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Original Research Article

Morbidity pattern of admitted neonates at selected district hospital special newborn care units in Odisha, India

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ABSTRACT

Background: To provide focused recommendations to reduce neonatal fatalities, the study intends to evaluate the patterns of morbidity among admitted neonates in special newborn care units (SNCUs).
Methods: Through secondary data from the SNCU portal of ten SNCUs at district hospitals in Odisha, we performed a cross-sectional descriptive retrospective analysis on all admitted neonates over three calendar years (2020-2022). We profiled the age, gender, birth weight, admission indication, maturity, mortality profile, referral, and type of admission. Excel 2021 was used to extract the data, while Epi info and excel were used for analysis.
Results: The 24383 (or 48.5%) of the 50226 newborns admitted to the SNCU were inborn. Of the newborns, 58.4% were male. Of the 50226 newborns, 58.5% had low birth weights (LBWs) (less than 2500 gm); 995 babies (2.0%) weighed less than 1000 gm. Three days was the median length of stay in the SNCUs. 28.7% of admissions are due to perinatal asphyxia (n=14421), which is followed by newborn jaundice (n=9616, 19.1%), LBW (n=6757, 13.5%), refusal to feed (n=5327, 10.6%), and prematurity (n=4363, 8.7%). Out of the total, 74.8% were discharged, 11.3% were referred, 9.7% passed away, and 4.1% defied medical advice and left the SNCU. Birth asphyxia, hypoxic-ischemic encephalopathy (HIE), infection, and preterm were the main causes of death.
Conclusions: The main reason for neonates' morbidity and mortality is birth asphyxia. Early referrals, successful intervention, and superior prenatal care are crucial to avoid it.

Keywords: Special newborn care unit, Neonate, Birth asphyxia, Neonatal morbidity, Neonatal mortality

INTRODUCTION

Infant care has received unmatched funding and attention since the national rural health mission (NRHM) was established in India in 2005 by the ministry of health and family welfare (MoHFW).[1] One of the program's primary objectives was to lower the burden of morbidity and mortality among mothers and newborns. 2013 saw the introduction of the reproductive, maternal, neonatal, child, and adolescent health (RMNCH+A) plan. The national health mission (NHM) child health program tackles the variables contributing to newborn and under-five mortality and thoroughly incorporates therapies that increase child survival. It is now widely acknowledged that maternal health, which is further influenced by the adolescent's development and health, is a crucial factor in determining the survival of the child.[2] Due to the Janani Suraksha Yojana (JSY) program of the NRHM, there has been a noticeable increase in institutional deliveries and a flow of mothers and infants into the facilities. Additionally, the integrated management of neonatal and childhood illness (IMNCI) and home-based new born care (HBNC) programs have been operationalized. As a result of all these initiatives, more sick newborns are increasingly presenting to other reference hospitals and district hospitals.[3] Nevertheless, it has been found that vital infant care and care for sick newborns are lacking in the current healthcare facilities.

Under NRHM and reproductive child health (RCH) II, newborn care is crucial to the MoHFW, government of India's (MoHFW, GoI) child health strategy. The MDG 4 target is something the ministry is committed to attaining. One of the main ways to achieve this is by implementing Facility-based Newborn care (FBNC) services at all healthcare facilities. An estimated 130 million babies are born each year in the world, of which 4 million are left to die as newborns, and over 25% of neonatal fatalities take place in India.[4] About two-thirds of infant deaths in India occur in the first 28 days after delivery, and these deaths can be specifically prevented by increasing neonatal endurance.

Approximately 70% of newborn deaths can be prevented if proven interventions are implemented properly, quickly, and most importantly.[5] In terms of infant mortality rates in India, Odisha is a leading state. According to the sample registration system (SRS) 2022, Odisha has an IMR of 36, whereas the national average is 28.[6]

Comprehensive prenatal care, skilled attendance at birth, resuscitation at birth, and essential newborn care for small and sick newborns-which includes critical care provided in health facilities through SNCUs and newborn stabilisation units (NBSUs), HBNC, and IMNCI-are just a few of the interventions that the government of Odisha has put into place. This has been shown to increase the survival rate of newborns.

SNCUs were established at district and sub-district hospitals to treat unwell newborn babies, offering all sorts of neonatal care, saving major surgeries, and providing assisted ventilation, with an annual delivery load exceeding 3000. With 12 or more beds, a SNCU is a unique hospital.

It is managed by staff nurses, physicians, and support personnel who have completed the required training to offer round-the-clock services, and it is situated next to the labor room. To guarantee the greatest possible utilization of resources, bed strength, and services, these units have admission and discharge criteria.[7] Unmet needs exist for parents of seriously ill children in the PICU. Members of the healthcare team should take the initiative to help parents cope better and feel less distressed.[8]

Objectives

In this study, we examined the admission patterns of neonates admitted to 10 SNCUs situated at the district hospitals in the state over a three-year time period. We examined year-to-year fluctuations as well as the reasons for admission, the kind of admission, birth weight, gestational age, morbidities, referral, and cause of death.

The objective was to assess the morbidity pattern intended to provide focused recommendations for reducing the number of neonatal fatalities.

METHODS

For the three calendar years 2020-2022, we conducted a cross-sectional descriptive analysis on all neonates who received care at the SNCUs in ten chosen districts in Odisha. The study SNCUs are SNCU Balangir, SNCU Dhenkanal, SNCU Gajapati, SNCU Kalahandi, SNCU Kandhamal, SNCU Koraput, SNCU Malkangiri, SNCU Nabarangpur, SNCU Nuapada and SNCU Rayagada. All SNCUs are situated at the district hospitals of the respective Districts. We collected desired information from the SNCU online database (https://sncuindiaonline.org), the pre-designed SNCU observational checklist, and the SNCU progress reports. Interview schedules and facility evaluation checklists tailored to SNCUs were created using the 2011 operational guidelines on facility-based newborn care, MoHFW, government of India.[7] The data, which was further separated into two categories: inborn babies (those born in the hospital where the SNCU was located) and outborn babies (those delivered at home or in other non-SNCU facilities and sent to the SNCU), comprised all neonates hospitalized during the study period. The age, gender, kind of admission, birth weight, maturity, referral, admission indication, and death were among the study's demographic features. The diagnoses (birth asphyxia, LBWs, prematurity, respiratory distress, sepsis, etc.) that were made upon admission were classified. Data was analyzed in excel and Epi Info software version 7.2.5.0. Descriptive statistics were used in the study to assess newborn demographic characteristics, clinical aspects, and outcomes. A line diagram with month and year plots was used to analyze the time distribution. Time, place, and person analysis was made and depicted in tables and graphs using proportions. Permission for the study and Ethics approval was obtained from the department of health and family welfare govt of Odisha.

Inclusion criteria

All newborns admitted in the 10 SNCUs from January 2020 to December 2022 are included in the study.

Exclusion criteria

All newborns admitted in the 10 SNCUs from January 2020 to December 2022 are included in the study, so there is no exclusion.

RESULTS

As shown in Table 1, in 2020-2022, a total of 50226 newborns were admitted to the 10 SNCUs. Of all newborns, 25259 (50.3%) were under one day, and 20881 (41.6%) were female. There are 24383 (48.5%) admissions to the inborn unit and 25843 (51.5%) admissions to the outborn unit. There were 14708 (29.3%) preterm births. 995 newborns (2%) out of 29401 (58.5%) LBWs babies (below 2500 gm) were under 1000 gm. 68.3% of the 25843 outborns, or 17645 ill neonates,

were transported to the SNCUs by government vehicles. Birth asphyxia constituted the majority of the neonates' final diagnoses (19%, or 9590 neonates).

The final diagnosis of the admitted neonates at the SNCUs, 2020-2022: Out of 50226 admitted neonates, 9590 neonates (19.1%) were diagnosed with birth asphyxia, 9274 (18.5%) were neonatal jaundice, 7923 (15.8%) were LBW neonates (1000-2499 gm), and 5226 neonates (10.4%) were found to be diagnosed with neonatal sepsis.

The place of delivery of the admitted neonates at the SNCUs, 2020-2022: 42689 neonates (85%) were delivered in government facilities (district hospital, sub divisional hospital, community health center, primary health center, sub health center), 3268(6.5%) delivered at private health facility, other districts (2331,4.6%), home delivery (1791,3.4%) and 147(.4%) were delivered on the way to hospital.

Duration of stay of admitted neonates 2020-2022: median average duration of stay for newborns hospitalized in the SNCUs is 3 days, ranging from 0-98 days.

The reasons for the mortality of admitted neonates, 2020-2022: A total of 4883 (9.7%) of the 50226 neonates admitted to the hospital died. The top five causes of death for the admitted infants were birth asphyxia (1459, 30%), neonatal sepsis (684, 14%), HIE of newborn (499, 10%), prematurity (birth between 28 and 37 weeks) (485, 10%), and LBW, defined as birth between 1000 and 2499 gm (462, 9%).

The reasons for referral of admitted neonates to higher center, 2020-2022: Out of 50226 admitted neonates, 5666 (11%) babies have been referred to higher facilities for treatment. The top five reasons of referral were birth asphyxia (1520, 27%), HIE of the newborn (771,14%), neonatal sepsis (720,13%), LBW, i.e., 1000-2499 gm (520, 9%) and congenital malformation (453,8%).

Table 2 provides data on admissions and deaths in SNCUs across ten SNCUs of district hospitals from 2020 to 2022. Key indicators include the percentage of admissions discharged after treatment, ranging from 63% to 80%. SNCU Gajapati, Nabarangpur and Rayagada was seen around 80% discharge. The percentage of admitted babies who died while in SNCU ranged from 2% to 14%. Koraput SNCU was found with around 14% death. The least deaths (2%) were in Dhenkanal SNCU. The table also details the causes of death, with sepsis, HIE/asphyxia, and prematurity/LBW being significant factors. Death from HIE/Asphyxia was the most important reason for mortality (41.6%). A maximum (56.9%) death was found in SNCU Gajapati from HIE/ birth asphyxia.

Table 3 presents data on various reasons for admission to the SNCUs, detailing the number of inborn and outborn cases and their respective percentages. Perinatal asphyxia (28.7%), neonatal jaundice (19.1%), LBW (<1800 gm) (13.5%), refusal to feed (10.6%) and prematurity (8.7%) are the major reasons of admission at the SNCUs. Compared to outborns (24.4%), inborns had a one-tenth-point greater prevalence of birth asphyxia (33.4%). The p value is higher than the significance level of 0.05, indicating no statistically significant difference between the Inborn and outborn groups.

As shown in Figure 1, the admission pattern through all the months shows a slight upward trend. However, downward peaks in Sept. 2020, Feb. 2021 and May, Jun, and Jul 2021 are due to the COVID-19 upsurge in the districts

As shown in Figure 2, a total of 50226 neonates were admitted to the 10 SNCUs. 48.5% of admitted neonates were inborn, and 51.5% were outborn (from other health facilities/homeborn). 37594 (or 74.8% of the total) were well enough to be discharged, 5666 (or 11.3% of the total) were sent to higher-level hospitals for better care, 4883 (or 9.7% of the total) were pronounced dead, and 2083 (or 4.1% of the total) were left the SNCU against medical advice (LAMA).

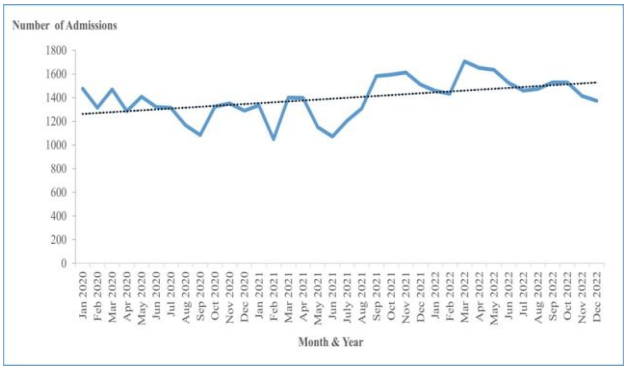

Figure 1: Month-wise admission pattern of admitted neonates, 10 SNCUs, district hospitals, Odisha, 2020-22, (n=50226).

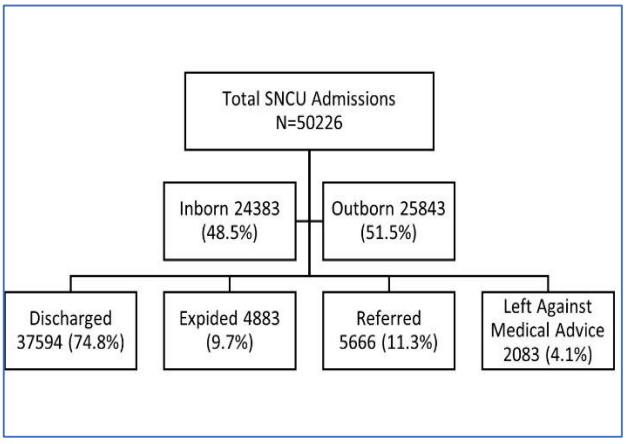

Figure 2: Overall result, 10 SNCUs, district hospitals, Odisha, 2020-22, (n=50226).

Table 1: Profile of admitted neonates, 10 SNCUs, district hospitals, Odisha (n=50226), 2020-2022.

Characteristics	N	Proportion (%)
Age group (in days)		
<1	25259	50.3
1 to 3	12065	24.0
4 to 7	5426	10.8
>7	7476	14.9
Total	50226	100
Gender		
Male	29310	58.4
Female	20881	41.6
Agender	35	0.1
Total	50226	100
Delivery location		
In born	24383	48.5
Out born	25843	51.5
Total	50226	100
Maturity (in weeks)		
Full-term (37-42)	33846	67.4
Pre-term (<37)	14708	29.3
Post-term (≥ 42)	1672	3.3
Total	50226	100
Birth weight (gm)		
Normal (≥ 2500)	20825	41.5
Low birth weight (1500-2499)	23085	46.0
Very low birth weight (1000-1499)	5321	10.6
Extremely low birth weight (<1000)	995	2.0
Total	50226	100
Mode of transport from the other facilities		
Govt. vehicle	17645	68.3
Self-arranged	8198	31.7
Total	25843	100
Final diagnosis		
Birth asphyxia	9590	19.1
Neonatal jaundice	9274	18.5
Other low birth weight (1000-2499 gm)	7923	15.8
Others	6037	12.0
Neonatal sepsis	5226	10.4
HIE of newborn	4480	8.9
Prematurity (28-<37 weeks)	3112	6.2
Any other diagnosis	2321	4.6
RDS of newborn (HMD)	1167	2.3
Congenital malformation	1096	2.2
Total	50226	100
Place of delivery		
Government institute	42689	85
Private institute	3268	6.5
Other districts	2331	4.6
Home delivery	1791	3.6
On the way to the hospital	147	0.3
Total	50226	100

Table 2: Admissions and deaths in SNCUs, district hospitals, Odisha 2020-2022.

Indicators, N (%)	SNCU Balangir	SNCU Dhenkanal	SNCU Gajapati	SNCU Kalahandi	SNCU Kandhamal	SNCU Malkangiri	SNCU Nabarangapur	SNCU Nuapada	SNCU Rayagada	SNCU Koraput	Total
Total SNCU admissions (N)	7914	3492	3403	6977	4411	3741	4204	3684	5540	6860	50226
Admitted babies-got discharged after getting treatment at SNCU	5012 (63.3)	2801 (80.2)	2738 (80.4)	5409 (77.5)	3481 (78.9)	2774 (74.1)	3373 (80.2)	2657 (72.1)	74431 (80)	4918 (71.7)	37594 (74.8)
Admitted babies who died while in SNCU	1001 (12.6)	70 (2)	116 (3.4)	868 (12.4)	391 (8.9)	270 (7.2)	350 (8.3)	457 (12.4)	370 (6.7)	990 (14.4)	4883 (9.7)
Admitted babies who LAMA	409 (5.2)	83 (2.4)	158 (4.6)	129 (1.8)	35 (0.8)	277 (7.4)	41 (1)	67 (1.8)	342 (6.2)	542 (7.9)	2083 (4.1)
Admitted babies are referred to another facility	1492 (18.9)	538 (15.4)	391 (11.5)	571 (8.2)	504 (11.4)	420 (11.2)	440 (10.5)	503 (13.7)	397 (7.2)	410 (6)	5666 (11.3)
Admitted babies-LBW (<1800 gm)	828 (10.5)	288 (8.2)	327 (9.6)	822 (11.8)	537 (12.2)	757 (20.2)	762 (18.1)	741 (20.1)	784 (14.2)	911 (13.3)	6757 (13.5)
Admitted babies expired	1001	70	116	868	391	270	350	457	370	990	4883
Admitted babies who died by sepsis	320 (32)	8 (11.4)	4 (3.4)	124 (14.3)	140 (35.8)	16 (5.9)	43 (12.3)	112 (24.5)	51 (13.8)	219 (22.1)	4883 (21.2)
Admitted babies who died by HIE/ asphyxia	400 (40)	15 (21.4)	66 (56.9)	390 (44.9)	164 (41.9)	70 (25.9)	157 (44.9)	106 (23.2)	196 (53)	468 (47.3)	2032 (41.6)
Admitted babies who died by prematurity/ low birth weight	196 (19.6)	12 (17.1)	19 (16.4)	235 (27.1)	28 (7.2)	97 (35.9)	125 (35.7)	93 (20.4)	58 (15.7)	115 (11.6)	978 (20)

Table 3: Reasons of admission (inborn versus outborn), 10 SNCUs, district hospitals, Odisha (n=50226), 2020-2022.

Reason of admission	Inborn	%	Outborn	%	Total	%
Perinatal asphyxia	8150	33.4	6271	24.4	14421	28.7
Neonatal jaundice	5613	23.0	4003	15.6	9616	19.1
Low birth weight <1800 gm	2718	11.1	4039	15.7	6757	13.5
Refusal to feed	1810	7.4	3517	13.7	5327	10.6
Prematurity <34 weeks	1956	8.0	2407	9.4	4363	8.7
Any other	1097	4.5	1711	6.6	2808	5.6
Respiratory distress (rate>60 or grunt/retractions)	822	3.4	982	3.8	1804	3.6
Congenital malformation	386	1.6	697	2.7	1083	2.2
Hyperthermia >37.5 C	237	1.0	608	2.4	845	1.7
Meconium aspiration	679	2.8	162	0.6	841	1.7
Abdominal distension	99	0.4	433	1.7	532	1.1
Neonatal convulsions	171	0.7	357	1.4	528	1.1
Hypothermia <35.4 C	251	1.0	190	0.7	441	0.9
Hypoglycemia <45 mg%	139	0.6	201	0.8	340	0.7
Apnea/gasping	49	0.2	81	0.3	130	0.3
Diarrhea	28	0.1	60	0.2	88	0.2
Large baby (>4 kg. At 40 weeks)	75	0.3	12	0.0	87	0.2
Baby of diabetic mother	52	0.2	12	0.0	64	0.1
Oliguria	20	0.1	36	0.1	56	0.1
Bleeding	14	0.1	40	0.2	54	0.1
Central cyanosis	11	0.0	19	0.1	30	0.1
Shock	6	0.0	5	0.0	11	0.0
Total	24383	100.0	25843	100.0	50226	100%
T statistics	**Inborn**	**Outborn**				
Mean	1108	1175				
Standard deviation	2047.91	1754.6				
Standard error	436.62	374.07				
P value	0.70	T value	2.02			

DISCUSSION

A total of 50226 neonates were admitted to the SNCU in the study period January 2020 and December 2022. 25843 (51%) were outborn, meaning they were born at home or at another healthcare institution, whereas 24383 (49%) were inborn, meaning they were born at the same facility. Our results were similar to those of the Uttarakhand study that found 53.54% outborn admissions and 46.46% inborn admissions and in line with the studies of Sridhar et al, Baruah et al and Rakholia et al.[9-11]

Among the newborns admitted, males comprised the majority (58.4%) as opposed to females (41.6%). Comparable results were also observed in research projects by Jena et al and Shah et al.[12,13] Male gender vulnerability may be connected to male dominance. However, it is also a result of Indian social and cultural contexts, where family members give male children more attention and take them to medical facilities on a preference basis. Further studies might be necessary to do additional research to comprehend male babies' preferential health-seeking behavior fully.

Around 29% of admissions had neonatal asphyxia as the major reason for admission. Compared to outborns (24.4%), inborn had almost one-tenth point greater prevalence of birth asphyxia (33.4%). Additional research from Assam (16.2%) revealed greater rates of birth asphyxia.[14-16]

Birth asphyxia is much more common than expected. This can be attributed to several factors, including poor prenatal care, delayed referrals of high-risk mothers, limited access to healthcare facilities, subpar intranatal care, a delay in caesarean sections when labor is prolonged, and inadequate neonatal resuscitation. Additional research could provide more insight into the factors listed above. Inborn 23% and outborn 15.6% of newborn jaundice were comparable to those from earlier studies by Sridhar et al and Neogi et al.[9,17] One of the main reasons for admission to the pediatric intensive care unit (PICU) and a major contributor to unfavorable results are sepsis 5226 neonates (10.4%) were found to be diagnosed with neonatal sepsis.[18]

The discharge rate in this study is higher than that of studies by Shah et al (67.00%) and Adikane et al (65.89%).[13,19] Around 4% of cases were left against medical advice (LAMA). High percentages of neonates LAMA were found in the research conducted by Baruah and Panyang (6.58%), Shah et al (10%), Sinha et al (9.5%), Sharma and Gaur (7.89%).[10,13,20,21] Since SNCU did not have access to these facilities, 5666 (11.3%) neonates were referred to a higher facility for additional specialized surgical and/or critical care. Comparable to Verma et al (11%) and Ravikumar et al (10.4%), the study's death rate was 9.7%.[22,23] 74.8% of newborns admitted to the SNCU in this study were discharged following effective treatment; similar outcomes were noted in studies by Sinha et al (84.30%) and Ravikumar et al (83.39%).[20,23] While Shah et al identified a higher rate of mortality (16.00%) in Gujarat, Sinha et al (0.9%) and Randad et al (1.55%) reported decreased death risks among hospitalized neonates in Bihar and Mumbai.[13,20,24]

The 3.5% of deliveries were made at home, whereas institutional deliveries accounted for the majority (91.5%). This is a good finding because institutional births lower the risk of newborns and increase the likelihood of high-risk kids being identified early and receiving professional care, including the right referral, which will ultimately lower the babies' mortality and morbidity. Birth weight and gestational age are essential to determine the prognosis and measure neonatal risk. Preterm birth (gestational age <37 weeks) and LBW (<2,500 gm) compromise the survival and general health of newborns. Of all infants admitted to the hospital, 59% were LBW. This figure was comparable to that of Baruah and Panyang (66.10%), Shah et al (63.00%), Verma et al (61.6%), and Kumar et al (61.52%), who discovered that nearly 60% of neonates in SNCUs had LBW.[10,13,22,25]

The alarmingly high percentage of LBW neonates suggests that to reduce the incidence of LBWs, community-level interventions must be increased to change related social, maternal (especially about nutrition), and biological factors. At the same time, LBW proportions were significantly lower in Mumbai (39.18%) and Bihar (27.6%), according to Sinha et al and Randad et al.[20,24]

Because interventions start right away, early admission to an SNCU or NICU is essential for the survival and prognosis of newborns. Early admission is contingent upon a high-risk mother giving birth in a hospital equipped with an SNCU or NICU, as well as early detection and prompt referral of neonates in need of peripheral care. These outcomes will be achieved through regular training for relevant staff members and an efficient transportation network. In addition to the clinical state of the infant, the availability of trained medical staff, specialized tools, and medications, as well as timely admission and intervention, all impact recovery and mortality. When creating and executing SNCU services, these concerns need to be researched and considered.

Limitations

Secondary data during the COVID-19 pandemic (2020-2022) was included in the study. Therefore, the study results could not be attributable to the post-COVID era.

CONCLUSION

Perinatal asphyxia (14421, 28.7%) was the most common reason for SNCU admission. Neonatal jaundice and LBW were the next most common reasons for admission to the SNCUs. Furthermore, birth asphyxia was the most common cause of death. Therefore, quick action is

required to prevent and manage birth asphyxia through increased health functionaries' capacity building and community-based incentives to raise the intended beneficiaries' awareness level.

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