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Morbidity and Mortality pattern among neonates admitted in a Special Newborn Care Unit of Central India : A Retrospective Observational Study

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INTRODUCTION

Neonatal period that is first 28 days of life is very crucial period in terms of survival of a newborn. Durind this period, a newborn adapts himself for the changes that take place by transition from intra-uterine life to extra-uterine life. Though this period of just 28 days accounts for less than 2% of total under 5 childhood, it carries the greatest risk of morbidity and mortality for the newborn.

In India SRS 2012 neonatal deaths accounts for 56% of under five and 69% of infant deaths. First week of death alone accounts for 45% of total under 5 years deaths[1]. The major causes of neonatal deaths as per Sample Registration System Report (2010-13) are Prematurity and low birth weight (48.1%), Birth asphyxia & birth trauma (12.9%), Neonatal Pneumonia(12.0%), Other non communicable diseases (7.1%), Sepsis (5.4%), Ill defined or cause unknown(5.0%), Congenital anomalies(4.0%), Diarrhoeal diseases (3.1%), Injuries (0.9%), Tetanus (0.5%) and all other remaining causes (0.9%)[2]. Almost three fourth of all neonatal deaths occur among the low birth weight newborns. Of all the neonatal death about 40% occur within first 24 hours, half within 72 hours and 3/4 within one week of birth[1]. Appropriate care of the mother during pregnancy and childbirth has positive influence on neonatal outcome. But still high neonatal mortality in India is a subject of great concern. According to the UNICEF report 2021, the current neonatal mortality rate (NMR) in India is 20 per 1000 live birth[3]. According to SRS, Infant mortality rate in INDIA is 30 per 1000 live birth, but in Madhya Pradesh, the Infant mortality rate (IMR) is 46, which is highest among all the states of India [4]. This study was conducted to study the mortality and morbidity patterns of newborns admitted in newly set up SCNU at a tertiary care centre of Madhya Pradesh.

METHODS

Study Design: It was a Retrospective, Hospital based study which was done among neonates admitted to SNCU, tertiary care centre of Sagar District, Madhya Pradesh, India. Study period was for one complete year starting from 1st January 2021 to 31th December 2021.

Inclusion criteria : All the neonates (0-28days) admitted to SNCU, Department of paediatrics, Bundelkhand Government Medical College, Sagar, Madhya Pradesh during the study period were included in the study.

Exclusion criteria : Babies > 28 days old, newborns admitted to paediatric ward/PICU were excluded from the study.

Study tool : The data was collected using predesigned semi-structured proforma. The data was entered in Excel Sheet and analyzed using SPSS software version 21. Institutional ethical committee permission was obtained for the conduct of the study.

RESULTS

During the study period, there were a total of 5092 deliveries in the hospital. Caesarean section comprised 43.3% of total deliveries. Still births comprised 5.3% of total births. The profile of babies as per birth weight show that 35.6% were Low Birth Weight (Birth

weight<2500gm) and 10.5% were born preterm (< 37 completed weeks of gestation). A total of 2.1% babies required resuscitation at birth.
In the study period, total of 1193 babies were admitted in the SCNU of which 700(58.7%) were admitted in the inborn unit while 493 (41.3%) babies were admitted in the outborn unit. In the inborn unit, 46% were of normal birth weight while 54% were LBW. In the outborn unit, 43.8% were normal birth weight while 56.2% were LBW. As per birth weight criteria, overall 45.1% were ≥2.5 kg (Normal Birth Weight), 41.2% were 1.500-2.499kg (LBW) category, 11.2% were 1.000-1.499kg (VLBW) category while 2.5% were < 1.000kg (ELBW) category(Table/Fig. 1).

Table 1: Showing admission characteristics on the basis of birth weight.

Birth weight	Inborn(n=700)	Outborn(n=493)	Total(n=1193)
>2.5kg	322 (46)	216 (43.8)	538 (45.1)
1.5-2.5kg	278 (39.7)	213 (43.2)	491 (41.2)
1-1.5kg	79 (11.3)	55(11.2)	134 (11.2)
<1kg	21(3)	9 (1.8)	30(2.5)

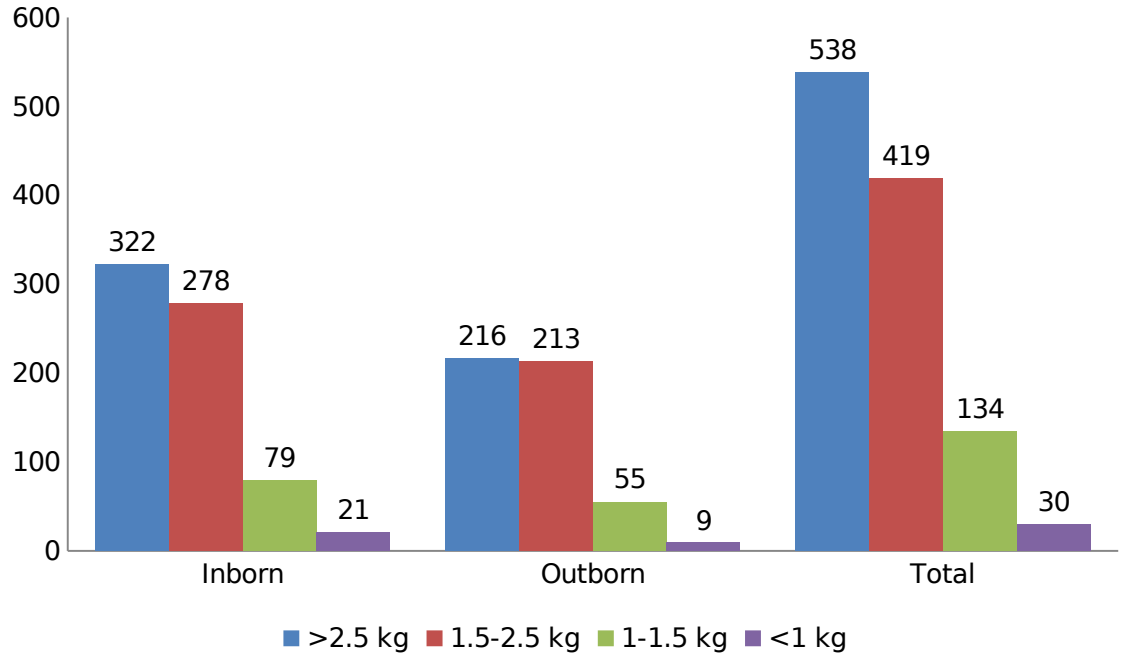

Chart 1: Showing admission characteristics on the basis of birth weight.

As per gestation, preterm babies comprised 54.1% and 50.7% of admitted babies respectively in the inborn and outborn units. So, approximately half of the inborn and outborn cases were preterm babies (Table/Fig. 2). The male: female ratio of admitted babies was 1.5:1 (59.9% vs 40.1%) and 1.2:1(54.8% vs 45.2%) in the inborn and outborn units respectively suggesting higher male admission in both the units(Table/Fig. 3).

Table 2: Showing admission characteristics on the basis of gestational age

Gestational age	Inborn(n=700)	Outborn(n=493)	Total(n=1193)
≥37 weeks	321 (45.9)	243 (49.3)	564 (47.3)

34–<37 weeks	229(32.7)	169(34.3)	398 (33.4)
32-34 weeks	75(10.7)	42 (8.5)	117 (9.8)
28-32 weeks	69(9.9)	35 (7.1)	104 (8.7)
<28 weeks	6(0.9)	4 (0.8)	10 (0.8)

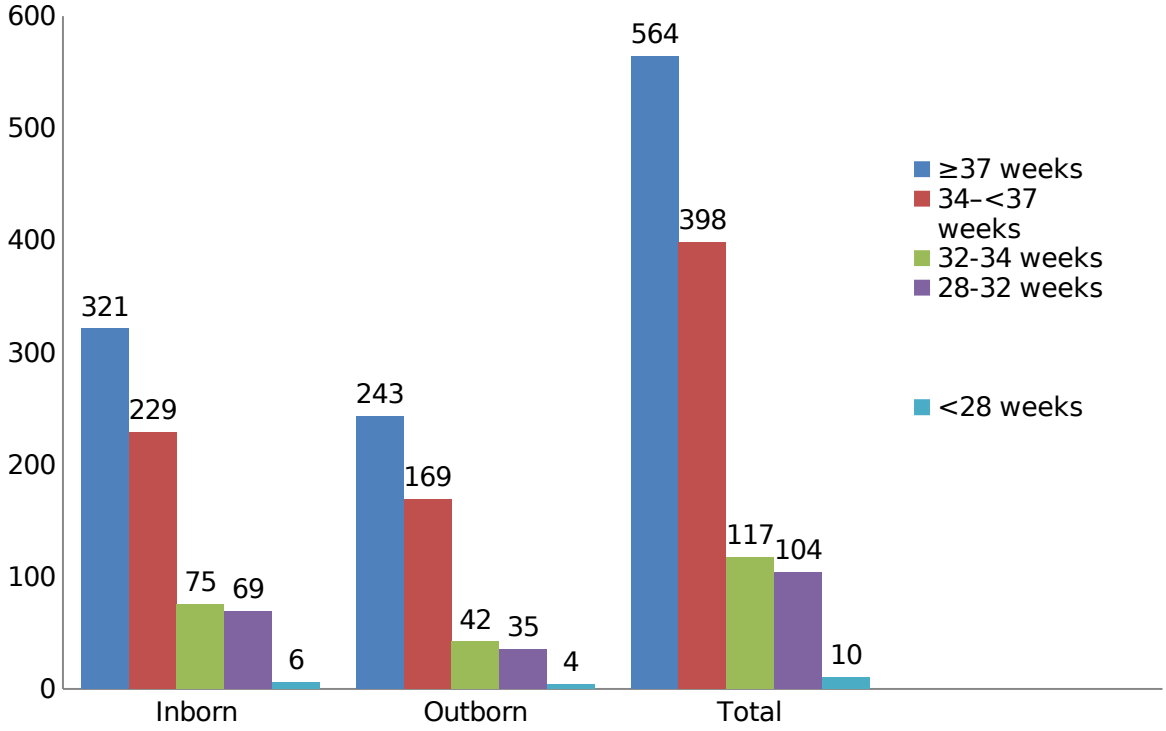

Chart 2 : Showing admission characteristics on the basis of gestational age

Table 3: Showing admission characteristics on the basis of sex

Sex	Inborn(n=700)	Outborn(n=493)	Total(n=1193)
Male	419 (59.9)	270 (54.8)	689(57.8)
Female	280 (40.1)	222 (45.2)	502 (42.1)

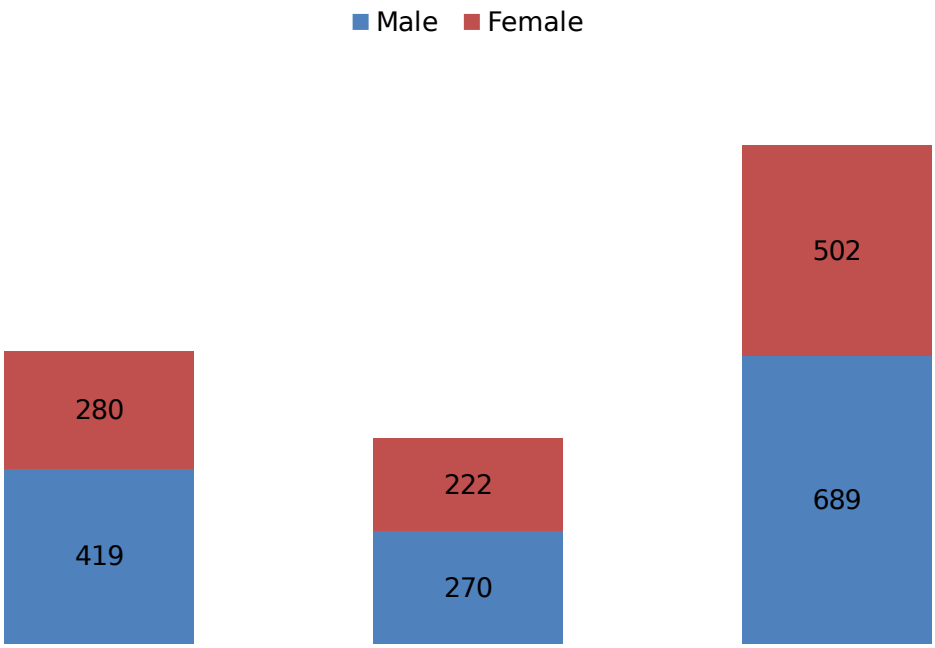

Chart 3: Showing admission characteristics on the basis of sex

In the inborn unit, birth asphyxia(38.5%) was the most common cause of admission followed by LBW and prematurity (26.7%), respiratory distress (14%) and Neonatal jaundice (5.9%). In the outborn unit Neonatal jaundice (n=119) was the commonest cause of admission (24.1%) followed by LBW and prematurity (20.9%), respiratory distress (15.8%) and birth asphyxia (8.5%)(Table/Fig. 5).

Table 4: Showing admission characteristics on the basis of duration of stay.

Duration of stay	Inborn(n=700)	Outborn(n=493)	Total(n=1193)
<1day	32 (4.6)	29 (5.9)	61 (5.1)
1-3days	223 (31.9)	229(46.5)	452 (37.9)
4-7days	254(36.3)	124(25.1)	378 (31.7)
>7days	191 (27.3)	111(22.5)	302(25.3)

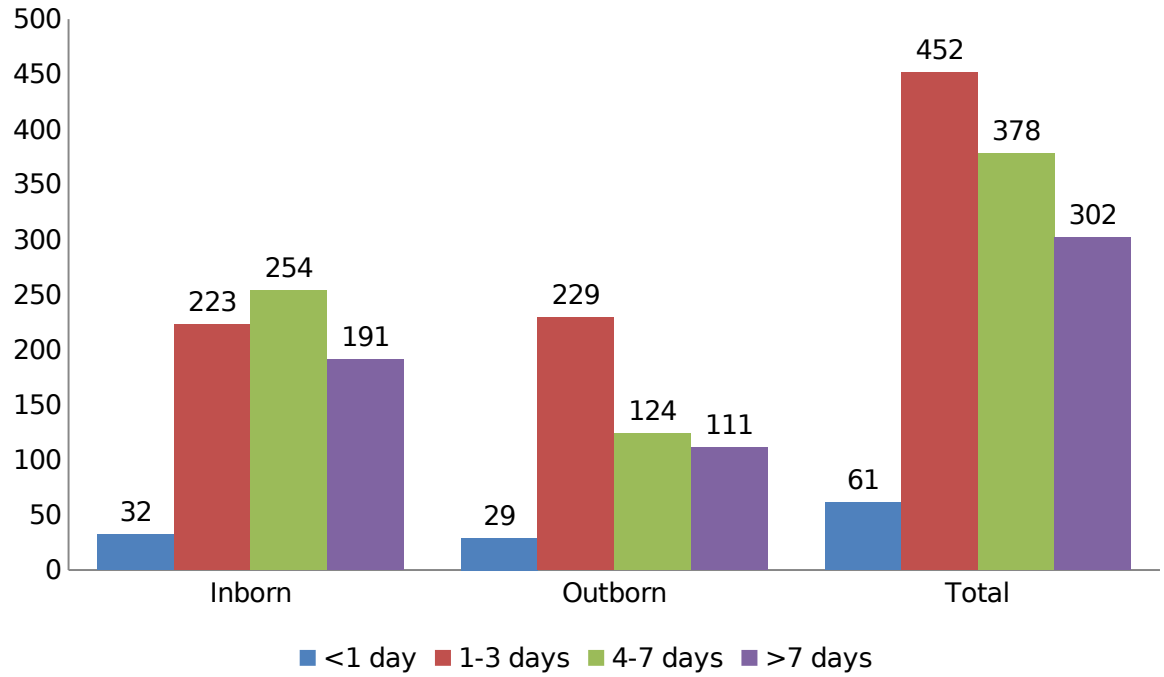

Chart 4: Showing admission characteristics on the basis of duration of stay.

Table 5: Showing indication for admission

Indication of admission	Inborn(n=700)	Outborn(n=493)	Total(n=1193)
Respiratory distress	98(14)	78(15.8)	176(14.8)
Birth asphyxia	270(38.6)	42(8.5)	312(26.2)
Major congenital malformation	19(2.7)	30(6.1)	49(4.1)
Prematurity +LBW	187(26.7)	103(20.9)	290(24.3)
NNHB	41(5.9)	119(24.1)	160(13.4)
others	85(12.1)	121(24.5)	206(17.3)

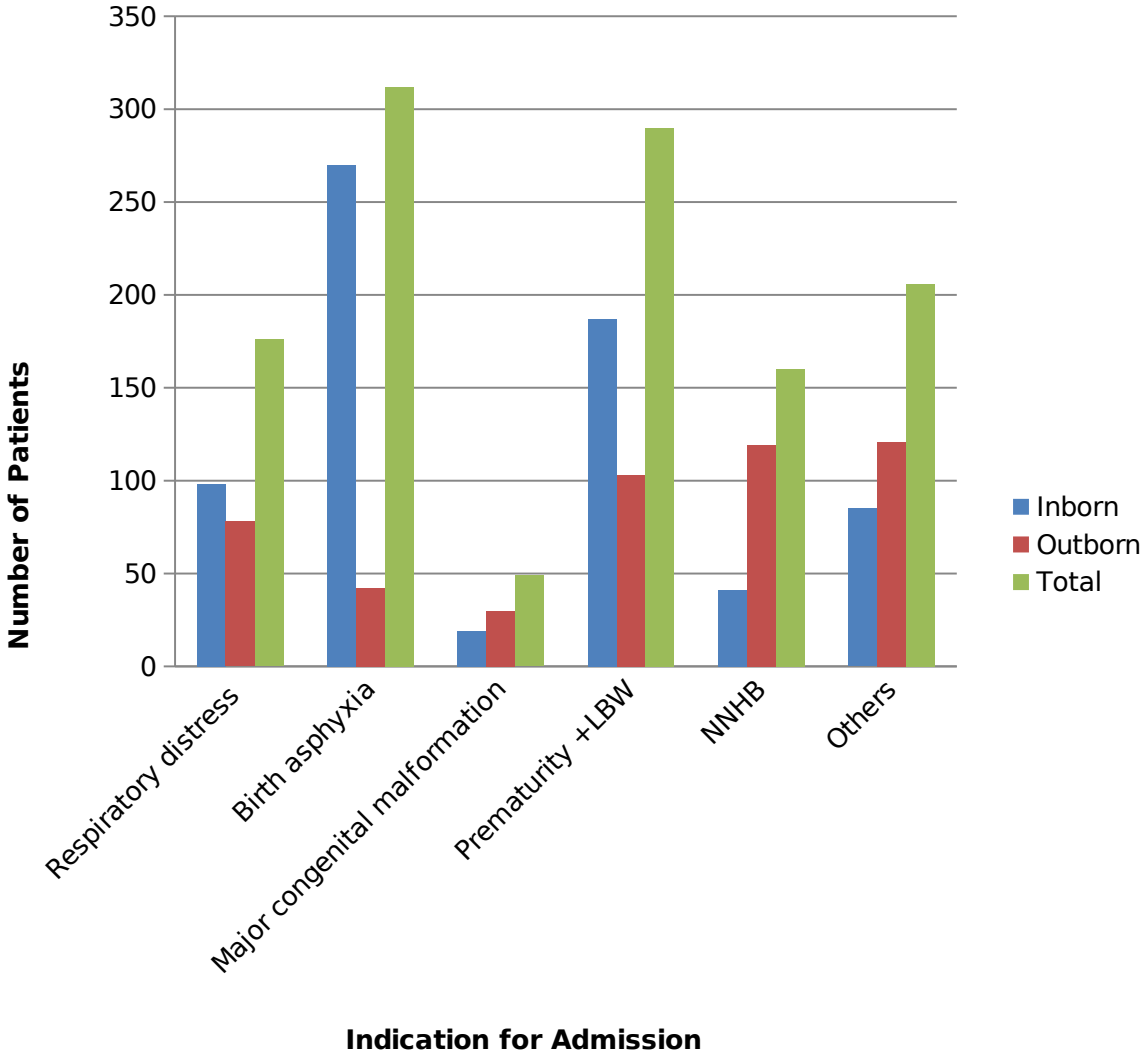

Chart 5: Showing indication for admission

72.4% (n=507) of inborn babies were successfully discharged from the unit. 4.9% of cases left against medical advice (LAMA) while 4.1% were referred mainly for surgical reasons as pediatric surgery facilities are not available in this Medical College. The inborn mortality was 18.6% with male:female ratio of 1.5:1. Among outborn patients, 68.8% (339) were successfully discharged, 8.3% left against medical advice (LAMA) while 7.5% were referred to higher centre. The overall outborn mortality was 15.4% with male:female ratio of 1.2:1(Table/Fig. 6).

Table 6: Showing characteristics on the basis of outcome

Outcome	Inborn(n=700)	Outborn(n=493)	Total(n=1193)
Discharged	507(72.4)	339 (68.8)	846 (70.9)
Referral	29 (4.1)	37 (7.5)	66 (5.5)
LAMA	34 (4.9)	41 (8.3)	75 (6.3)
Died	130 (18.6)	76 (15.4)	206 (17.3)

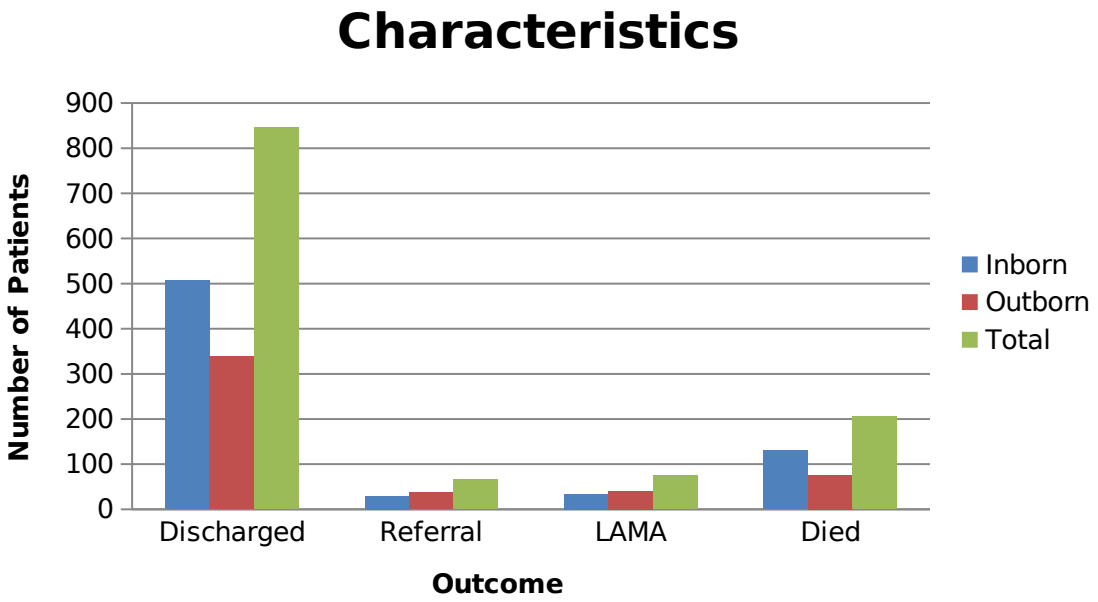

Chart 6: Showing characteristics on the basis of outcome

Among inborn cases, preterm RDS (24.6%) was the commonest cause of death followed by birth asphyxia (23.8%), sepsis (23.1%) and prematurity(16.9%). While among outborn babies, sepsis (43.4%) was the commonest cause of death followed by preterm RDS (28.9%), prematurity(11.8%) and major congenital malformations(7.9%)(Table/Fig. 7).

Table 7: Showing mortality rate according to cause of death

Mortality profile	Inborn(n=130)	Outborn(n=76)	Total(n=206)
Respiratory distress syndrome	32(24.6)	22(28.9)	54(26.2)
Meconium aspiration syndrome	9(6.9)	1(1.3)	10(4.9)
Birth asphyxia	31(23.8)	3(3.9)	34(16.5)
Sepsis	30(23.1)	33(43.4)	63(30.6)
Major congenital malformation	6(4.6)	6(7.9)	12(5.8)
Prematurity	22(16.9)	9(11.8)	31(15.1)
Others	0	2(2.6)	02(1)

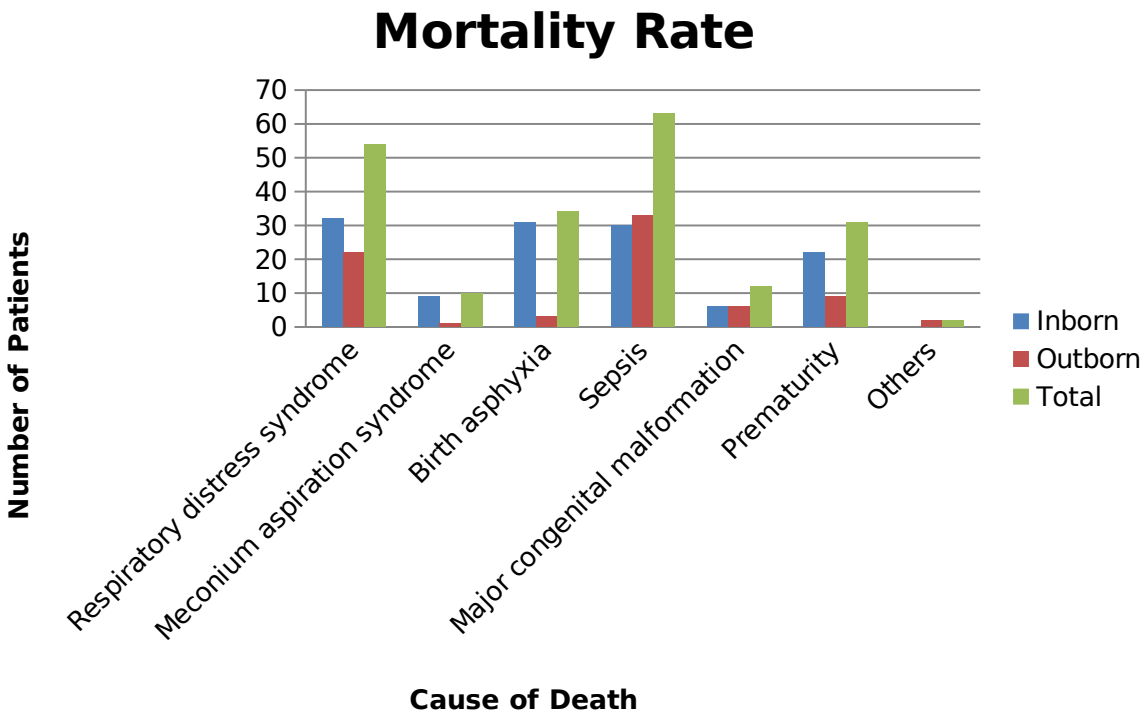

Chart 7: Showing mortality rate according to cause of death

Neonatal age at death shows that only 13.8% of inborn and 9.2% of outborn deaths occurred in the first 24 hours of life, while majority of deaths occurred between 1-6 days of life that is 75.4% in inborn unit and 52.6% in outborn unit(Table/Fig. 8).

Table 8: Showing mortality rate according to age at death

Age at death	Inborn(n=130)	Outborn(n=76)	Total(n=206)
<1day	18(13.8)	7(9.2)	25(12.1)
1-6days	98(75.4)	40(52.6)	138(67)
>7days	14(10.8)	29(38.2)	43(20.9)

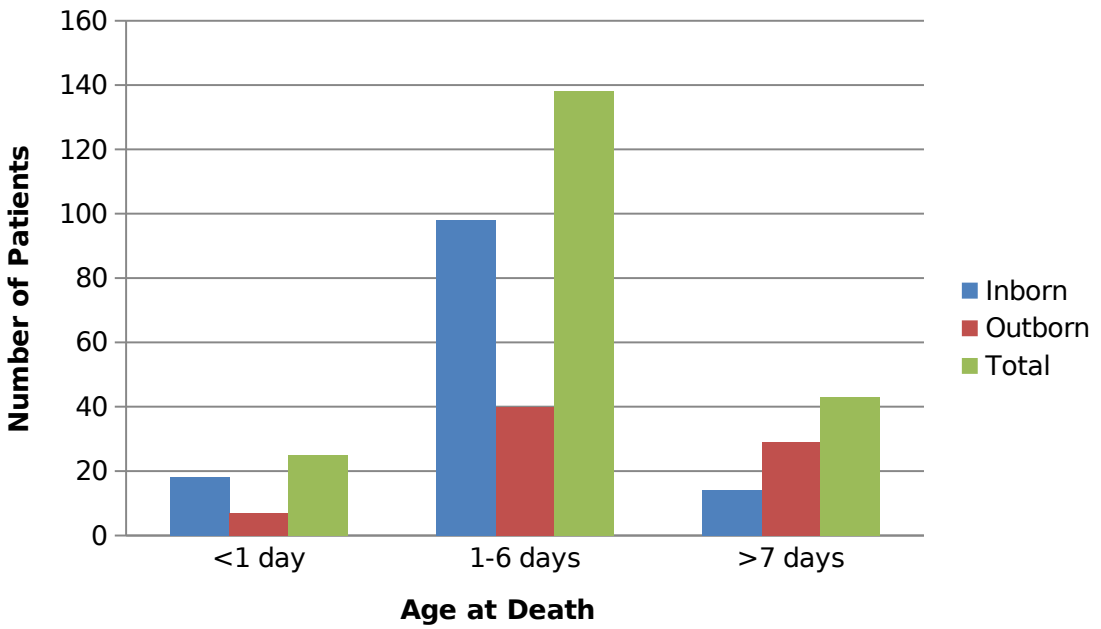

Chart 8: Showing mortality rate according to age at death

Of all neonates who expired in the SCNU, the distribution of birth weight show that 68.5% of inborn and 78.9% of outborn were less than < 2.5kg . The proportional mortality according to birth weight shows that in the inborn babies, mortality in the normal birth weight category is only 12.7% which progressively increases with decreasing weight: LBW: 15.8%, VLBW: 38.0%, ELBW 71.4%). The outborn unit shows 7.4% mortality among normal weight babies, 12.7% in LBW, 45.5% in VLBW and 88.9% in the ELBW category(Table/Fig. 9).

Table 9: Showing proportional mortality rate according to birth weight

Birth weight	Inborn(n=700)	Outborn(n=493)	Total(n=1193)
>2.5kg	41/322(12.7)	16/216(7.4)	57/538(10.6)
1.5-2.5kg	44/278(15.8)	27/213(12.7)	71/491(14.5)
1-1.5kg	30/79(38)	25/55(45.5)	55/134(41.1)
<1kg	15/21(71.4)	8/9(88.9)	23/30(76.7)

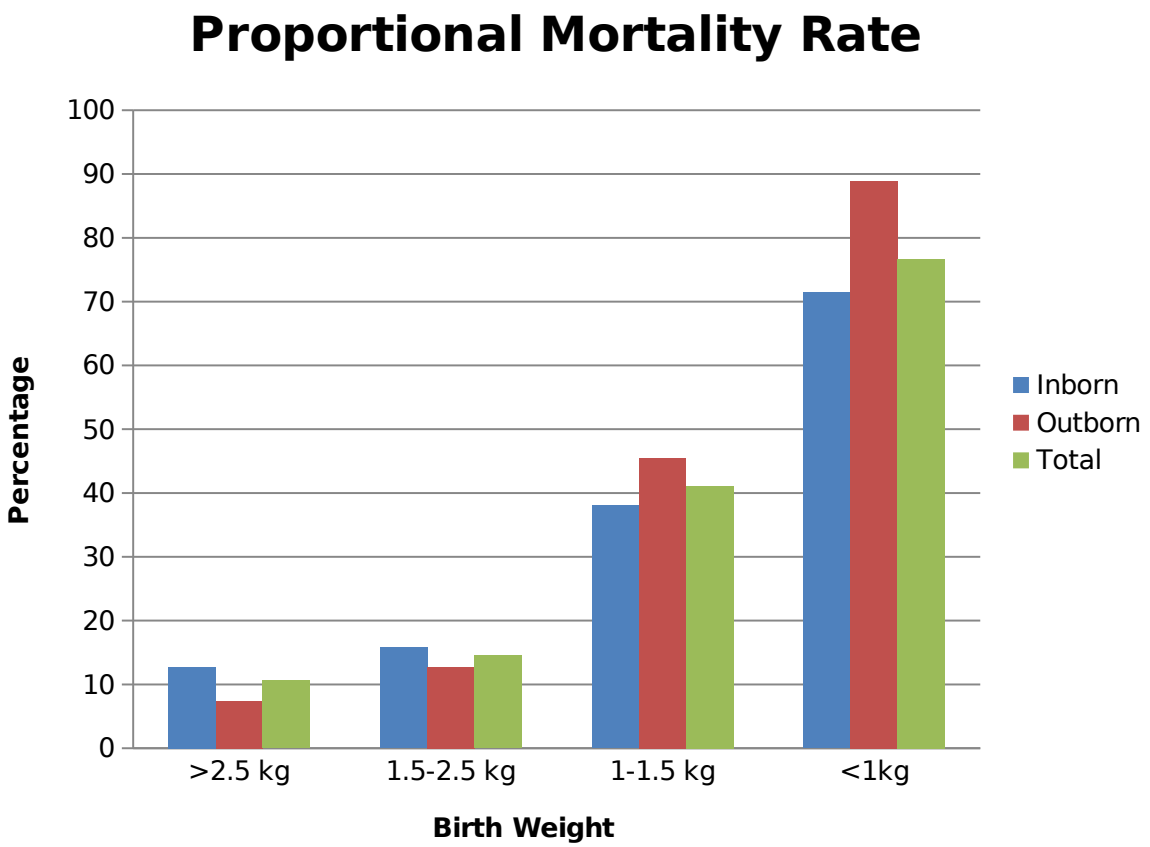

Chart 9: Showing proportional mortality rate according to birth weight

Study of duration between admission and death shows that most of the deaths occurred between 1-3 days of admission (inborn 57.7%, outborn 55.3%). After this period, next maximum deaths in inborn unit occurred in 4-7 days(20.8%) , while in outborn unit, next maximum deaths occurred in >7days(17.1%)(Table/Fig. 10).

Table 10: Showing mortality rate according to Duration between time of admission and death

Duration between time of admission and death	Inborn(n=130)	Outborn(n=76)	Total(n=206)
<1day	18(13.8)	11(14.5)	29(14.1)
1-3days	75(57.7)	42(55.3)	117(56.8)
4-7days	27(20.8)	10(13.2)	37(17.9))
>7days	10(7.7)	13(17.1)	23(11.2)

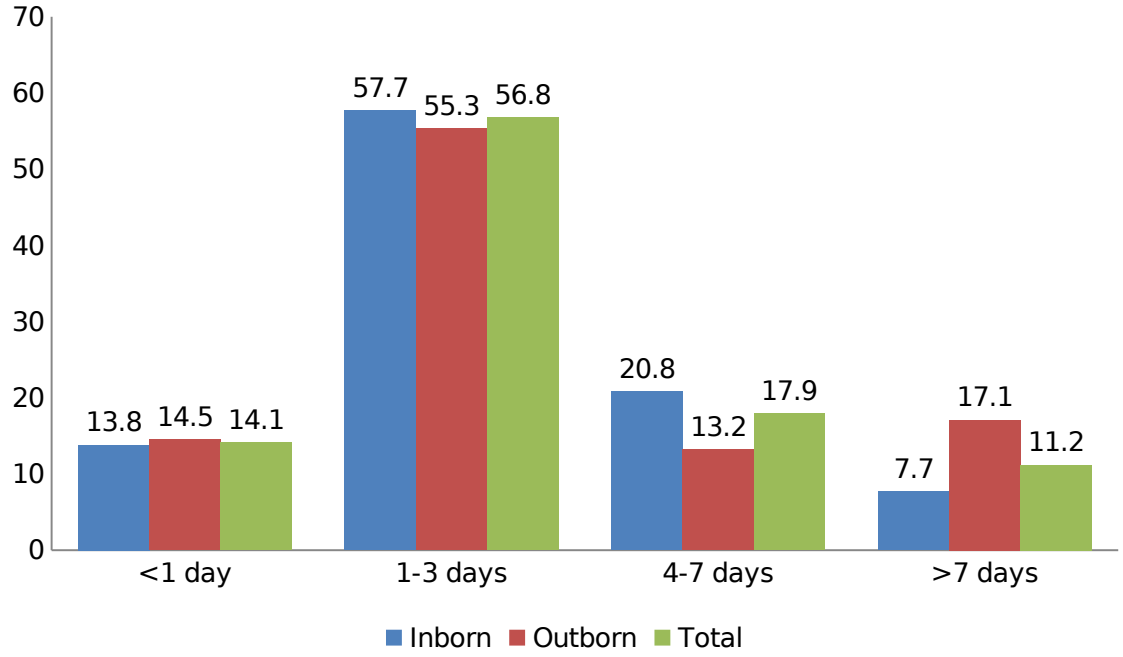

Chart 10: Showing mortality rate according to Duration between time of admission and death

Table 11: Showing mortality rate according to gestational age at birth

Gestational age	Inborn(n=130)	Outborn(n=76)	Total(n=206)
Term	38(29.2)	19(25)	57(27.7)
Preterm	92(70.8)	57(75)	149(72.3)

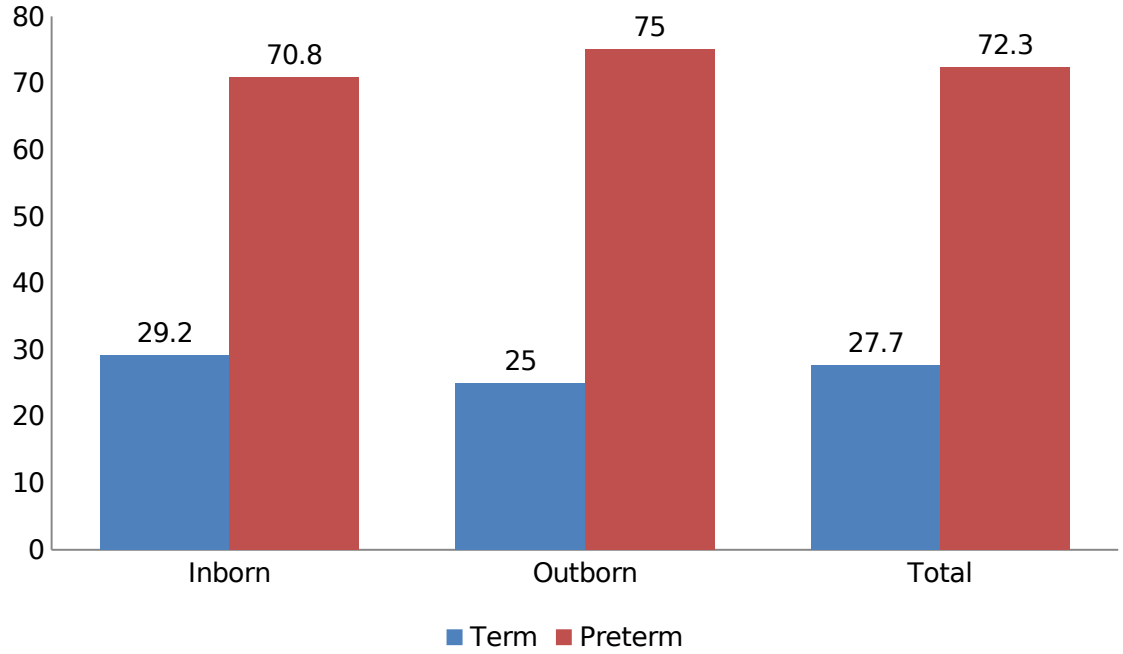

Chart 11: Showing mortality rate according to gestational age at birth

DISCUSSION

The inborn versus outborn admission (58.7%) vs 41.3%) is different that reported by Sridhar et al (71.7% vs 28.3%) [5], and Baruah et al (75.6% vs 24.4%)[6]. This may be attributed to the fact that we included babies born in this institute but admitted at more than 24 hours of life in outborn unit. The overall male female ratio(57.8% male vs 42.1% female) is comparable to that reported by Baruah et al from Assam SCNU(58.4% male vs 41.6% female) [6] and Niruprabha Saharia et al from Gauhati Medical College(male 60%, female 40%)[7] . Male female ratio in inborn unit was 1.5:1, while that in outborn unit was 1.2:1, so the male outnumbered females in both units In inborn unit, the proportional mortality rate among male and female was 18.6 %, while in out born unit the proportional mortality rate among male was 15.6% and female was 15.3%, so there was no significant difference between mortality rate among male and female babies. These results were contradictory to the result observed in a study done by Singh and Haider, where male had higher mortality as compared to female 53.8% versus 46.15%[8].

In this study, LBW comprised 54.9% of the total admissions which is higher than that reported from SCNU Assam (43.2%)[6] and SCNU Mumbai (40%) [9]. The percentage of babies less than 2.5 kgs weight was 54% in inborn unit and 56.2% in outborn unit. The proportional mortality rate increased as the birth weight of baby decreased both in inborn and outborn unit which shows that improved birthweight definitely has positive impact on the survival of babies. The proportional mortality according to birth Weight shows 10.6% mortality in the normal weight category which is higher than that reported by Modi R et al (5.6%)[10] and Baruah et al (4.8%)[6].

In our study the percentage of babies less than 37 week of gestation was 54.1% in inborn and 50.7% in outborn unit, so there is only slight difference between term and preterm admission in both the units with slightly more admission of preterm babies in both the units. Similar results were found in study by Baruah et al(56.5% of inborn and 50.7% of outborn were preterm)[6]. The proportional mortality rate among term baby was 11.8% in inborn and 7.8% in outborn unit, while proportional mortality rate among preterm babies was 24.3% in inborn and 22.8% in outborn unit.. This shows that immaturity has direct correlation with mortality. Study by Baruah et al shows similar results where death among term babies was 3.9% in inborn and 10.4% in outborn, and death among preterm babies was 12.8% in inborn and 18.7% in outborn babies[6]. While study by Malpani et al shows higher proportional mortality rate among term babies(65.2%) vs preterm(25%)[11].

In this study, birth asphyxia was the most common cause of admission followed by prematurity and low birth weight, respiratory distress and NNHB among inborn babies ,while most common indication of admission was NNHB followed by prematurity and low birth weight, respiratory distress and birth asphyxia among outborn babies.

The incidence of sepsis is much higher in the outborn unit (18.1%) compared to inborn (5.9%). While the incidence of sepsis in outborn babies reported by NNPD is more (39.7%) [12]. However, the overall incidence of sepsis in this study (10.9%) is less than that reported from a survey of eight SCNUs across the country by Neogi et al in 2009 (18%)[13]. The incidence of birth asphyxia is much higher in the inborn unit (36.4%) compared to outborn (8.9%); though it is higher than that of the NNPD data (8.3%)[12]. Mani Kant Kumar et al reported 18.2% asphyxia among neonates admitted to a teaching hospital in Bihar[14]. The incidence of neonatal jaundice 13.6% (inborn 6.1%, outborn 24.3%) is in between to that of other studies Neogi et al (18%)[13] and Sridhar et al 7%[5]. The incidence of preterm RDS (5.4%) is lower than that reported by others- Mani Kumar et al (9.7%)[14], Sridhar et al

(23.4%)[5], Rakholia et al (21.9%)[15], but is comparable to that reported by Baruah et al (5.6%)[6]. In our study, average duration of stay was 6.4 days in inborn unit and 5.5 days in outborn unit,. similar results were found in Randad et al (inborn 6.5 days, outborn 7.2 days) [16]. In inborn unit, maximum babies had duration of stay between 4-7 days (36.3%), followed by 1-3 days (31.9%), while in outborn unit maximum babies had duration of stay between 1-3 days (46.5%), followed by 4-7 days (25.1%). The mortality data shows higher mortality in inborn (18.6%) compared to outborn (15.4%). The overall mortality of the SCNU (17.3%) is higher than that reported by Sridhar et al (7.2%)[5] and Gauhati Medical College (13%)[7].

In our study, sepsis(30.6%) was the leading cause of death followed by Respiratory Distress Syndrome(26.2%), birth asphyxia(16.5%) and prematurity(15.1%). The outborn sepsis mortality (43.4%) is higher than inborn (23.1%) which is similar to that of NNPD (inborn 18.6% vs outborn 37.6%)[12]. Birth asphyxia is responsible for 23.8% of deaths in inborn compared to 3.9% in the outborn unit. This is higher than that reported by Rakholia et al (inborn 16%, outborn 21.4%)[15] and lower than reported by Baruah et al (inborn 34.3%, outborn 24.2%)[6]. Major congenital malformation is responsible for 5.8% of total deaths which is lower than that of NNPD (7.8%)[12], but higher than reported by Baruah et al (3.5%)[6].

In our study, percentage of deaths within 24 hours of life was 13.8% in inborn and 9.2% in outborn units, while the maximum number of deaths occur during 1-6 of life both in inborn (75.4%) and outborn (52.6%) units. This is contradictory to what the literature says that 40% deaths take place during 1st 24 hours of life[1]. The overall percentage of early neonatal deaths of the SCNU (79.1%) is comparable to national data, SOIN 2014 (72.9%) [17], and Baruah et al (77.5%)[6].

In our study, maximum number of deaths occurred during periods of 1-3 days after admission in inborn babies(57.7%) as well as in outborn babies (55.3%). Similar results were found in studies done by Baruah et al (inborn 53.2%, outborn 54.5%)[6]. Sridhar et al reported majority of deaths at < 1 day (42.3%) followed by 1-3 days of admission (40.2%)[5].

In our study, among inborn babies 72.4 % were successfully discharged, and 4.1% were referred, 4.9% went LAMA and 18.6% died; while among outborn babies 68.8 % were successfully discharged, 7.8% were referred, 8.3% went LAMA and 15.4% died. The overall incidence of LAMA (6.3%) is comparable to that of other studies NNPD 7.5%[12], Rakholia et al 8.3%[15], and Baruah et al 7.5%[6].

CONCLUSION

Sepsis, preterm RDS and Birth asphyxia are the leading causes of mortality in our study. The inborn mortality is slightly higher than the outborn mortality. All the leading causes of mortality in the study are largely preventable. Hence improved perinatal care can significantly reduce the neonatal morbidity and mortality. Setting up of SCNUs in various districts of Madhya Pradesh has significantly reduced neonatal mortality but Since Madhya Pradesh is still leading in case of infant mortality, hence appropriate measures should be taken further to reduce infant and neonatal mortality. Illiteracy, poor socio economic status and delayed referral of pregnant females for institutional deliveries are indirect factors contributing to neonatal mortality. Hence these factors should also be addressed.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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