

# Mortality Cause in Goldsmith Workers of Bangladesh: Findings From Verbal Autopsy

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## Research Article

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# Abstract

**Background:** Information on the mortality causes of goldsmith workers in Bangladesh is very limited. This study was conducted to find out the causes of death in this group of population.

**Methods:** The study subject was deceased goldsmith workers where face-to-face interviews were conducted with the family members who were present during the deceased's illness preceding death. A World Health Organization recommended questionnaire was adapted to conduct 20 deceased goldsmith workers' verbal autopsy. Causes of death were determined by reviewing the outcomes of the interviews by the expert physicians.

**Results:** The mean age of the goldsmith workers at death was  $59.2 \pm 9.3$  years. Among the deceased goldsmith workers, 70.0% were smokers, and 50.0% of them were alcohol consumers. Cardiovascular diseases (CVD) were the most common immediate and underlying cause of death (55.0% and 45.0%, respectively). Acute ischemic heart disease was the single most common (30.0%) immediate cause of death among the deceased goldsmith workers, whereas, for underlying causes of death, it was both acute and chronic ischemic heart diseases (35.0%).

**Conclusions:** The life expectancy of goldsmith workers was much lower than the average life expectancy of Bangladesh, where CVD was the common cause of death. Smoking and alcohol consumption were prevalent among the majority of the deceased goldsmith workers. Awareness of healthy lifestyles should be prioritized for a successful CVD control program for this population.

**Trial registration:** Not applicable.

## Background

Goldsmith workers are exposed to various hazardous chemicals e.g. cyanide, lead, zinc, cadmium, palladium, iridium, sulphuric acid, nitric acid, silica [1]. The long-time exposure to these hazardous chemicals and particles puts their lives at risk of various particle toxicity [2]. Goldsmith workers' cause-specific mortality showed an excess proportion of pancreatic cancer, stomach cancer and liver cancer [3, 4]. Among the non-malignant causes of death, non-malignant kidney disease, arteriosclerotic heart disease, rheumatic heart disease were high among the jewelry workers in the United States of America [5].

In Bangladesh, about three hundred thousand goldsmith workers are involved in jewelry-making works [6]. To date, data are scarce on the causes of mortality among goldsmith workers in different parts of Bangladesh. The current study aimed to find out the causes of death in this population.

## Methodology

### Study participants

To ascertain the causes of death, verbal autopsy (VA) was conducted among the deceased goldsmith workers of Bangladesh (between January to March 2017). Before commencing the study, a list of goldsmith workers

(70 persons) of Dhaka city, Bangladesh who died in the last four years was collected from a local recognized welfare club for the goldsmith workers (Dhaka Swarna Shilpi Sromik Shongho). From that list, the family members of the deceased were traced following the mentioned addresses. After approaching 35 deceased goldsmith workers' addresses, because of the incorrect address and migration, a total of 20 deceased's VA was finally completed.

## Study sites

All the deceased goldsmith workers workplace was Dhaka. Most of the subjects (n = 12) resided in Tanti bazar of Kotoali thana, Dhaka, which occupies one of the largest goldsmith clusters in Bangladesh [7]. Other areas in Dhaka from where the deceased information was gathered are Hazaribagh (n = 1), Mohammadpur (n = 1), Lalbagh (n = 2) etc. Besides Dhaka, Shaibaloy (n = 3) of Manikganj, and Nagarpur (n = 1) of Tangail district were also included, as those were the deceased's permanent addresses.

## Data collection

Starting with the most recent death, data was collected from the 20 deceased goldsmith workers' family members who were present during the deceased's illness preceding death. For the field activities, a data collection team consisting of trained data collectors and local coordinators was formulated, and for the outcome assessment, another team was established comprising of two physicians.

A pretested semi-structured questionnaire used in the face-to-face interviews for data collection was adapted from the existing VA instrument developed by the World Health Organization (WHO) [8]. To make it culturally acceptable, an expert first translated the questionnaire into Bengali. Then the Bengali version was back-translated into English by a different person and compared for consistency.

The VA questionnaire included information on socio-demographic characteristics, age in years at death, specific sections on suffering from noncommunicable diseases (NCD), signs, symptoms, injury, NCD risk behaviors (smoking and alcohol consumption) and available health records including the deceased's death certificates. In the current study, cardiovascular disease (CVD), cancer, diabetes mellitus, chronic obstructive pulmonary disease (COPD)/bronchial asthma were considered as major NCDs [9]. Hypertension, heart disease, and stroke were included in the CVD [9].

An open-ended section for additional information on the deceased terminal illness was also included within the questionnaire. Medical records and death certificates were also collected based on their availability.

## Outcome assessment

Identification of underlying and immediate causes of death were considered as the outcome. The underlying cause was termed as "the disease or injury which initiated the train of morbid events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury" [10]. "The final disease or injury causing the death" was termed as immediate cause of death [11]. The causes of death were then coded according to the International Classification of Diseases, 10th Revision (ICD-10) [12]. For determination of the causes of death, initially, two physicians reviewed the outcome of all the interviews (combinations of the reported illness, signs, and symptoms) and assigned a cause of death for each case. As suggested by WHO [8], for a discrepancy in finalizing the cause of deaths, a third physician adjudicated the result.

# Statistical analysis

Descriptive analysis of all the continuous variables is presented as frequency percentages. The mean and Standard Deviation (SD) of the age of the subjects was calculated and also categorized into two groups as  $\leq 70$  years and  $> 70$  years, where death before  $< 70$  years is considered as premature death [13]. Smoking was categorized into three groups i.e. light (1–10 sticks/day), moderate (11–19 sticks/day), and heavy ( $\geq 20$  sticks per day) smokers [14, 15]. Data entry and analyses were done by using SPSS software version 24.

## Results

The study was conducted among 20 deceased goldsmith workers where all of them were male. Family members of the deceased goldsmith workers were the respondents. Among them, 40.0% were sons/daughters/daughters-in-law, 30.0% were spouses and 20.0% were brothers/sisters of the deceased. For medical history, the deceased's health records and information provided by the respondents were collected. Half (50.0%) of the respondents had medical records, of which 50.0% could produce the records while interviewing.

Table 1 demonstrates the socio-demographic characteristics of the deceased goldsmith workers. The majority (85.0%) of the deceased goldsmith workers were in  $\leq 70$  years age group, where the mean age of death was  $59.2 \pm 9.3$  years. More than half (60.0%) of them were educated up to the primary level.

Table 1  
Socio-demographic characteristics of  
the deceased goldsmith workers (N =  
20)

Characteristics	n (%)
Age at death	
≤ 70 years	18 (85.0)
> 70 years	2 (10.0)
Mean age (SD) in years	59.2 ± 9.3
Religion	
Islam	1 (5.0)
Hinduism	19 (95.0)
Education	
No formal education	4 (20.0)
Up to primary	12 (60.0)
Secondary	4 (20.0)
Place of death	
Home	9 (45.0)
Hospital	10 (50.0)
Brought dead	1 (5.0)

Table 2 depicts the NCD risk behaviors of the deceased. Most (70.0%) of the deceased goldsmith workers were smokers and among them, 42.9% were heavy smokers ( $\geq 20$  sticks/day). Fifty percent of the subjects were alcohol consumers; of them, 40.0% consumed alcohol for  $\geq 15$  years.

Table 2  
NCD risk behaviors of the deceased goldsmith workers (N = 20)

NCD risk behaviors	n (%)
History of smoking (bidi/cigarette)	
Smoker	
Yes	14 (70.0)
No	6 (30.0)
Level of smoking	
Light smoker (1–10 sticks/day)	8 (57.1)
Moderate smoker (11–19 sticks/day)	0 (0.0)
Heavy smoker ( $\geq 20$ sticks/day)	6 (42.9)
History of alcohol consumption	
Alcohol consumer	
Yes	10 (50.0)
No	10 (50.0)
Duration	
< 15 years	3 (30.0)
$\geq 15$ years	4 (40.0)
Don't know	3 (30.0)
Frequency of consumption	
Daily	2 (20.0)
Weekly	4 (40.0)
Monthly	4 (40.0)

Table 3 shows the major NCDs among the deceased goldsmith workers. Majority (65.0%) of the deceased was suffering from hypertension. More than two-thirds (70.0%) of the deceased in the current study suffered from at least two major NCDs (data not shown).

Table 3  
Major NCDs<sup>a</sup> among the deceased goldsmith  
workers<sup>b</sup> (N = 20)

<b>Disease name</b>	<b>n (%)</b>
CVD	
Hypertension	13 (65.0)
Heart disease	7 (35.0)
Stroke	3 (15.0)
Cancer	3 (15.0)
Diabetes mellitus	10 (50.0)
Chronic Obstructive Pulmonary Disease (COPD)/Bronchial asthma	3 (15.0)

<sup>a</sup>Major NCDs includes CVDs, Cancer, DM, COPD

<sup>b</sup>Multiple responses

The immediate causes of death of the deceased goldsmith workers are presented in Table 4. CVD (I00-I99) was the immediate cause of death for 55.0% of the deceased, and acute ischemic heart disease, unspecified (I24.9) was the single most common (30.0%) immediate cause of death.

Table 4  
Immediate causes of death among the goldsmith workers (N = 20)

Causes of death (ICD-10 code)	%
<b>Certain infectious and parasitic diseases (A00-B99)</b>	10.0
Sepsis (generalized) (unspecified organism) (A41.9)	5.0
Severe dengue (A97.2)	5.0
<b>Endocrine, nutritional and metabolic diseases (E00–E90)</b>	
Other disorders of electrolyte and fluid balance, not elsewhere classified (E87.8)	5.0
<b>Cardiovascular diseases (I00-I99)</b>	55.0
Acute ischemic heart disease, unspecified (I24.9)	30.0
Nontraumatic intracerebral haemorrhage, unspecified (I61.9)	10.0
Cerebral infarction, unspecified (I63.9)	5.0
Cardiac arrest due to other underlying condition (I46.8)	5.0
Cardiac arrest due to underlying cardiac condition (I46.2)	5.0
<b>Diseases of digestive system (K00-K93)</b>	10.0
Hematemesis (K92.0)	5.0
Hepatic encephalopathy (K72.91)	5.0
<b>Diseases of genitourinary system (N00-N99)</b>	
Acute kidney failure, unspecified (N17.9)	5.0
<b>Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00–R99)</b>	
Septic shock (R57.2)	5.0
<b>Injury, poisoning and certain other consequences of external causes (S00–T98)</b>	
Traumatic hemorrhagic stroke (S06.36)	5.0

Table 5 depicts the underlying causes of death of the subjects. CVD (I00-I99) was the underlying cause of death for nearly half (45.0%) of the deceased, where acute and chronic ischemic heart diseases (I24.9, I25.9) were the most common (35.0%) cause of death. Cancer (C00-C97) was the underlying cause of death for 20.0% of subjects.

Table 5  
Underlying causes of death among the goldsmith workers (N = 20)

Causes of death (ICD-10 code)	%
<b>Certain infectious and parasitic diseases (A00–B99)</b>	
Severe dengue (A97.2)	5.0
<b>Cancer (C00–C97)</b>	20.0
Kidney (C64.9)	5.0
Lung (C34.90)	5.0
Brain (C71.9)	5.0
Penis (C60.9)	5.0
<b>Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (D50–D89)</b>	
Aplastic anaemia (D61.9)	5.0
<b>Endocrine, nutritional and metabolic diseases (E00–E90)</b>	10.0
Dyselectrolyteamia (E87.8)	5.0
Type 2 DM with hypoglycemia with coma (E11.641)	5.0
<b>Cardiovascular diseases (I00–I99)</b>	45.0
Acute & chronic ischemic heart disease (I24.9, I25.9)	35.0
Essential (primary) hypertension (I10)	5.0
Cerebral infarction (I63.9)	5.0
<b>Disease of respiratory system (J00–J99)</b>	
Acute exacerbation of bronchial asthma (J45.51)	5.0
<b>Disease of digestive system (K00–K93)</b>	
Cirrhosis of liver (K74.6)	5.0
<b>Diseases of the genitourinary system (N00–N99)</b>	
Chronic kidney disease, unspecified (N18.9)	5.0

## Discussion

The mean age of the deceased goldsmith workers was nearly 60 years which is 13 years less than the national life expectancy (72.6 years) of the population in Bangladesh [16]. The proportion of premature death was very high (85.0%) among the study subjects compared to the proportion of premature death in average males of Bangladesh, which is 23.0% [13]. More than two thirds (70.0%) of the goldsmith workers of the

present study suffered from at least two NCDs, which might be the reason behind this higher proportion of premature deaths.

In the current study, CVD was found to be the most common immediate cause of death as well as the underlying cause of death (55.0% and 45.0%, respectively) among the deceased goldsmith workers. Although this finding is consistent with Bangladesh's overall mortality profile, where CVD is the leading cause (30%) of all deaths [9], the proportion of deaths due to CVD in the current study, was higher among the goldsmith workers. Arteriosclerotic heart disease, a subgroup of CVD was reported as a non-malignant prime cause of death among jewelry workers by Hayes, et al. [5]. In contrast, some previous studies claimed malignancy as the major mortality cause among jewelry workers [3–5]. In the current study, common NCD risk behaviors identified were smoking (70.0%) and alcohol consumption (50.0%). Another study in Bangladesh also reported a higher proportion (58.3%) of smokers among the goldsmith workers [17]. Similar scenario of death by CVD (55.0%) among the deceased goldsmith workers in the present study may be explained by the existence of NCD risk behaviors, which are the established risk factors for CVD [18, 19].

Some limitations need to be considered before interpreting the results. Recall bias could be a probable limitation here though it has been reported that recall bias of an event like a loss is not affected from 1 year to 5 years' time period [20, 21]. In the present study, the period between the event and interview was highest up to 4 years. The absence of proper medical records hindered the process of adjudication for the determination of the cause of death.

## Conclusions

The majority of the goldsmith workers died prematurely, where CVD was the common cause of death. NCD risk behaviors like smoking and alcohol consumption were prevalent among the majority of the deceased goldsmith workers. Awareness of healthy lifestyles should be prioritized for a successful CVD control program for this population.

## Abbreviations

BSMMU: Bangabandhu Sheikh Mujib Medical University, COPD: Chronic obstructive pulmonary disease, CVD: Cardiovascular diseases, ICD-10: International Classification of Diseases, 10<sup>th</sup> Revision, NCD: Noncommunicable disease, SD: Standard deviation, VA: Verbal autopsy, WHO: World Health Organization.

## Declarations

### *Ethics approval and consent to participate*

This study was conducted according to the Declaration of Helsinki and performed after getting official clearance from the Institutional Review Board of Bangabandhu Sheikh Mujib Medical University (BSMMU). During data collection, family members of the deceased goldsmith workers were contacted by the interviewers ensuring confidentiality and anonymity. An informed consent form was provided to them with the details of the research, rights regarding participation, recording the medical reports and death certificates of

the deceased workers, and the respondent's withdrawal from the study at any stage. Written informed consent was obtained from the responding family member of the study subjects.

### ***Consent for publication***

Not Applicable.

### ***Availability of data and other materials***

This study's analyzed dataset is not publicly available due to participants' confidentiality and privacy issues but is available from the corresponding author on reasonable request.

### ***Competing interests***

The authors declare that there are no competing interests.

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The study received financial support from Bangabandhu Sheikh Mujib Medical University.

### ***Authors' contributions***

FK contributed to the study conception and method design, coordination, data analysis, and data interpretation, and drafted the manuscript, MK to the study conception and design, coordination and supervision of the drafting the manuscript, MI to the data analysis & interpretation, AR to field coordination and execution, SR and KR to the coordination and drafting of the manuscript, and SI to the study conception and design and drafting the manuscript. All authors have revised the manuscript and approved the final version.

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