Original Research Article

A cross sectional study to ascertain various causes of neonatal mortality using verbal autopsy in Etawah district

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ABSTRACT

Background: Neonatal death is defined as no. of deaths during the first 28 completed days of life per 1000 live births in a given year or period. Around 2.6 million deaths or roughly 46% of all under five deaths had occurred during this period in 2016 which means that 7000 newborn deaths occur each day. Most of the neonatal deaths occur on the first day and week accounting to about 1 million dying on the 1st day. Objective of this study was to ascertain various causes of neonatal mortality using verbal autopsy in Etawah district.

Methods: The present study was a retrospective cross-sectional study carried out for a period of 1 year (July 17 to June 2018) using WHO verbal autopsy questionnaire by finding out the study subjects from medical information system of UPUMS, Saifai and district hospital, Etawah. A total of 89 neonatal deaths were found out of which 87 were interviewed by going to their residences to get the relevant information regarding the causes of deaths.

Results: Most common cause of neonatal mortality came out to be low birth weight with prematurity 44 of 87 (50.6%), followed by birth asphyxia 23 of 87 (26.4%) and sepsis 8 of 87 (9.2%).

Conclusions: Effective interventions should be incorporated into policy decisions to reduce neonatal mortality due to these causes.

Keywords: Neonates, Neonatal deaths, Verbal autopsy

INTRODUCTION

Neonatal death is defined as no. of deaths during the first 28 completed days of life per 1000 live births in a given year or period. Neonatal deaths may be subdivided into early neonatal deaths occurring during the first seven days and late neonatal deaths occurring after the seventh day but before the 28 completed days of life.[1]

Formula to calculate neonatal deaths

No. of deaths of children under 28 days of age in a year /total live births in the same year ×1000.[2]

First 28 days of life i.e., neonatal period has been the most critical time for the survival of the child. 2.6 million deaths or roughly 46 percent of all under five deaths had occurred during this period in 2016 which means that 7000 newborn deaths occur each day.

Most of the neonatal deaths occur on the first day and week accounting to about 1 million dying on the 1st day and approximately 1 million deaths in next six days. About 80% of the burden of neonatal deaths in 2016 will be because of more than 60 countries which will miss the Sustainable Development Goals (SDGs) target of reducing neonatal mortality to at least as low as 12 deaths per 1000 live births by 2030.[3]

According to sample registration system statistical report 2017, NMR of India is 23 of 1000 live births overall. However, it is 27 of 1000 live births in rural population and 14 per 1000 live births in urban population. Overall NMR in U.P. is 30 of 1000 live births. Also, NMR is 33 per 1000 live births in rural population of U.P and it is 18 of 1000 in urban population of U.P.[4] Globally causes of neonatal mortality are-preterm (34.8%), intrapartum related complications (24%), sepsis (15.1%), congenital abnormalities (11.3%), other (6.8%), pneumonia (6.1%), tetanus (1.2%) and diarrhea (0.6%).[5]
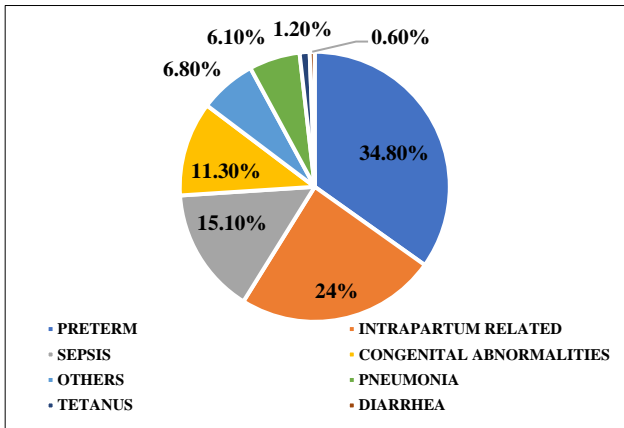

Figure 1: Causes of neonatal mortality globally.
Source: UNICEF (2018), Child mortality estimates, country, globaland and regional specific estimates, 18 September 2018.[5]
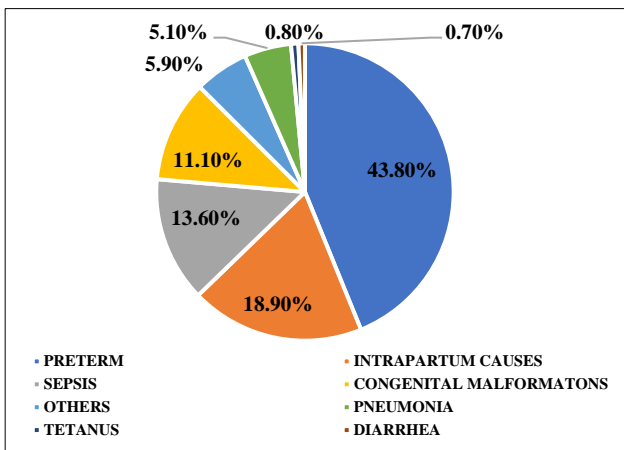

Figure 2: Causes of neonatal deaths in India.
Source: UNICEF (2018), Child mortality estimates, country, globaland and regional specific estimates, 18 September 2018.[5]

The major causes of neonatal deaths in India are - Preterm (43.8%), intrapartum causes (18.9%), sepsis (13.6%), congenital malformations (11.1%), others (5.9%), pneumonia (5.1%), tetanus (0.8%) and diarrhea (0.7%).[5]

Objectives

The objectives of this study were to ascertain various causes of neonatal mortality using verbal autopsy in Etawah district and to recommend measures to reduce neonatal mortality.

METHODS

Study design

A cross sectional retrospective study of neonatal deaths in UPUMS, Saifai and district hospital, Etawah district, Uttar Pradesh.

Study population

Parents of all neonates who had died in one-year duration i.e., 1st July 2017 to 30th June'2018 and those who had given consent.

Sample size

All neonatal deaths registered during the period of 1st July 2017 to 30th June 2018 at UPUMS, Saifai and district Hospital, Etawah.

Duration of study

The duration of study period was between January 2018 to June 2019.

The present study was a retrospective record-based study which included verbal autopsy regarding neonatal deaths of Etawah district which had occurred in two health facilities, UPUMS, Saifai and district hospital, Etawah. A list of all deaths of neonates from 1st July 2017 to 30th June 2018 who were fulfilling the inclusion and exclusion criteria were included in the study. Detailed addresses of the deceased neonates were taken including phone numbers from the hospital records of the two health facilities, UPUMS, Saifai and district hospital, Etawah. All the interviews were conducted within six months of the neonatal deaths.

A telephonic call was made to the parents of the deceased neonates and date and time of interview was fixed. For parents of those deceased neonates whose telephonic number was not available, a house to house visit was made for the interview. If the parents were not contacted even after three visits they were excluded from the study.

On the fixed day a predesigned, pretested questionnaire based on WHO verbal autopsy was used to gather information regarding neonatal deaths.[6]

The information was collected basic information about the interview and the respondent, information on the deceased and date and place of death, series of events leading to death, pregnancy history of the mother, delivery history of the mother, condition of the baby soon after birth, any history of injuries or accidents, neonatal illness history and facilities availed during illness.

A total of 1930 neonates were admitted during the above period i.e., 1st July 2017 to 30th June 2018 in UPUMS, Saifai, Etawah. Of these 617 neonates were from district Etawah and among these 73 neonates had died within this duration. Also 11 neonates were referred, parents of 13 neonates had taken leave against medical advice and 520 neonates had been discharged after becoming well.

Similarly, 494 neonates were admitted in District hospital, Etawah. Of these 391 neonates were from Etawah district and 16 neonatal deaths were reported during the study period. Among those admitted 82 neonates were referred, parents of 10 neonates had taken leave against medical advice and 283 neonates had been discharged after being declared well. Thus, a total of 89 neonatal deaths were included in the study. Of these, 2 participants could not be contacted even after three visits thus making a total final sample of 87. However, none of the participants refused to participate in the study.

Tools of the study

Verbal autopsy questionnaire (WHO 2012) was used to gather information on neonatal mortality.[6] Verbal autopsy is a method used to ascertain the cause of a death based on an interview with mother or other caregivers. This is done using a standardized questionnaire that elicits information on signs, symptoms, medical history and circumstances preceding death. The cause of death, or the sequence of causes that led to death, are assigned based on the data collected by a questionnaire and any other available information.

Statistical analysis

The data thus collected were entered in Microsoft excel worksheet which was analyzed using SPSS V-23, IBM Inc. Chicago, USA software. Chi square test was applied for the analysis and interpretation of data.

RESULTS

Table 1 shows that in UPUMS out of 1930 admitted neonates, 617 were from Etawah district and 73 of them had died. Similarly, out of 494 neonates admitted in district hospital, 391 were residents of Etawah district among which 16 of them had died. The death rate in UPUMS was 11.8 and 4.1 in district hospital. Total 87 families were contacted for verbal autopsy. Out of 87 neonatal deaths 48 (55.2%) were males and 39 (44.8%) were females.

Table 1: Distribution of neonatal deaths of Etawah district in health facilities.

Health facility	Total admission	Resident of Etawah	Death	Death rate	Total families contacted	Families not contacted
UPUMS	1930	617	73	11.8	71	2
District hospital	494	391	16	4.1	16	0
Total	2424	1008	89		87	2

Figure 3 shows that among deceased neonates (n=87) most of them belong to Hindu religion (86.2%) followed by Muslim religion (13.8%).
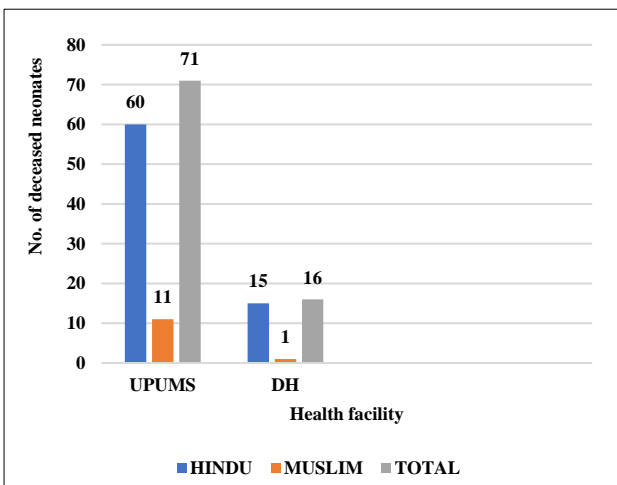

Figure 3: Distribution of neonatal deaths according to religion.

Table 2 indicates that the early neonatal period i.e., 0-7 days was the most vulnerable period and maximum deaths (76) were seen in this period only. However, most neonatal deaths 39/87 (44.8%) had occurred within 24 hours of birth. Deaths within 7 days were considered as early neonatal deaths and deaths from 8-28 days were considered as late neonatal deaths.

Table 2: Distribution of neonates according to age at death (n=87).

	Age at death	Frequency	%
Early neonatal deaths	0-7 days	76	87.4
Late neonatal deaths	8-14 days	7	8.0
	15-21 days	3	3.4
	22-28 days	1	1.1
Total		87	100.0

Figure 4 depicts most common (48.3%) age group of mothers of deceased neonates was 20-22 years and Figure 5 indicates that most of the respondents of verbal autopsy of deceased neonates were mothers (75/87).
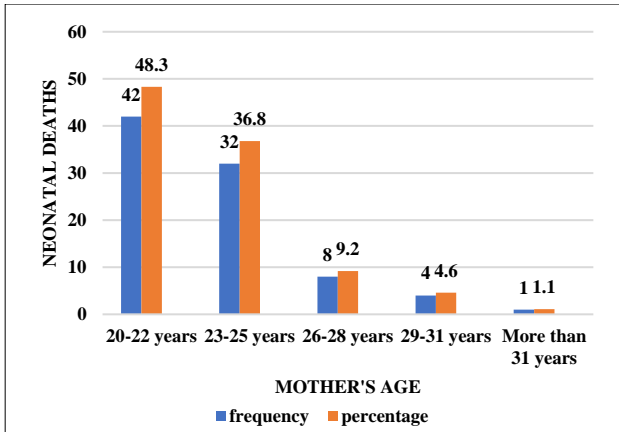
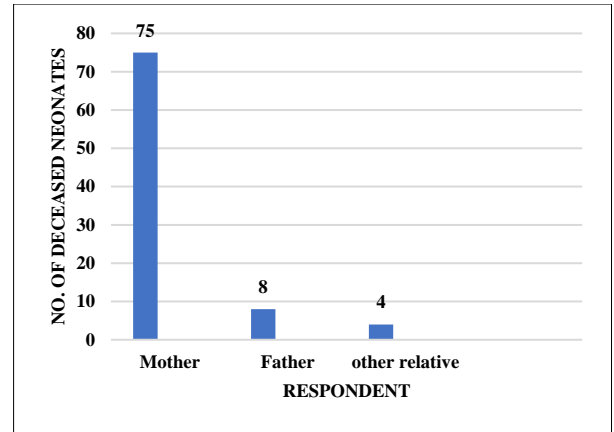**Figure 4: Distribution of neonatal deaths according to mother's age.**

Figure 5: Distribution of respondents according to the relation with the deceased neonates.

Table 3: Distribution of neonatal deaths according to specific causes in early and late neonatal period (n=87).

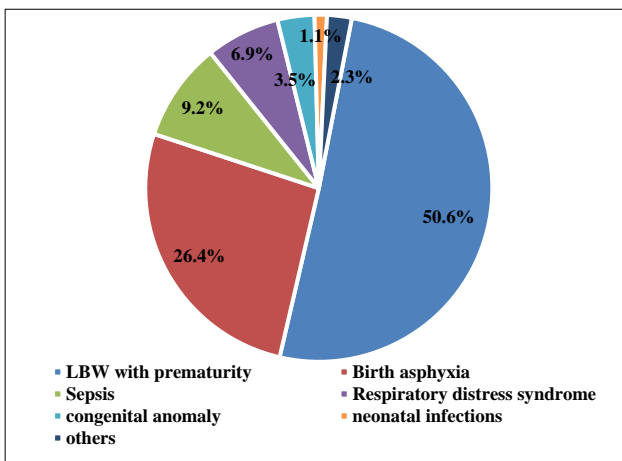| S. no.	Cause of death	No. of early neonatal death	%	No. of late neonatal deaths	%	Total	%	Chi square test
1.	LBW with prematurity	38	50.0	6	54.5	44	50.6	
2.	Birth asphyxia	20	26.3	3	27.3	23	26.4	
3.	RDS	6	7.9	0	0	6	6.9	
4.	Neonatal infections	1	1.3	0	0	1	1.1	χ^2=3.959 df=6 p=0.661
5.	Congenital anomaly	3	3.9	0	0	3	3.4	
6.	Sepsis	7	9.2	1	9.1	8	9.2	
7.	Others	1	1.3	1	9.1	2	2.3	
Total	87	76	100.0	11	100.0	87	100.0	

Figure 6: Distribution of neonatal deaths according to causes.

Figure 6 shows that most frequent cause of neonatal mortality was low birth weight with prematurity 44 (50.6%) followed by birth asphyxia 23 (26.4%), sepsis 8 (9.2%), respiratory distress syndrome 6 (6.9%), congenital anomaly 3.5%), others (2.3%) and neonatal infections (1.1%).

Table 3 revealed that among total neonatal deaths (87), majority were early neonatal deaths (76). Most common cause of death was low birth weight with prematurity in both early neonatal period (38 of 76) and late neonatal period (6 of 11) followed by birth asphyxia in both early neonatal period (20 of 76) and late neonatal period (3 of 11).

Least common causes of death in early neonatal period were others and neonatal infections (1 of 76 each) while respiratory distress syndrome, neonatal infections and congenital anomaly (0 of 11 each) were the least common causes in late neonatal period. Overall most common cause was LBW with prematurity 44 of 87 (50.6%) and least common cause of neonatal mortality was neonatal infections 1 of 87 (1.1%). A non-significant relation was seen between causes of death and early and late neonatal deaths (p=0.661).

DISCUSSION

A total of 89 records of neonatal deaths from the two health facilities i.e., UPUMS and District hospital has been taken, however 87 families were contacted for the verbal autopsy, rest 2 families were not contacted despite

of three visits they were not located (Table 6). Similar studies for verbal autopsy regarding neonatal deaths included sample size such as 55 by Koueta et al, 92 by Jain et al, 118 by Manortey et al, 210 by Bapat et al, 83 by Kulkarni et al, 13 by Bazzano et al.[7-12] In this study majority of the verbal autopsy respondents were mothers of the deceased neonates 75/87 i.e., 86.2%. Other studies also correspond to the mother being most common respondent. Dhakwa et al reported mothers as 90% respondents, Jain et al noticed main respondent as mother in 50.72% cases, 92% respondents were mothers as per Khanal et al, 57.78% respondents were mothers as in study by Parashar et al.[8,13-15] In this study of deceased neonates (n=87), mostly the gender of the deceased neonates was male 41 of 71 (57.8%) in UPUMS but female neonates were more 9 of 16 (56.2%) in DH. Thus, a total of 48 of 87 (55.2%) were males and 39 (44.8%) were females. Other studies also correspond to the same result in terms of male and female. For example, in a study by Parashar et al female neonatal deaths were 57.78% and male neonatal deaths were 42.23%, Manandhar et al reported 54% male neonatal deaths and 46% female neonatal deaths, male deaths were 58% according to Dhakwa et al and 57.7% were male neonatal mortality and 42.3% were female neonatal mortality Majumder et al.[13,15-17] Mean age of mothers of deceased neonates was 23.3±2.96 years in our study. According to Majumder et al, mortality was more in 15-20 years age group (45%), 75% perinatal deaths occurred more in mothers aged 20-35 years Engmann et al.[17,18] Mother's mean age was 27.66±6.71 according to Maharlouei et al, Kulkarni et al reported more perinatal deaths in mothers of age group 21-25 years.[11,19] In the present study mostly, neonatal deaths had occurred within 7 days i.e., early neonatal period 76/87 (87.4%), however only 12.6% neonatal deaths had occurred in late neonatal period (8-28 days). Similarly, various other studies had also shown more deaths in early neonatal periods e.g. According to Parashar et al, neonatal deaths were 37.78%, among which 20% deaths had occurred in early neonatal period rather on the first day. Most (55%) of the deaths were in early neonatal period in a study by Koueta et al, 75.8% deaths had occurred in early neonatal period according to Oza et al, 87 (75%) neonatal deaths were seen in early neonatal period Bapat et al and 52 early neonatal deaths were seen out of 83 perinatal deaths Kulkarni et al.[7,10,11,15,20] In the present study most common cause of neonatal mortality was LBW with prematurity 44/87 (50.6%) followed by birth asphyxia 23 of 87 (26.4%), sepsis 8 of 87 (9.2%), respiratory distress syndrome 6/87 (6.9%), congenital anomaly 3 of 87 (3.5%), others 2/87 (2.3%), neonatal infections 1 of 87 (1.1%) (Table 3). Similarly, other studies correspond to the various causes of neonatal mortality. Most common cause of infant deaths was severe infection (15.55%) followed by pneumonia (13.33%) in both neonates and post neonates Parashar et al.[15] Other causes were LBW with prematurity (11.11%), diarrhoea (11.11%), birth asphyxia (8.89%), congenital anomalies (8.89%) and injuries (2.22%). According to a study by Koueta et al, main direct causes

of neonatal mortality were sepsis (41.1%), preterm birth (19.4%) and antenatal hypoxia and asphyxia at birth (11.1%).[7] Antenatal hypoxia and asphyxia at birth (20%) and preterm birth (25%) were most common causes in early neonatal period and sepsis in the late neonatal period.

In a study by Oza et al most common causes in early and late neonatal period were preterm birth and congenital anomalies in 2000 and in 2013 major causes of neonatal death globally were preterm birth (35.7%), intrapartum complications (21.4%) and sepsis (15.6%).[20] Baqui et al identified most common cause of death on day zero as birth asphyxia or injury (31%) followed by preterm birth (26%) while on days 1-6, most common cause was preterm birth (30%) followed by sepsis or pneumonia (25%).[21]

Also, most common cause of neonatal death was prematurity Chauhan et al, Mengesha et al.[22,23]

The current study is a hospital-based study relying on records of deaths provided by the hospital, so it cannot be generalized to the larger population. Recall bias may be present since verbal autopsy has not been conducted as soon as the neonate had expired, rather a duration of 6 months has been fixed within which the interview has to be conducted. So, some respondents might be approached late thus resulting in recall bias.

CONCLUSION

The most common cause of neonatal mortality came out to be LBW with prematurity (50.6%), followed by birth asphyxia (26.4%), sepsis (9.2%), respiratory distress syndrome (6.9%), congenital anomalies (3.5%), others (2%) and neonatal infections (1%). This has been attributed to improper care of the mother during pregnancy along with the socio-biological factors affecting the neonatal deaths.

Most (76/87, 87.4%) of the neonatal deaths had occurred in the early neonatal period. This shows that the early neonatal period is the most vulnerable period and intervention has to be applied before and during pregnancy period in order to reduce early neonatal deaths.

Recommendations

Since most of the causes of neonatal mortality are related to prematurity, birth asphyxia and sepsis, which are amenable to effective low-cost care, but the interventions mainly rely on the availability of facilities at the health care centres. Verbal autopsy-based surveys have a clear role in public health programmes seeking to target broad areas for health improvement. Various investments in the development of novel community-based strategies might prove to have notable impacts on public health outcomes. Surveillance around the causes of neonatal mortality

should be continued longitudinally by using the best available data to guide policy decisions.

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