

## Original Research Article

# Verbal autopsy of neonatal and infant deaths from Bhavnagar rural and comparison with recent data

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**Received:** 19 October 2020

**Accepted:** 09 December 2020

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### ABSTRACT

**Background:** Infant deaths from Bhavnagar rural areas were studied by using a verbal autopsy tool.

**Methods:** Community visit based retrospective study of Bhavnagar rural by WHO verbal autopsy questionnaire.

**Results:** Of the 92 deaths analyzed, 59 % (early), 12% (late), and 29% were during the post neonatal period. Male deaths were 55 (60%). The most common immediate causes were infection (39%), birth asphyxia (23%), and hyaline membrane disease (15%). Underlying causes were: maternal illness with feeding problem (45%), prematurity (26%), meconium aspiration syndrome (9%), and congenital/genetic anomalies (10%). Infant and neonatal deaths were seen more with illiteracy of mother, age of mother (25-29 years), third parity, anemia, and vaginal discharge; and non-breastfed, low birth weight and preterm. Birth asphyxia and hyaline membrane disease were during early, and meningitis and pneumonia were after the neonatal period. Verbal autopsy was accurate in 18/23 (78%) of the facility-based deaths where the cause of death was available. Ethics approval was obtained.

**Conclusions:** Reproductive health education to adolescent girls and mothers, regarding the treatment of fever, vaginal discharge; and breastfeeding counselling with vitamin B12 should be used as more infant deaths are associated with anemia of mother. Health workers should be skilled in neonatal resuscitation, prematurity management, and referral, after stabilization, identification of congenital anomaly, antenatal screening by USG, and neonatal metabolic screen. Recent 2018 data obtained from Bhavnagar District Health Authority shows that over a period of eight years, institutional deliveries have increased and home deliveries, early neonatal deaths, HMD, and septicemia have decreased. Perinatal care should be check-list based, monitored, and mentored.

**Keywords:** Bhavnagar, Infant death, Neonatal death, Rural community, Verbal autopsy

## INTRODUCTION

Several types of causes such as medical, social, cultural, genetic, biological, economic, environmental, may combine together and lead to the death of a newborn child. These causes act differently over different subsets of infant deaths. This is evident by the wide variation in Infant Mortality Rate (IMR) seen in different parts of the world [2 per 1000 live birth (LB) in infants in developed countries like Japan to 89 in sub-Saharan Africa].<sup>1</sup>

In Gujarat IMR was 53 and 50 in 2007 and 2008 respectively.<sup>2</sup> While in villages of India the average was

58 per 1000 LB; in urban areas it was 36. Recent (2016) IMR of Gujarat is 33 (urban 21, rural 41).

Currently there are two schemes for monitoring cause of death in India (a) Survey of Causes of Death based on lay reporting from rural India (that can be made precise by adding Verbal Autopsy), and (b) Medical Certification of Cause of death. Although Sample Registration Survey (SRS), has been using verbal autopsy (VA) method since 1999.<sup>3</sup> Verbal autopsy is defined as a method of obtaining as much information about a deceased person by asking questions to the family and others who can describe the mode of death and circumstances preceding it.<sup>4</sup>

Information gathered relies on recall of events by the informants; therefore, recall bias is a limitation of this tool.<sup>5</sup>

### ***Benefits of verbal autopsy tool***

Verbal autopsy provides information that cannot be found by postmortem and therefore is a necessary adjuvant tool to post mortem. The exact cause of death and underlying pathology can be known by postmortem. VA adds to medical diagnosis of death by looking at social determinants of health seeking behavior and health systems performance. For example, vaccines not received, spacing duration between pregnancies, delay in reaching health facility, why balanced diet was not available, and availability of clean water etc. cannot be known by postmortem alone.

### ***Limitations of verbal autopsy tool***

It requires skilled field-based personnel to record evidence as well as office-based staff to assess cause of death, and to code and analyse data.

Only a small sample of the list of causes used for medical certificates can be assessed by verbal autopsy. The quality of the assessment depends on sensitivity and specificity of each diagnosis. The use of verbal autopsy is more problematic with diseases that have less specific symptoms, but which are equally important. For example, septicaemia and inborn error of metabolism (IEM), both may present as lethargic child or hypoglycaemia.

## **METHODS**

### ***General and demographic information***

Bhavnagar is a port district on the coastal region of the Saurashtra. The district is well connected to major cities of Gujarat by rail, road and by air. It is the second-largest district of Saurashtra region. It is also known as cultural capital of Saurashtra. It occupies area of 9980.90 sq. km. As per 2011 census, total population of Bhavnagar, Gogha and Sihor talukas was 413,630. Males constitute 57% of the population and females 43%. The average literacy rate was 67%, (national average 59.5%); with male literacy 68% and female literacy 53%. The sex ratio was found to be 903 females per 1000 males.

### ***Information about health system***

There are 12 PHC (primary health centre), two CHC (community health centre), and one trust hospital. Under ICDS (Integrated Child Development Services), there are 198 Anganwadi. Each anganwadi is manned by one anganwadi worker and one helper. In each Taluka there is one CDPO (child development project officer) and supervisor, who supervises all the activities of AWWs (anganwadi workers).and there are 75 subcenters, which

are manned by FHW (female health worker), MHW (male health worker), ASHA (accredited social health activist) Workers.

### ***Study sample***

A list of all registered neonatal and infant deaths was obtained from District health office, Bhavnagar. Total 126 neonatal and infant deaths were registered from 1<sup>st</sup> January 2010 to 31<sup>st</sup> December 2010 in Bhavnagar, Sihor and Gogha talukas. Out of these verbal autopsy of 92 cases of neonatal and infant deaths became possible.

### ***Study design***

Community based retrospective analytical study by WHO standard verbal autopsy questionnaires.<sup>5</sup>

### ***Inclusion criteria***

All registered deaths of neonatal and infant of the year 2010 in Bhavnagar, Sihor and Gogha talukas of Bhavnagar district.

### ***Exclusion criteria***

House cannot be traced due to incomplete address or respondent refuses to give information or knowledge of person giving information is not enough or migration of the family.

### ***Study period***

The field based data collection of this study was carried out between May to June, 2011. It was done on working days of Anganwadi. Special/repeat visit were made during late evening to those cases, where informant was not available during routine hours.

### ***Study method***

The information regarding neonatal and infant deaths was obtained from the district Panchayat Bhavnagar. Then information of all PHC, Sub centres, FHW, MPH, ASHA worker and Anganwadi was collected from block health office of respected Taluka.

Approach of informant was through FHW, anganwadi and ASHA worker of the same area. The interview was conducted at respondent's house and in the local language or in the language which they can understand for interview. The child's mother was selected as respondent wherever possible. In her absence or non-availability, father or foster parents who used to take care of the child was selected as respondent. Before starting interview, I introduced myself and explained all the reasons for the study and consent of every participant was obtained. The average time taken for an interview was 30 to 45 minutes

## Study tool

The tool which was used in this study is standard Verbal autopsy questionnaire developed by WHO.<sup>5</sup> A questionnaire for the survey was available in English and translated into Gujarati language which they can understand.

## RESULTS

The majority of (83.7%) respondents were mothers followed by father (14.1%) and grandmother (2.2%). Out of total respondent mothers, 58.4% were illiterate, While 37.7% mothers were educated up to primary level.

In 10.9% cases, mother's age was below 21 years and in 29.3% cases it was between 22-24 years, in 45.7% cases it was between 25-29 years and in 14.1% it was between 30-34 years. Parity of mothers showed 19.6% (18) [66.7% (12) in early neonatal period] were 1<sup>st</sup> para. Maximum death 28.3% (26) occurred in third parity.

**Table 1: Distribution of infant deaths according to intra-natal care, n (%).**

Place of birth	Early neonatal	Late neonatal	Post neonatal	Total
Gov hospital	17 (60)	2 (7)	9 (33)	28 (30)
Private hospital	15 (60)	2 (8)	8 (32)	25 (27)
Trust hospital	4 (33)	3 (25)	5 (42)	12 (13)
Home	16 (64)	4 (16)	5 (20)	25 (27)
Other	2 (100)	0	0	2 (3)
<b>Total</b>	<b>54 (59)</b>	<b>11 (12)</b>	<b>27 (29)</b>	<b>92 (100)</b>
Normal delivery	53 (61)	8 (9)	26 (30)	87 (95)
LSCS	1 (20)	3 (60)	1 (20)	5 (5)

Early 0-6 days; late 7-29 days; post 30 days onwards; LSCS lower segment caesarean section; Gov- government.

Two doses of antenatal tetanus toxoid (TT) were received by 72.8%. 27.2% mothers had not received TT. IFA (iron-folic acid) was received by 75 % mothers during antenatal period.

Age wise analysis showed 65 (70.7%) deaths in neonatal period, and 27 (29.3%) in post-neonatal age group. Within neonatal period, 54 (58.7%) were early neonatal deaths and 11 (12%) late neonatal deaths. Sex distribution revealed a preponderance of male deaths 55 (60%) [female 37 (40%)] and of these 33 (60%) were early neonatal deaths.

In 52 (56.5%) cases pre-lacteal feed and breastfeeding (BF) was given; Exclusive BF was given in 13 (14.2%) cases; and no BF was given in 27 (29.3%).

28 (30.4%) infants died at a Government hospital, and 37 (40.2 %) at the private hospital and 27 (29.4%) at home (Table 1).

Distribution of infant deaths according to health problems/complication during mother's pregnancy/delivery is mentioned in Table 2.

Anemia and pre-eclampsia, and vaginal infection/bleeding were still the major problems in mother.

**Table 2: Distribution of infant deaths according to health problems/complication during mother's pregnancy/delivery, n (%).**

Health problem/ complication	Early neonatal	Late neonatal	Post neonatal	Total
Anaemia	23 (72)	2 (6)	7 (22)	32 (55)
Edema feet	12 (52)	2 (9)	9 (39)	23 (40)
Vaginal bleeding/smelly discharge	14 (82)	0	3 (18)	17 (29)
High blood pressure	7 (64)	1 (9)	3 (27)	11 (19)
Fever	4 (50)	2 (25)	2 (25)	8 (13)
Twin delivery	4 (66)	1 (17)	1 (17)	6 (10)
Severe abdominal pain that was not a labour pain	3 (75)	1 (25)	0	4 (7)
Oligohydramnios	3 (75)	1 (25)	0	4 (7)
Puffy face	1 (33)	1 (33)	1 (33)	3 (5)
Pallor and breathlessness (both)	2 (67)	0	1 (33)	3 (5)
Convulsion and Blurred vision	2 (100)	0	0	2 (3)
Severe vomiting	2 (100)	0	0	2 (3)
Any other chronic illness	3 (100)	0	0	3 (5)
Transverse lie	1 (100)	0	0	1 (2)

Early 0-6 days; Late 7-29 days; Post 30 days onwards.

Immediate major causes of infant deaths were severe birth asphyxia, hyaline membrane disease, septicaemia/ meningitis and prematurity (Table 3).

Birth weight data was available for 74 deaths (Table 4). The last treating hospital records were available for the 23 deaths out of 65 hospital deaths studied. When compared to verbal autopsy method, the diagnosis of cause of death was matching in 18 (78.3%) of these 23 cases.

**Table 3: Distribution of causes of infant deaths 2010 from verbal autopsy.**

Immediate cause	Early neonatal	Late neonatal	Post neonatal	Total
	N (%)	N (%)	N (%)	N (%)
Severe birth asphyxia	20 (95)	1 (5)	0	21 (23)
Hyaline membrane disease	14 (100)	0	0	14 (15)
Septicaemia	12 (67)	6 (33)	0	18 (20)
Meningitis	0	1 (10)	9 (90)	10 (11)
Pneumonia	0	1 (14)	6 (86)	7 (8)
Diarrhoea	0	0	3 (100)	3 (3)
Hypothermia	2 (100)	0	0	2 (2)
Birth injury	0	1 (33)	2 (67)	3 (3)
Trecheoesophageal fistula	2 (100)	0	0	2 (2)
Tetanus	1 (100)	0	0	1 (1)
Drowning	0	0	1 (100)	1 (1)
Not identified	3 (60)	1 (10)	6 (10)	10 (11)
<b>Total</b>	<b>54 (59)</b>	<b>11 (12)</b>	<b>27 (29)</b>	<b>92 (100)</b>
<b>Underlying cause</b>				
Prematurity	20 (83)	4 (17)	0	24 (26)
Congenital heart disease	2 (40)	0	3 (60)	5 (5)
Meconium aspiration syndrome	6 (75)	2 (25)	0	8 (9)
Hydrocephalus/meningocele	0	1 (100)	0	1 (1)
Maternal illness, feeding problem	14 (34)	2 (20)	19 (46)	35 (45)
Inborn error of metabolism	0	1 (33)	2 (67)	3 (3)
Other	12	1 (1)	3 (99)	16 (10)
<b>Total</b>	<b>54 (59)</b>	<b>11 (12)</b>	<b>27 (29)</b>	<b>92 (100)</b>

Early 0-6 days; Late 7-29 days; Post 30 days onwards.

**Table 4: Distribution of infant deaths according to birth weight and age at death.**

Age at death	Extensive LBW (<1000 gm)	Very LBW (1000-<1500 gm)	LBW (1500-<2500 gm)	Normal weight (≥2500 gm)	Total (n=74)*
	N (%)	N (%)	N (%)	N (%)	N (%)
Immediate	3 (60)	2 (15)	10 (28)	3 (15)	18 (24)
Early Neo	1 (20)	7 (54)	11 (31)	8 (40)	27 (37)
Late Neo	1 (20)	3 (22)	5 (14)	1 (5)	10 (14)
Post Neo	0 (0)	1 (8)	10 (28)	8 (40)	19 (26)
<b>Total</b>	<b>5 (7)</b>	<b>13 (18)</b>	<b>36 (49)</b>	<b>20 (27)</b>	

\*weight of only 74 infants was available. Neo- Neonatal period; Early- 0-6 days; Late-7-29 days; Post- 30 days onwards

**Table 5: Distribution of infant deaths 2018, comparison with our study 2010.**

Place of birth	Early neonatal	Late neonatal	Post neonatal	Total 2018	Total 2010
	N (%)	N (%)	N (%)	N (%)	N (%)
Gov. Hospital	11 (27)	20 (50)	9 (23)	40 (22)	28 (31)
Private Hospital	35 (29)	46 (39)	37 (31)	118 (62)	25 (27)
Trust Hospital	01 (50)	01 (50)	0	02 (1)	12 (13)
Home	06 (22)	13 (46)	09 (32)	28 (15)	27 (29)
<b>Total</b>	<b>53 (28)</b>	<b>80 (43)</b>	<b>55 (29)</b>	<b>188</b>	<b>92 (100)</b>

Early 0-6 days; Late 7-29 days; Post 30 days onwards; Gov government

## DISCUSSION

Recent data (2018) obtained from Bhavnagar District Health Authority about the place of delivery and causes

of infant deaths in year 2018, is mentioned in Tables 5 and 6.

The home deliveries reduced and institutional deliveries increased including those at private hospitals, due to

Government scheme of paying the private hospitals an attractive package for conducting deliveries.

This data was generated from records only without processing by verbal autopsy. The difference in the cause of deaths show the trend of improvement in health care produced by changes in different strategies of health care by the State Government over a period of eight years. As newborns survived, the inborn errors of metabolism as a disease became apparent. The prematurity was not reduced but rest other causes reduced as seen in Tables 5 and 6.

In our study, out of 92 verbal autopsies, 70.7% infant deaths were in neonatal period, chiefly in the early neonatal period (58.7%).

Mother's age less than 21 years at time of birth was in 10.3%.

Study on socio-demographic profile of all registered infant deaths in Bhavnagar city by Rathod et al showed that out of 96 verbal autopsies, 73 (76%) infant deaths were in neonatal period, chiefly in the early neonatal period (62.5%).<sup>6</sup> Male infant were 57.3% and 42.7% were female. Mother age less than 20 years at time of birth was in 15%.

In our study, maximum deaths (28.3%) occurred in third parity and in 1<sup>st</sup> parity 19.6% deaths occurred, among that 66.7% occurred in early neonatal period. A study from Chandigarh by Aggarwal et al shows highest neonatal mortality in first gravida.<sup>7</sup>

Another study done in Nepal also shows highest mortality in primiparous, which was not observed in our study.<sup>8</sup>

**Table 6: Distribution of causes of infant deaths 2018, comparison with our study 2010.**

Immediate cause	Early neonatal	Late neonatal	Post neonatal	Total 2018	Total 2010
	N (%)	N (%)	N (%)	N (%)	N (%)
Severe birth asphyxia	27 (71)	6 (16)	5 (13)	38 (20)	21 (23)
Hyaline membrane disease	8 (62)	5 (38)	0	13 (7)	14 (15)
Septicaemia	2 (11)	12 (67)	4 (22)	18 (9)	18 (20)
Meningitis	0	1 (25)	3 (75)	4 (2)	10 (11)
Pneumonia	1(12)	2 (25)	5 (63)	8 (4)	7 (8)
Diarrhoea	0	2 (40)	3 (60)	5 (3)	3 (3)
Hypothermia	0	0	0	0	2 (2)
Birth injury	0	3 (100)	0	3 (1)	3 (3)
Trecheoesophageal fistula	0	2 (100)	0	2 (1)	2 (2)
Tetanus	0	0	0	0	1 (1)
Drowning	0	0	2 (-)	2 (1)	1 (1)
Snake bite	0	0	1 (-)	1 (1)	-
Fever	1	0	1 (-)	2 (1)	-
Jaundice	1 (50)	1 (50)	0	2 (1)	-
Convulsion	1 (25)	0	3 (75)	4 (2)	-
Severe bleed	2 (40)	2 (40)	1 (20)	5 (3)	-
Not identified	10 (12)	44 (55)	27 (33)	81 (43)	10 (11)
<b>Total</b>	<b>53 (28)</b>	<b>80 (43)</b>	<b>55 (29)</b>	<b>188</b>	<b>92</b>
<b>Underlying cause</b>					
Prematurity	20 (45)	23 (52)	1 (2)	44 (23)	24 (26)
Congenital heart disease	3 (37)	2 (25)	3 (37)	8 (4)	5 (5)
Meconium aspiration syndrome	2 (50)	2 (50)	0	4 (2)	8 (9)
Hydrocephalus/ meningocele	0	1 (50)	1 (50)	2 (1)	1 (1)
Maternal illness/ feeding problem	3 (60)	2(40)	0	5 (3)	35 (45)
Inborn error of metabolism	1 (11)	3 (33)	5 (56)	9 (5)	3 (3)
LBW	12 (1)	6 (27)	5 (22)	23 (12)	-
Congenital Deformity	2 (18)	3 (27)	6 (54)	11 (5)	-
Skin Problem	0	0	1 (100)	1 (1)	-
Cerebral palsy	0	1 (100)	0	1 (1)	-
Other	11 (13)	37 (45)	33 (40)	81 (43)	16 (10)
<b>Total</b>	<b>53 (28)</b>	<b>80 (43)</b>	<b>55 (29)</b>	<b>188</b>	<b>92</b>

Early- 0-6 days; Late-7-29 days; Post- 30 days onwards

As per Table 2, anaemia was most common (55.1%) of which 72% deaths occurred in early neonatal period; followed by edema feet (39.65%), vaginal discharge/bleeding (29.31%), high blood pressure (18.9%), and twin delivery (10.36%). Other health problems or complication found were- severe abdominal pain, fever, convulsion, oligohydramnios, severe vomiting, puffy face, transverse lie.

As per NFHS-3 data in Gujarat, problem during pregnancy were anemia (60.6%) which is almost same as our study, and vaginal bleeding (15.8%), which are less as compared to our study.<sup>9</sup>

NFHS-3 data of India and Gujarat showed neonatal mortality of 68.4% and 67.4% of total infant mortality rate respectively which is less than our study (70.7%).<sup>9</sup>

A study done by Kameswan et al showed early neonatal deaths due to birth asphyxia [SBA (33%)] and hyaline membrane disease [HMD (16%)], while in our study it was; SBA 23%, HMD 15%.<sup>10</sup> Similarly a study done in urban slum of Tamil Nadu by Vaid et al showed leading causes of infant deaths as birth asphyxia (17%), respiratory infections (10%), congenital anomalies (9.6%), prematurity (9.1%) and meningitis (2.3%).<sup>11</sup>

#### **Possible intervention points**

##### *Birth asphyxia (SBA)*

There were 37% deaths in early neonatal period due to SBA as compared to 2% in late and post neonatal period. There was a significant ( $p=0.0003$ ) association of deaths due to birth asphyxia reported in early neonatal period, predominantly in full term normal weight baby.

##### *Hyaline membrane disease*

There was statistically significant ( $p=0.0018$ ) alliance of HMD with deaths in early neonatal period and preterm delivery.

##### *Septicaemia*

There was a significant ( $p=0.0067$ ) relation of deaths due to septicaemia with late neonatal period. There were 42% deaths due to septicaemia in preterm infant and 12% in full-term babies. 30% LBW babies died due to septicaemia as compared to 10% normal weight babies. 22% who died due to septicaemia were delivered at home and 18% at hospital ( $p=0.563$ ).

##### *Birth weight*

Weight of only 74 infants was available (Table 4). 49% infant were LBW (<2500 gm) out of whom 28% died in post neonatal period; 18% had very low birth weight (1000 gm-<1500 gm) and 7% had extremely low birth

weight (<1000 gm) among which 60% died within one hour.

A study showed 15.2% neonatal deaths and 0.7% post neonatal deaths were due to LBW which is less as compared to our study.<sup>12</sup> A study by Pratinidhi et al showed that nearly 70% of the neonatal deaths were associated with LBW.<sup>13</sup>

##### *Prematurity*

Infant deaths related to prematurity were 37% early, 36% late; and no premature death in post neonatal period ( $p=0.0006$ ). Similarly one study showed higher deaths related to prematurity in neonatal compared to post neonatal period.<sup>14</sup> Infant death due to prematurity was related to maternal illness during pregnancy (31%), primipara mothers (44%), and with no ANC (antenatal care) visits during pregnancy (40%).

##### *Meningitis*

There were 33% deaths in post neonatal period as compared to 2% in late neonatal period and no case in early neonatal period. 19% home and 8% hospital delivered infants developed meningitis. So higher chances ( $p=0.0001$ ) of deaths due to meningitis in post neonatal period as compared to neonatal period. Similar result was reported in study also, showing higher chances of deaths due to meningitis in post neonatal period as compared to neonatal period.<sup>12</sup>

##### *Pneumonia*

Infant deaths due to pneumonia were 22% in post neonatal period and 2% in neonatal period. This difference is significant ( $p=0.0029$ ). Similar type of result also reported in studies showing higher chances of deaths due to pneumonia in post neonatal period as compared to neonatal period.<sup>12</sup> And 9% deaths were in non-breast fed infants and no death in exclusively breast fed infant ( $p=0.542$ ).

In our study, for the 23 deaths the last treating hospital records were available. When compared to verbal autopsy method, the diagnosis of cause of death was matching in 18 (78.3%) cases. So, verbal autopsy seems to be a fairly accurate and useful tool for assessing the cause of death, where applicable in a community setting.

2018 data obtained from Bhavnagar District Health Authority is as per Table 5, 6. It shows-

Death reported was 188 in eight months as compared to previous 126 deaths in one year (2010). This is because of improvement in data reporting system.

Home delivery decreased from 27% to 15% and institutional deliveries increased. This change is because of increased registration for antenatal care and 'e-Mamta'

and transfer facility esp. 108 free ambulance services (Table 5).

Early neonatal death decreased from 58% to 28 % due to above. The decrease in death due to birth asphyxia was only from 23% to 20%, so it requires improvement.

Death due to HMD in preterm decreased from 15% to 7% which is because of increased institutional delivery, antenatal steroids, and early availability of free surfactant therapy and CPAP.

Infection- septicemia, pneumonia and meningitis related death decreased. This may be because of improvement in aseptic precautions during delivery and post natal period through training and social messaging, with emphasis on breast feeding.

## CONCLUSION

Infant and neonatal deaths were seen more with, illiteracy of mother, age of mother (25-29 years), 3<sup>rd</sup> parity, anaemia, and vaginal discharge; and non-breast fed, low birth weight and preterm. There was association of deaths due to birth asphyxia and hyaline membrane disease with early neonatal period and meningitis and pneumonia with post neonatal period.

There was no association between infant or neonatal death and mother receiving one or two dose of inj. TT, Tab. iron-folic acid; home or hospital delivery; male gender. There was no association of pneumonia in non-breastfed infants.

Comparison with 2018 data shows that over eight years there has been: decrease in home delivery, early neonatal death, and death due to HMD in preterm, and septicemia. But in birth asphyxia and prematurity related death there was less improvement. Verbal autopsy is a very important tool for robust data collection to find out the cause and other related and contributing factors of death.

### *What is already known?*

Causes and timing of infant deaths are available only through the analysis of secondary data in Gujarat; and Separate data for each district is not available.

### *What this study adds?*

First community (Bhavnagar Rural district) based verbal autopsy (for causes of death) of its kind in the state to identify pattern of infant deaths. Over a period of eight years; the early neonatal deaths have decreased, institutional deliveries increased and home deliveries have decreased; deaths due to hyaline membrane disease HMD of preterm and septicemia have decreased. Associated maternal illness and feeding problem have

decreased; and birth asphyxia, prematurity and inborn errors of metabolism IEM have not changed much.

## Recommendations

At community level improvement is required in reproductive health education to all adolescent girls and mothers, treatment of fever and vaginal discharge; and breast feeding counselling. Along with iron supplementation, vitamin B12 should be given as most of mothers are vegetarian and more infant deaths are associated with anemia of mother. Health workers attending deliveries should be skilled in neonatal resuscitation, prematurity management and early referral. More attention is to be paid to identification of congenital anomaly and inborn error of metabolism by means of antenatal screening and USG and neonatal metabolic screen.

## ACKNOWLEDGEMENTS

We thank the District Health authority, Bhavnagar for help in data access.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee Government Medical College, Bhavnagar*

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**Cite this article as:** Patel RB, Sinol HA, Jindal SV, Gohil JR. Verbal autopsy of neonatal and infant deaths from Bhavnagar rural and comparison with recent data. *Int J Community Med Public Health* 2021;8:351-8.