Burden of disease and survival rate amongst hospitalized newborns in Himalayan region in North India

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ABSTRACT

Objective: To describe the patient population, priority diseases, and outcomes in neonates admitted to neonatal unit in the Himalayan region of North India. **Study Design:** The retrospective study was conducted at a University teaching hospital in Himachal Pradesh, and captured anonymized data on all admissions in newborn unit over 6-year period. **Results:** Total 12449 newborns were admitted, 4669 were outborn, M:F of 1.35:1 and 81% of them were discharged successfully. Overall admissions surged by 76 percent in six years, preterm admissions increased by 41%. During the same period delivery load grew by 24.7%. Majority 64.9% were full-term; 50.4% (6279/12449) of neonates were low birthweight (LBW; <2.5 kg) and 3.8% were Extreme LBW (ELBW; <1.0 kg). Among intramural, out of 20.2% preterm, 1.8% were <28 week; compared to 1.5% <28 week and 14.1% preterm in extramural. The intrauterine growth restriction rate was 17.6% for intramural and 19.3% for extramural, respectively. The most common morbidities were prematurity (40.2% & 27%), jaundice (32.6% & 27.5%), RDS and respiratory problems (19.2% & 9.8%), sepsis (11.3% & 23.5%), and perinatal asphyxia (6.2% and 7.5%) among inborn and outborn respectively. Total 798 (6.4%) newborns died, 10.5% of all deaths happened within 24 hours; mortality was very high amongst ELBW (110/205, 53.7%) and very preterm infants <28 weeks (81/135,60%). Only 993 inborn and 18 outborn received antenatal corticosteroids, with only 383 inborn and 4 outborn receiving four doses of Dexamethasone. Low gestational age, LBW, less of antenatal corticosteroids, outborns, male sex, and congenital deformity were all found to have a significant association with death ($P < 0.001$). **Conclusion:** Preterm accounts for a considerable majority of our total admissions. Greater efforts and investment in better prenatal care, infrastructure, therapeutic facilities, manpower, and periodic training and review of staff nurses are all urgently needed to address the extremely high burden of illnesses and mortality among hospitalized newborns; otherwise, lowering the NMR will remain an unattainable goal.

Keywords: Infant, mortality, newborn unit, premature, very low birth weight

Introduction

Globally, neonatal deaths are the highest contributors to infant and under-5 mortality rate, most newborn deaths occur in low middle-income countries, including Africa and South Asia.[1] The Lancet Series 2005 was crucial in bringing attention to initiatives that help impoverished countries improve newborn survival rates.[2] RMNCH + A strategy by NHM emphasizes on continuum of care and life cycle approach.[3] In this context, facility-based newborn care (FBNC) at various levels plays an important role in bolstering newborn care.[4,5] With a target of fewer than ten neonatal deaths per 1000 livebirths by 2030, India Newborn Action Plan was launched in 2014[6] and Special newborn care units (SNCU) were established in all districts to strengthen care of sick, premature, and low birth weight newborn.[4]

In the context of Himachal Pradesh, a north Indian Himalayan state, SRS data from 2014,2015,2016,2017 showed a downward trend in NMR from 25,19,16,14 respectively.[7] However, the rate of decline has been moderate, lagging behind that of infants and

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children under the age of five. Understanding the trends and causes of neonatal deaths and the preventable factors associated with it at smaller geographical subnational level has the potential to decrease newborn mortality, through evidence to inform programs and policies. The current study sought to determine the pattern of neonatal admissions, as well as give data on newborn morbidity and mortality for health planners and care providers since SNCU became functional.

Methods

Overview of Facility based newborn care in Himachal Pradesh

Himachal Pradesh has total population is 70 Lacs with Infant mortality rate (IMR) of 35.[7] An estimated 19% of all live births have low birthweight and 11.2% born preterm.[8] Many among them do not survive even their first day of life. There are 11 Level 2 SNCU in districts, and 2 Level 3 functioning in state Medical colleges.

Study setting

The study was conducted in SNCU at a University teaching hospital and providing tertiary level care in state. Facility provides 24-h admissions and care for both intramural and extramural sick neonates in separate wards. Two consultant pediatricians along with resident doctors/registrars, intern house officers, and one to three staff nurses manage admissions per shift. SNCU has bed capacity of 30, though the bed occupancy remains more than 100%. Care is provided according to National neonatology protocols.[9] Unit has access to temperature-regulated rooms, oxygen through central line as well as cylinders, monitoring devices pulse oximeter and multipara monitors, servo-controlled radiant warmers, infusion pumps for fluids and antibiotics, phototherapy, non-invasive ventilation (i.e. Continuous positive airway pressure) along with facility to ventilate 2 sick newborns at one time, but these are often limited in availability. Resuscitation, exchange transfusion, portable X ray, ultrasound facility and in-house laboratory service are available at all times. Labor room and operation theatre are equipped with radiant warmer and resuscitation equipments. The unit is also used to train doctors and nurses from SNCU of other districts.

Study design, study population and data collection

This was a single-center, retrospective study to investigate causes of neonatal mortality among inborn (born in the study hospital) and outborn (born in other hospitals or home and referred to our SNCU) neonates admitted to newborn unit over a 72-month period between June 2015 and May 2021. After obtaining approval from the Institutional Ethics Committee (IEC), necessary permission was taken from the hospital authorities. Clinical database was extracted from the records available in Facility Based Newborn Care Database of SNCU[10] on a standardized case report form (CRF), and entered in excel sheet. Information was collected on primary admission diagnosis, gestational age, birth weight, mode of delivery, place of delivery (intramural/other facility/home), congenital abnormality, maternal data, outcomes in terms of mortality and

other types of discharges (referral, discharge against medical advice, cure), and duration of stay. Due to retrospective use of anonymized data, informed consent was not deemed necessary.

Data analysis

Categorical variables were presented as frequencies and percentages, continuous data were reported in means and standard deviations (SDs) or median and interquartile ranges (IQRs). Chi-square test was used for association. Statistical analysis was done using EpiInfo software.

Results

Information of all the 12449 neonates admitted to the SNCU from June 2015 to May 2021 was retrieved, M:F ratio of 1.35:1. The outcome was categorized as successfully discharged, referred to higher centers, LAMA, and died. Maternal data are mentioned in [Table 1]. The analysis found that 81% were discharged successfully during the course of management. The study had not explored the reasons behind the LAMA and referred to higher centers, neither analyzed them.

Birth weight and gestation of SNCU admissions

As is the protocol of unit, the birth weight was measured by electronic weighing scale with discrimination of ± 5 grams, and gestation age assessment was done by last menstrual period (LMP), where LMP not known, new Ballard scoring was done within 24 hours of admission. During the six years of SNCU service 7780 inborn and 4669 outborn were admitted. [Table 2] A total of 6279 (50.4%) of admissions were low birth weight (LBW <2.5 kg); among inborn 51.6% LBW, 14.4% admissions were very low birth weight (VLBW <1.5 kg) and 2.6% extremely low birth weight (ELBW <1 kg). During the same time period, a total of 48.4% of outborn neonates were LBW (according to the admission weight), including 10.2% VLBW and 1.2% ELBW. Gestation wise 64.9% were term newborn. Among inborns, out of 20.2% preterm, 1.8% were below 28 weeks gestation. Among outborn, 14.1% were preterm, 1.5% were extremely preterm less than 28 weeks. The intrauterine growth restriction was quite high; 17.6% among inborn, and 19.3% among outborn.

Total 40941 deliveries happened in the hospital during the study period, with an increase of 24.7% from 5656 to 7545 during year 2015 to year 2021. The total admissions also increased by 76% over these 6 years. The total inborn admission rate increased from 15% (of total live births) in 2015 to 25% in 2021. (Supplementary digital material Appendix A). Preterm admission rate increased from 608 to 858, an increase of 41%, this increase was more for inborn (59%) vs only 3.5% for outborn. The outborn admissions decreased during the COVID period in year 2020-21.

Diagnosis at admission

Prematurity (40.2%), jaundice (32.6%), RDS and respiratory problems (19.2%), sepsis (11.3%) either culture proved or

suspected, and perinatal asphyxia (6.2%) were the most common inborn conditions [Figure 1]. The major diagnosis among outborn admission was jaundice (27.5%), prematurity (27%), sepsis (23.5%), RDS and respiratory complications (9.8%), and perinatal asphyxia (7.5%). Congenital malformations were observed in 84 inborn and 130 outborn including neural tube defect, digestive tract obstruction, anal-imperforation, congenital heart disease, and Down syndrome.

Causes of neonatal mortality

During the six-year period, there were 798 deaths (6.4%), with 445 and 353 deaths among inborn and outborn neonates, respectively. (Supplementary digital material Appendix B & C) 10.5 percent of all deaths occurred within 24 hours of admission, with another 0.8 percent occurring within the next three days. The main causes were preterm births and their consequences, sepsis, birth asphyxia, and congenital defect [Table 3]. Males and outborns had greater death rates, which did not decrease over time. Survival has improved among those who weigh more than 2.5 kg, has remained stable among those who weigh 1500-2499 grams, and has increased among those who have a very low birth weight. At our SNCU, mortality among premature babies under 32 weeks has increased [Figure 2]. Antenatal corticosteroids (ANCS) usage below 34 weeks gestation was less, only 993 (63%) inborn and 18 (2.7%) of outborn received any dose, among them only 383 inborn and 4 outborn had received the entire course of four doses of Dexamethasone recommended by the Ministry of Health and Family Welfare to the Indian government [Table 1].[11]

Neonatal mortality and associated factors

In the SNCU, newborn mortality among inborn admissions remained from 9 to 11 per 1000 live births, but during COVID periods, it rose to 16 per 1000 live births [Table 4]. Low gestational age, LBW, less of antenatal corticosteroids, outborns, male sex, and congenital deformity were all found to have a significant association with death ($P < 0.001$) [Table 5]. The majority of ELBW (55.9%) died.

Discussion

Governments at all levels have been paying attention to and focusing on newborn health. Various interventional programs have been launched by the WHO, UNICEF, government of India and state governments to lower perinatal and neonatal mortality rates. We, as the state's leading tertiary health institute planned this study as the largest inpatient neonatal audit from the Himalayan region of North India. The discovered baseline data patterns will assist us in finding gaps and barriers in achieving SDG goal on NMR and help us in developing a newborn health roadmap.

Table 1: Maternal data		
Total admissions	Inborn 7780	Outborn 4669
Age in years		
>35	352	101
31-35	1019	495
26-30	2994	1660
22-25	2337	1700
18-21	1071	705
<18	7	8
Weight in kg at Admission to labour room		
<45	31	42
45-50	586	390
>50-55	1959	962
>55-60	2609	1606
>60	2595	1600
Birth Spacing in Years		
>3	2370	1190
>2-3	1926	1047
1-2	1956	1345
<1	1528	1087
Birth outcome for Birth spacing <1 year		
<1000	291	203
1000-1499	307	214
1500-1999	290	310
2000-2499	316	228
≥2500	324	132
Antenatal Corticosteroids (ANCS) received		
Total <34 week admissions	1574	658
No history/not given	199	636
Received 4 Dose	382	4
Received<4 dose	993	18
Type of Delivery		
Assisted Vaginal	1268	46
Caesarean	3132	536
Normal Vaginal	3380	4087
Maternal Anemia		
Hb 9-11 gm %	4711	1900
HB 7-9 gm %	2399	370
Hb <7 gm %	128	169
Unbooked, Hb not known	542	2230
Maternal Education		
Graduate and above	2101	1278
Senior secondary	4789	2876
Matriculate	768	456
Illiterate	122	59
Antenatal Check-up visits		
>3	6219	4189
<3	1216	401
Nil	345	79
Gestational Diabetes	471	279
PIH	350	211
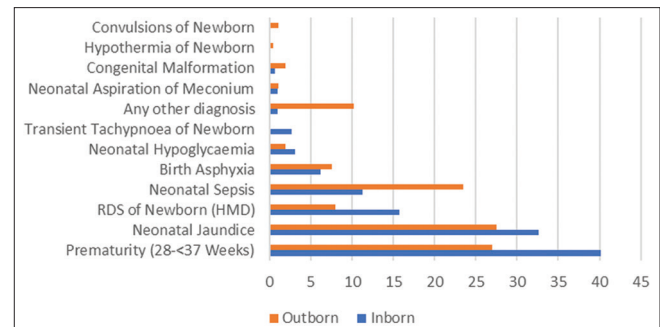
Figure 1: Admission diagnosis

Table 2: Admission and mortality data during study period

	2015-2021		
	Total, *n* (%)	Inborn, *n* (%)	Outborn, *n* (%)
Total Admissions	12449	7780 (62.5)	4669 (37.5)
Male	7158 (57.5)	4319 (55.5)	2839 (60.8)
Female	5284 (42.5)	3454 (44.5)	1830 (39.2)
Total deaths	798 (6.4)	445 (5.7)	353 (7.6)
Male	494 (62)	266 (6.1)	228 (8)
Female	303 (38)	179 (5.2)	124 (6.8)
Total LAMA	822	398	424
Total Referral	700	354	346
Admission by birth weight			
>2500 gram	6170 (49.5)	3761 (48.3)	2409 (51.6)
1500-2499	4676 (37.5)	2894 (37.3)	1782 (38.2)
1000-1499	1338 (10.7)	920 (11.8)	418 (9)
<1000	265 (2.1)	205 (2.6)	60 (1.2)
Death by Birth weight			
>2500 gram	163 (2.6)	52 (1.4)	111 (4.6)
1500-2499	239 (6.3)	108 (3.7)	131 (7.4)
1000-1499	262 (19.6)	175 (19)	87 (20.8)
<1000	134 (50.6)	110 (53.7)	24 (40)
Admission by Gestation			
>37 week	8074 (64.9)	4650 (59.8)	3424 (73.3)
34-37	2143 (17.2)	1556 (20)	587 (12.6)
32-<34	1154 (9.3)	792 (10.2)	362 (7.8)
28-<32	874 (7)	647 (8.2)	227 (4.8)
<28	204 (1.6)	135 (1.8)	69 (1.5)
Death by Gestation			
>37 week	270 (3.3)	77 (1.7)	193 (5.7)
34-37	85 (4)	59 (3.8)	26 (4.4)
32-<34	109 (9.4)	57 (7.2)	52 (14.4)
28-<32	220 (25)	171 (26.6)	49 (21.6)
<28	114 (55.9)	81 (60)	33 (47.8)

Table 3: Cause of newborn mortality among total admissions

Cause of Death	Inborn	Outborn
Prematurity and complications	190	102
Sepsis	104	115
Birth Asphyxia	80	56
Any Other	35	66
Congenital Malformation	31	2
Meconium Aspiration Syndrome	5	12

Table 4: Newborn Mortality rate among Inborns

	Total Live births	Total inborn deaths	NMR/1000 live births
2015-21	40827	445	11
2015-16	5565	45	8
2016-17	6561	56	9
2017-18	6740	63	9
2018-19	6768	73	11
2019-20	7647	84	11
2020-21	7546	124	16

Over the study years from June 2015 till May 2021, our research found a 76 percent increase in total admissions, with a male
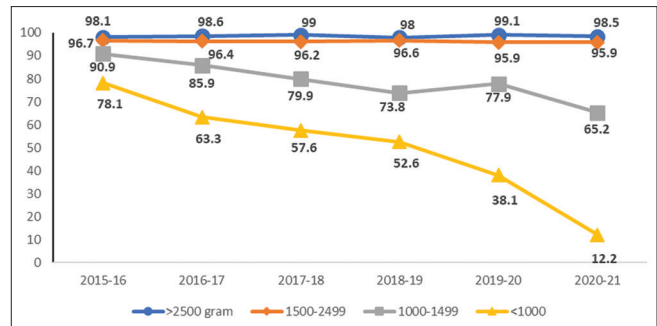

Figure 2: SNCU survival across different weights over study time period

majority. Sixty-two percent of overall admissions were inborn and 37.5 percent were outborn, which is consistent with previous findings from India by Randad *et al.* and Deepeshwara *et al.*[12,13] Few studies even have found outborn neonates outnumber inborn admissions in India.[14,15] In Himachal Pradesh, community has more faith and access to the public hospitals, state also outperforms the rest of India in terms of health and education.[16] According to the NFHS-5 survey data, institutional births account for 88.2 percent of all births, and women of reproductive age have a literacy rate of 91.7 percent.[8,17] Increase admissions may also be due to promotion of institutional deliveries through FBNC, JSSK and JSY under NHM, and incentivizing ASHA workers to promote institutional and safe outcome deliveries. Higher male admissions need to be explored and investigated whether this is attributable to gender bias and Indians' higher attention and desire for male kids.

In keeping with global trends, the rate of preterm admission has also increased by 41% throughout this time period.[18] Prematurity has become a major cause of neonatal hospitalizations, death, and morbidity, prompting the globe to observe World Prematurity Day on November 17 each year. Various studies in India, notably the National Neonatal Perinatal Database, have revealed similar conclusions.[9,15,19–21]

Extreme preterm and ELBW neonates had a high mortality rate in our study. Newborn gestational age and birth weight are key factors in determining its chances of survival, healthy growth, and development. With decrease in birth weight and gestational age, newborn mortality increases. Prematurity and low birth weight have been proven in numerous studies to play a significant influence in neonatal death, either directly or indirectly.[2,22–24] Antenatal corticosteroids administration was linked with a quick and substantial fall in mortality, reaching a plateau with a risk reduction of more than 50%. A single dose provided three hours before delivery to infants who did not receive ANS revealed a 26 percent reduction in mortality.[25] The majority of preterms in our study missed this critical intervention, which requires immediate attention from authorities.

Neonatal mortality in our study had remained relatively stable over the last five years, with a slight increase in the last year, which can be attributed to a delay in seeking care due to the COVID pandemic, as well as an increased burden of admissions

Table 5: Association of various variables with mortality			
Variables	**Alive**	**Dead**	***P***
Sex			
Male	6664	494	<0.01
Female	4981	303	
Weight at Admission			
>2500	6007	163	<0.01
<2500	5644	635	
1500-2499	4437	239	<0.01
<1500	1207	396	
1000-1499	1076	262	<0.01
<1000	131	134	
Inborn vs Outborn			
Inborn	7335	445	<0.01
Outborn	4316	353	
Congenital Malformation			
CMF +	181	33	<0.01
CMF-	12268	765	
ANCS given			
ANCS + Inborn	954	39	<0.01
ANCS - Inborn	311	270	
ANCS+	949	62	<0.01
ANCS -	837	381	
Gestation age			
≥37 POG	7804	270	<0.01
<37 POG	3847	528	
≤28 POG	90	204	<0.01
>28 POG	12245	684	

to our hospital as many peripheral hospitals were converted into exclusive COVID care facilities. However, a relatively flat curve for the rest of the previous year's clearly indicates that we need to make significant efforts if we want to reduce our neonatal mortality rate further, which would include undertaking Quality Improvement-based studies and strengthening our infrastructure to deal with prematurity and low birth weight babies. The first 24 hours of life account for 25% to 45 percent of newborn fatalities worldwide.[2,24] Our research found that 10.5 percent of deaths occur within the first 24 h of life, with the highest percentage of deaths occurring within the first three days.

Prematurity, sepsis and birth asphyxia were the leading causes of death in our nursery. Several other investigations including national neonatal perinatal database have found similar results.[9,13,15,23,24] However in developed countries, where sepsis is better controlled, extreme prematurity-related conditions and congenital malformations are the main mortality causes.[26]

Our study's strength is that it is the first of its kind in the Himalayan region, with a large number of participants, both intramural and extramural and hence a complete reflection of the problem in the community as a whole, whose causes of death would undoubtedly aid policymakers in supporting SNCU across the state with better infrastructure and policies to reduce NMR after detecting bottle necks in management gaps including a dearth of competent staff nurses recommended for sick and small neonates. However, because it is a single-center retrospective study, there are limitations in the data retrieved from online case files, where information is occasionally absent. It solely looked at the major cause of death, ignoring other factors that affect mortality. Neonates who underwent LAMA and those who were referred to other institutions were omitted from the study, which may have influenced the findings. We also couldn't track down discharges to see if there was any ongoing morbidity.

Conclusion

Our findings show that there is a lot of space for improvement in our condition, with prematurity, birth asphyxia, and infection being the leading causes of mortality. All of these issues appeared to be avoidable. Preterm infants make up a large percentage of all newborn admissions in our tertiary care center SNCU. Without better prenatal care, lowering the NMR and thus the infant mortality rate will remain an unaccomplished dream. The need of the hour is for the improved infrastructure, therapeutic facilities, manpower, and periodic training and review of the staff nurses. The goal of this study was to learn about recent neonatal morbidity and mortality patterns in SNCUs so that these common illnesses might be prioritized in government neonatal health plans and facility-based intervention packages developed. In Himachal Pradesh, where the NMR is 14 per 1000 live births,[7] putting in place appropriate measures and enhanced services during the prenatal, intrapartum, and postpartum periods will be beneficial. Also, it would be more reasonable to do a multi SNCU prospective study to provide a fuller picture of newborn care in the country.

Key points

1. Neonatal deaths are the leading cause of infant and under-5 mortality worldwide.
2. The India Newborn Action Plan was launched in 2014 with a goal of fewer than ten newborn deaths per 1000 livebirths by 2030.
3. Special newborn care units (SNCU) are established in all districts to strengthen care of sick, premature, and low birth weight newborn.
4. Preterm babies account for a significant portion of all newborn admissions to our SNCU. Lowering the infant mortality rate will remain an unfulfilled idea without better prenatal care.
5. With avoidable causes like prematurity, birth asphyxia, and sepsis as the top causes of newborn deaths, there is a lot of room for improvement in our situation.
6. Improvement of infrastructure, treatment facilities, manpower, and regular training and review of staff nurses are all urgently needed.

Key message

Understanding the trends and causes of neonatal fatalities, as well as the preventive variables associated with them, at a smaller geographical subnational level offers the potential to reduce newborn mortality by informing programs and policies with evidence.

Novelty

This was a 72-month period retrospective study that looked into the causes of neonatal mortality among inborn (born in the study hospital) and outborn (born in other hospitals or at home and referred to our SNCU) neonates hospitalized to the newborn unit between June 2015 and May 2021. It is the first of its kind in the resource limited setting, with a large number of participants, and thus a complete reflection of the problem in the community as a whole, since SNCU have become operational. The study findings highlighted the trend of neonatal admissions as well as offer statistics on infant morbidity and mortality for health planners and care providers. Findings would undoubtedly aid policymakers in supporting SNCU across the country with better infrastructure and policies to reduce NMR after detecting bottlenecks in management gaps, such as a shortage of competent staff nurses, infrastructure of treatment facilities, and regular trainings and review.

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Conflicts of interest

There are no conflicts of interest.

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Appendix A: Year-wise admission data in absolute numbers during the study period

	2015-16			2016-17			2017-18			2018-19			2019-20			2020-21		
	Total	Inborn	Outborn	Total	Inborn	Outborn	Total	Inborn	Outborn	Total	Inborn	Outborn	Total	Inborn	Outborn	Total	Inborn	Outborn
Total Admissions	1472	832	640	1781	1038	743	1926	1135	791	2254	1370	884	2419	1511	908	2596	1893	703
Male	905	484	421	1044	596	448	1103	633	470	1260	757	503	1406	822	584	1441	1028	413
Female	567	348	219	737	442	295	822	502	320	995	614	381	1010	686	324	1155	865	290
Admission by Birth weight																		
>2500 gram	392	161	231	764	416	348	939	525	414	1209	699	510	1343	816	527	1523	1144	379
1500-2499	679	396	283	728	422	306	744	443	301	844	530	314	831	517	314	850	586	264
1000-1499	359	243	116	252	170	82	199	134	65	175	122	53	191	136	55	162	115	47
<1000	42	32	10	37	30	7	44	33	11	26	19	7	54	42	12	62	49	13
Admission by Gestation																		
>37 week	864	420	444	1118	572	546	1215	633	582	1531	858	673	1608	929	679	1738	1238	500
34-37	289	200	89	303	219	84	357	255	102	382	277	105	384	266	118	429	340	89
32- <34	164	104	60	203	125	78	184	119	65	195	131	64	199	149	50	209	164	45
28- <32	124	82	42	138	108	30	132	104	28	117	88	29	189	145	44	166	112	54
<28	24	19	5	19	14	5	38	24	14	29	16	13	39	22	17	55	40	15

Appendix B: Year-wise mortality data in Numbers (Percentage) during the study period

	2015-16			2016-17			2017-18			2018-19			2019-20			2020-21		
	Total, n (%)	Inborn n(%)	Outborn n(%)	Total, n(%)	Inborn n(%)	Outborn n(%)	Total, n(%)	Inborn n(%)	Outborn n(%)	Total, n(%)	Inborn n(%)	Outborn n(%)	Total, n(%)	Inborn n(%)	Outborn n(%)	Total, n(%)	Inborn n(%)	Outborn n(%)
Total deaths	87 (5.9)	45 (5.4)	42 (6.6)	134 (7.5)	56 (5.4)	78 (10.5)	113 (5.9)	63 (5.6)	50 (6.3)	148 (6.6)	73 (5.3)	75 (8.5)	132 (5.5)	84 (5.6)	48 (5.3)	184 (7.0)	124 (6.6)	60 (8.5)
Male	60 (6.6)	27 (5.6)	33 (7.8)	87 (8.3)	38 (6.3)	49 (10.9)	74 (6.7)	42 (6.6)	32 (6.8)	90 (7.1)	48 (6.3)	42 (8.3)	78 (5.5)	47 (5.7)	31 (5.3)	106 (7.3)	64 (6.2)	42 (10.1)
Female	27 (4.7)	18 (5.2)	9 (4.1)	47 (6.3)	18 (4.0)	29 (9.8)	39 (4.7)	21 (4.1)	18 (5.6)	58 (5.8)	25 (4.0)	33 (8.6)	54 (5.3)	37 (5.4)	17 (5.2)	78 (6.7)	60 (7.0)	18 (6.2)
Death by Birth weight																		
>2500 gram	18 (4.6)	3 (1.9)	15 (6.5)	26 (3.4)	6 (1.4)	20 (5.7)	24 (2.5)	5 (1)	19 (4.6)	38 (3.1)	14 (2)	24 (4.7)	25 (1.9)	7 (0.9)	18 (3.4)	32 (2.1)	17 (1.5)	15 (4)
1500-2499	24 (3.5)	13 (3.3)	11 (3.9)	41 (5.6)	15 (3.6)	26 (8.5)	35 (4.7)	17 (3.8)	18 (6)	51 (6)	18 (3.4)	33 (10.5)	36 (4.3)	21 (4.1)	15 (4.8)	52 (6.1)	24 (4.1)	28 (10.6)
1000-1499	35 (9.7)	22 (9.1)	13 (11.2)	53 (21)	24 (14.1)	29 (35.4)	37 (18.6)	27 (20.1)	10 (15.4)	47 (26.9)	32 (26.2)	15 (28.3)	41 (21.5)	30 (22.1)	11 (20)	49 (30.2)	40 (34.8)	9 (19.1)
<1000	10 (23.8)	7 (21.9)	3 (30)	14 (37.8)	11 (36.7)	3 (42.9)	17 (38.6)	14 (42.4)	3 (27.3)	12 (46)	9 (47.4)	3 (42.9)	30 (55.5)	26 (61.9)	4 (33.3)	51 (82.2)	43 (87.8)	8 (61.5)
Death by Gestation																		
>37 week	32 (3.7)	10 (2.3)	22 (22.5)	52 (4.6)	9 (1.6)	43 (7.9)	38 (3.1)	8 (1.3)	30 (5.2)	60 (3.9)	19 (2.2)	41 (6.1)	41 (2.5)	12 (1.3)	29 (4.3)	47 (2.7)	19 (1.6)	28 (5.6)
34-37	13 (4.5)	10 (5)	3 (3.4)	17 (5.6)	9 (4.1)	8 (9.5)	11 (3)	8 (3.1)	3 (2.9)	19 (5)	12 (4.3)	7 (6.7)	8 (2)	6 (2.3)	2 (1.7)	17 (4)	14 (4.1)	3 (3.4)
32- <34	13 (7.9)	5 (4.7)	8 (13.3)	30 (14.7)	11 (8.8)	19 (24.4)	20 (10.9)	11 (9.2)	9 (13.8)	20 (10.2)	9 (6.9)	11 (17.2)	9 (4.5)	8 (5.4)	1 (2)	17 (8.1)	13 (7.9)	4 (8.9)
28- <32	21 (17)	15 (17.6)	6 (14.3)	29 (21)	23 (21.3)	6 (20)	30 (22.7)	26 (25)	4 (14.3)	34 (29)	26 (29.5)	8 (27.6)	50 (26.4)	40 (27.6)	10 (22.7)	56 (33.7)	41 (36.6)	15 (27.8)
<28	8 (33.3)	5 (26.3)	3 (60)	6 (31.5)	4 (28.6)	2 (40)	14 (36.8)	10 (41.7)	4 (28.6)	15 (51.7)	7 (43.8)	8 (61.5)	24 (61.5)	18 (81.8)	6 (35.3)	47 (85.4)	37 (92.5)	10 (66.7)

Appendix C: Summary of Year-wise mortality data in Percentage of total admissions during the study period						
Time Period	Total	Inborn	Outborn	Inborn Male	Inborn Female	Outborn Male	Outborn Female
2015-16	5.9	5.4	6.6	5.9	5.4	7.8	4.1
2016-17	7.5	5.4	10.5	6.4	4.1	10.9	9.8
2017-18	5.9	5.6	6.3	6.6	4.2	6.8	5.6
2018-19	6.6	5.3	8.5	6.3	4.1	8.3	8.7
2019-20	5.5	5.6	5.3	5.7	5.4	5.3	5.2
2020-21	7.1	6.6	8.5	6.2	6.9	10.2	6.2