Plan. *BMJ Open Qual.* 2022;11:e001971. doi: 10.1136/bmjopen-2022-001971
- Kumar J, Saini SS, Kumar P. Care During Labour, Childbirth, and Immediate Newborn Care in India: A Review. *Indian J Pediatr.* 2023;10.1007/s12098-023-04721-7. doi: 10.1007/s12098-023-04721-7
- Mandal S. A Study on Clinical Profile and Outcome of Sick Neonates in a District Level SNCU. *J Evid Based Med Healthc.* 2020;7(1):29-33. doi: 10.18410/jebmh/2020/7
- Iyer DCR, Gornale DVK, Pj DH, Katwe DN, V SP, Y K. Morbidity and Mortality pattern of neonatal intensive care unit in a Medical College Hospital from South India. *Pediatr Rev Int J Pediatr Res.* 2015;2(4):77-82. doi: 10.17511/ijpr.2015.i04.08