# Verbal autopsy to determine the timing and causes of infant deaths in the northern state of India.

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## Abstract

**Background:** Data on timing and probable causes of infant deaths are very important for the design of intervention to reduce infant mortality. Also there are few or limited community based study in our state. This study was undertaken to determine the timing and causes of infant deaths using verbal autopsy in the community. The suggestions and recommendations can be used to strengthen and improve the existing facilities and services for the better outcome of life in the early childhood.

**Methods:** A cross sectional study was conducted in 180 selected clusters in 6 districts of Himachal Pradesh using WHO cluster sampling method and data collected through validated verbal autopsy tool.

**Results:** Verbal autopsy was done for 45 infant deaths. 37.8% infant deaths were early neonatal, 15.5% in late neonatal and 46.7% in post neonatal period. The mean age at death was 5.79 ± 6.35 days in neonatal period while it was 5.07 ± 3.38 months in post neonatal period. Of all the infants 57.78% were females. The observed causes of death were severe infection (15.5%) in neonates, pneumonia (13.3%) in post neonates followed by LBW with prematurity (11.1%) and Diarrhea (11.1%) in both periods. No specific cause could be determined in 13.3% cases.

**Conclusion:** The major causes of infant deaths are preventable. It emphasizes for the robust reporting mechanism of all infant mortality utilizing the existing collaborative health system to determine the exact causes at local level and strengthening of comprehensive health care delivery with local consideration and ensuring the accessibility to the health care services to have a healthy infanthood.

## What is Already Known?

Causes and timing of infant deaths are available only through the analysis of secondary data in state of Himachal Pradesh. No community based evidences on pattern of infant deaths (timing and causes) in our state is available so far.

## What this Study Adds?

First community based effort of its kind in the state. Findings of this study open an access to untouched and over relied components of our health system. Suggestions and recommendations of this study can be considered for strengthening and improving the existing facilities and services, right from grassroots level for achieving the better outputs of health care during the pregnancy and in the early childhood. It will ultimately add to the overall socioeconomic development of our state and country.

## Introduction

The Infant mortality rate of the nation is a widely accepted and long standing indicator of well being of its people. It measures the probability of dying before the age of one and the rate is expressed per 1000 live births. A high IMR is indicative of unmet health needs and unfavorable environmental factors [1]. The pattern of infant deaths also assesses the impact of various intervention programs aimed at improving child survival. Every year, there are an estimated 4.5 million infant deaths globally, accounting for almost 75% of deaths in children younger than 5 years [2]. About a quarter of global infant deaths occur in India, which has an infant mortality of 43 per

thousand live births, and it is 32 per 1000 for Himachal Pradesh [3].

The infant mortality has almost halved worldwide in the last 25 years with India realizing impressive gains in child survival over the last two decades. However, India couldn't meet the targets for Millennium Development Goal (MDG-4), which aimed to reduce the under-five mortality rate by two thirds, between 1990 and 2015 [4]. Also there is a small or no decline in the rate of early neonatal mortality (ENMR), which is an indicator of quality of perinatal care [5]. Therefore, it is crucial to address the timing and causes of infant mortality to reduce it in India and Himachal Pradesh.

In India and other South East Asian countries, the main causes of infant mortality are thought to be preterm birth, sepsis or pneumonia, birth asphyxia, congenital abnormalities and diarrhea.

Verbal autopsies, which are interviews with care givers, have been used to establish causes of infant deaths. Data on timing and probable causes of infant deaths are very important for the design of intervention to reduce mortality as no study of infant mortality has been reported from the state.

Hence we proposed to determine the timing and causes of infant deaths in our state using verbal autopsy. The outcome of this study has been used to give suggestions and recommendations so that the existing facilities and services can be strengthened and improved for the better outcome of life in the early childhood. It will ultimately add to the overall socioeconomic development of our state and country.

## Methods

### Study Design

A cross sectional study was conducted in the six districts of Himachal Pradesh for determination of timing and causes of infant deaths using verbal autopsy tool by the department of community Medicine, Indira Gandhi medical college, Shimla under the aegis of National Health Mission of the state.

The period of the study was from July 2015 to September 2015.

### Sampling

The study was undertaken as an adjunct to the immunization survey of Himachal Pradesh using the World Health Organization's 30 × 7 cluster sampling method, developed in 1978, for the selection of clusters. A total of six districts were selected for the study with equal representation given to three zones based on altitude. Lower zone districts were Bilaspur and Mandi (altitude: 250-1000 m), Middle zone districts were Solan and Sirmour (altitude less than 2000 m) and upper zone districts were Shimla and Kinnaur (altitude above 2000 m). Same clusters assigned for immunization survey were observed for the determination of timing and cause of infant deaths using the verbal autopsy. Within the cluster, all the infant deaths noticed during the preceding one year from 01 July 2015 to 30 September 2015 were included [6].

### Inclusion Criteria

1) All the infants who died during the specified period and the parents or family members were available to give consent and interview (Figure 1).

2) Infant's family was the permanent resident, living for more than 6 months in the selected cluster.

### Methodology

From each of the 6 districts, 30 clusters using the WHO 30 × 7 cluster sampling method were selected. In each cluster, enquiry was done from Health worker/AWW/ ASHA worker or any responsible village personnel for any infant deaths during the specified period in that cluster area [7,8]. The household was visited by the team of Medical Officers and after confirming the eligibility criteria and consent from the concerned family member, verbal autopsy form, as used in the million death study by Registrar General of India through Centre of Global Health Research was filled with the information as required along with the detailed narration of events that led to death, from the relative (preferably mother) of the deceased infant [9,10]. A detailed history of the events of birth and the circumstances leading to death were elicited from the respondent. The age of the deceased child was ascertained by the exact date of birth if the parents could recall or by the religious and the ritual events. Subsequent
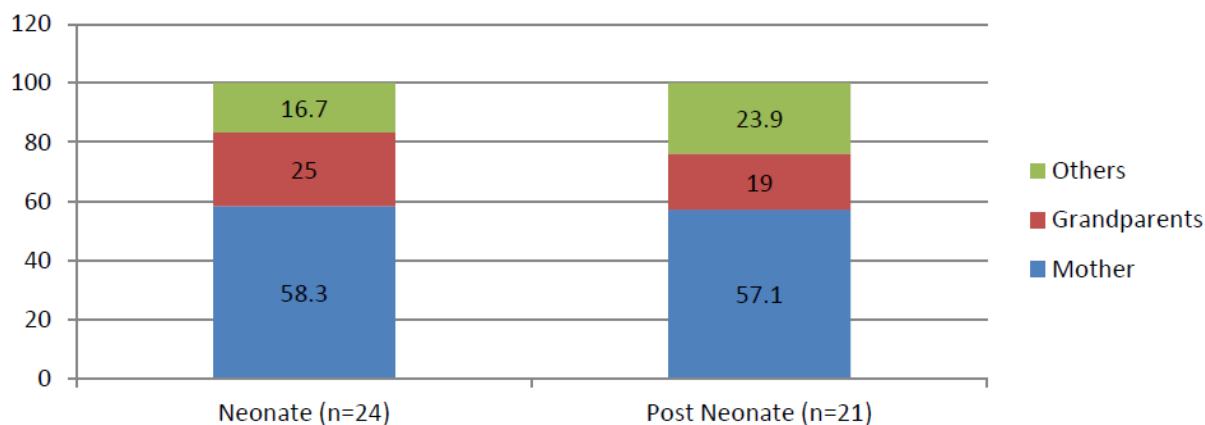


*Figure 1. Interviewee for verbal autopsy*

cases were searched using snowball sampling technique or if already in the notice of the visited family or health worker/ASHA/Aanganwadi worker of that area. The stillbirths were excluded from the study. The cause of death was ascertained using standard verbal autopsy procedure. In case of doubt, the cause of death was determined after discussion with the jury of consultants in the Department of Community Medicine at IGMC Shimla.

Ethical approval: The study was approved by the Institutional Ethics Committee of IGMC Shimla.

## Results

In our study, six teams visited 21,146 households in 180 clusters, where we came across 45 families having infant deaths in the period specified. We excluded the four still births that came across in our study.

Interview was taken from mothers of the deceased child in 57.78% cases; from grandparents in 22.23% and from other relatives in the remaining cases. 37.78% infant deaths were early neonatal. 20% of them were on the very first day of life which accounts for the maximum number infant deaths (1 in every 5). 15.5% deaths were in late neonatal and 46.67% in post neonatal period. Mean age of death in neonatal period was 5.79 days while in post neonatal period, it was 5.07 months. Half of the deaths in the neonatal period occurred by the end of 3rd day while half of the deaths in the post neonatal period occurred by the end of 5th month.

Overall there were 57.78% female and 42.23% male infant deaths whereas there was no difference of gender in the deaths observed in the neonatal period.

We observed the cause of infant deaths in the following order of magnitude: severe infection (15.55%) and pneumonia (13.33%) were the leading cause respectively in neonates and post neonates followed in both groups by LBW with prematurity (11.11%), diarrhea (11.11%), birth asphyxia (8.89%), congenital anomalies (8.89%) and injuries (2.22%). In 15.55% cases, the causes were rare and occasional such as cord around the neck, intestinal obstruction, fever, seizures and bleeding disorders and in remaining 13.33% cases, exact cause couldn't be determined either due to lack of reliable information or availability of death records. Duration of illness before death ranged from few hours in neonates to 25 days in post neonate.

Other significant findings of our study include high percentage of home deliveries amongst the deceased infant (33.3%) conducted by either trained or untrained TBA. High proportion of deaths took place at home (40%) while it was 42.23% at some health institutions. 65% babies were of normal size and weight at time of birth while it was low in 16% and high in 12% of cases. Multiple pregnancy was a cause of preterm and LBW in 12% of cases. Almost 85% post neonates were vaccinated for their age till death.

## Discussion

In our study, we observed 45 infant deaths out of which 53% deaths were in the neonatal period (37.78% in the early neonatal period and 15.5% in the late neonatal period) as compared to 60-68.5% in previous studies [11,12]. It is also below our national and state figure of 69% and 77.5%, respectively as per SRS 2012. The lower proportion of neonatal deaths in our study may be true, supported by the adequate antenatal health coverage reflecting the maternal health status during the pregnancy and better socioeconomic conditions reflected by per capita income in our state as compared to the rest of the country (Table 1). The higher proportion of 46.67% deaths in the post neonatal period as compared to national (31%), state (22.5%) and other study (40%) can be due to the casual health seeking behavior of the people for perceived presence of danger signs despite available preventive and treatment facilities. Or the difference can be merely due to small sample size of our study [12,13].

In our study the gender distribution of deaths in infancy was 57.78% in females and 42.23% in males which is almost similar to what had been observed in previous study (53 and 47% respectively) (Figure 2) [14].

In our study the main causes of death in neonates were severe infection (29%) followed by LBW with prematurity (21%), Birth Asphyxia (16.6%), Congenital anomalies (12.5%) and diarrhea (4%). In post neonates, deaths were due to Pneumonia in (28.5%) followed by Diarrhoea 19% (4), Injury 4.7% (1) and congenital anomalies 4.7% (1). These findings were coherent with results from the community based studies in south Asia which have reported neonatal causes of death within the following ranges: preterm birth,8-38%; sepsis or pneumonia,7-52%; birth asphyxia 10-28%; (sometimes including birth injury);tetanus 2-36%; and diarrhea 9% [15-18].

*Table 1. District wise demographic and facility details (SRS 2014)*

|  | Shimla | Sirmour | Bilaspur | Kinnaur | Solan | Mandi |
|---|---|---|---|---|---|---|
| Total Population (in thousands) | 814 | 529 | 382 | 84.1 | 580.3 | 999.8 |
| Average Literacy Rate (%age) | 83.64 | 78.80 | 84.59 | 80 | 83.68 | 81.53 |
| Female Literacy Rate (%age) | 77.13 | 71.36 | 77.9 | 70.96 | 76.97 | 73.66 |
| Total Clusters Covered | 30 | 30 | 30 | 30 | 30 | 30 |
| Total Household covered (Numbers) | 4203 | 2986 | 2805 | 4415 | 3352 | 3385 |
| Total Infant Deaths encountered (Numbers) | 5 | 7 | 7 | 9 | 7 | 10 |
| Villages having Govt. health Facility(%age) [7] | 70 | 69.4 | 75.7 | 72.5 | 60.6 | 48.6 |
| Per Capita Income of Himachal (Rs.) | 130,067 (2015-16) [8] | | | | | |

We were unable to find cause for 13.34% of deaths which is within the range of previous study who has reported similar proportions of death for which no specific cause could be identified by verbal autopsy [15].

In our study 42.23% of deaths were in the health institution while 40% were at home. So in settings where considerable number of deaths occurs outside of the health system, verbal autopsy is considered the most practicable method for determining the cause of death but with all its limitation as a part of study. These includes problems inherent to certain case definitions, difficulty in eliciting closely related symptoms as in severe pneumonia and septicemia, limited in differentiating viral and bacterial infections, subjectively classifying preterm babies of their sizes and weight and limited information regarding the maternal health status and the last treatment offered to the deceased child. Although every effort has been done to overcome all the limitations but some unforeseen circumstances are always unavoidable.

The strength of this study is that it used the previously validated methods for both sampling as well as for gathering information, i.e., standardized and well validated verbal autopsy tool as used in the million death study by the Registrar General of India through Centre of Global Health Research. Further the whole study was carried by the team of doctors, all of whom are the postgraduates in the community medicine department having exposure and experience in the related subject and above that the causes of death were further confirmed by the independent team of consultants in the department of community medicine.

The process of examining deaths by number of days since birth yielded useful insights for health program planning and illustrates the need for a continuum of care. Antenatal education regarding health and nutritional status of the mother, routine antenatal visits, clean delivery practices, immediate breast feeding and care seeking for complications is required. In view of high deaths on the first day of life, it emphasizes the need to increase the coverage of skilled birth attendants and to equip them with the capabilities to identify and manage birth complications including birth asphyxia. For early deaths in the post natal period, it also requires to ensure strict adherence for vigilant postnatal visits with preventive care for all

newborn babies and prompt recognition and referral for the needy along with universal access to quality emergency neonatal care.

Our findings suggest that the surveillance during the pregnancy and postnatal period needs to be effectively implemented and monitored. A key finding of this study is that the burden of early neonatal death is high for which more detailed and extensive studies are required to define the exact burden and to evaluate the ongoing programs on continuum of care. And greater coverage of antepartum, intrapartum and early postnatal health interventions, in combination with promotion of care seeking behavior and effective communication between community and health facilities would be expected to have the greatest effect in this setting.

## Conclusion

This community based study is one of the few of its kind in the state. The results can be used for comparison of the timing and causes of infant mortality in this hilly state to other parts of the country. The major causes of infant deaths are preventable to a large extent (Figures 3 and 4). Although our state has improved statistically in the indicators of economic growth, literacy and infant mortality over a period of time, lot of improvement is yet to be done at grass-root level. It necessitates the determination of exact causes of all infant mortality with robust and mandatory reporting mechanism utilizing the collaborative system that includes all the ASHA/AWW and even the AYUSH providers apart from the allopathic health workers only. Also it warrants the need of innovating the delivery of comprehensive health care services to all newborns and infants at the remotest areas. In addition to the strengthening of existing continuum of care services through RMNCH+A program (promotion of institutional deliveries, intranatal and neonatal care, early recognition of danger signs at household and facility level and correct management through trained health functionaries), people should be motivated to attend the health days observed in their village through involvement of dedicated PRIs and other religious organisation. Also it emphasizes the need of more studies to ensure the universal accessibility to the health care services along with strengthening and accountability of referral system to have a healthy infanthood to all born alive.
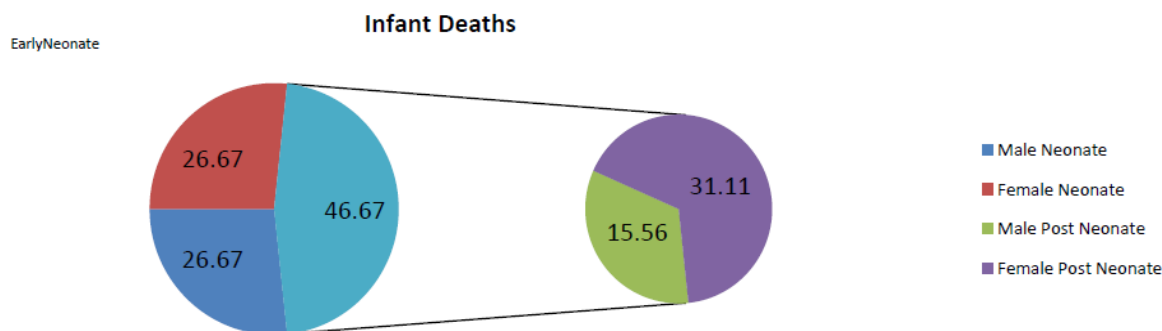


***Figure 2.** Gender distribution of infant death (n=45)*
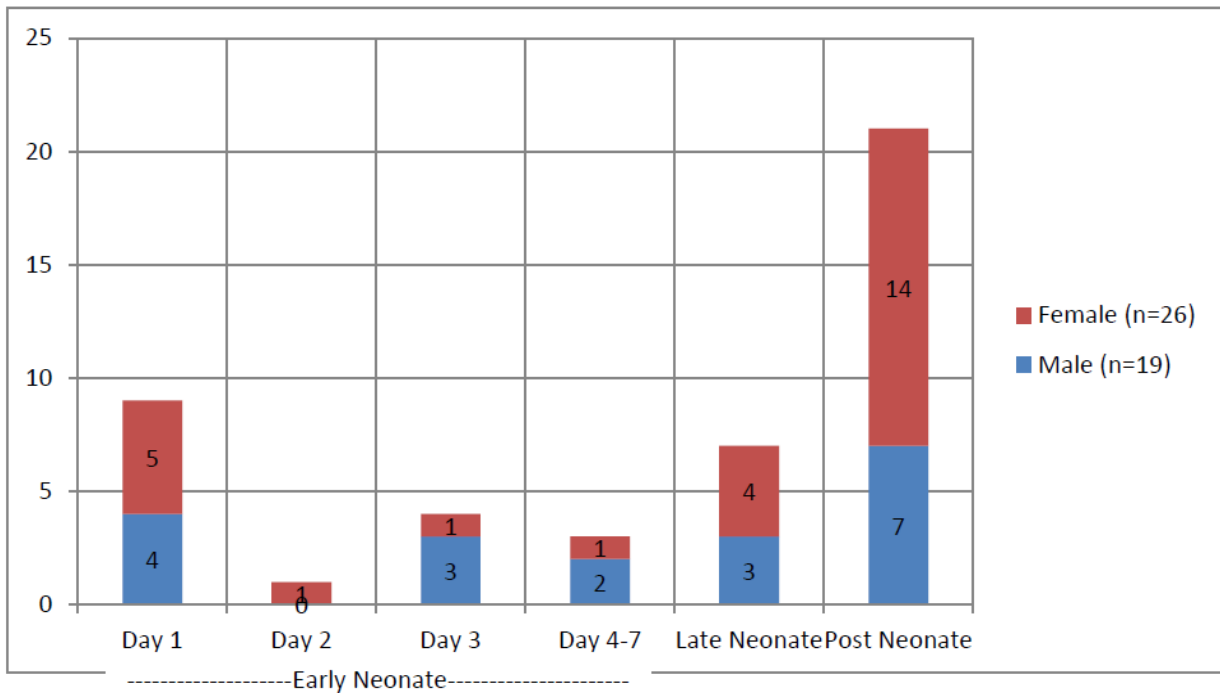
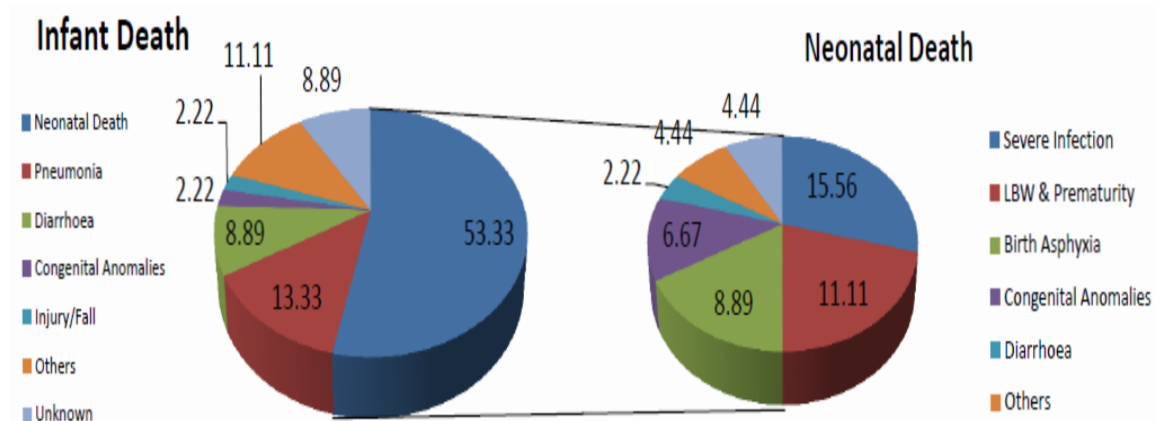**Figure 3.** *Timing of infant death (n=45)*



**Figure 4.** *Causes of infant (n=45) and neonatal death (n=24)*

## References

1. NIMS, ICMR, UNICEF. Infant and child mortality in India: Levels, trends and determinants, National Institute of Medical Statistics (NIMS), Indian Council of Medical Research (ICMR) and UNICEF India Country Office, New Delhi, India 2012.

2. http://www.who.int/gho/child_health/mortality/neonatal_infant_text/en/

3. Registrar General India. SRS bulletin. Sample Registration System 2014; 49: 1-6.

4. http://unicef.in/PressReleases/374/The-Infant-and-Child-Mortality-India-Report#sthash.eiHwz6QT.dpuf

5. National Institute of Medical Statistics (NIMS), Indian Council of Medical Research (ICMR) and UNICEF India Country Office. Infant and Child Mortality in India, Levels Trends and determinants, Fact sheet, New Delhi, India. 2012.

6. http://himachal.nic.in

7. International Institute for Population Sciences (IIPS). District level household and facility survey (DLHS-4), 2012-2013: India. Himachal Pradesh: Mumbai: IIPS. 2014.

8. http://timesofindia.indiatimes.com/city/shimla/Economic-Survey-projects-Himachal-Pradeshs-growth-rate-at-7-7/articleshow/51266064.cms

9. Anker M, Black R, Coldham C, et al. A standard verbal autopsy method for investigating causes of death in infants and children. Geneva, World Health Organization 1999: 1-83.

10. Registrar General of India, Centre of Global Health Research. Prospective study of one million deaths in India: Rationale, design and validation results. 2005.

11. Reeta R, Bhavan VR. Age profile of neonatal deaths. Indian Pediatrics 2008; 45: 991-994.

12. Shah MS, Khalique N, Khan Z, et al. Verbal autopsy to determine causes of deaths among under-five children. Curr Pediat Res 2010; 14: 51-53.

13. http://censusindia.gov.in/vital_statistics/SRS_Bulletins/Bulletins.aspx

14. Khanna R, Kumar A, Vaghela JF, et al. Community based retrospective study of sex in infant mortality in India. BMJ 2003; 327: 126.

15. Fikree FF, Azam SI, Berendes HW. Time to focus child survival programs on the newborn: Assessment of levels and causes of infant mortality in rural Pakistan. Bull World Health Organ 2002; 80: 271-276.

16. Freeman JV, Christian P, Khatry SK, et al. Evaluation of neonatal verbal autopsy using physician review versus algorithm-based cause of death assignment in rural Nepal. Paediatr Perinat Epidemiol 2005; 19: 323-331.

17. Baqui AH, Paul VK, Reddy HM, et al. Why do neonates die in rural Gadciroli, India? (Part I): primary causes of death assigned by neonatologist based on prospectively observed records. J Perinatol 2005; 25: S29-34.

18. Aggarwal AK, Kumar P, Pandit S, et al. Accuracy of WHO verbal autopsy tool in determining major causes of neonatal deaths in India. Plos One 2013; 8: 1-9.

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