

# Ascertainment of causes of neonatal death using verbal autopsy in Rishikesh, Uttarakhand: A cross-sectional study

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## ABSTRACT

**Background:** India shares a huge burden of the total number of global neonatal deaths. The neonatal mortality rate in Uttarakhand is higher in comparison to the national rate. Understanding the causes and contextual factors that contribute to neonatal deaths is critical for developing a health programme and policy. Therefore, this study was aimed to ascertain causes of neonatal deaths using verbal autopsy in Rishikesh, Uttarakhand. **Material and Methods:** A community-based cross-sectional study was conducted in Rishikesh, Uttarakhand from July 2018 to June 2019. The study participants were mothers or primary caregivers of deceased neonates. The verbal autopsy tool of the National Health Mission, Government of India was used to collect data. All neonatal deaths from July 2018 to June 2019 were included in this study. The cause of neonatal death was ascertained by two independent doctors. **Results:** A total of 23 neonatal deaths could be traced during July 2018 through June 2019 in Rishikesh. One death was excluded from the study. Sixty-eight percent (15/22) of neonatal deaths occurred in the first week of life. Major causes of neonatal deaths were perinatal asphyxia (7/22), congenital malformation (6/22), and prematurity (4/22). Most (9/22) of the delays were in making a decision to seek medical care for neonates. **Conclusion:** The major causes of neonatal deaths were perinatal asphyxia, congenital malformation, and prematurity. Most of the deaths occurred during the early neonatal period.

**Keywords:** Congenital malformation, delay levels, neonatal deaths, perinatal asphyxia, prematurity, sepsis, verbal autopsy

## Introduction

“Globally 2.4 million deaths occur every year in the first month of life.”<sup>[1]</sup> India shares a huge burden of these deaths. A majority of neonatal deaths occur at home. However, most of the available information on the causes of such deaths is from health facility data, which are not representative of the general population. Consequently, understanding the epidemiology of neonatal deaths in developing countries is, to a great extent, based

only on statistical estimations that present many uncertainties. Understanding the causes and contextual factors surrounding neonatal deaths is important for formulating a health programme and policy. Moreover, tracing the treatment delay for every sick newborn is equally important in order to take any preventive measures.

In the absence of optimal functioning of a vital registration system and to capture population-based data on the causes of neonatal deaths, verbal autopsy has been widely used. Verbal autopsy is a validated method to understand causes of neonatal deaths. This is a process during which in-depth post-mortem interviews with the primary caregiver, usually the mother of the newborn, is performed. This approach assumes that each cause

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of death has a set of observable symptoms that can be recognized and recalled by the primary caregiver.

Neonatal mortality in India varies across the states. That of Uttarakhand is higher in comparison to the national rate. Moreover, overall, only 47.3% of deaths are registered in Uttarakhand.<sup>[2]</sup> The registration of neonatal deaths is likely to be less than this. Therefore, this study was aimed to ascertain causes of neonatal deaths using verbal autopsy in Rishikesh, Uttarakhand.

## Material and Methods

A community-based cross-sectional study was conducted in both urban and rural areas of Rishikesh, Uttarakhand, from July 2018 to June 2019. The study participants were the mother or primary caregiver of deceased neonates. The verbal autopsy tool of the National Health Mission, Government of India was used to collect the data.<sup>[3]</sup> This tool has three important sections: section 1 contains details of the respondent and of the deceased neonate; section 2 contains details of the pregnancy and delivery, of the baby after birth, and of the sickness at the time of death; section 3 contains a written narrative in the local language (Hindi). The inclusion criteria were all neonatal deaths between July 2018 and June 2019 and all neonatal deaths in cases where the mother belonged to other areas but stayed in Rishikesh for a period of at least six months during the pregnancy.

Data on neonatal deaths of the study area Rishikesh, available in the office of Chief Medical Officer, Dehradun, Uttarakhand, were accessed. Because data regarding neonatal deaths are likely to be unregistered, enquiry from accredited social health activists (ASHAs) and auxiliary nurses and midwives (ANMs) of Rishikesh regarding neonatal deaths in their respective areas were made. All neonatal deaths from July 2018 to June 2019 were included in this study. Only those households where neonatal deaths happened within six months were visited during the study period. Thus, for the period July 2018 to December 2019, it was retrospective. However, from January 2019 to June 2019 data on neonatal death was captured prospectively. No family was visited within six weeks of neonatal death considering their time for bereavement. Once the household was visited, informed and written consent was obtained from the mother or primary caregivers of the deceased neonate. Subsequently, the verbal autopsy tool was administered to elicit time of neonatal death from birth and factors resulting or contributing to the neonatal death. The cause of death of the neonates was ascertained by two independent doctors and there was no disagreement between them.

## Data entry and statistical analysis

The data were entered into a Microsoft Excel spread sheet and were double checked. The analysis was done using IBM SPSS Statistics version 23.0 for Windows. Descriptive analysis was carried out, and proportions were reported wherever possible.

## Results

A total of 23 neonatal deaths could be traced during July 2018 to June 2019 in Rishikesh. Only one neonatal death data could be extracted from records; the rest were traced with the help of ASHAs and ANMs of Rishikesh. However, 22 neonatal deaths were included in this study because in one of the cases, consent had been declined. Of the 22 neonatal deaths investigated, 54.5% (12/22) were male. In the first week of life, 68% (15/22) of neonatal deaths occurred, of which 45% (10/22) occurred between the first day and first week after birth. Seven deaths happened in the late neonatal period [Table 1].

The median age at the time of death was 3.5 days (interquartile range [IQR] 2.00–8.75). Of the 22 newborns that died, 11 had been born in government hospitals, 10 in private hospitals, and 1 at home. Fifteen (68%) newborns were born at term, and 72.7% (16/22) were delivered via normal vaginal delivery. Except for one, every newborn reported to have been weighed after birth. Out of those newborns that were weighed, only five had normal birth weight ( $\geq 2500$  grams). Eight of the 22 neonatal deaths happened in private nursing homes, five in government hospitals, six at home, and three on their way to the hospital.

The majority of the newborns were never breastfed (12/22); of those who were, only one was breastfed within a day of birth. The majority (14/22) of newborns had respiratory symptoms at the time of death.

All the verbal autopsy interviews were carried out with mothers except in one case where the grandmother was the key informant. Median age of the study respondents was 25 years (IQR 22.25–29.00). The majority (15/22) of the respondents were literate. All belonged to the Hindu religion, except one who belonged to the Muslim religion.

## Causes of neonatal deaths

Major causes of neonatal deaths were perinatal asphyxia (7/22), congenital malformation (6/22), and prematurity (4/22). Among all congenital malformations, congenital heart disease was the most common (4/6) cause of death. Other causes of neonatal deaths were sepsis (3/22) and sudden infant death syndrome (2/22). The most common cause of death among term neonates (15/22) was congenital malformation, whereas it was prematurity in preterm neonates (7/22). Perinatal asphyxia (7/15) was the most common cause of death in the early neonatal

**Table 1: Timing of neonatal deaths from July 2018-June 2019 in Rishikesh (n=22)**

Time	n
Early neonatal period	15
0-<1 day	05
1-<7 days	10
Late neonatal period	07
Total	22

period, while congenital malformations (3/7) were the most common cause of death in the late neonatal period.

### Delay(s) involved based on the verbal autopsy investigations

Most (9/22) of the delay was in making the decision to seek medical care for neonates. Delay at the level of facility was found in 5 of 22 neonatal deaths. There were two neonatal deaths in which there was delay at both the levels: in one case delay in decision-making to seek medical care and at the facility level was found and, in another case there was a delay in both decision-making and in reaching the health facility. In the remaining neonatal deaths (6/22), there was no delay at any level [Table 2].

## Discussion

This study comprised of 22 neonatal deaths, and a verbal autopsy was performed to ascertain the causes of neonatal deaths in Rishikesh, Uttarakhand. It also tried to find out delays at various levels that contributed to these neonatal deaths.

In this study, it was found that most of the births took place at an institution; yet birth asphyxia was the most common (7/22) cause of death. Numerous studies conducted in India have found birth asphyxia to be a significant cause of newborn death, which is consistent with our study's findings.<sup>[4-15]</sup> The lack of sufficient resuscitation care at the time of birth is reflected in the high rate of neonatal mortality caused by birth asphyxia. Unnecessary augmentations of labour and inadequate foetal monitoring during the intranatal period have been considered as contributors of neonatal death. Overall, this indicates suboptimal quality of intranatal care. Therefore, it is necessary to increase the coverage of trained birth attendants to ensure timely identification and management of birth asphyxia in this area.

Out of 22 neonatal deaths, it was found that congenital malformations were the second most frequent cause, accounting for six deaths. In India, congenital malformations are emerging as an important contributor of neonatal mortality. Neonatal deaths due to congenital malformation are preventable by regular antenatal visits and better use of an effective diagnostic modality during the early stage of pregnancy. In the study area, better quality of antenatal care

and an effective screening strategy can prevent congenital malformation-related mortality.

Prematurity and neonatal sepsis also contributed to neonatal deaths in this study. Access to better antenatal and intranatal care can improve neonatal survival in this area.

It was observed that the majority (15/22) of neonatal deaths happened during the early neonatal period. Five out of a total of 15 early neonatal deaths happened in less than a day since birth and most of them (10/15) died between the first day of birth and less than seven days. These findings suggest that the early neonatal period is the most vulnerable period for the survival of a child. Our health care delivery system should focus particularly on this period.

Home-based neonatal care (HBNC) through ASHAs exists in our programme; however, its coverage is suboptimal. Strengthening HBNC could result in a decrease in neonatal deaths between one and seven days. Apart from this, creating awareness and educating the community on newborn and neonatal care will go a long way in the improvement of neonatal survival.

It was also observed in the current study that around one-third (7/22) of deaths happened during the late neonatal period. Even after institutional delivery, the majority of neonates are at home in the late neonatal period. Therefore, care at home and routine visits by ASHAs and ANMs need to be improved to identify at-risk neonates at the earliest.

However, in comparison to these findings in present study, it was found that male neonates (12/22) had higher mortality than female neonates. This finding supports the well-documented biological survival advantage of girls during the neonatal period.

Nine out of the 22 infant deaths in this study showed evidence of delayed decision-making to seek medical care. This indicates a lack of awareness regarding danger signs and access to neonatal care. There is a need to educate the community on these and enable them to seek timely care. Community-based interventions to enhance the mother's or primary caregiver's knowledge to identify danger signs at the earliest has been found to be effective for decreasing neonatal mortality. It was also found that 5 out of 22 neonatal deaths occurred due to delay at the facility level. These delays were mostly due to lack of infrastructure and lack of health care providers.

Similar to this study, Upadhyay *et al.*<sup>[16]</sup> revealed that delay by caregivers in making the decision to seek care (44%) and delay in reaching a health care facility (34%) were the two main delays contributing to neonatal death.

Only one participant in this study reported being late in reaching a health care facility. This could be due to a difference in the study setting. The study by Upadhyay *et al.*<sup>[16]</sup> was conducted in rural Haryana, where availability of transport is not 24 × 7.

**Table 2: Point of delay contributing to neonatal deaths from July 2018-June 2019 in Rishikesh (n=22)**

Variable	n (%)
Delay at level one*	09 (41%)
Delay at level one* and three***	01 (4.5%)
Delay at level one* and two**	01 (4.5%)
Delay at level three***	05 (22.7%)
No delay	06 (27.3%)
Total	22 (100%)

\*Delay in making a decision to seek medical care. \*\*Delay in reaching the health facility. \*\*\*Delay at the level of the health facility

However, Rishikesh is very small in terms of geographical area and the distance to be covered to reach a health care facility is not much. This is a region with reasonably good physical access to health care facilities. Thus, a delay at level two is not expected to be a major limiting factor. Moreover, 24 × 7 availability of ambulance services by the Uttarakhand government could have resulted in lesser reported delay at level two.

Upadhyay *et al.*<sup>[17]</sup> in another study noted that delay in receiving necessary medical care after arriving at a medical facility (level 3 delay) was 38.7% and delay in taking the decision to seek medical care for the illness (level 1) was 28%. In comparison to this study, we found that the delay at the level of seeking medical care (9/22) was more than delay at the facility level.

In this study, we also observed that there was no delay at any level in 6 out of 22 neonatal deaths. This could be attributed to the failure to seek care from a health facility, realising the baby was seriously ill. It has been reported that when mothers realise their child is seriously ill, they frequently do not seek care outside the home.<sup>[18]</sup> The other possibility is that seriously ill babies may have been identified early by mothers, and reasonably good physical access to health care facility in the study area may have resulted in no delay at level two. They may have reached the hospital without delay and were given timely treatment.

This study is the first study to document causes of neonatal death in an area. It shares its limitations too. Despite the fact that the study lasted a year, only 23 neonatal deaths were identified; this small sample size may appear insufficient. The nature of the study results, on the other hand, is unlikely to be influenced by sample size.

## Conclusion

The major contributing factors to neonatal mortality were perinatal asphyxia, congenital malformation, and prematurity. The majority of neonates died during the early neonatal period. Delay in making the decision to seek medical care was associated with most of the neonatal deaths.

## Ethical approval

Institutional Ethical Committee Approval: Reference number-219/IEC/PGM/2018.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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