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## Characteristics & outcomes of tribal & non-tribal neonates admitted to a special newborn care unit in rural Gujarat, India

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**Background & objectives:** This study aimed to compare the admission characteristics and outcomes of tribal and non-tribal neonates admitted to a level II special newborn care unit (SNCU) in rural Gujarat.

**Methods:** This was a retrospective observational study that looked at all neonates admitted to a high-volume SNCU between 2013 and 2021. A series of quality improvement measures were introduced over the study period. Admission characteristics, such as birth weight, gestational age, gender and outcomes for tribal and non-tribal neonates, were compared.

**Results:** Six thousand nine hundred and ninety neonates [4829 tribal (69.1%) and 2161 (30.9%) non-tribal] were admitted to the SNCU. Tribal neonates had lower mean birth weight (2047 vs. 2311 g,  $P<0.01$ ) and gestational week at birth (35.8 vs. 36.7 weeks,  $P<0.01$ ) compared to non-tribal neonates. Common causes of admissions were neonatal jaundice (1990, 28.4%), low birth weight (1308, 18.7%) and neonatal sepsis (843, 12%). Six hundred and thirty-eight (9.1%) neonates died during the treatment in the SNCU. The odds of death among tribal neonates was similar to non-tribal neonates [adjusted odds ratio: 1.12 (95% confidence interval [CI]: 0.89, 1.42)]. The tribal neonates had significantly higher cause-specific case fatality rate from sepsis [relative risk (RR): 2.18 (95% CI: 1.41, 3.37)], prematurity [RR: 1.98 (95% CI: 1.23, 3.17)] and low birth weight [RR: 1.83 (95% CI: 1.17, 2.85)]. The overall case fatality rate in the SNCU decreased from 18.2 per cent during the year 2013-2014 to 2.1 per cent in the year 2020-2021.

**Interpretation & conclusions:** There was a reduction in the case fatality rate over the study period. Tribal and non-tribal neonates had similar risk of death. Sepsis prevention and management, mechanical respiratory support and timely referral to a higher centre might help further reduction in mortality for these neonates.

**Key words** Neonatal mortality - scheduled tribe - special newborn care unit

Neonatal deaths, defined as deaths occurring in the first 28 days of life, account for 44 per cent of deaths in children under five years of age worldwide, with

99 per cent of them occurring in low- and middle-income countries<sup>1-4</sup>. It is important to look specifically at neonatal mortality in India, as the country accounts

for more than a quarter of neonatal deaths globally<sup>5-7</sup>. Neonates born in rural areas of India are at even higher risk of mortality<sup>6</sup>. In the State of Gujarat, neonatal mortality rate accounts for 58 per cent of the mortality in under-five children<sup>8</sup>. While there has been a decrease in neonate mortality in Gujarat from 30 deaths/1000 live birth in 2011 to 17 in 2019, there is wide variability in this rate across different parts of the State<sup>8</sup>.

Full supportive care for sick neonates is essential to help decrease the neonatal mortality rate in India. The Government of India has promoted special newborn care units (SNCUs) across the country at district and sub district levels to provide round-the-clock care varies to sick neonates. SNCUs are specialized units set up throughout India that provide level II neonatal intensive care for sick newborns in more remote districts where the burden of neonatal deaths is higher<sup>5,9,10</sup>. There are more than 700 SNCUs in India<sup>11</sup>.

Neonates in rural settings and those coming from tribal communities are considered more vulnerable, with neonates born to tribal mothers [Scheduled Tribes (STs)] having a 19 per cent increased risk of neonatal mortality when compared to other social classes<sup>6,12,13</sup>. In this study, it was hypothesized that tribal neonates might have a higher risk of mortality in SNCUs compared to the non-tribal neonates. It was also hypothesized that such higher risk of mortality might be associated with lower birth weight, higher rate of prematurity among tribal neonates as well as social factors related to delay in seeking care to SNCU as well as reluctance for further referral to higher centre. This study aimed to compare admission characteristics and outcomes among neonates admitted to a high-volume SNCU at a tribal block-level hospital in Gujarat, specifically comparing tribal with non-tribal neonates to further understand how to continue to improve neonatal survival. Furthermore, this study aimed to explore whether sociodemographic characteristics, causes of admission, case fatality rate and causes of deaths of tribal neonates were significantly different from that of the non-tribal neonates admitted to a level II SNCU from 2013 to 2021.

### Material & Methods

This was a retrospective observational study conducted based on the secondary data from the SNCU at Kasturba Hospital located in Jhagadia, Bharuch district, Gujarat, India. Ethical approval for the use of data was obtained from the Society for Education Welfare and Action (SEWA) Rural Institutional Ethics

Committee. The data used in this study were primarily collected for monitoring of services within the hospital.

*Study setting:* This study was conducted at Kasturba Hospital, a 250-bed secondary-level health facility that is managed by the voluntary, non-profit organization SEWA Rural. It is located in Jhagadia block in Bharuch district. The population of the Jhagadia block is 1,50,000, and 69 per cent of the population is tribal<sup>14</sup>.

Kasturba Hospital provides medical care to surrounding 2500 villages and serves as a first referral unit. The hospital focuses on serving the underprivileged tribal populations and works to provide free or highly subsidized care to these patients. Within the hospital, there is a 20-bed, level II SNCU. The SNCU is staffed by a paediatrician, trained nursing staff and a team of counsellors and has the capacity to provide supplemental oxygen, intravenous drugs, phototherapy for jaundice, neonatal resuscitation and warmers. Neonates are referred by the paediatrician to a higher centre of care if ventilator support, blood components or surgical care are needed.

*Data source & sample size:* An SNCU digital registry was used as a source of information. Data from the clinical records of all neonates admitted to the SNCU were recorded into the SNCU digital registry by trained data entry operators. For this study, all neonates admitted to the SNCU at Kasturba Hospital from April 1, 2013 to March 31, 2021 were included in the analysis. This time period was chosen since systemic data recording and management through a software started since 2013.

*Variables of interest & statistical analysis:* The records of the SNCU digital registry were analyzed to study variables such as birth weight, gestational age, gender, type of admission, year and length of stay. Tribal neonates were compared with the non-tribal neonates. The tribal population residing in the study area has certain surnames/last names that are exclusive to tribal population and indicative of their tribal status. Therefore, a newborn with these exclusive surnames was marked as tribal for this study. There were four types of outcomes at the end of SNCU stay which included (i) neonate discharged from SNCU, (ii) died during care at SNCU, (iii) referred to higher facilities or (iv) discharged against medical advice (DAMA). Odds ratios were calculated for each of these four outcomes among tribal and non-tribal neonates using

**Table I.** Admission characteristics and outcomes of neonates admitted to the SNCU from 2013 to 2021 (n=6990)

Admission characteristics & outcomes	Total SNCU admissions 2013-2021 (n=6990)	SNCU admissions in 2013-2015 (n=1190)	SNCU admissions in 2015-2017 (n=1495)	SNCU admissions in 2017-2019 (n=1992)	SNCU admissions in 2019-2021 (n=2313)	<i>P</i> value for linear trend*
Mean birth weight in grams ( $\pm$ SD)	2129 (615)	2135 (650)	2031 (632)	2100 (592)	2216 (596)	0.02
Mean gestational age at delivery in wk ( $\pm$ SD)	36.1 (3.3)	35.9 (3.4)	36 (3.3)	35.4 (3.5)	36.8 (3)	<0.01
Gender, female n (%)	3149 (45)	502 (42.2)	683 (45.7)	914 (45.9)	1050 (45.4)	<0.01
Type of admission, n (%)						
Inborn	6027 (86.2)	991 (83.3)	1283 (85.8)	1698 (85.2)	2055 (88.8)	<0.01
Outborn	963 (13.7)	199 (16.7)	212 (14.2)	294 (14.8)	258 (11.2)	<0.01
Caste, n (%)						
Tribal	4829 (69.1)	875 (73.5)	1035 (69.2)	1327 (66.6)	1592 (68.8)	<0.01
Non-tribal	2161 (30.9)	315 (26.5)	460 (30.8)	665 (33.4)	721 (31.2)	<0.01
Primary cause for admission, n (%)						
Birth asphyxia	533 (7.6)	133 (11.2)	121 (8.1)	139 (7)	140 (6.1)	0.24
RDS	606 (8.6)	17 (1.4)	72 (4.8)	102 (5.1)	415 (17.9)	<0.01
Sepsis	843 (12)	334 (28.1)	245 (16.4)	185 (9.3)	79 (3.4)	<0.01
Prematurity	435 (6.2)	246 (20.7)	37 (2.5)	94 (4.7)	58 (2.5)	<0.01
LBW	1308 (18.7)	38 (3.2)	441 (29.5)	403 (20.2)	426 (18.4)	<0.01
Jaundice	1990 (28.4)	232 (19.5)	345 (23.1)	732 (36.7)	681 (29.4)	<0.01
Other causes	1275 (18.2)	190 (16)	234 (15.7)	337 (16.9)	514 (22.2)	<0.01
Outcomes, n (%)						
Discharge alive	5328 (76.2)	832 (69.9)	936 (62.6)	1534 (77)	2026 (87.6)	<0.01
DAMA	439 (6.2)	64 (5.4)	127 (8.5)	128 (6.4)	120 (5.2)	<0.01
Referred to higher centre	585 (8.3)	96 (8.1)	182 (12.2)	194 (9.7)	113 (4.9)	<0.01
Death during admission	639 (9.1)	198 (16.6)	250 (16.7)	136 (6.8)	54 (2.3)	<0.01

\*Significant result indicates non-linear trend over the study period. DAMA, discharge against medical advice; SD, standard deviation; SNCU, special newborn care unit; RDS, respiratory distress syndrome; LBW, low birth weight

multivariate logistic regression adjusting for birth weight, gestational age and type of admission (inborn vs. outborn admission). Cause-specific case fatality rate and the trend of case fatality among tribal and non-tribal neonates were also calculated. Chi-square test was done to assess the linearity of the trend.

## Results

There were 42,288 live births at Kasturba Hospital during the study period of which, 6027 neonates were admitted to the SNCU and were labelled as an 'inborn admission' (immediate referral). An additional 963 neonates were referred and admitted to Kasturba Hospital from other health facilities or from the community (labelled as an 'outborn admission' or 'external referral'). Of the 6990 neonates admitted

during the study period, there were 4829 tribal (69.1%) and 2161 non-tribal (30.9%) neonates. The characteristics of neonates admitted to the SNCU during the study are shown in Table I. There was no significant trend of admission profile and outcomes observed over the study period except for birth asphyxia ( $P=0.24$ ) as cause of admission. The number of admissions in SNCU doubled from 1190 admissions during the first two years to 2313 admissions during the last two years. The tribal neonates had lower birth weight compared with the non-tribal neonates (mean birth weight in grams: 2047 vs. 2311 g,  $P<0.01$ ). The tribal neonates had higher rates of premature birth compared to the non-tribal neonates (35.8 vs. 36.7 weeks,  $P<0.01$ ).

The neonatal outcome at the time of discharge is reported in Table II. Tribal neonates had higher odds of

**Table II.** Outcomes of tribal and non-tribal neonates admitted to the SNCU between 2013 and 2021 (n=6990)

Outcomes	Total tribal and non-tribal frequency, n (%)	Tribal frequency, n (%)	Non-tribal frequency, n (%)	Unadjusted odds ratio (95% CI)	Adjusted odds ratio** (95% CI)
<b>Overall (inborn+outborn) admissions in SNCU</b>					
Total SNCU admissions	6990 (100)	4829 (100)	2161 (100)	-	-
Discharged alive	5328 (76.2)	3703 (76.6)	1625 (75.1)	1.08 (0.96-1.22)	1.57 (1.38-1.79)
DAMA**	439 (6.2)	277 (5.7)	162 (7.4)	0.75 (0.61-0.92)	0.61 (0.50-0.75)
Referred to higher centre	585 (8.3)	340 (7)	245 (11.3)	0.59 (0.49-0.7)	0.58 (0.49-0.69)
Death during admission	638 (9.1)	509 (10.5)	129 (5.9)	1.86 (1.52-2.27)	1.12 (0.89-1.42)
<b>Inborn admissions in SNCU</b>					
Total SNCU admissions	6027 (100)	4041 (100)	1986 (100)	-	-
Discharge alive	4691 (77.8)	3177 (78.6)	1514 (76.2)	1.14 (1.01-1.3)	1.61 (1.4-1.85)
DAMA	342 (5.6)	202 (5)	140 (7)	0.69 (0.56-0.87)	0.59 (0.47-0.74)
Referred to higher centre	518 (8.5)	292 (7.2)	226 (11.4)	0.61 (0.51-0.73)	0.58 (0.48-0.7)
Death during admission	476 (7.8)	370 (9.2)	106 (5.3)	1.78 (1.43-2.23)	1.24 (0.96-1.6)
<b>Outborn admission in SNCU</b>					
Total SNCU admissions	963 (100)	788 (100)	175 (100)	-	-
Discharge alive	637 (66.1)	521 (66.8)	111 (63.4)	1.15 (0.82-1.62)	1.38 (0.95-1.99)
DAMA**	97 (10)	75 (9.5)	22 (12.6)	0.73 (0.44-1.21)	0.68 (0.41-1.14)
Referred to higher centre	67 (6.9)	48 (6.1)	19 (10.9)	0.53 (0.31-0.93)	0.55 (0.31-0.96)
Death during admission	162 (16.8)	139 (17.6)	23 (13.1)	1.42 (0.88-2.28)	1.28 (0.76-2.16)

\*\*Adjusted for birth weight, gestational age and type of admission (inborn-outborn). CI, confidence interval

getting discharged alive [adjusted odds ratio (AOR): 1.57, 95% CI: 1.38, 1.79] compared to non-tribal neonates. However, the tribal neonates had similar odds of death compared to the non-tribal neonates after adjusting for birth weight, gestational age, type of admission and referral status [AOR: 1.12 (95% CI: 0.89, 1.42)]. The tribal neonates were at 42 per cent lesser odds for referral to higher centre compared with the non-tribal neonates in case of a need for tertiary level care (7 vs. 11.3%, AOR: 0.58, 95% CI: 0.49, 0.69). The overall case fatality rate reduced from 18.2 per cent in 2013-2014 to 2.1 per cent in 2020-2021. The case fatality rate improved for both tribal and non-tribal neonates over the study period. The overall referral rate showed a decline over the study period.

The overall causes of death for neonates in the SNCU are reported in Table III. The leading causes of death for the eight-year period were sepsis (117 deaths, 18.3% of all deaths), extremely low birth weight (98 deaths, 15.3%), respiratory distress syndrome (RDS) (93 deaths, 14.5%) and prematurity (93 deaths, 14.5%). Other causes of death were major congenital

malformations, meconium aspiration syndrome and pneumonia.

When comparing mortality in tribal vs. non-tribal participants, the leading causes of death differed. As Table III demonstrates, the leading cause of death in tribal neonates over the study period was sepsis (cause-specific case fatality rate: 24.2 deaths per 1000 tribal admissions). For non-tribal individuals, the leading cause of mortality was RDS (cause-specific case fatality rate: 31 deaths per 1000 tribal admissions). The tribal neonates had significantly higher cause-specific death from sepsis [relative risk (RR): 2.18, 95% CI: 1.41, 3.37], prematurity (RR: 1.98, 95% CI: 1.23, 3.17) and low birth weight (RR: 1.83, 95% CI: 1.17, 2.85) compared to the non-tribal neonates.

## Discussion

This is one of the few studies that examined admission characteristics and outcomes of tribal vs. non-tribal neonates in an SNCU in India<sup>15</sup>. There was a decrease in case fatality rate over eight years in both tribal and non-tribal neonates in the context of an increasing patient volume. Adjusted case fatality rate



**Table III.** Cause-specific case fatality rate comparing tribal and non-tribal neonates in the SNCU between 2013 and 2021

Cause of death	Number of neonatal deaths in 4829 tribal admissions	Cause-specific case fatality rate per 1000 tribal admissions	Number of neonatal deaths in 2169 non-tribal admissions	Cause-specific case fatality rate per 1000 non-tribal admissions	RR (95% CI)
Sepsis	117	24.2	24	11.1	2.18 (1.41-3.37)
Birth asphyxia	69	14.3	20	9.3	1.54 (0.94-2.53)
RDS	93	19.3	31	14.3	1.34 (0.89-2.01)
Prematurity	93	19.3	21	9.7	1.98 (1.23-3.17)
Extreme LBW (<1000 g)	98	20.3	24	11.1	1.83 (1.17-2.85)
Other causes	39	8.1	9	4.2	1.94 (0.94-3.99)
RR, relative risk					

among the tribal neonates was similar to that in non-tribal neonates.

The case fatality rate for the last few years was less than the reported mortality rate for SNCUs in India for 2013-2015, which was 10.5 per cent<sup>9</sup>. It was also less than the overall mortality rate for SNCUs in the State of Gujarat, which was reported as 19 per cent from 2013 to 2015<sup>9</sup>. The causes of death in newborns in the SNCU at Kasturba Hospital were similar to those listed in studies of neonatal mortality in other SNCUs in India where studies have shown the main causes of death being sepsis/pneumonia, birth asphyxia, prematurity and respiratory problems<sup>6,7,16-24</sup>. These causes of mortality are also similar to other SNCUs throughout Gujarat, where analyses revealed the main causes of death being prematurity-related complications, birth-related complications and infections leading to sepsis and pneumonia<sup>8,9</sup>. A similar study of government SNCUs in Gujarat reported RDS (23%), sepsis (21%), prematurity (17%) and perinatal asphyxia (16%) as leading causes of neonatal deaths<sup>8</sup>. A report on all SNCUs in India reported complications of prematurity (336%), perinatal asphyxia (32%) and sepsis (18%) as major contributors for death<sup>9</sup>.

Over the last few years, a variety of quality improvement interventions were introduced at SNCUs. The infrastructure at the study-SNCU was expanded from 13 beds to 20 beds in 2017 to comply with infection control guidelines. Protocols were developed and regularly used for infection control since 2013. This includes having separate septic and non-septic rooms as well as hand washing stations. Cultures from various surfaces were taken and monitored on a regular basis by an infection control committee. Every newborn was screened for sepsis through the use of serum C reaction protein (CRP) and complete blood count. In

case of high CRP or total count, timely antibiotics were administered to treat sepsis as per recommendation from the paediatrician. Surfactant therapy was started. Use of inotropic agent to increase the blood pressure of neonates was started in case of hypotension and shock. Continuous positive airway pressure was initiated during the study period to provide respiratory support among selected cases. Paediatricians having special training in managing critical neonatal cases in SNCU setting were available since 2017. A dedicated cadre of nurses working only in SNCU was developed since 2017. The number of full-time nursing staff doubled. Nurses were trained to implement various clinical care as well as infection control protocols and also to conduct counselling sessions to strengthen kangaroo care with mothers since 2013. The leadership and nursing staff was motivated to improve outcomes by showcasing a dashboard consisting of neonatal outcomes in a publicly visible location and the outcomes were regularly tracked through a technology-based registry since 2013. For neonates requiring higher centre of care, strong referral linkages were established in 2017. The aforementioned quality improvement activities were implemented in an incremental way over the study period.

There was a higher case fatality rate in tribal neonates compared to non-tribal neonates as per unadjusted analysis; however, this difference did not persist after adjusting for confounders such as birth weight, gestational age, type of admission and referral status. The tribal neonates were noted to have a lower birth weight at admission and younger gestational age when compared to non-tribal neonates. This fact highlights the need to improve birth weight and reduce premature deliveries among tribal women. However, the referral rate among tribal neonates was lower than the

non-tribal neonates. Many tribal families were reluctant to get referred to cities for a variety of socioeconomic reasons and many eventually decided to continue care at secondary-level SNCU at Kasturba Hospital despite associated risks. In addition, families are advised for referral to a higher centre when neonates require care from a tertiary level SNCU (where respiratory support like ventilators as well as portable imaging and surgical care) irrespective of caste.

There are a few limitations of this study. This study is based on only one SNCU located in a first referral unit in a predominantly tribal area. The characteristics of neonatal admissions in other SNCUs in tribal and rural areas might be similar to SNCU at SEWA Rural. However, the findings might not be generalizable to other SNCUs located in non-tribal-rural areas or urban areas. The main objective of this study was to compare mortality between tribal and non-tribal neonates and not to study the effectiveness of the intervention that would require an experimental study design. As this study looked at outcomes over an eight-year period, there were many changes in doctors and there could be minor discrepancies in how diagnoses and causes of mortality were documented over time.

There are important implications for practice and research based on our results. The Kasturba Hospital has successfully managed to reduce case fatality despite an increase in the number of neonates. The evidence-based practices implemented here are worth implementing at other SNCUs that cater to a high volume of neonates. When looking at the next steps to help decrease mortality at the Kasturba Hospital, respiratory management is an important area of focus as RDS was the leading cause of death in the unit. The use of invasive ventilator support in addition to optimal surfactant therapy could help decrease mortality from RDS in the unit and is an option that could be explored<sup>14</sup>. Interventions to reduce prematurity and low birth weight are urgently required. More studies on the admission characteristics and outcomes of sick neonates in other tribal communities are needed to continue to learn how to best serve these patients and communities.

In conclusion, overall, the tribal neonates were noted to have lower birth weight and gestational age at birth but similar adjusted risk of death compared to non-tribal neonates. The mortality in the SNCU at Kasturba Hospital decreased during 2013-2021. Moving

forward, care for more premature neonates through increased respiratory support by invasive ventilator support, referral of neonates needing ventilator services and continued vigilance in sepsis prevention and management could help in continuing with decrease mortality reduction within the SNCU of the hospital.

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## References

1. Wardlaw T, You D, Hug L, Amouzou A, Newby H. UNICEF Report: Enormous progress in child survival but greater focus on newborns urgently needed. *Reprod Health* 2014; 11 : 82.
2. Sankar MJ, Natarajan CK, Das RR, Agarwal R, Chandrasekaran A, Paul VK. When do newborns die? A systematic review of timing of overall and cause-specific neonatal deaths in developing countries. *J Perinatol* 2016; 36 : S1-11.
3. Lawn JE, Cousens S, Zupan J, Lancet Neonatal Survival Steering Team. 4 million neonatal deaths: When? Where? Why? *Lancet* 2005; 365 : 891-900.
4. UNICEF. *Every Child Alive: The urgent need to end newborn deaths*. Available from: <https://data.unicef.org/resources/every-child-alive-urgent-need-end-newborn-deaths/>, accessed on November 1, 2021.
5. Ministry of Health & Family Welfare, Government of India. *INAP India Newborn Action Plan; 2014*. Available from: <https://nhm.gov.in/images/pdf/programmes/inap-final.pdf>, accessed on September 26, 2022.
6. Sankar MJ, Neogi SB, Sharma J, Chauhan M, Srivastava R, Prabhakar PK, et al. State of newborn health in India. *J Perinatol* 2016; 36 : S3-8.
7. Lahariya C, Sudfeld CR, Lahariya D, Tomar SS. Causes of child deaths in India, 1985-2008: A systematic review of literature. *Indian J Pediatr* 2010; 77 : 1303-11.
8. Shah HD, Shah B, Dave PV, Katariya JB, Vats KP. A step toward healthy newborn: An assessment of 2 years' admission pattern and treatment outcomes of neonates admitted in special newborn care units of Gujarat. *Indian J Community Med* 2018; 43 : 14-8.
9. National Health Mission. Ministry of Health & Family Welfare, Government of India. *Care of Small and Sick Newborns in Special Newborn Care Units (SNCUs) India: Two Year Report April 2013-March 2015*. Available from: <https://www.healthynetwork.org/hnn-content/uploads/Care-of-small-sick-newborns-in-SNCU-of-India-Two-year-Report.pdf>, accessed on November 1, 2021.
10. Neogi SB, Malhotra S, Zodepy S, Mohan P. Assessment of special care newborn units in India. *J Health Popul Nutr* 2011; 29 : 500-9.

11. UNICEF. *Special newborn care units: Saving precious young lives*. Available from: <https://www.unicef.org/india/stories/special-newborn-care-units-saving-precious-young-lives>, accessed on September 26, 2022.
12. Niswade A, Zodpey SP, Ughade S, Bangdiwala SI. Neonatal morbidity and mortality in tribal and rural communities in central India. *Indian J Community Med* 2011; 36 : 150-8.
13. Sahu D, Nair S, Singh L, Gulati BK, Pandey A. Levels, trends & predictors of infant & child mortality among Scheduled Tribes in rural India. *Indian J Med Res* 2015; 141 : 709-19.
14. Census India. *Jhagadia Taluka population, caste, religion data-Bharuch district, Gujarat* -. Available from: <https://www.censusindia.co.in/subdistrict/jhagadia-taluka-bharuch-gujarat-3917>, accessed on November 1, 2021.
15. Vaishnav K, Galhotra A, Jindal A, Parhad P. Profile and predictors of babies admitted to SNCUs of two tribal districts of Chhattisgarh. *J Family Med Prim Care* 2023 ; 12 : 1165-171.
16. Bansal S, Arora A, Bansal S, Gupta M, Singh P. Pattern of morbidity and mortality in preterm newborns in a tertiary care teaching hospital. *J Evol Med Dent Sci* 2015; 4 : 11976-82.
17. Saini N, Chhabra S, Chhabra S, Garg L, Garg N. Pattern of neonatal morbidity and mortality: A prospective study in a District Hospital in Urban India. *J Clin Neonatol* 2016; 5 : 183-8.
18. Kamath SS. Reducing the infant mortality rate of India to 20 by 2020: Together we can do. *Indian Pediatr* 2015; 52 : 193-4.
19. Baghel B, Sahu A, Vishwanadham K. Pattern of admission and outcome of neonates in a NICU of tribal region Bastar, India. *Int J Med Res Prof* 2016; 2 : 6-10.
20. Verma J, Anand S, Kapoor N, Gedam S, Patel U. Neonatal outcome in new-borns admitted in NICU of tertiary care hospital in central India: A 5-year study. *Int J Contemp Pediatr* 2018; 5 : 1364-7.
21. Kumar M, Paul VK, Kapoor SK, Anand K, Deoraria AK. Neonatal outcomes at a subdistrict hospital in north India. *J Trop Pediatr* 2002; 48 : 43-6.
22. Juneja MC, Adikane H, Lothe A, Mohabey A. A prospective observational study of morbidity and mortality profile of neonates admitted to neonatal Intensive Care Unit in a tribal area of central India. *Indian J Child Health* 2018; 5 : 340-4.
23. Babu MC, Prakash PS, Prasanna CL. Neonatal morbidity and mortality patterns of babies admitted in Sncu @ Acsr Government Medical College, Nellore, Andhra Pradesh. *J Evol Med Dent Sci* 2018; 7 : 203-6.
24. Sridhar PV, Thammanna PS, Sandeep M. Morbidity pattern and hospital outcome of neonates admitted in a tertiary care teaching hospital, Mandya. *Int J Sci Stud* 2015; 3 : 126-9.

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