

Validity of Verbal Autopsy Questionnaire for Assessment of Causes of Death among Patients with Hypertension in Bangladesh

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Abstract

Background: Hypertension has become as an important cause of premature mortality and morbidity due to its major etiologic role in the development of coronary artery disease (CAD), stroke and renal failure. The present study aims to determine the validity of verbal autopsy questionnaire in our setting to find out the causes of death among known hypertensive patients.

Subjects Design and Methods: Of 200 decedents approached from July 2013 to December 2013, relatives of only 118 responded for this study. All the families of these victims were contacted individually to find out the cause of deaths by verbal autopsy questionnaire. Every effort was made to find out the closest relative of the victim, who was present at the time of death of the deceased. A trained health worker completed the verbal autopsy questionnaire by asking leading questions in a structured interview. Clinical manifestations of the primary cause of death were collected by the principal investigator by asking leading questions over telephone. Further clinical data and investigations were collected from available records of our center and the board of experts examined all the available clinical data and finalized the cause of death of the victim. In case of available death certificate, mentioned cause of death was reassessed. Students t test and chi square test were used for comparison of the data.

Results: Of 118 victims assessed; mean age at the time of death was 62.40 (SD 62.2years). Male victims were greater than females 72.9 vs 27.1%. Majority (71.2%) of the victims died due to hypertension related complications; 33.3% due to stroke, 20.3% CAD and 17.8% chronic kidney disease. Rest 28.82% of the victims died due to other causes unrelated to hypertension, e.g. 10.2% due to malignancy and in 13.6%, the cause could not be determined. Only 15.5% of the victims who died due to hypertension related complications were under regular follow up. The mean follow up blood pressure were 155.54/90.01 (uncontrolled), and mean duration of hypertension at the time of death was 5.77 years. Majority of the subjects were either illiterate or only literate having lower income farmers and house wives.

Conclusion: Verbal autopsy accurately determined the causes of deaths in known patients of hypertension. CAD,

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stroke and chronic kidney disease were common causes of deaths. Majority of the victims were from lower social classes. Ignorance and poor literacy rate appear to be the important risk factors for premature death among these patients.

Keywords: Stroke, heart attack, hypertension, education, social class

Introduction

NCDs were estimated to have contributed to almost 60% of deaths in the world and among them about 80% occurred in the developing countries [1] Of total number of deaths, 51% of deaths in Bangladesh occur due to NCDs and other chronic health conditions [2] High blood pressure is an important preventable cause of mortality, and accounts for a substantial portion of global burden of disease. [3,4] People with hypertension have higher rates of mortality than people without hypertension, which is mainly due to vascular diseases [5,6] Among the NCDs, hypertension is the major risk factor for developing coronary artery disease (CAD), stroke, heart and renal failures and peripheral vascular diseases [7] Hypertension has been reported to be responsible for 57 per cent of all stroke deaths and 24 per cent of all cardiovascular deaths in East Asians [8] A marked increase in prevalence of hypertension (from 11.3% to 17.9%) was observed in Bangladesh from 1999 to 2010. [9,10] In Rangpur division (Northern part) of Bangladesh prevalence of hypertension and pre-hypertension is 33.3% and 29.9% respectively.¹¹ Because of the high prevalence of this condition and the increased morbidity and mortality associated with this condition, the economic cost of hypertensive disease was estimated at \$76.6 billion in 2010. [12] Many developing countries with the highest burden of poverty and disease continue to lack routine, representative and high quality information on the causes of death.[13,14] This is crucial for health and development policies, health programs; program monitoring and evaluation purposes [15]. In this regard, mortality surveillance systems and demographic surveillance sites using validated verbal autopsy procedures appear to be a cost-effective alternative method for ascertaining cause of death and sustainable medium-term solutions [16,17]. As a result, verbal autopsy method has been

an epidemiological tool for the last few decades to estimate cause specific mortality of child, maternal and adult deaths. [16, 18]

Causes of deaths are less commonly known in developing countries, although hospital records indicate a rapid increase in mortality and morbidity due to NCDs. [19]. Due to religious considerations, autopsy is not possible in many countries, therefore WHO experts and the International College of Nutrition, International College of Cardiology and the Tim Tom Institute have developed a verbal autopsy questionnaire to find out the causes of deaths in these countries. [20, 21]. Verbal autopsy is a method by which we interview the relatives or health professionals to find out the signs, symptoms, attributes of social class and other characteristics experienced by the deceased before their death and the circumstances surrounding their death [22]. It is based on the assumption that most of the causes of deaths can be distinguished by their signs and symptoms and that these can be accurately recognized, recalled and reported by lay respondents [23]. Singh et al has shown that causes of deaths can be accurately assessed by a modified version of verbal autopsy questionnaire (WHO), based on medical records and interview of the family members [24]. In the present study, we report the estimates for the causes of death among known hypertensives, based on modified Singh's verbal autopsy questionnaire²⁴ which is completed with the help of spouse and available medical records of the victim at our center.

Methodology

Populations and Methods

Hypertension and Research Center, Rangpur was established on 14th November, 2008, serves only those patients with hypertension, to generate awareness of hypertension in the population of Bangladesh. Approximately, 12 thousand patients have been registered in this center till 2013. If any patient does not come for follow up for 3 months after the scheduled follow up visit, he/she is declared as drop out from follow up and a telephone call is given to know the cause of drop out. Our study was approved by the ethic committee of our center and we

took informed consent from the family members who were interviewed by our health worker.

We have been successful in tracing 200 patients (by approximately 5000 telephone calls?), who died between November, 2008 to December, 2013. Of these 200 decedents, only 118 could be included in this study depending upon cooperation from the family members of the victim. Rest 82 victims could not be contacted due to non-cooperation and our failure in motivation of the family members of the victim. At least three calls were made before any subject or family was declared a non-contact or non-replier; one in the morning, one in the evening, around 17.00 hrs, and the last one at the weekend. The family members preferably spouse of these 118 victims, were contacted individually to find out the causes of deaths by verbal autopsy questionnaire.

Verbal Autopsy Procedure

Our health worker visited the household of the decedent, between July 2013 to January 2014, to find the closest relative son/daughter/wife/husband of the victim, who was present besides the deceased before the time of death. The family members, for motivation, were given to understand that inquiry about the cause of death aims to prevent illness and death in your other family members which can be done by changing the health behaviour. The health worker was trained in understanding the questionnaire and in data collection, during the structured interview (Appendix 1). The interview consisted of a modified Singh's verbal autopsy questionnaire [24] to record the socio-demographic and clinical characteristics of the deceased as well as clinical manifestations at the time of illness and cause of death. Symptoms and clinical data before the time of death were confirmed over telephone, and recorded by the principal investigator. Finally any available medical records or death certificate were collected from each of the family. The medical records, follow up status, modifiable risk factors of hypertension, investigation reports, know target organ damage and mean follow up blood pressure were collected from records system of Hypertension and Research Center, Rangpur to find the cause of death. A board consisting of internist, cardiologist, neurologist, nephrologist,

endocrinologist, pulmonologist was appointed to review all the available clinical data to finalize the cause of death. In case of available death certificate, the mentioned primary cause of death was also assessed in the light of available evidence in our record system.

Criteria of Diagnosis

Hypertension was diagnosed due to presence of systolic or diastolic blood pressure or both $\geq 140/90$ mm of Hg (according to NICE guideline). Or any individual diagnosed as hypertension and currently taking antihypertensive drugs.

Data Collection

Data regarding attributes of social classes; education of the victim, occupation and family income as well as per capita income were collected by interview of close relative, preferably spouse of the decedents. Medical records of the victims were taken and examined from the register of medical records available at Hypertension and Research Center, Rangpur.

Statistical Analysis

The data were analyzed by SPSS windows version 17.0. The socio-demographic data of the study population were expressed in frequency distribution and their observed difference was tested by one sample 't' test and 'chi square' test. P value < 0.05 was and two tailed t test were considered as statistically significant with the 95% confidence interval.

Results

Of 200 victims, whose families were contacted, 118 family members volunteered for the interview. Mean age of the victims at the time of death were 62.40 years and males were more common than female (72.9% vs 27.1%, $P < 0.01$) (Table 1).

Table 1. Socio-demographic characteristics of the victims. Values are number (%)

Variables	Number (n=118)	Percentage
Mean age (SD)years	62.40 ±12.21	
Mean body weight (Kg/M2)	21.59 Kg/M2	
Sex-Male	86	72.9%*
Female	32	27.1%
Level of education		
Illiterate	16	13.6%
5 or less class	28	23.7%
>5-10 class	40	33.9%
>10-12 class	19	16.1%
Graduate and above	15	12.7%
Occupation		
Housewife	31	26.3%
Agriculture	36	30.5%
Business	15	12.7%
Service	34	28.8%
Retired	1	0.8%
Others	1	0.8%
Monthly income		
<62.5 USD	33	28%
62.5-125 USD	45	38.1%
125-187.5 USD	30	25.4%
>187.5 USD	10	8.5%

* = P<0.01.

Table 2. Causes of death among decedents with hypertension

Cause of death	Male (n=86)		Female (n=32)		Total (n=118)
Stroke	29	33.7%	10	31.3%	33.1 (39)
Coronary artery disease	19	22.1%	5	15.6%	20.3 (24)
Chronic kidney disease	14	16.3%	7	21.9%	17.8 (21)
Malignancy	8	9.3%	4	12.5%	10.2 (12)
Diabetic ketoacidosis	1	1.2%	00	00	2.5 (3)
Post diarrhoeal ARF	00	00	1	3.1%	0.8 (1)
Traffic accident	3	3.5%	00	00	0.8 (1)
Electric shock	00	00	1	3.1%	0.8 (1)
Undetermined	12	14%	4	12.5%	13.6 (16)

ARF= acute renal failure.

Approximately 81.4% of the victims were from rural areas. Majority of the victims (57.6%) were educated from the 5th to 10th class and higher education was least common. The decedents were mainly house wives among females and farmers among males with poverty and ignorance (Table 1).

Only 16.1% (n=19) of the hypertensive patients were coming for regular follow up, 30.5% (n=36) were on irregular follow up and 53.4% (n=60) did not

come to any follow up (p value 0.00001558). Among victims who regularly or irregularly came for follow up, blood pressure was controlled only in 20%. Among the controlled hypertensive subjects, causes of death were unrelated to hypertension e.g., malignancy, traffic accidents, electric shock etc in 45.46%, whereas in uncontrolled hypertensive subjects, these causes were observed only among 25% (P value =0.1336144).

Majority of the victims (71.2%) died due to stroke, CAD and chronic renal failure (Table 2). Rest 15.2 % of the victims died due to non-hypertension related diseases (e.g. malignancy, traffic accidents, electric shock etc). The causes of deaths were undetermined in 13.6%. (Table 2).

Among the three leading cause of death; CAD, Stroke, chronic kidney disease, percentage of death was significantly higher among men than in women victims with stroke ($p = 0.00234725$) and CAD ($p = 0.00426594$). (Figure 1)

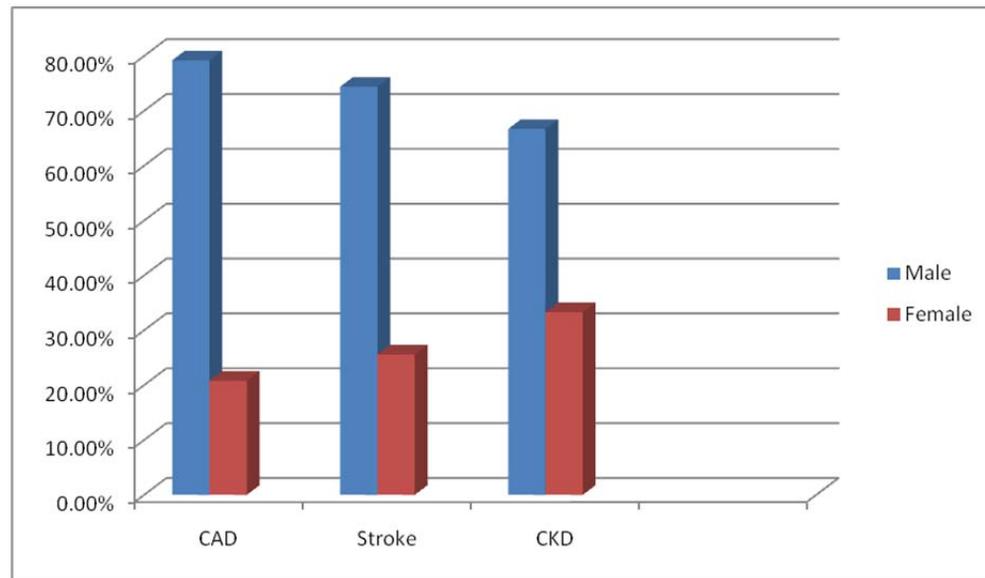


Figure 1. Proportions of deaths due to CAD, stroke and chronic kidney disease among men and women. CAD= Coronary artery disease, CKD= chronic kidney disease.

Discussion

High blood pressure is the leading cause of mortality around the world. Though prevalence, awareness and control rate of hypertension is increasing day by day, there is limited data on causes of death in hypertensive patients from South Asia [1,2]. Verbal autopsy questionnaire has been used to find out the causes of death among hypertensive subjects for the first time in Bangladesh.

This study shows that 71.2% of the victims died due to complications of hypertension; 33.3% due to stroke, 20.3% due to CAD and 17.8% due to chronic renal failure (Table 2). Hua Cui et al have shown causes of death among elderly hypertensive patients in a hospital-based sample of Chinese subjects indicating cardiovascular disease in 45.2%, cerebrovascular disease in 34.3% and renal failure in 11.9%²⁵ It is clear that the proportions of deaths from cardiovascular and cerebrovascular disease are higher

in this study compared to our study. A possible explanation may be that this study was a hospital based study carried out among the elderly patients in which these problems are more common (>60 years).

Singh et al showed that using the modified verbal autopsy questionnaire allowed to diagnose 23.4% deaths due to heart diseases and 9.8% due to brain diseases, including stroke and inflammatory brain diseases [24]. However, Khademi et al used other verbal autopsy questionnaire based on WHO guidelines, where CAD could be diagnosed only in 10.0% and cerebrovascular disease in 7.8% and rest causes of CV deaths were classified into the “other” causes of death [26]. In this study, only transport accidents were included in the questionnaires, but accidental deaths according to modified questionnaires were much higher (14.0% vs. 2.3%) [24,29]. Renal diseases including acute renal failure and chronic renal failure were the cause of death among 11.2% of victims, which are difficult to

diagnose using the other questionnaire [26]. Among “other” causes of death, comparing modified questionnaire, with WHO questionnaire revealed that there were 37.3 vs. 8.5 % deaths respectively, due to other causes which means that among one third of victims, causes of death could not be classified according to body systems [24-26]. Singh et al observed that using the modified questionnaires, most of the victims could be classified systematically, relatively more accurately, into various causes of death according to body systems [24]. In the present study, we used similar approach, but, in 13.6% victims, we failed to determine the cause of death, due to inadequate history from the relatives which may be due to illiteracy and ignorance. Suicides, AIDs and tuberculosis are possible causes of deaths in this subgroup, because these causes are not disclosed by the relatives due to socio-cultural reasons.

Verbal autopsy questionnaire allowed the health workers to ascertain the clinical presentation of the victim during illness and up to death. These details may or may not be available in the medical records and from the spouse and other family members and doctors of the decedents.

This information on probable cause of death related to each body system was reviewed by the internist physician (RNM) to assess the accurate cause of death among all the victims. In patients with known hypertension, using the modified questionnaires, most of the decedents could be classified systematically in accordance of target organ damage due to hypertension, relatively more accurately, into various causes of death (Table 2).

Our verbal autopsy questionnaire appears to be a valid and reliable supplemental method to assess causes of death in a population where records of death are not yet maintained in a municipal corporation in any developing country. The success of our verbal autopsy may be due to the appropriate modifications made in the WHO and Singh’s questionnaires to adapt it to local setting and to known patients of hypertension (24).

Verbal autopsy methodology and questionnaire appear to have many variations depending upon the investigators [14-18, 24-31]. In some of them, ICD coding system for the causes of death may not have been used and hence WHO has recently published instructions to improve In many low resource

countries, verbal autopsy has been found to provide more valid causes of death compared to routine death certificates issued by the doctors [14-18,24-31].

In few studies using verbal autopsy for finding out the causes of death among adults, did not find similar results. Yang et al reported that verbal autopsy is not a very precise tool for assessing the leading causes of death among adults and provide only marginal support to this method [29]. It seems that verbal autopsy is a developing method which may be the cause of inconsistency in results in some of the studies [29].

This verbal autopsy method among known patients of hypertension appears to be a promising approach and of gold standard in identifying most precisely the exact cause of death which may be compared with postmortem. However, causes of deaths due to myocarditis, cardiomyopathy, pericarditis, aneurism of aorta and oesophageal problems in relation to heart attack may be missed, unless records are available. One important weakness in our study is that we could not compare our results with causes of death obtained by death certificate alone verses verbal autopsy combined with medical records by using kappa statistics.

In the verbal autopsy by Singh et al, only one internist physician reviewed the records of all the victims and only when diagnosis of cause was doubtful, a second opinion was taken from another internist physician [24]

In our study a board of super-specialists was available to review the records to finalize the cause of death. It is possible that many people die at home due to lack of resources for hospitalization, although government hospitals provide free service to poor in most of the towns in developing countries.

In future, use of MP3 players to compare audio (observed on computer) with paper record on a 5% population to determine the degree of concordance of the autopsy questionnaire can further improve the verbal autopsy.

In a recent study, non-communicable diseases, sensitivity of the verbal autopsy diagnoses was 69% (CI, 62%–76%), specificity 78% (CI, 71%–85%) and positive predictive value 79% (CI, 73%–85%). Sensitivity was highest for stroke 68% (CI, 49%–87%), and lower for respiratory diseases 24% (CI, 3%–44%). [27] lower socioeconomic status, health

perception and low level of education can also be important.

A few studies has shown monthly income of the hypertensive patients was <5000 BDT (62.5 USD). [11,32] In the present study majority of the hypertensive had monthly income 5000-10000 BDT (62.5-125 USD).

The target organ damage of hypertensive patient in different study [11,33] was found 43.75%-44.5% which is similar to our study (39.83%) Figure 1 in our study, CAD, stroke and chronic renal failure were predominantly found among males, with a high male-female ratio. This may be due to hormonal protection of female against cardiovascular diseases and dependency of the female to male to get health care facilities in developing countries.

In brief, verbal autopsy appears to be an accurate method to find out the causes of death among known patients with hypertension. Majority of the hypertensive patients died due to target organ damage to different body systems; stroke, CAD chronic renal failure due to illiteracy and ignorance. A cohort study with large sample size will be needed to clarify the causes of death in hypertensive patients.

Limitation

Sample size was small and data were collected in some of the patients many days (even up to 4 years) after the death of the victims.

Conflict of interest

There was no conflict of interest.

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Contributions by the authors

Dr. Ratindra Nath Mondal planned and supervised the study. Dr. Md. Ashraful Haque, Dr. Abul Kalam Azad analysed the data. Dr. Shah Md. Sarwer Jahan, Dr. Md. Mahfuzer Rahman, Dr. Md. Kumruzzaman Sarker, Dr. Moni Rani, AKM Shaeheduzzaman, Md. Shafiul Alam, Devendra Nath Sarker, helped to collect the data. Dr. B. D. Bidhu, Professor Dr. Md. Zakir Hossain, Professor Dr. Amaresh Chandra Shaha, Professor Ram B. Singh, Professor Dr. Md. Noor Islam helped in writing of the manuscript and presentation of the data.

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Appendix. I

HYPERTENSION AND RESEARCH CENTER, Rangpur, Bangladesh.
 VERBAL AUTOPSY QUESTIONNAIRE Modified from Singh's Verbal Autopsy Questionnaire
 INTERVIEW.

Name and post of expert filling the Questionnaire..... Telephone.....
 History given by: Spouse / Father / Mother / Sister / Son / Daughter / In-laws (tick)
 Education of person.....
 Date.....Place.....Time of Interview.....
 Unique ID.....

GENERAL DATA:

Name of Victim.....Surname..... Sex.....Age...
 Address.....
Tel No.....
 1. Religion: (a) Hindu (b) Moslem (c) Christian (d) Sikh
 2. Final education of victim.....Occupation of victim.....Family Type.....
 3. The date..... Place and Time of Death.....
 4. Physically matching subject with victim/Name, address.....

CLINICAL DATA OF VICTIM. (By Medical Records)

5. Family history of diabetes, hypertension, cholesterol, heart attack, stroke, cancer, Bronchitis, asthma, obesity, suicide, HIV, depression, psychosis, alcohol intake, tobacco.
 6. Any past history of above, illnesses (Name)
 7. HeightcmWeightKg, BMI... (Kg/M 2)
 8. Waist circumference..... cm, maximum hip circumference.....WHR.....
 9. Blood pressure..... mmHg, Grey hair/Cataract/Wrinkles. (Tick)
 10. History of surgery.....
 11. Chest Pain.
 12. CLINICAL MANIFESTATIONS. (Ask leading questions to know the symptoms)
 Headache, vomiting, fever, loss of consciousness, convulsions, breathlessness, chest pain, sweating, palpitation, heaviness in chest, nausea, vomiting, coughing, burning in urine, decrease in urine, h/o depression, diabetes mellitus, heart attack, sudden cardiac death, paralysis, trauma etc., loose motions with persistent vomiting, persistent headache with fever and vomiting, persistent cough with high fever;
 Yellow eyes, bleeding from any part of body.

**Table. Causes of deaths reported based on available records and verbal autopsy (modified from WHO)
 (Ask leading questions to know the system involved)**

Cause of death based on Death Certificate	interview of Spouse/relative/ Doctor Final cause
1. Circulatory diseases; Coronary artery disease, Sudden cardiac death, Diabetes, Vascular disease, Valvular heart disease, Inflammatory cardiac disease.	
2. Nervous system diseases; Cerebrovascular disease, Meningitis, encephalitis.	
3. Malignant neoplasm; Lung, oral, liver, stomach, breast, uterus, cervix, ovary.	
4. Injury- accidents; Unintentional, road accidents, poisonings, fires, falls, drowning.	
5. Renal diseases. Acute renal failure, chronic renal failure.	
6. Pulmonary diseases; Chronic bronchitis, asthma, tuberculosis, acute pulmonary infection.	
7. Liver diseases; Hepatitis, cirrhosis	
8. Miscellaneous; Pregnancy and perinatal, suicide, congenital anomalies. Burns, Diarrhoea/dysentery.	