ORIGINAL RESEARCH ARTICLE

Assessing The Mortality Patterns in Rural Villages of Gujarat State of India Through Field Based Study Using Verbal Autopsy Tool

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ABSTRACT

Background: Well-planned verbal autopsies can provide timely, robust, and plausible information on mortality causes and can have positive influence on disease control priorities. The present study was intended to assess probable causes of death in rural areas of Anand district of Gujarat State by implementing "Verbal autopsy tool."

Material and Methods: A Cross-sectional study was conducted where all recorded 227 deaths from six villages of selected areas during January 2017 to December 2018 were considered for the study. Multiple steps were employed in conducting verbal autopsy including staff training, development of study questionnaires, physician's involvement in assigning causes of death etc. The data analysis was performed using Statistical Package for Social Sciences (SPSS) Software with Version 24.

Results: Out of 227 deaths, the maximum deaths were attributed to non-communicable diseases (NCDs). The predominant NCDs among deceased individuals were cardiovascular diseases (66.01%), malignancy (21.56%), chronic pulmonary diseases (9.80%) and Diabetes Mellitus type 2 (2.63%). Among communicable diseases, nearly 48% of deceased individuals had bacterial infections including Tuberculosis followed by viral infections including HIV (31%), parasitic infections (21%).

Conclusions: Despite few limitations, lay reporting of deaths supplemented with physician assignment of cause of death for verbal autopsies, remains a practicable strategy to record the various patterns of mortality reliably for unattended deaths.

Key words: Adjudication, Cross Sectional Study, Cause of Death, ICD Classification

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INTRODUCTION

Evidence of death and disease is essential in providing standards of health care and eventually to understand the health in the society.[1] Out of 60 million estimated deaths globally, 9.6 million deaths are estimated to occur in India annually, which is 16% of total global deaths.[1] More than 75% of deaths in India occur at home and majority of them do not have certified cause.[2]

Mortality statistics provides valuable insights into the health status and current and future health needs of population. However, the patterns of mortality as well as associated rates such as crude death rate, age and sex specific death rates, proportional mortality rates still vary greatly around the world. The countries with high mortality rates like South Africa, Rwanda and Republic of Tanzania indicate the pattern of high childhood and adult mortality primarily due to infectious ailments like tuberculosis, HIV/AIDS, and nutritional deficiencies.[1,2] The upsurge in maternal mortality in these nations might be attributed to inadequate healthcare facilities for care of the woman during pregnancy, during delivery and post-natal care.[3] In developed countries like United Kingdom, Australia and United States of America, there is low level of child and adult mortality except in old age, where non communicable diseases form the main cause of death.[1,2] Countries like Russian Federation and Estonia has been shown low childhood and high adult mortality whereas India and Afghanistan report high childhood and adult mortality.[4]

Verbal Autopsy is an investigation of chain of events, circumstances, key symptoms leading to death through structured interviews of living family members or associates of deceased. Trained physicians then utilize this information to determine causes of death. It is widely employed for the estimation of cause specific mortality in regions with little or no medical death certification.[5,6] It has also been witnessed that well implemented verbal autopsies can provide timely, robust, and plausible information on mortality causes and may have positive influence on disease control priorities.[7,8]

Pertaining to mortality patterns in India, only one-fifth (20%) of deaths from rural regions and one-third (33%) of deaths from urban areas take place in hospital settings.[9] Most of the hospital deaths are generally attended by a physician but many deaths which occur outside the health care settings make identifying cause of death very difficult.[5-9] Even the deaths which occur in hospital settings, the use of clinical and laboratory investigation is limited. In conjunction with very infrequent use of post-mortem examinations, the available scarce clinical information makes reliable certification of cause of death very challenging throughout India.[10-21] Studies in various states of India have revealed that verbal autopsies can be used effectively among rural population.[11, 12] The supporting evidence also indicates that health workers can be potentially trained to use the verbal autopsy to ascertain the cause of mortality among various population groups.[13]

The present study was envisioned to assess mortality patterns by cause, age groups and gender in well-defined rural areas of Anand District of Gujarat by conducting "Verbal autopsy tool" over the period of 24 months.

METHODOLOGY

Study Design: A Cross-sectional descriptive study was implemented in Anand District of Gujarat State of India. A total of 27 villages, which were under the field practice area of one of the tertiary health care centres were included as the sampling frame. Of 27, six villages were selected using the convenience sampling method. Village Health Worker (VHW) and Field Supervisor of each respective village assisted in selection of villages. The Ethics Committee Review Board of the respective institute provided an approval for the study (Reference no-HMPC/MCE/IEC/UG/PG/20/11/16, Approval date: 11/07/2016). An informed consent was received from the respondents.

Study Population and Sample Size Estimation: All recorded 274 deaths which occurred in the six villages of the selected area from January 2017 to December 2018 were considered for the study. All deaths were verified with the local community for completeness of death reporting. The houses of deceased individuals in selected villages were approached for conducting interviews of respondents. Of which, 47 houses were identified as locked and revisited the same houses after one week, but the houses were locked. No third attempt was made to visit these 47 houses and excluded from the study. The revised sample size was 227 deaths.

Selection of Deceased Individuals and Recruitment Process

There steps were implemented in conducting verbal autopsy.

Step-1: Continuous monitoring and recording of vital events in the registers such as deaths, births, pregnancies by Female Health Worker (FHW) under supervision of field supervisors.

Step-2: Verbal autopsy interview process in the field area by field supervisors and investigator.

Step-3: Assigning "cause of death" by two trained physicians using ICD-10 classification.

Survey Instrument: The study used validated structured verbal autopsy (VA) questionnaire as a tool for data collection. The questionnaire was modified version of existing World Health Organization (WHO) standard verbal autopsy (VA) questionnaire.[22] It was translated into local language (Gujarati) and its fea-

sibility in data collection was ensured. Four separate translated VA questionnaires were used to collect detailed information each for neonatal, child, adult, and maternal deaths respectively. The questionnaire was translated (Forward translation) and back translated (Backward translation) by panel of three independent translators. The back translated version of questionnaire was further assessed by other two multilingual experts. A pilot study was carried out to ensure the validity of the tool and to assess the VA procedure. The VA questionnaire comprised of demographic information of respondents and deceased, information on the events surrounding the death, the cardinal symptoms and probing details for each cardinal symptom. When available, laboratory investigation reports, hospital records, and death certificates were photocopied and incorporated in the review process. The face validity, content validity and consensus validity of the survey instrument were ascertained before the commencement of the study.

Training of Field Supervisors: Two full days of training sessions were utilized for field supervisors who were female graduates and willing to perform assigned tasks. All sessions were facilitated by experts and were concluded with constructive feedback process. The classroom and field work-based training were imparted to field supervisors. The training agenda emphasized on skills to conduct a good interview, mock VA interview exercises, orientation about cardinal signs and symptoms related to mortality.

Data Collection: The list of the deceased individuals was prepared according to their place of residence (Faliya) and respondents were contacted by house-to-house visit. An approximate duration of each interview was around 20-25 minutes. Two-third of the data collection work was done by field supervisors, while one-third work was performed by investigators to ensure the data quality and to assess the completeness of the field work. Entire verbal autopsy process was supervised and monitored by investigators as per preformed checklist. Weekly review meetings were organized to evaluate the progress of data collection process till its completion.

Assignment of Causes of Death by Trained Physicians: Figure one illustrates the entire process of assigning cause of death. In case of any disagreements among physicians, they were given 'reconciliation task' to ensure consensus. 'Adjudication Process' was also instigated in case of further disagreement between two physicians by consulting third senior experienced physician to make final decision on ICD code.

Statistical Analysis: The data analysis was performed using Statistical Package for Social Sciences (SPSS) software version 24. The frequency tables were prepared for nominal variables. Interval variables (viz. Age of the respondent, age of deceased) were converted into categorical variables and frequency, proportions were calculated. Outcome variables were probable causes of death, quality of narrative, certainty of diagnosis. Outcome variables such as non-communicable diseases, communicable diseases were converted into dichotomous variables category for the purpose of applying chi-square test and logistic regression. P value less than 0.05 was considered as statistically significant.

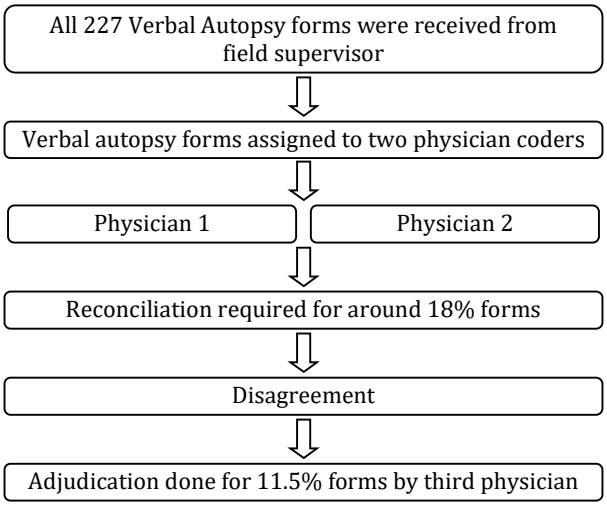

Figure 1: Flow of Physician coding of cause of Death

RESULTS

Sociodemographic Profile of Deceased Individuals: In the present study, out of 274 deaths, verbal autopsy was carried out for 227 deaths with overall response rate of 82.8%. The female response rate (61.2%) was greater than male response rate (38.8%). The mean age of the respondent and deceased individuals was 43.4 (95% CI [41.4-45.5]) and 59.5 (95% CI [56.7.4-62.3]) years respectively. Table one delineates age and gender wise details of deceased people. Among the deceased individuals, 172 (75.7%) were Hindus, 46 (20.3%) were Muslims and 9(4%) belonged to Christian community.

In this study, 69(30.4%) deceased individuals were illiterate, 79(34.8%) and 44(19.4%) had completed primary and secondary education respectively.

Table 1: Age and gender distribution of the deceased individuals (n=227)

Age of the deceased individual	Gender		
	Male (%)	Female (%)	Total (%)
28 days or less	0	04 (100)	04 (100)
29 days to 14 years	03 (60)	02 (40)	05 (100)
15 to 25 years	08 (80)	02 (20)	10 (100)
26 to 35 years	12 (85.7)	02 (14.3)	14 (100)
36 to 45 years	11 (61.1)	07 (38.9)	18 (100)
46 to 55 years	29 (69.1)	13 (30.9)	42 (100)
56 to 65 years	24 (66.7)	12 (33.3)	36 (100)
>65 years	60 (61.2)	38 (38.8)	98 (100)
Total	**147 (64.8)**	**80 (35.2)**	**227 (100)**

Table 2: Mean crude death rate and gender specific death rates

Death rates	Population	Mean	95% CI
Crude Death Rate	No of deaths in specific year/ midyear population in all 6 villages (274/ 29780)	9.2/1000	8.4-11.1
Specific Death Rate for males	No of deaths among males/ midyear population of males in all 6 villages (167/15078)	11.1/1000	9.1-13.6
Specific Death Rate for females	No of deaths among females/Midyear population of females in all 6 villages (107/14702)	7.3/1000	5.3-10.1

CI- Confidence Interval, multiplying factor – per 1000 males, SD- Standard Deviation

Table 3: Distribution of deaths according to broad categories as per ICD-10 (n=227)

Broad categories as per ICD-10	ICD code	Deaths (%)
Intestinal infectious diseases	A00-A09	13 (5.7)
Tuberculosis	A15-A19	5 (2.2)
Other bacterial diseases	A30-A64	1 (0.4)
Viral infections of central nervous system	A80-A89	2 (0.9)
Viral hepatitis	B15-B19	1 (0.4)
Human immunodeficiency virus (HIV) disease	B20-B34	2 (0.9)
Protozoal diseases	B50-B64	1 (0.4)
Pediculosis, acariasis and other infestations	B85-B99	3 (1.3)
Malignant neoplasms of mouth/upper GI	C00-C14	2 (0.9)
Malignant neoplasms of digestive organs	C15-C39	19 (8.4)
Malignant neoplasms of bone and articular cartilage	C40-C41	1 (0.4)
Melanoma and other malignant neoplasms of skin	C43-C44	1 (0.4)
Malignant neoplasm of breast	C50	2 (0.9)
Malignant neoplasms of female genital organs	C51-C58	2 (0.9)
Malignant neoplasms of male genital organs	C60-C63	1 (0.4)
Malignant neoplasms of eye, brain, and other part of CNS	C69-C72	1 (0.4)
Malignant neoplasms of ill-defined, secondary, and unspecified sites	C76-C80	3 (1.3)
Malignant neoplasms of lymphoid, haematopoietic, and related tissue	C81-C96	1 (0.4)
Diabetes mellitus	E10-E14	4 (1.8)
Mood (affective) disorders	F30-F39	1 (0.4)
Unspecified mental disorder	F99	1 (0.4)
Inflammatory diseases of central nervous system	G00-G09	1 (0.4)
Episodic and paroxysmal disorders	G40-G47	7 (3.1)
Polyneuropathies and other disorders of PNS	G60-G99	1 (0.4)
Pulmonary heart disease and diseases of pulmonary circulation	I20-I28	47 (20.7)
Other forms of heart disease	I30-I52	13 (5.7)
Cerebrovascular diseases	I60-I69	24 (10.6)
Influenza and pneumonia	J10-J18	3 (1.3)
Other acute lower respiratory infections	J20-J22	1 (0.4)
Chronic lower respiratory diseases	J40-J47	11 (4.8)
Diseases of oesophagus, stomach and duodenum	K20-K31	2 (0.9)
Diseases of liver	K70-K77	6 (2.6)
Renal failure	N17-N19	3 (1.3)
Respiratory and cardiovascular disorders specific to perinatal period	P20-P29	1 (0.4)
Other disorders originating in the perinatal period	P90-P96	1 (0.4)
Other congenital malformations of digestive system	Q38-Q45	1 (0.4)
General symptoms and signs	R50-R68	14 (6.2)
Ill-defined and unknown causes of mortality	R95-R99	4 (1.8)
Motorcycle rider injured in transport accident	V20-V29	4 (1.8)
Occupant of three wheeled motor vehicle injured in transport accident	V30-V39	1 (0.4)
Falls	W00-W19	8 (3.5)
Other accidental threats to breathing	W75-W84	1 (0.4)
Contact with venomous animals and plants	X20-X29	1 (0.4)
Accidental poisoning by an exposure to noxious substances	X40-X49	2 (0.9)
Event of undermined intent	Y10-Y34	1 (0.4)
Sequel of external causes of morbidity and mortality	Y85-Y98	2 (0.9)
Total		227 (100)

ICD- International Classification of Diseases

Fifty-nine (26%) of them were housewives and 34 (15%) were non-workers. Agricultural and non-agricultural wage labourers accounted for 12.8% and 10.1% of deceased individuals respectively. The majority (84.58%) of individuals belonged to Class IV (lower middle) and Class V (lower) of socioeconomic class (Modified Prasad Classification). More than half 123(54%) of verbal autopsy interviews were conducted 6-12 months (recall period- time period between occurrence of the death event and date of in-

terview) after the death of deceased individuals. Out of total 227 deaths, 183(80.60%) deaths were registered with local registration authority (Village Panchayat). However, 10 (4.4%) deaths were not registered whereas registration status remained unknown for 34 (15%) deaths.

Predominant Causes of Mortality: The mean crude and gender specific death rates among the diseases individuals are depicted in Table 2. For calculation of crude death rate and gender specific death rates, all 274 deaths were considered. Pertaining to information about place of death of 227 deceased, 176 (77.5%) deaths occurred at home while remaining 51(22.46%) deaths were reported in different health care settings such as Primary health centres (PHC), Community health centres (CHC), District and private hospitals etc.

Table 3 delineated probable causes of deaths among 227 deceased individuals through verbal autopsy method. The maximum deaths were ascribed to non-communicable health problems (NCDs) (Table 3). After in-depth analysis of reports of laboratory investigations and clinical case records, it was revealed that, the predominant NCDs among deceased individuals were cardiovascular diseases (66.01%), malignancy (21.56%), chronic pulmonary diseases (9.80%) and Diabetes Mellitus type 2 (2.63%). Among communicable diseases, nearly 48% of deceased individuals had bacterial infections including Tuberculosis followed by viral infections including HIV (31%), parasitic infections (21%). In the current study, only four (1.76%) deaths occurred among neonates. Pneumonia, birth asphyxia, convulsions and congenital atresia were the leading causes of death among them and contributed equally.

Table 4 indicates the distribution of co-morbidity profiles of adult deceased who were above 15 years of age. Out of 218 adult deceased individuals, 110 (50.45%) were smokers and tobacco chewers while 35 (16.05%) were alcoholics. Tobacco chewing (X^2 = 6.37, p=0.01) and alcohol (X^2 = 9.17, p = 0.002) showed statistically significant association with the mortality due to NCDs. More than two-thirds (71.1%) of the deceased were vegetarian and around one-thirds (28.9%) were non- vegetarians. However, the study could not show any statistically positive correlation between other risk factors and NCDs induced mortality. Table 5 explains the relationship between various risk factors and occurrence of non-communicable diseases among deceased. Tobacco chewing and alcohol were significantly associated with NCDs (p<0.05). The information about variables could not be retrieved for one deceased person.

Reconciliation and Adjudication of Deaths: The present study also assessed the process of reconciliation and adjudication of deaths. Out of 227 deaths, major disagreements were observed between two physicians in 43 (18.9%) of deaths. Both the physicians were agreed in diagnosis of 81.1% of deaths

Table 4: Distribution of co-morbidity profiles of adult deceased (>15 years) reported by respondents (n=218)

Co-morbidities	Frequency (%)
Hypertension	
Yes	69 (31.7)
No	135 (61.9)
Unknown	14 (6.4)
Heart disease	
Yes	25 (11.5)
No	180 (82.6)
Unknown	13 (5.9)
Stroke	
Yes	29 (13.3)
No	180 (82.6)
Unknown	9 (4.1)
Cholesterol problem	
Yes	5 (2.3)
No	192 (88)
Unknown	21 (9.6)
Diabetes	
Yes	26 (11.9)
No	185 (84.9)
Unknown	7 (3.2)
Tuberculosis	
Yes	10 (4.6)
No	198 (90.8)
Unknown	10 (4.6)
HIV/AIDS	
Yes	1 (0.4)
No	197 (90.4)
Unknown	20 (9.2)
Cancer	217 (100)
Yes	27 (12.4)
No	177 (81.2)
Unknown	14 (6.4)
COPD	
Yes	37 (16.9)
No	173 (79.4)
Unknown	8 (3.7)

COPD- Chronic Obstructive Pulmonary Disease

Table 5: Distribution of deaths due to non-communicable diseases according to life style variables (n=152)

Life style variables	Mortality due to NCD		P value*
	Yes (%) (n=162)	No (%) (n=65)	
Smoking			
Yes	80 (72.7)	30(27.3)	0.38
No	72 (67.3)	35 (32.7)	
Tobacco chewing			
Yes	17 (51.5)	16 (48.5)	0.01*
No	135 (73.4)	49 (26.6)	
Tobacco applying			
Yes	07 (58.3)	05 (41.7)	0.36
No	145 (70.7)	60 (29.3)	
Alcohol			
Yes	17 (48.6)	18 (51.4)	0.002*
No	135 (74.2)	47 (25.8)	
Diet			
Yes	42 (65.1)	22 (34.9)	0.32
No	110 (71.9)	43 (28.1)	

NCD -Non communicable diseases
P<0.05 = statistically significant

before reconciliation, which was raised to 88.5% after reconciliation. Out of 227 deaths, 26 (11.5%) deaths required adjudication by third senior physician.

Table 6: Distribution of Deaths According to the Certainty of Diagnosis Given by Two Physicians (n=227)

Certainty of diagnosis of physician 1	Certainty of diagnosis of physician 2		
	Low (%)	High (%)	Total (%)
Low	36 (85.7)	06 (14.3)	42(100)
High	20 (10.8)	165 (89.2)	185(100)
Total	56 (24.7)	171 (75.3)	227(100)

Kappa coefficient (0.66) applied to determine level of agreement; P value <0.001

Table 7: Distribution of the Deaths Due to Communicable Diseases according to Socio-Economic Profile of the Deceased

Variables	Mortality due to CD		P value
	Yes (%)	No (%)	
Age groups			
<15 years	05(55.6)	04 (44.4)	0.02*
15-65	17(14.2))	103(85.8	
>65	11 (11.2)	87 (88.8)	
Total	33 (14.5)	194 (85.5)	
Gender			
Male	18(12.2)	129 (87.8)	0.1
Female	15 (18.8)	65 (81.3)	
Total	33 (14.5)	194 (85.5)	
Religion			
Hindu	27 (15.7)	145 (84.3)	0.6
Muslim	05 (10.9)	41 (89.1)	
Christian	01 (11.1)	08(88.9)	
Total	33 (14.5)	194 (85.5)	
Education			
Illiterate	11 (15.9)	58 (84.1)	0.25
Informal education	02 (18.2)	09 (81.8)	
Primary or below	13 (16.5)	66(83.5)	
Secondary	04 (9.1)	40 (90.9)	
Graduate & above	01 (6.3)	15 (93.8)	
Total	31 (14.2)	188 (85.8)	
Occupation			
Non worker	04(11.8)	30 (88.2)	0.4
Salaried	02 (8.7)	21 (91.3)	
Business	03 (14.3)	18 (85.7)	
Farmer	01 (4.0)	24 (96.0)	
Agricultural wage labourer	04 (13.8)	25 (86.2)	
Non-agricultural wage labourer	03 (13.0)	20 (87.0)	
Student	02 (50.0)	02 (50.0)	
Housewife	11 (18.6)	48 (81.4)	
Other	01 (25.0)	03 (75.0)	
Total	31 (14.0)	191 (86.0)	
Socio-economic class [24]			
I	0 (0.0)	3 (100.0)	0.69
II	02 (22.2)	07 (77.8)	
III	02 (8.7)	21 (91.3)	
IV	07 (12.1)	51 (87.9)	
V	22 (16.4)	112 (83.6)	
Total	33 (14.5)	194 (85.5)	

P<0.05 = statistically significant; CD - Communicable diseases

Quality of narrative was rated high among 141 (93.4%) of deaths by both the physicians with strong (85.9%) level of agreement [kappa coefficient (k) = 0.67, Z = 10.18, p<0.05). Certainty of diagnosis was rated high in 165 (89.2) deaths by both the physicians with strong (88.5%) level of agreement (k=0.66, p <0.001) (Table 6). Overall, the agreement between both the physicians in ascertaining diagnosis was very strong (k=0.76, p <0.001). The level of agreement between causes of death according to respondents and causes of death given by ICD-10 was with moderately strong agreement (k=0.59, p <0.001).

Age Group Patterns: Table 7 depicts distribution of the mortality patterns due to infectious diseases. Except gender, for none of the variables, there was a statistically significant difference (Table 7). However, the detailed information of 5 deceased individuals could not be obtained. The study also detected trends of deaths among different age groups. The deaths due to NCDs revealed rising trends among young and middle-aged individuals followed by decline between age group of 45-55 years and again there was a sharp upsurge among elder groups. The mortality due to communicable diseases was high among individuals of 15-45 years age and with more than 60 years of age. Injuries were more common among deceased of 15-45 years of age.

DISCUSSION

The present study used local female graduates since it is highly expensive to recruit professionally trained persons to conduct verbal autopsy interviews and related tasks. Generally, it is challenging to get female workers willing to perform to do field work but in the present study, all field supervisors (interviewers) were females and were extremely motivated to handle assigned responsibilities.

The VA tool for adult mortality is an open narrative format which includes the check list of signs and symptoms with filters to retrieve additional data about events or circumstances associated with death. This tool is highly sensitive and the validity of it was influenced by the intensive training provided to the field supervisors (interviewers) on instant random scrutiny of 5% of interview data and reviewing VA reports centrally by two physicians to ascertain probable underlying cause of mortality which is found to be more effective than opinion-based algorithms.[11] However, in India, there is sparse literature about validity of cause of mortality among adults through verbal autopsy.

In the current study, overall, the deaths from unspecified and unknown reasons reduced from 51% to 19% (p<0.05) in study area. Two full day's comprehensive training to write VA reports followed by sustained supervision of submitted reports led to identify probable underlying cause of mortality for most of

the deaths. The specific causes of mortality arrived through VA reports may be utilized to compute death rates for Anand District of Gujarat State.

One of the significant findings of the present study was that physicians were accurate in appropriately certifying causes of mortality among the target population. In this study, during reconciliation process, only among 18.9% of deaths, there was major disagreement between two physicians; otherwise, they diagnosed causes of deaths accurately in the majority (81.9%) of deaths. This might be attributed to high level of agreement between two physicians in first round of coding only and good quality of verbal autopsy narrative. Physicians are precisely trained to assess pathological processes and, in principle at least, to suitably apply the directions and procedures of the ICD to certify the cause of death. Reporting of deaths paired with physician coding assignment of verbal autopsies, despite some challenges, is more practicable technique to document mortality patterns than automated algorithms.[16] These findings were supported by the present study.

In our study, the leading causes of mortality, in descending order, were non-communicable (NCDs) diseases, infectious diseases and injuries. Prospective study of one million deaths conducted by Jha P et al. [16] reported NCDs as cause of death among 42% of deceased individuals. A MINErVA study carried out by AIIMS New Delhi [17] mentioned NCD as major cause of death among 55% of study population. Comparing to these studies, the mortality rate due to NCDs was higher in the current study. The difference in findings could be due to enhancing trend of NCD induced mortality over last decade due to changes in life-style patterns as well as social and economic transitions in the society.

In the current study, the majority (96%) of deceased individuals were adults and remaining 4% were neonates and children. Two-third (64.8%) of deceased were males and one-third (35.2%) of them were females. Almost similar findings were also noted in studies of Jha P et al[18] and Khademi H et al[19].

A key element in the reliability of data regarding cause of death through verbal autopsy (VA) is the recall period. The existing literature shows varying optimal recall time to attain maximum validity of a VA from as soon as the mourning occurs up to 12 months and beyond.[20] World Health Organization (WHO) recommends that, after a period of death, the verbal autopsy should be implemented as soon as possible and recalls exceeding one year must be interpreted with caution.[20-22] In the present study, around 80% of interviews were conducted within 12 months and recall time exceeded one year for 20% of interviews which were derived up to maximum 24 months. Overall, in this study, the recall time during verbal autopsy was consistent with WHO recommendation.

The existing study indicated the mean crude death rate (CDR) of all the deaths occurred in six villages was 9.2 which was comparable to national average CDR of rural population of India.[23] By comparing CDR of study site (9.2) with CDR of rural residence of Gujarat State (7.3), it was seen that, the current study had higher than state average. This disparity might be possibly due to variation in demography across the other parts of Gujarat state of India. The present study also reported comparative findings of gender specific CDR in males (11.1) and females (7.3) with national CDR of 8.3 and 6.8 in males and females respectively.[23] These differences could be attributed to differences in the geographical and demographic patterns across other regions of country.

This study showed that information on probable causes of death can be effectively obtained by this alternative tool (planned verbal autopsy) and the study can also be expanded to cover remaining 21 villages of study area. In the current study, it was also observed that, even though, the performance of field supervisors in conducting interviews was satisfactory, the study revealed few lacunae in their functioning. Peripheral health workers such as female health workers (FHWs), field supervisors should be trained in conducting verbal autopsy and refresher training should be taken at regular intervals. Resident doctors can also be involved in capacity enhancement as well as monitoring of these health workers.

The present study recommends few reforms in government health system. Undoubtedly, to ensure the authenticity and validity of verbal autopsy method, it should be implemented by government as a routine data collection tool at Primary Health Centres (PHCs) and grass root level staff such as Multipurpose Workers (MPHWs), Accredited Social Health Activists (ASHAs), Anganwadi Workers (AWWs) should be trained in conducting verbal autopsy. Panchayat (local government) system in the village should be linked with health care systems such as sub centres and PHCs. Deaths registered in the Panchayat should be regularly informed to PHC Medical officers and accordingly verbal autopsy can be carried out by concerned authorities. Similarly, death certification system may be implemented at the PHCs and other government health centres.

LIMITATIONS

An important potential limitation of the present study was the small sample size and restriction of sample only from rural settings. Therefore, the emerging findings cannot be generalized. The reliability of the information on symptoms at the time of deaths given by the respondents was based on cooperation and reliable description on the part of the respondents. Additionally, extra medical information of deceased regarding investigations, diagnosis, treatment received was not available with some of the family members. These things might have affected the quality of narrative and probable causes of

death. In the study, maternal deaths had not been documented so maternal autopsy could not be performed and conclusions for maternal deaths could not be drawn. Neonatal and child deaths were also less in number, so valid conclusions about their mortality causes could not be made.

Conclusion

Lay reporting of unattended mortalities with cause of death assignment' by physician can be widely practicable. High prevalence of NCDs induced deaths among population of age groups less than 45 years and geriatrics calls for well-planned and an effective life style modification measure. The upsurge in mortality due to infectious diseases like tuberculosis and HIV among young population reiterates the need for targeted interventions to control similar diseases. The outcomes of this study can be beneficial to the local health authority in establishing health and research priorities. However, multicentric studies with large sample size are highly warranted to generalize the study findings.

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