

An assessment of admission and outcome trends among neonates admitted in special newborn care unit (SNCU) of Jalgaon, Maharashtra

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Abstract

Background: Children face the highest risk of dying in their first 28 days of life (neonatal period). Simple interventions have been tested and found to be effective in reducing the neonatal mortality. Facility Based Newborn Care (FBNC) has a significant potential for improving newborn survival. SNCU is a neonatal unit in the vicinity of labor room which is to provide special care (all care except assisted ventilation and major surgery) for sick newborns. **Aims and objectives:** To study the trend of neonatal admissions and their outcomes over a period of 7 years i.e. from the year (2013) of establishment to current year (2019) at SNCU in a district level hospital in Maharashtra. **Materials and method:** The present descriptive observational study with longitudinal design was conducted in the Government supported SNCU of District Hospital of Jalgaon District of Maharashtra which included all the neonates admitted in SNCUs from January 2013 to December 2019. The SNCU monthly report which is in a predefined format from Ministry of Health and Family Welfare, Government of India, which includes data on admission information, reasons of admission, course of admission, and mortality reasons (if any) with treatment outcomes was used for data collection. **Result:** It was seen that during the study period (i.e. from January 2013 to December 2019) total 16489 neonates were admitted to the SNCU. During the first year (2013) total 1182 neonates were admitted which went on increasing in subsequent years as 2494, 2916, 2944, 2525, 2078 and 2350 neonates were admitted in the year 2014, 2015, 2016, 2017, 2018 and 2019. Yearwise data shows proportions of males and females were approximately similar with male preponderance in each year. Proportion of outborn neonates went on steadily increasing (26.90% in 2013 to 46.26% in 2019) and that of inborn neonates went on decreasing (73.10% in 2013 to 53.74% in 2019). Yearwise trend shows that more and more (54.65% in 2013 to 68.13% in 2019) LBWs were admitted as compared to NBWs neonates (45.35% in 2013 to 68.13% in 2019). Decreasing trend in the mortality was observed from 2013 to 2019 as neonatal mortality rate went on decreasing. It was recorded 18.75% in 2013, 12.43% in 2014, 11.48% in 2015, 12.59% in 2016, 10.54% in 2017, 4.75% in 2018, and 5.77% in 2019. **Conclusion:** Over a period of 7 years from 2013 to 2019 neonatal mortality went on decreasing including decrease in LBW and preterm neonates.

Key words: SNCU, mortality, low birth weight,

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Received Date: 04/03/2021 Revised Date: 11/04/2021 Accepted Date: 15/05/2021

DOI: <https://doi.org/10.26611/10111822>

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Access this article online	
Quick Response Code:	Website: www.medpulse.in
	Accessed Date: 07 May 2021

Children face the highest risk of dying in their first 28 days of life (neonatal period). At a global rate of 17 (17, 19) deaths per 1,000 live births and approximately 6,700 neonatal deaths every day in 2019, the neonatal period (the first 28 days of life) is the most vulnerable time for children under age 5.¹ Simple interventions have been tested and found to be effective in reducing the neonatal mortality.^{2,3} Estimates have suggested that more than 70% of neonatal mortality can be reduced by existing evidence-based practices, but coverage of these interventions is low and uneven in geographic areas with highest burden of

mortality.^{4,5} Facility Based Newborn Care (FBNC) programme is one of the key initiatives launched by the Government of India under the National Rural Health Mission and RMNCH+A strategic programme to improve the status of newborn health in the country. Under the programme, efforts are being made to provide different level of newborn care at the health facilities. Facility Based Newborn Care (FBNC) has a significant potential for improving newborn survival. Provision of newborn care facilities at various levels at health facilities will not only increase the confidence in the health care delivery system but also increase the coverage of services at the time of greatest risk – birth and the first few days of life – and thus addresses the challenge of bringing down neonatal mortality in the country.⁶ Newborn Care Corner (NBCC), Newborn Stabilization Unit (NBSU) and Special Newborn Care Unit (SNCU) are newborn care facilities at MCH level I (PHC/SC), MCH level II (CHC/FRU) and MCH level III (District hospital/Medical College/tertiary care hospital) respectively. SNCU is a neonatal unit in the vicinity of labour room which is to provide special care (all care except assisted ventilation and major surgery) for sick newborns. As FBNC including SNCU is relatively new implementation for neonatal survival and neonatal health, operational research in this arena are very less till date. Though various studies documenting admission and mortality profile of neonates admitted in SNCU are conducted, very few studies revealing yearwise trend neonatal admissions and their outcomes in SNCU are carried out in India. Therefore, this study was designed with the objective to assess the trend of neonatal admissions and their outcomes over a period of 7 years i.e. from the year (2013) of establishment to current year (2019) at SNCU in a district level hospital in Maharashtra. This study will provide trend of neonatal admissions and their outcomes over a period of 7 years i.e. from the year (2013) of establishment to current year (2019) at SNCU which will highlight achievement as well as scope of improvement in care of newborn at SNCU.

Aims and objectives: To study the trend of neonatal admissions and their outcomes over a period of 7 years i.e. from the year (2013) of establishment to current year (2019) at SNCU in a district level hospital in Maharashtra.

MATERIALS AND METHOD

The present descriptive observational study with longitudinal design was conducted in the Government-supported SNCU of District Hospital of Jalgaon District of Maharashtra. The SNCU is a 20 bedded unit and equipped with radiant warmer, phototherapy machines, ventilation facilities. Trained manpower including pediatricians, medical officers, nurses, counselors, data entry operators, supportive staffs, etc. are posted. All services including stay, investigations, treatments are provided free of cost to the admitted neonates. Standard national level guidelines and protocols are practiced for the diagnosis and management of neonates as well as recording and reporting of the information. All the neonates admitted in SNCUs were considered as the study participants. In the present study aggregated yearly data from January 2013 to December 2019 was collected. The source of information was SNCU reports generated from admitted (Indoor cases only) neonates. Permission from the head of institute was obtained before starting the study. Ethical approval was sought from the institutional ethical committee of Government Medical College, Jalgaon. Confidentiality of data was strictly maintained at all levels. The SNCU monthly report is in a predefined format from Ministry of Health and Family Welfare, Government of India, which includes data on admission information, reasons of admission, course of admission, and mortality reasons (if any) with treatment outcomes. It also includes information on gender, birth weights, gestation age, and duration of stay. These participants were categorized into two sections as in-born, who have delivered in same facility and outborn, who have referred from peripheral health facilities or community. The outcomes were classified into four groups viz. Expired (died during the management), Discharged (discharged after successful treatment), LAMA (left against medical advice) and Referred (referred to higher center for further management). The collected data was entered in Microsoft excel and was analysed by using Statistical Package for the Social Sciences (SPSS) version 20 (SPSS-Inc., IBM, USA).

Table 1: Yearwise Distribution of Neonates Admitted in SNCU

Year	No. of Admitted Newborns
2013	1182
2014	2494
2015	2916
2016	2944
2017	2525
2018	2078
2019	2350
Total	16489

It was seen that during the study period (i.e. from January 2013 to December 2019) total 16489 neonates were admitted to the SNCU. During the first year (2013) total 1182 neonates were admitted which went on increasing in subsequent years as 2494, 2916, 2944, 2525, 2078 and 2350 neonates were admitted in the year 2014, 2015, 2016, 2017, 2018 and 2019

Table 2: Genderwise Distribution of Neonates Admitted in SNCU

Year	Male		Female		Total
	No.	%	No.	%	
2013	646	54.65	536	45.35	1182
2014	1374	55.09	1120	44.91	2494
2015	1656	56.79	1260	43.21	2916
2016	1648	55.98	1296	44.02	2944
2017	1429	56.59	1096	43.41	2525
2018	1145	55.10	933	44.90	2078
2019	1290	54.89	1060	45.11	2350
Total	9188	55.72	7301	44.28	16489

Among the total admissions, 55.72% were male neonates while 44.28% were female neonates. Yearwise data shows proportions of males and females were approximately similar with male preponderance in each year.

Table 3: Distribution of Neonates Admitted in SNCU According to Place of Delivery

Year	Inborn		Outborn		Total
	No.	%	No.	%	
2013	864	73.10	318	26.90	1182
2014	1543	61.87	951	38.13	2494
2015	1911	65.53	1005	34.47	2916
2016	1834	62.30	1110	37.70	2944
2017	1515	60.00	1010	40.00	2525
2018	965	46.44	1113	53.56	2078
2019	1263	53.74	1087	46.26	2350
Total	9895	60.01	6594	39.99	16489

Out of total 16489 neonates admitted, 9895 (60.01%) were inborn i.e. delivered at same facility where SNCU is situated while 6594 (39.99%) were out-borne delivered at other health facility or at home. Proportion of outborn neonates went on steadily increasing (26.90% in 2013 to 46.26% in 2019) and that of inborn neonates went on decreasing (73.10% in 2013 to 53.74% in 2019).

Table 4: Distribution of Neonates Admitted in SNCU According to Birth Weight

Year	NBW (≥ 2500 gm)		LBW (< 2500 gm)		Total
	No.	%	No.	%	
2013	536	45.35	646	54.65	1182
2014	1071	42.94	1423	57.06	2494
2015	1242	42.59	1674	57.41	2916
2016	1238	42.05	1706	57.95	2944
2017	959	37.98	1566	62.02	2525
2018	707	34.02	1371	65.98	2078
2019	749	31.87	1601	68.13	2350
Total	6502	39.43	9987	60.57	16489

Among all admitted newborns, 39.43% had normal birth weight (≥ 2500 gm.) and 60.57% were LBW i.e. low birth weight (< 2500 gm.). Yearwise trend shows that more and more (54.65% in 2013 to 68.13% in 2019) LBWs were admitted as compared to NBWs neonates (45.35% in 2013 to 31.87% in 2019).

Table 5: Distribution of Neonates Admitted in SNCU According to Gestational Age

Year	Term		Preterm		Post Term		Total
	(34 -37 weeks)		(<37 weeks)		(>37 weeks)		
	No.	%	No.	%	No.	%	
2013	888	75.13	291	24.62	3	0.25	1182
2014	1811	72.61	683	27.39	0	0.00	2494
2015	2147	73.63	710	24.35	59	2.02	2916
2016	1241	42.15	722	24.52	982	33.36	2944
2017	1399	55.41	763	30.22	363	14.38	2525

2018	1179	56.74	706	33.97	193	9.29	2078
2019	1255	53.40	799	34.00	296	12.60	2350
Total	9920	60.16	4674	28.34	1896	11.50	16489

It was found that among the total SNCU admissions, 31.31% neonates were preterm while only 0.02% were post term, rest 68.67% were full term. Among the preterm, 19.16% and 8.59% neonates had gestational age 32 to 36 weeks and 28 to 32 respectively. Proportion of preterm neonates was 24.62% in the year 2013 which went on increasing in subsequent years and proportion of term neonates was 75.13% in the year 2013 which went on decreasing in subsequent years.

Table 6: Distribution of Neonates Admitted in SNCU According Outcomes

Year	Ref		LAMA		Expired		Discharge		Total
	No	%	No	%	No	%	No	%	
2013	56	4.79	57	4.88	219	18.75	836	71.58	1168
2014	37	1.49	166	6.68	309	12.43	1973	79.40	2485
2015	11	0.38	174	5.98	334	11.48	2390	82.16	2909
2016	8	0.28	133	4.66	359	12.59	2352	82.47	2852
2017	80	3.18	171	6.80	265	10.54	1999	79.48	2515
2018	221	10.59	149	7.14	99	4.75	1617	77.52	2086
2019	241	10.30	192	8.21	135	5.77	1772	75.73	2340
	654	4.00	1042	6.37	1720	10.52	12939	79.11	16455

Decreasing trend in the mortality was observed from 2013 to 2019 as neonatal mortality rate went on decreasing. It was recorded 18.75% in 2013, 12.43% in 2014, 11.48% in 2015, 12.59% in 2016, 10.54% in 2017, 4.75% in 2018, and 5.77% in 2019.

Table 7: Yearly Neonatal Mortality Rates According to Gender

Year	Male			Female		
	No. Admitted	No. Died	% Died	No. Admitted	No. Died	% Died
2013	645	118	18.29	536	102	19.03
2014	1374	185	13.46	1120	124	11.07
2015	1656	196	11.84	1260	138	10.95
2016	1648	205	12.44	1296	153	11.81
2017	1429	142	9.94	1096	123	11.22
2018	1145	58	5.07	933	41	4.39
2019	1290	78	6.05	1060	57	5.38

Table 8: Yearly Proportional Neonatal Mortality According to Gender

Year	Male		Female		Total
	No.	%	No.	%	
2013	118	53.64	102	46.36	220
2014	185	59.87	124	40.13	309
2015	196	58.68	138	41.32	334
2016	205	57.26	153	42.74	358
2017	142	53.58	123	46.42	265
2018	58	58.59	41	41.41	99
2019	78	57.78	57	42.22	135
Total	982	57.09	738	42.91	1720

Similar reducing trends were observed for mortalities among both male and female neonates as it was 18.29% and 19.53%, 13.46% and 11.07, 11.84% and 11.45, 12.44% and 11.81%, 9.94% and 11.22%, 5.07% and 4.9%, 6.05% and 5.38% in the year 2013, 2014, 2015, 2016, 2017, 2018, and 2019 respectively. Yearly proportional mortality among males and females was somewhat similar with male preponderance.

Table 9: Yearly Neonatal Mortality Rates According to Place of Birth of Neonates

Year	Inborn			Outborn		
	Admitted	No. Died	% Died	Admitted	No. Died	% Died
2013	864	145	16.78	318	74	23.27
2014	1543	153	9.92	951	156	16.40
2015	1911	182	9.52	1005	152	15.12
2016	1834	196	10.69	1110	163	14.68
2017	1515	129	8.51	1010	136	13.47
2018	965	51	5.28	1113	48	4.31
2019	1263	74	5.86	1087	61	5.61

Table 10: Yearly Proportional Neonatal Mortality According to Place of Birth of Neonates

Year	Inborn		Outborn		Total
	No.	%	No.	%	
2013	145	66.21	74	33.79	219
2014	153	49.51	156	50.49	309
2015	182	54.49	152	45.51	334
2016	196	54.60	163	45.40	359
2017	129	48.68	136	51.32	265
2018	51	51.52	48	48.48	99
2019	74	54.81	61	45.19	135
Total	930	54.07	790	45.93	1720

Mortality rate among outborn neonates was observed to be on gradual decline over the period of 6 years from 2013 (23.27%) to 2018 (4.31%) and some increase in 2019 (5.61%). Similar trend was also recorded among the inborn neonates, but except in 2014, reduction was less (16.70%, 9.92%, 9.52%, 10.69%, 8.51%, 5.28% and 5.86% in the year 2013, 2014, 2015, 2016, 2017, 2018 and 2019 respectively) than that among the inborns. Proportional mortality was almost similar (almost half half) among the inborn and outborn neonates in all years except in 2013 (66.21% and 33.79%).

Table 11: Yearly Neonatal Mortality Rates According to Birth Weight of Neonates

Year	NBW (>=2500 gm)			LBW (<2500 gm)		
	Admitted	No. Died	% Died	Admitted	No. Died	% Died
2013	536	53	9.89	646	166	25.70
2014	1071	72	6.72	1423	237	16.65
2015	1242	83	6.68	1674	251	14.99
2016	1238	73	5.90	1706	286	16.76
2017	959	45	4.69	1566	220	14.05
2018	707	11	1.56	1371	88	6.42
2019	749	21	2.80	1601	114	7.12

Table 12: Yearly Proportional Neonatal Mortality According to Birth Weight of Neonates

Year	NBW (>=2500 gm)		LBW (<2500 gm)		Total
	No.	%	No.	%	
2013	53	24.20	166	75.80	219
2014	72	23.30	237	76.70	309
2015	83	24.85	251	75.15	334
2016	73	20.33	286	79.67	359
2017	45	16.98	220	83.02	265
2018	11	11.11	88	88.89	99
2019	21	15.56	114	84.44	135
Total	358	20.81	1362	79.19	1720

Overall neonatal mortality went on decreasing from 18.53% in year 2013 to 4.76% in year 2018 and increased slightly in the year 2019 (5.74%). Similarly mortality among LBWs and NBWs went on consistently decreasing over the period of 6 years from 2013 (25.70% and 9.89%) to 2018 (6.42% and 1.56%) and increased slightly in 2019 (7.12% and 2.80%). Proportional mortality among NBW neonates showed yearly gradual decline from 2013 (24.20%) to 2018 (11.11%) while it among LBW neonates showed yearly gradual increase from 2013 (75.80%) to 2018 (84.44%).

Table 13: Yearly Neonatal Mortality Rates According to Gestational Age of Neonates

Year	Term			Preterm			Post Term		
	Admitted	No. Died	% Died	Admitted	No. Died	% Died	Admitted	No. Died	% Died
2013	888	112	12.61	291	107	36.77	3	0	0.00
2014	1811	128	7.07	683	181	26.50	0	0	0.00
2015	2147	147	6.85	710	187	26.34	59	0	0.00
2016	1241	131	10.56	722	228	31.58	982	1	0.10
2017	1399	85	6.08	763	180	23.59	363	0	0.00
2018	1179	27	2.29	706	72	10.20	193	0	0.00
2019	1255	42	3.35	799	93	11.64	296	0	0.00

Table 14: Yearly Proportional Neonatal Mortality According to Gestational Age of Neonates

Year	Term		Preterm		Post Term		Total
	(34 -37 weeks)		(<37 weeks)		(>37 weeks)		
	No.	%	No.	%	No.	%	
2013	112	51.14	107	48.86	0	0	219
2014	128	41.42	181	58.58	0	0	309
2015	147	44.01	187	55.99	0	0	334
2016	131	36.49	228	63.51	1	0.28	359
2017	85	32.08	180	67.92	0	0	265
2018	27	27.27	72	72.73	0	0	99
2019	42	31.11	93	68.89	0	0	135
Total	672	39.09	1047	60.91	1	0.06	1720

Mortality among term and preterm neonates went on consistently decreasing over the period of 6 years from 2013 (12.61% and 36.77%) to 2018 (2.29% and 10.20%) and increased slightly in 2019 (3.35% and 11.64%). Proportional mortality among term neonates showed yearly gradual decline from 2013 (51.14%) to 2018 (27.27%) while it among preterm neonates showed yearly gradual increase from 2013 (48.86%) to 2018 (72.73%).

DISCUSSION

The present study was conducted in the Government supported SNCU of District Hospital of Jalgaon District of Maharashtra. The SNCU is a 20 bedded unit established in the year 2013 under the Facility Based Newborn Care (FBNC) strategy of Government of India. This SNCU has served 16489 sick neonates over the period of 7 years from 2013 to 2019. Every year almost 2000-2500 neonates, maximum from the same district and some from outside, were admitted and treated accordingly. Every year, comparatively more number of male (approximately 55%) neonates was admitted in SNCU than female (approximately 45%) neonates. This trend was constant in all 7 years from 2013 to 2019. This male preponderance among admitted neonates was also documented by several studies conducted in various parts of India⁷⁻¹⁰ and Nepal.¹¹ Male predominance might be due to higher susceptibility of male gender as well as due to social and cultural situations in India where comparatively male children are given more attention by family members and preferentially brought to the health facilities. Out of all admitted neonates, inborn (60.01%) neonates outnumbered the outborns (39.99%). Over the period of 7 years, proportion of outborn neonates showed the increasing trend as in 2013 it was 26.90% and in 2017 53.56%. It might be due to increased awareness about SNCU care among peripheral health care workers as well as early diagnosis and facilitated referral services for sick newborns at rural and semi urban areas. Yearwise trend shows that more and more (54.65% in 2013 to 68.13% in 2019) LBWs were admitted as compared to NBWs neonates (45.35% in 2013 to 68.13% in 2019). In subsequent years after the establishment of SNCU, the number of referred neonates for SNCU admission must have increased and priority might have given to low birth weight neonates, as they have higher risk of mortality, morbidity and growth retardation. Similar to the yearwise trend of admission of

low birth weight babies, proportion of preterm babies admitted went on increasing (from 24.62% in 2013 to 34.00% in 2019). Just like LBW neonates, pre term neonates also have higher risk of mortality, morbidity and growth retardation. They require special care to catch-up normal growth and development. Hence more preterm neonates might have brought to SNCU and priority was given for their admission. Decreasing trend in the mortality was observed from 2013 to 2019 as neonatal mortality rate went on decreasing (from 18.75% in 2013 to 5.77% in 2019). Government of India published two biyearly reports (April 2011 to March 2013 and April 2013 to March 2015) on "Care of Small and Sick Newborns in SNCUs"^{12,13} Similar decreasing trend of neonatal mortality was also observed among these two reports as neonatal mortality rate reduced from 14% to 10.5% and 16.7% to 12% for India and Maharashtra respectively. Reduction of mortality might be due to improved functioning of SNCUs due to increased availability of budget, trained manpower, essential infrastructures and strict monitoring over the period of time. In line with decrease in overall neonatal mortality, that among both, male and female neonates went on decreasing (from 18.29% and 19.53%, in 2013 to 6.05% and 5.38%) equally. Yearly proportional mortality among males (55-60%) and females (40-45%) was somewhat similar with male preponderance. But this difference was insignificant. UNICEF's evaluation of SNCU over a period of 10 years (2007-2017) had also documented similar decreasing mortality trend among male and female neonates.¹⁴ Mortality rate among both, outborn as well as inborn, neonates was observed to be on gradual decline over the period of 6 years from 2013 (23.27% and 16.78%) to 2019 (5.61% and 5.86%). Thus this decline was more pronounced among outborns than inborns. Except in 2013, yearly proportional mortality among outborn (45-50%) and inborn (50-55%) neonates didn't affected significantly. Government of India published two biyearly

reports (April 2011 to March 2013 and April 2013 to March 2015) on “Care of Small and Sick Newborns in SNCUs”.^{12,13} Similar decreasing trend of mortality of inborn and outborn neonates was also observed among these two reports. Mortality among both LBW (25.70% to 7.12%) and NBW (9.89 to 2.80%) neonates had revealed consistent declining trend from 2013 to 2019. Proportional mortality among NBW neonates showed yearly gradual decline from 2013 (24.20%) to 2018 (11.11%) while it among NBW neonates showed yearly gradual increase from 2013 (75.80%) to 2018 (84.44%). Thus it indicates that mortality among LBW neonates more dramatically decreased than NBW neonates. Comparatively NBW neonates admitted have conditions like congenital malformations which are difficult to manage than LBW neonates admitted who have conditions like infections and respiratory distress which are managed very well at SNCU and decrease the mortality. UNICEF’s evaluation of SNCU over a period of 10 years (2007-2017) had also documented similar decreasing mortality trend among LBW and NBW neonates.¹⁴ Mortality among both LBW (25.70% to 7.12%) and NBW (9.89 to 2.80%) neonates had revealed consistent declining trend from 2013 to 2019. Proportional mortality among NBW neonates showed yearly gradual decline from 2013 (24.20%) to 2018 (11.11%) while it among NBW neonates showed yearly gradual increase from 2013 (75.80%) to 2018 (84.44%). Thus it indicates that mortality among LBW neonates more dramatically decreased than NBW neonates. Comparatively NBW neonates admitted have conditions like congenital malformations which are difficult to manage than LBW neonates admitted who have conditions like infections and respiratory distress which are managed very well at SNCU and decrease the mortality. UNICEF’s evaluation of SNCU over a period of 10 years (2007-2017) had also documented similar decreasing mortality trend among LBW and NBW neonates.¹⁴ Mortality among both, term (12.61% to 3.35%) and preterm (36.77% to 11.77%) neonates had revealed consistent declining trend from 2013 to 2019. Thus decrease in mortality was more pronounced among term than preterm neonates. Proportional mortality among term neonates showed yearly gradual decline from 2013 (51.14%) to 2019 (31.11%) while it among preterm neonates showed yearly gradual increase from 2013 (48.86%) to 2019 (68.89%). Thus it indicates that mortality among term neonates more dramatically decreased than preterm neonates. Comparatively preterm neonates had less chances of survival than term neonates as the fail to catch-up growth. UNICEF’s evaluation of SNCU over a period of 10 years

(2007-2017) had also documented similar decreasing mortality trend among term and preterm neonates.¹⁴

CONCLUSION

Over a period of 7 years from 2013 to 2019 neonatal mortality went on decreasing including decrease in LBW and preterm neonates.

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Source of Support: None Declared
Conflict of Interest: None Declared