Original Research Article

Profile of neonatal mortality in special newborn care unit of tertiary care hospital

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ABSTRACT

Background: In India presently around 8 million LBW infant are born each year. India accounts for 24% of global neonatal mortality. Improving NMR is an essential component of reducing U-5MR. The aim of this study was to determine the causes of morbidity and mortality in neonates admitted in our hospital.

Methods: This study was conducted at SNCU of Kamala Raja Hospital, Gwalior providing level III neonatal care. This is a retrospective hospital based observational study. Data from SNCU online database were taken for a period of 3 year from March 2016 to March 2019. Data obtained included sex, birth weight, Gestation age, morbidity profile, Diagnosis, and Mortality profile, Duration of stay and outcome. Categorical variables were tabulated and Statistical analysis was done.

Results: A total of 12,027 neonates were recruited, 63.07% were males and 36.92% were females. 54.87% were extramural, while 45.13% were intramural neonates. Prematurity was the most common morbidity 56.98% in the admitted neonates. Major contributors to the neonatal morbidity were Birth asphyxia (24.61%), others (21.60%), Respiratory Distress(14.06%), Sepsis(13.77%). The mortality rate in the present study is 25.45%. Major contributors for neonatal mortality includes Respiratory distress (37.76%), Birth Asphyxia (26.75%), Sepsis(13.91%). Mortality was more in out born babies 33.03% compared to inborn babies 22.03%.

Conclusions: Improving antenatal care, more deliveries at institutions with SNCU facility, improved access to health facility, early identification of danger signs, timely referral of high risk cases, capacity building, can reduce neonatal mortality and its complications.

Keywords: Extramural, Intramural, Mortality profile, Outcome, Respiratory distress

INTRODUCTION

The measure of a civilization is how it treats its weakest members,” said Mahatma Gandhi. Newborns are undisputedly the weakest members of ours society. Globally, Neonatal deaths now account for over 40% of the under -5 deaths and must be addressed to accelerate progress towards the Sustainable Development Goal-3 (SDG3), since reducing the neonatal mortality to 12 per 1000 live births by 2030 is one of the targets under SDG3.\(^1\) India is the epicentre of world’s neonatal mortality with every fourth dying newborn of the world being Indian.\(^1,2\) Close to 700,000 newborns die every year in India - a horrifying rate of neonatal deaths every minute.\(^2\) In India nearly 67% of infant deaths occur in the neonatal period. Half of the neonates die in the first week of life.\(^3\) Neonatal mortality rate of India was reported as
29 and the early neonatal mortality as 20, which contributed 53% to the IMR.\(^3\)

Madhya Pradesh 35, Odisha 32 and Uttar Pradesh 30 has neonatal mortality rate of >30. Four states Uttar Pradesh, Madhya Pradesh, Bihar, Rajasthan – alone contributes to 55% of total neonatal Death in India and to 15% of global neonatal deaths that occur every year. Madhya Pradesh has neonatal mortality rate of 35 which is higher than national average 24 and contribute around 67.70% to its IMR of 47.\(^4,5\) By the end of 12th five year plan, the aim is to reduce IMR to 25 at national level and to 34 in Madhya Pradesh.\(^7\) Goal 3 of SDG targets to end preventable neonatal deaths and under 5 death to single digit by 2030 in India.\(^6\) Preterm birth complication(34%), Infection(21%) and Birth Asphyxia(24%) are the three topmost causes of neonatal mortality worldwide.\(^1\) Mortality risk is highest on the first day of life contributing upto 36% of all neonatal deaths-most of these due to birth Asphyxia.\(^1\) Substantial decrease in the under 5 mortality has been achieved during the passing years but decline in neonatal mortality has been much slower\(^8\) In order to accelerate progress it is important that preventing neonatal deaths should be prioritized.\(^9\) Since NMR contributes a major portion to IMR and under-5 mortality(U5MR), there is an utmost need to bring down the neonatal deaths drastically to achieve these targets. SNCU, as a part of newborn care plays important role in the reduction of neonatal morbidity and mortality.\(^10\)

Variation is seen among the neonates delivered in well-equipped health facility like Medical colleges and those referred from peripheral facility.\(^11\) Regional diversity and socio cultural determinants largely affect neonatal health. It is important to study the mortality and morbidity pattern in a region as it helps in implementation of new treatment protocols, interventions and planning and policy making which helps in better outcome and improvement in the quality of life among survivors. There is scanty data available regarding morbidity and mortality of neonates of Gwalior region.

Most newborn deaths are preventable by improving the quality of care during delivery and care at birth. Simple interventions like skilled birth attendance and access to emergency obstetric care can reduce NMR. With this background, the present study was conducted with aim of studying the socio demographic profile of neonates admitted to SNCU and to explore the difference between the morbidity pattern of inborn and out born neonates if any and their causes to recommend improvement measure.

**METHODS**

This study is a retrospective, descriptive study of medical record carried out in the Special Newborn Care Unit (SNCU) Kamala Raja Hospital Gwalior. The period of present study was 3 year from March 2016 to March 2019.

**Inclusion criteria**

All neonates admitted before 28 days of life.

**Exclusion criteria**

Neonates taken against medical advice and those referred to tertiary care centers were excluded in analysis of survival outcome as their final outcome was not known. After obtaining ethical committee approval, data of all admitted babies were recorded by analyzing all the case sheets from the records section and SNCU online software database. Data was collected as Inborn or out born, admission, sex, gestation age, age at presentation, indication of admission, duration of hospitalization, procedure done during hospitalization and outcome. Primary Diagnosis was considered as final diagnosis even if the baby developed complications of primary disease or having more than one disease.

**Following definitions were used for categorizing the neonates**

**Intramural**

- Babies delivered in the hospital.

**Extramural**

- Babies delivered outside of hospital.

WHO definitions were used for term, Preterm, Low Birth weight (LBW), VLBW, ELBW

**Meconium Aspiration Syndrome**

- Diagnosed on basis of history, clinical and radiological finding.

**Birth Asphyxia**

- Diagnosed on basis of APGAR<7 at 1 min.

**Neonatal jaundice**

- Diagnosed after assessment of serum bilirubin and in pathological zone as per AAP charts.

**Sepsis**

- Diagnosed by clinical and appropriate lab screening test.\(^12\)

**Congenital malformation**

- Diagnosed on clinical features and diagnostic facilities like Ultrasound, Echocardiography, X rays, and Electrocardiography (ECG).
**Statistical analysis**

The data was filled in EXCEL sheet and categorical variable were tabulated. Calculation was done as percentage and proportions. Chi square test was used for calculating statistical significance.

**RESULTS**

Between March 2016 to March 2019, a total of 12027 newborn were admitted during study period. Out of this total newborn admitted 5428(45.13% ) were inborn i.e. they were born at the same health facility where SNCU is located and 6599(54.86% ) were outborn they were born at facilities where there is no SNCU or at home. The gender distribution among the admitted newborns was 7586(63.07%) males and 4441(36.92%) females giving a male: female ratio of 1.7:1 (1.5:1 inborn vs 2:1 outborn). The gestation age distribution had 56.98% neonates were in between 34 to <37 weeks, 23.03% in 37 to <42 weeks and 19.98% in 34 to <37 weeks. Majority of the neonates were low birth weight (61.47%). Higher numbers of inborn babies were stay compared to outborn babies within first 7 days of life (72.98% vs 71.64%). (Table 1)

Out of the total babies admitted in SNCU, 7925 were discharged successfully, 3061 expired, 92 neonates were referred to other centers for need of surgical intervention or due to unavailable resources and 949 neonates were leave against medical advice (Table 2). Out of the remaining 10986 neonates 7925 (65.89%) were discharged successfully and 3061 (25.45%) expired. The difference in discharge and death was significant among inborn and out born neonates.(Table 3)

| Variables                        | Intramural(I) | Extramural(E) | Total 12027 | p-value |
|----------------------------------|---------------|---------------|-------------|---------|
| **Sex**                          |               |               |             |         |
| Male                             | 3216(59.24%)  | 4370(66.22%)  | 7586(63.07%)| <0.001  |
| Female                           | 2212(40.75%)  | 2229(33.77%)  | 4441(36.92%)|         |
| **Birth Weight Wise Classification at Admission** | | | | |
| >=2500gm                         | 2192(40.38%)  | 2436(36.91%)  | 4628(38.48%)| <0.001  |
| 1500 - 2499gm                    | 2575(47.43%)  | 3165(47.96%)  | 5740(47.72%)|         |
| 1000 - 1499gm                    | 552(10.16%)   | 824(12.48%)   | 1376(11.44%)|         |
| < 1000gm                         | 109(2.00%)    | 174(2.63%)    | 279(2.31%)  |         |
| **Gestation**                    |               |               |             |         |
| >37 weeks                        | 1321(24.33%)  | 1449(21.95%)  | 2770(23.03%)| 0.0026  |
| 34- 37 weeks                     | 3073(56.61%)  | 3781(57.29%)  | 6854(56.98%)|         |
| < 34 weeks                       | 1034(19.04%)  | 1369(20.74%)  | 2403(19.98%)|         |
| **Duration of Stay**             |               |               |             |         |
| < 1 day                          | 265(4.88%)    | 435(6.59%)    | 700(5.82%)  | <0.001  |
| 1-3 day                          | 1708(31.4%)   | 2346(35.55%)  | 4054(33.70%)|         |
| 4-7 day                          | 1993(36.71%)  | 1947(29.50%)  | 3940(32.75%)|         |
| >7 day                           | 1462(26.93%)  | 1871(28.35%)  | 3333(27.71%)|         |
| Average Duration of stay         | 5.98          | 6.15          |             |         |

| Outcome                         | Intramural(I) | Extramural(E) | Total   | p value |
|---------------------------------|---------------|---------------|---------|---------|
| **Discharge**                   |               |               |         |         |
| 4027(74.18%)                    | 3898(59.06%)  | 7925(65.89%)  |         |         |
| **Referral**                    | 17(0.31%)     | 75(1.13%)     | 92(0.76%)|         |
| **Leave against medical advice**| 246(4.53%)    | 703(10.65%)   | 949(7.89%)|         |
| **Expired**                     | 1138(20.96%)  | 1923(29.14%)  | 3061(25.45%)|         |

| Outcome                         | Intramural(I) | Extramural(E) | Total   | p value |
|---------------------------------|---------------|---------------|---------|---------|
| **Discharge**                   |               |               |         | <0.001  |
| 4027(77.96%)                    | 3898(66.96%)  | 7925(72.13%)  |         |         |
| **Expired**                     | 1138(22.03%)  | 1923(33.03%)  | 3061(27.86%)|         |

Table 1: Profile of the Admitted Neonates.

Table 2: Survival Outcome of Admitted Neonate.

Table 3: Outcome analysis after excluding LAMA and Referral.
Major contributors to the neonatal morbidity were Birth asphyxia (24.61%), others (21.60%), Respiratory Distress (14.06%), Sepsis (13.77%) and Jaundice (10.65%) (Table 4). Respiratory distress, Birth Asphyxia, Sepsis were the most common mortalities accounting to (37.76%), (26.75%) and (13.91%) respectively. (Table 5)

### Table 4: Morbidity profile.

| Morbidity                                      | Intramural(I) n=5428 (45.13%) | Extramural(E) n=6599 (54.86%) | Total 12027 | p value |
|------------------------------------------------|-------------------------------|-------------------------------|-------------|---------|
| Respiratory Distress syndrome                  | 730 (13.44%)                 | 962 (14.57%)                 | 1692 (14.06%) |         |
| Meconium aspiration syndrome                   | 494 (9.1%)                   | 170 (2.57%)                  | 664 (5.52%)  |         |
| Other cause of respiratory Distress           | 115 (2.11%)                  | 73 (1.1%)                    | 188 (1.56%)  |         |
| HIE/Mild–Severe Birth Asphyxia                 | 1323/19 (24.72%)             | 1598/20 (24.51%)             | 2960 (24.61%)| <0.001  |
| Sepsis/Pneumonia/Meningitis                   | 603/26 (11.69%)              | 915/1097 (15.48%)            | 1657 (13.77%)|         |
| Major Congenital Malformation                 | 167 (3.07%)                  | 788 (11.94%)                 | 955 (7.94%)  |         |
| Jaundice requiring Phototherapy                | 681 (12.54%)                 | 600 (9.09%)                  | 1281 (10.65%)|         |
| Hypothermia                                    | 6 (0.11%)                    | 18 (0.27%)                   | 24 (0.19%)   |         |
| Hypoglycemia                                   | 3 (0.05%)                    | 4 (0.06%)                    | 7 (0.05%)    |         |
| Others                                         | 1255 (23.12%)                | 1344 (20.36%)                | 2599 (21.60%)|         |

### Table 5: Cause of mortality.

| Variable                                      | Intramural(I) n=1138 (37.17%) | Extramural(E) n=1923 (62.82%) | Total 3061 | p value |
|------------------------------------------------|-------------------------------|-------------------------------|-------------|---------|
| Respiratory Distress syndrome                  | 480 (42.17%)                 | 676 (35.15%)                 | 1156 (37.76%)|         |
| Meconium aspiration syndrome                   | 56 (4.92%)                   | 32 (1.66%)                   | 88 (2.87%)  |         |
| HIE/Mild–Severe Birth Asphyxia                 | 321 (28.20%)                 | 498 (25.89%)                 | 819 (26.75%)| <0.001  |
| Sepsis/Pneumonia/Meningitis                   | 115 (10.10%)                 | 311 (16.17%)                 | 426 (13.91%)|         |
| Major Congenital Malformation                 | 68 (5.97%)                   | 249 (12.94%)                 | 317 (10.35%)|         |
| Prematurity                                    | 87 (7.64%)                   | 121 (6.29%)                  | 208 (6.79%)  |         |
| Others                                         | 11 (0.96%)                   | 35 (1.82%)                   | 46 (1.5%)   |         |
| Cause not established                          | 0 (0)                        | 1 (0.05%)                    | 1 (0.03%)   |         |

### Table 6: Mortality Profile.

| Variable                                      | Intramural(I) n=1138 (37.17%) | Extramural(E) n=1923 (62.82%) | Total 3061 | p value |
|------------------------------------------------|-------------------------------|-------------------------------|-------------|---------|
| Birth Weight / Admission Weight               |                               |                               |             |         |
| ≥2500gm                                       | 233 (20.47%)                 | 512 (26.62%)                 | 745 (24.33%)| 0.0004  |
| 1500 - 2499gm                                 | 517 (45.43%)                 | 860 (44.72%)                 | 1377 (44.98%)|         |
| 1000 - 1499gm                                 | 299 (26.27%)                 | 426 (22.15%)                 | 725 (23.68%)|         |
| <1000gm                                       | 89 (7.8%)                    | 125 (6.5%)                   | 214 (6.99%)  |         |
| Gestation                                      |                               |                               |             |         |
| Term                                           | 496 (43.58%)                 | 984 (51.17%)                 | 1480 (48.35%)| 0.0001  |
| Preterm                                        | 640 (56.23%)                 | 938 (48.77%)                 | 1578 (51.55%)|         |
| Postterm                                       | 2 (0.17%)                    | 1 (0.052%)                   | 3 (0.09%)    |         |
| Duration (Between Admission And Death)         |                               |                               |             |         |
| < 1 day                                        | 216 (18.98%)                 | 306 (15.91%)                 | 522 (17.05%) | <0.001  |
| 1-3 day                                        | 602 (52.89%)                 | 1020 (53.04%)                | 1622 (52.98%)|         |
| 4-7 day                                        | 196 (17.22%)                 | 310 (16.12%)                 | 506 (16.53%) |         |
| > 7 day                                       | 124 (10.89%)                 | 287 (14.92%)                 | 411 (13.42%) |         |
| Age At Death                                  |                               |                               |             |         |
| <1 day                                        | 185 (16.25%)                 | 139 (7.22%)                  | 324 (10.58%) | <0.001  |
| 1-3 Day                                       | 770 (67.66%)                 | 1140 (59.28%)                | 1910 (62.39%)| <0.001  |
| >7 day                                        | 183 (16.08%)                 | 644 (33.48%)                 | 827 (27.01%) |         |
During management 96.48% of neonates received intravenous antibiotics, 43.95% received oxygen therapy, while 11.28% of neonates received phototherapy. 11% of neonates managed in step down care.

Average Duration of stay (admission to discharge, referred and LAMA) in SNUC is 5.98 days in inborn and 6.15 days in outborn. 33.70% neonates stay for 1-3 days, 32.75% stay for 3-7 days, 27.71% stay for >7 days while 5.82% stay for <1 day.

Total 3061 neonate expired after admission (out of 12027) constitute 25.45% mortality rate. 37.17% were in inborn neonates and 62.82% were in outborn neonates. 52.98% neonate died within duration of 1-3 days, 62.39% neonates died within 1st 7 day followed by 13.71% neonates died >7 days. 44.98% neonate died due to Low birth weight. Comparing the mortality in different weight groups highest number of mortality was observed in 1500-2499 grams (44.98%) followed by 2500-3999 grams (24.33%). The mortality rate of inborn babies was 22.03% and that of outborn babies was 33.03%. 51.55% neonate died due to prematurity. (Table 6)

**DISCUSSION**

Data pertaining to disease pattern and mortality are useful for health care providers and policy makers to modify and plan treatment or interventions and evaluate the effectiveness of health care initiatives respectively. There is less number of newborn units in these areas and number of level 3 Neonatal Intensive Care Units (NICU) is still lesser. Data pertaining to morbidity and survival from NICUs in India are less and this is probably the first study of its kind from the Gwalior region.

This study depicts the morbidity pattern in the SNUC. The inborn and out born admission rate (45.13% and 54.86%) is similar to other studies (28.5% and 71.5%) similar to a study by Orimadegun and Owa JA et al.,13,15 in Nigeria, a developing country (44.7% vs 55.3%). Majority of the admission were males as compared to females (63.07% vs 36.92%) similar finding in other studies.16-18 Significantly higher males were admitted in both inborn and outborn groups. Gender bias as a cause for higher number of male admissions needs to be further evaluated. In a study conducted in adjoining state of Uttar Pradesh it was found that the expenditure of health care is nearly fourfold higher in household with male newborn and female newborn use cheaper treatment options.19 In present study of the total neonates 76.96% were preterm and 23.04% were term which is comparable to the studies by Rakholia R et al, and Modi R et al.20

The common morbidities seen in the admitted babies are Birth asphyxia (24.61%), others (21.60%), Respiratory Distress (14.06%), Sepsis (13.77%) and Jaundice (10.65%). Other studies reported higher rates of Birth asphyxia and Sepsis.20,21,22 Out of the total admitted neonates 92 were referred to other centers and 949 were leave against medical advice. Out of the remaining 10986 neonates 7925 were discharged successfully and 3061 (27.86%) expired. The rate of successful discharge was 66.57% by Rakholia R et al, and 69.3% by NNPD. This may be because of the level of care being provided by the centers. Level III NICU takes more morbid and terminally ill newborns and the expected mortality remains high in these set ups. 7.89% neonates were leave against medical advice. This rate is comparable to other studies by Baruah MN et al (7.5%), Rakholia R et al (8.3%) and NNPD (0.7%).20,24 This may be because of lower understanding of the seriousness of the condition of neonate and the benefit of full treatment.

The Neonatal Mortality Rate of 25.45% in the current study is higher than developed countries like Canada (7.6%) suggested that minimal and timely interventions can reduce neonatal death rates.22 The mortality rate is slightly better than countries like Nepal (26.6%).25 Of the 3061, 37.17% were inborn and 62.82% were out born. The mortality rate of inborn babies was 22.03% and that of out born babies was 33.03%. This is higher with the findings of Baruah MN et al, 6.6% vs 13.6% and Modi R et al, 6.57% vs 13.22%.12,24

All of 61.47% of neonates admitted had LBW and 76.96% of neonates admitted were preterm baby. The study has done in a developing country such as Pakistan by Hussain (53.8%) and in South Africa by Hoque et al. (43.7%) found the very high incidence of LBW. However, higher number of preterm reported by Manzar et al (22%), Lala and Talsania (10.20%), and NNPD (14.5%).28-30 This could be explained by the special characteristics of the institution dealing with a much higher number of high-risk pregnancies leading to higher number of LBW and premature babies. The most common causes of mortality in our study was prematurity (52.55%) inborn vs outborn (56.23% vs 48.77%), RDS (37.76%), and birth asphyxia (26.75%) and Sepsis (13.91%). Similar pattern of outcome has been reported by study conducted by Sridhar and Rashid et al.31 Birth asphyxia is an important cause of neonatal morbidity and mortality, its incidence in our study is 24.61% which is similar to findings of Chandra et al.31 In contrast the study report published by ICMR reports Sepsis (32.8%) as the major cause for neonatal mortality followed by Birth asphyxia (22.3%) and Prematurity (16.8%).31 Other studies have reported prematurity as the commonest cause of mortality, this may partly be because of the fact that premature babies needs more specialized care and owing to infrastructure lack they are being referred from our hospital to better equipped centers whenever the parents are willing. The major causes of mortality remain same across studies. The reason for deaths related to RDS and Prematurity could be due to poor maternal health condition, inadequate antenatal checkups, and delay in referrals from peripheral hospitals. Comparing the mortality in different weight groups highest number of mortality was observed in 1500-2499 grams (44.98%) followed by 2500-3999 grams.
grams (24.33%). Mortality was more in babies less than one week compared to late neonatal death 73.47% vs 26.53% similar to Baruah MN et al, Sridhar PV et al, and NNPD.21,23,24 Further 17.05% of neonates succumbed in the first 24 hours which compares to that reported by Sridhar 42.3% and Prasad V et al, 40.2%.34

This study has some limitations, as this was a hospital based retrospective study, the cause of death was determined using the data available in case record sheets. Neonates who went LAMA and those who were referred to other centers, were excluded from outcome analysis in the study and could hence modify the results. The results from this study cannot be a complete reflection of the problem in the community as a whole. Multicenter, prospective studies including major centers providing neonatal care in the region will provide a better idea.

CONCLUSION

Despite many advances in the neonatal care, access to skilled health care resources is limited. Equipped facility, quality antenatal care, skilled health care providers, timely referral, strong link between communities and health facility, and prompt intervention at the health facilities can reduce neonatal mortality rate.

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REFERENCES

1. Lawn JE, Blencowe H, Oza S, You D, Lee AC, Waiswa P, Lalli M, Bhutta Z, Barros AJ, Christian P, Mathers C. Every Newborn: progress, priorities, and potential beyond survival. The Lancet. 2014 Jul 12;384(9938):189-205.
2. Million Death Study Collaborators. Changes in cause specific neonatal and 1-59-month child mortality in India from 2000 to 2015: a nationally representative survey. Lancet. 2017;390:1972-80.
3. Office of the Registrar General and Census Commissioner. Estimates of Mortality Indicators(SRS 2011-13) (Internet) 2014. Available at: http://www.censusindia.gov.in/vital_statistics/SRS_reports_2013.html.
4. Registrar General of India. Sample registration system(SRS) statistical report 2013. New Delhi: 2013.
5. Registrar General of India. Census 2011 Provisional population Totals of 2011.Available at: http://www.censusindia.gov.in/2011-prov-results/PPT_2.html. Accessed on 20 August 2014.
6. Office of the Registrar General and Census Commissioner. (SRS 2017). Available at: http://censusindia.gov.in/vital_statistics/SRS_Bulletins/Bulletins.html. Accessed on 29 August 2019.
7. Health Division PC. Report of the Steering Committee on Health for the 12th Five-Year Plan (Internet). 2012 (cited 2017 Mar 28). Available at: http://planningcommission.nic.in/aboutus/committee/strgrp12/str_health0203.pdf.
8. United Nations R and IS for D countries. India and Sustainable Development Goals: The Way Forward (Internet). Available at: http://ris.org.in/pdf/SDGs_Report_Chapter_3.pdf.
9. Modi R, Modi B, Patel JK, 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 Den Sci. 2015;3(3):208-12.
10. MoHFW GOI. Facility Based New-born Care: Operational Guidelines for Planning and Implementation (Internet). 2011:7-8. Available at: http://www.niifw.org/pdf/ Facility Based Newborn Care (FBNC) Operational Guide Guidelines for Planning and Implementation.pdf.
11. Sridhar PV, Thammanna PS, Sandeep M. Morbidity Pattern and Hospital Outcome of Neonates Admitted in a Tertiary Care Teaching Hospital, Mandya. Int J Sci Stud. 2015;3(6):126-9.
12. Som M, Nayak C, Padhi BK, Ashwani N. Patterns of morbidity among newborns admitted in SCNUs of Odisha, India. Int J Health Sci Res. 2018; 8(9):10-19.
13. Wardlaw T, You D, Hug L, Amouzou A, Newby H. UNICEF Report: enormous progress in child survival but greater focus on newborns urgently needed. Reproductive health. 2014 Dec;11(1):82.
14. Willis JR, Kumar V, Mohanty S, Singh P, Singh V, Baqui AH, et al. Gender differences in perception and care-seeking for illness of newborns in rural Uttar Pradesh, India. J Health Population Nutr. 2009 Feb;27(1):62-71.
15. 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 Oct 1;14(4):228.
16. Indian Council of Medical Research. National Neonatal Perinatal Database Network, New Delhi 2002- 2003; ICMR, 2005:2437. Available at: www.newbornnhocc.org. Accessed 03 March 2018.
17. Baruah MN, Panyang PP. Morbidity and mortality profile of newborns admitted to the special care newborn unit (SCNU) of a teaching hospital of upper Assam, India- a three year study. J Med Sci Clin Res. 2016 Aug;4(08):11689-95.
18. Patil R, Koppad R, Shreshthai B. Clinical profile and. outcome of babies admitted to Neonatal Intensive Care Unit (NICU), Mc Gann Teaching Hospital. Shivamogga, Karnataka: a longitudinal study. Sch J App Med Sci. 2014;2(6G):3357-60.
19. Jena D, Tripathy RM, Pradhan S, et al. 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):4077-81.
20. Orimadegun AE, Akinbami FO, Tongo OO, Okereke JO. Comparison of neonates born outside and inside hospitals in a children emergency unit,
Southwest of Nigeria. Pediatr Emerg Care. 2008;24(6):354-8.

21. Manikyamba D, Madhavi N, Prasad AK, Padmavathi IV, Anitha D. Morbidity and Mortality Profile of LBW Babies and Their Growth and Neurodevelopment Outcome at 1 year- NICU, Government General Hospital, Kakinada. Sch J App Med Sci. 2015 July;3(4B):1721-5.

22. Anand K, Kant S, Kumar G, Kapoor SK, Rakholia R, Bano M, et al. Neonatal morbidity and mortality of sick new-borns admitted in a teaching hospital of Uttarakhand. Chris Med J Heal Res. 2014;1(4):247-53.

23. Owa JA, Osinaike AI. Neonatal morbidity and mortality in Nigeria. Indian J Pediatr. 1998;65:441-9.

24. Modi R, Modi B, Patel JK, 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 Den Sci. 2015;3(3):208-12.

25. Shrestha S, Karki U. Indications of admission and outcome in a newly established neonatal intensive care unit in a developing country (Nepal). Nepal Med Coll J. 2012;14(1):64-7.

26. Hussain S. Neonatal morbidity and mortality pattern in a tertiary care neonatal unit of a teaching hospital. Ann Pak Inst Med Sci. 2014;10(1):7-11.

27. Hoque M, Haq S, Islam R. Causes of neonatal admissions and deaths at a rural hospital in KwaZulu-Natal, South Africa. South Afr J Epidemiol Infect. 2011;26(1):26-9.

28. Manzar N, Manzar B, Yaqoob A, Ahmed M, Kumar J. The study of etiological and demographic characteristics of neonatal mortality and morbidity - A consecutive case series study from Pakistan. BMC Pediatr. 2012;12(1):131.

29. Lala MK, Talsania NJ. Study of evaluation and prediction of neonatal morbidity and mortality using ICMR antenatal scoring method. Indian J Community Med. 2005;26(4):10-12.

30. National Neonatology Form of India. National Neonatology Perinatal Database Report for Year 2002-2003. New Delhi: National Neonatology Form of India; 2003. Available at: http://www.newbornwhocc.org/pdf/nnpd_report_2002-03.

31. Chandra S, Ramji S, Thrupuram S. Perinatal asphyxia: Multivariate analysis of risk factors in hospital births. Indian Pediatr. 1997;34(3):206-12.

32. Rashid A, Ferdous S, Chowdhury T, Rahman F. The morbidity pattern and the hospital outcome of the neonates who were admitted in a tertiary level hospital in Bangladesh. Bangladesh J Child Health. 2003;27:10-3.

33. ICMR Young Infant Study Group. Age profile of neonatal deaths. Indian Pediatr 2008;45:991-4.

34. Prasad V, Singh N. Causes of morbidity and mortality in neonates admitted in Government Medical College, Haldwani in Kumaun region (Uttarakhand) India. JPBS. 2011;8(8):1-4.

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