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Assessment of risk factors among cardiovascular patients: A WHO STEPS approach in Bangladesh

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Abstract. Non-communicable diseases (NCDs) have already become the leading cause of death in Bangladesh. Hence, the purpose of the study was to identify the prevalence and determinants of NCDs risk factors among cardiovascular patients in Bangladesh. This cross-sectional study was conducted among 355 cardiovascular patients, aged 18 years and above visiting several tertiary care hospitals in Bangladesh. A validated, structured WHO NCD STEPS questionnaire was utilized to collect information including blood glucose level and lipid profile. Among patients, 58.9% were males and 41.1% females. Tobacco use was observed in 28.7% of the patients and only 1.7% consumed alcohol. Low levels of physical activity were recorded among 44.5% of the participants. Most of the subjects (83.1%) consumed an insufficient amount of fruits and vegetables. The prevalence of overweight and obesity was 41.7% and raised blood pressure was noted among 56.9% of participants. Only 1.7% of respondents were reported to be free from any selected NCDs risk factors. The present study showed a high prevalence of NCDs risk factors among cardiovascular patients and demands a multisectoral approach by the government and other stakeholders to lessen the impact of NCDs.

Keywords: Non-communicable diseases; risk factors; cross-sectional study; Bangladesh.

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Introduction

Non-communicable diseases (NCDs), particularly cardiovascular diseases (CVDs), cancer, diabetes, kidney diseases and chronic lung diseases, etc. have been focused as a prime challenge of the future health. NCDs tend to be the major cause of death, accounting for almost 70% of all deaths worldwide (WHO, 2019). Low- and middle-income countries bear most of the mortality burden due to NCDs and often these deaths are premature - happening below 70 years of age. Bangladesh has also experienced the severity of NCDs where 67% of the total deaths are attributed to NCDs (WHO, 2018, 2019).

The global burden of NCDs is on rising; however, the risk factors of NCDs like smoking, alcohol consumption, overweight/obesity and raised blood pressure are highly preventable (WHO, 2019). Research revealed that about 80% of heart diseases, strokes and type 2 diabetes, and over 30% of cancers could be averted by alleviating common risk factors including smoking, unhealthy diet, and physical inactivity (WHO, 2003a, 2019). Few population-based studies including nationwide survey documented risk factors prevalence of NCDs in Bangladesh (Ahmed et al., 2017; Banik, Zaman, Ahmed, Choudhury, & Moniruzzaman, 2018; Non-Communicable Disease [NCD], 2011; Razzaque et al., 2011; Zaman et al., 2015; Zaman et al., 2016b), however, more nationally representative data are needed to establish baseline and identify the trends as per global NCDs monitoring framework (WHO, 2013).

For effective control and prevention of NCDs in Bangladesh, it is imperative to understand the distribution of established risk factors for NCDs within the community, especially among cardiovascular patients. CVDs have been reported to cause 44% of all NCDs global deaths, and 45% of all NCDs deaths in Bangladesh (WHO, 2018). All previous studies in Bangladesh collected information on NCD risk factors prevalence without giving any emphasis on cardiovascular patients although they are the most vulnerable to morbidity and mortality from NCDs. Hence, the present study aims to estimate the distribution and determinants of risk factors for NCDs among cardiovascular patients in Bangladesh.

Material and methods

Study design and participants

This cross-sectional study was carried out from January to June 2019 with CVDs patients seeking care at several tertiary care centers of Bangladesh. A total of five hospitals were selected: four from Cumilla and one from Noakhali district of Bangladesh. The selection of the centers was purposive and a convenient sampling technique was utilized to collect information from the subjects. The sample size was calculated using Cochran's formula (Cochran, 1997): Z^2pq/e^2, where, estimated proportion of the population is 0.5, the desired level of precision is 0.1, confidence limits of 95% and design effect of 2. After considering 10% non-response rate, the required sample size becomes 214, however, we collected information from 355 adolescents.

To meet the inclusion criteria, all participants were screened for CVDs based on their self-reporting, clinical history, and review of their medical records. Individuals identified as CVDs patients if they reported any of the disorders of the heart and blood vessels including coronary heart disease, cerebrovascular disease, rheumatic heart disease and other conditions (WHO, 2020). Critically ill patients, pregnant women, not consented or mentally disabled patients were excluded from the study. The study protocol was approved by the Human Ethics Review Committee of each of the hospitals and informed consent was obtained from participants before the study.

Study instruments

The WHO STEPS questionnaire (version 3.2) was employed for the determination of the prevalence of the NCD related risk factors (WHO, 2017). A locally adapted, Bengali translated and pre-tested version of the WHO STEPS questionnaire was used in the present study.

Step 1

Information on socio-demographic and behavioral measurements were incorporated in Step 1. Income status was categorized into three groups: low income Bangladeshi taka [BDT] (<8000/month), middle income (BDT 8000 - BDT 80000/month), and high income (BDT >80000/month). The WHO recommended show-cards and standard measures were applied for proper data collection.

Step 2

Step 2 of the STEPS questionnaire included physical measurements, for example, height, weight, blood pressure, waist circumference etc. The measurement of weight and height was done using standardized SECA instruments and weight measurement was taken to the nearest 100 g whereas height till closest 1 mm. Waist circumference was measured using non-stretchable measuring tapes to the nearest 1 mm. A digital sphygmomanometer was used to record blood pressure with an adult-sized cuff and measurements were taken till the closest 1 mm of Hg. Three successive measurements were documented, one minute apart and then the average was calculated.

Step 3

Information on biochemical parameters such as blood glucose level and lipid profile containing total cholesterol, triglyceride and high-density lipoprotein (HDL) cholesterol were recorded in Step 3. All the measurements except blood glucose were taken from individual's recent medical report. For blood glucose level measurement, a commercial glucometer (ACCU-CHEK Active, Roche India Ltd.) was used.

Data collection

The study team was comprised of four supervisors and three enumerators. All enumerators were postgraduate students who conducted the interviews. Supervisors included three physicians and two Lecturers. The supervisory team underwent 3-days training before starting the fieldwork. A pilot study was also made to pre-test survey instruments and procedures. The questionnaires were administered by face-to-face interviews and physical measurements were done following the WHO recommended techniques. The supervisory team visited the field regularly for quality assurance. They tend to check all completed questionnaires and, if any data missing, asked enumerators to consult with the participants via phone call. Data were coded and the computer-based entry was done by a data entry operator. Ten percent of the data was re-entered by a second data entry operator to make data valid against the original entries.

Data management and analysis

Data analyses were performed using SPSS (version 26.0) for Windows (SPSS, Inc. Chicago. IL.USA) and p-value <0.05 was considered statistically significant. Socio-demographic and risk factors prevalence data were showed by mean, median, range, standard deviation (SD), 95% confidence interval (CI) for mean and percentages where necessary. A multivariate logistic regression model was used to identify associations between sociodemographic factors and the outcome variables.

Operational definitions

WHO STEPS recommended cut off values were used to estimate risk factors prevalence (WHO, 2017). Behavioral risk factors included currently smoking (smoked in the past 30 days), harmful alcohol consumption ((i.e. ⩾60 g of pure alcohol for men and ⩾40 g of pure alcohol for women on an average day), low fruit and vegetable intake (consuming less than five servings of fruits and vegetables per day) and insufficient physical activity ((less than 600 metabolic equivalent task [MET] minutes per week). The assessed metabolic risk factors were overweight and obesity (Body mass index [BMI] between 23-24.9 kgm^{-2} and ⩾25 kg m^{-2}, respectively for Asian people (WHO, 2004)), raised blood pressure or hypertension (measured as systolic blood pressure [SBP] of ⩾140 mm of Hg, and/or diastolic blood pressure [DBP] of ⩾90 mm of Hg and/or the use of any medications for hypertension). A waist circumference of ⩾90 cm in men and ⩾80 cm in women was regarded as central or abdominal obesity. Raised blood glucose or diabetes was defined as a random plasma glucose ⩾200 mg dL^{-1} and/or taking medication for diabetes. Hypercholesterolemia was defined as a cholesterol level ⩾200 mg dL^{-1} whereas hypertriglyceridemia was triglycerides level ⩾150 mg dL^{-1}.

Results

Participant characteristics

About three-fifth of the participants were males and the rest were females with a mean±SD age of 52.9±14.6 years (52.1±13.6 years for male and 54.2±15.9 years for female). The socio-demographic and clinical characteristics of the study participants are summarized in Table 1. The majority of participants were between 55-64 years and most lived in rural areas. More than one-third of the patients had no formal schooling and around 80% of the participants were currently married. Among the participants, more than half were unemployed and most of the participants belonged to the middle-income category having monthly income between BDT 8000-80000. The mean (±SD) BMI of the participants was 24.5 (±4.4) kgm^{-2} and the majority were overweight and obese (BMI ⩾23 kgm^{-2}). The mean (±SD) SBP and DBP among the patients were 131.9 (±30.8) mm Hg and 90.5 (±23.4) mm Hg, respectively, and hypertensive participants were more prevalent. The mean (±SD) random blood glucose level was 153.3 (±78.5) mg dL^{-1} and more than one-third having diabetes. Hypercholesterolemia was observed in more than half and hypertriglyceridemia in nearly three-fourth of the participants. HDL cholesterol level was not satisfactory in about two out of five patients.

Table 1. Socio-demographic and clinical characteristics of the participants.

Variables	n (%)	P-value
Gender		
Male	209 (58.9)	0.001
Female	146 (41.1)	
Age (years)		
18-24	10 (2.8)	
25-34	34 (9.6)	
35-44	45 (12.6)	<0.001
45-54	82 (23.1)	
55-64	94 (26.5)	
>65	90 (25.4)	
Residence		
Rural	226 (63.7)	<0.001
Urban	129 (36.3)	
Education		
No formal schooling	129 (36.4)	<0.001

<Primary school	30 (8.5)	
Primary school	71 (20.0)	
Secondary school	48 (13.5)	
High school	25 (7.0)	
College/University	52 (14.6)	
Marital status		
Unmarried	11 (3.1)	
Currently married	278 (78.4)	
Separated	10 (2.8)	<0.001
Divorced	3 (0.8)	
Widowed	53 (14.9)	
Occupation		
Unemployed	185 (52.1)	
Government employee	21 (5.9)	<0.001
Non-government employee	41 (11.5)	
Self-employed	108 (30.5)	
Income		
Low-income	6 (1.7)	
Middle-income	329 (92.7)	<0.001
High-income	20 (5.6)	
BMI (kgm^{-2})		
<18.5	23 (6.5)	
18.5–22.9	100 (28.1)	
23.0–24.9	84 (23.7)	<0.001
25.0–29.9	114 (32.1)	
⩾30	34 (9.6)	
Hypertension*		
Yes	202 (56.9)	0.009
No	153 (43.1)	
Diabetes**		
Yes	126 (35.5)	<0.001
No	229 (64.5)	
Hypercholesterolemia†		
Yes	211 (59.4)	<0.001
No	144 (40.6)	
Hypertriglyceridemia††		
Yes	255 (71.8)	<0.001
No	100 (28.2)	
HDL cholesterol ($mg\ dL^{-1}$)		
<35	144 (40.6)	<0.001
⩾35	211 (59.4)	

BMI: Body mass index, HDL: High-density lipoprotein, MET: Metabolic equivalent task. *Systolic blood pressure ⩾140 mm Hg and/or diastolic blood pressure ⩾90 mm Hg and/or taking medication for hypertension, **Random plasma glucose ⩾200 mg dL^{-1} and/or taking medication for diabetes, †Cholesterol level ⩾200 mg dL^{-1}, ††Triglycerides level ⩾150 mg dL^{-1}.

Prevalence of NCDs risk factors

Overall, the prevalence of current smoking was 28.7%. Males were observed to smoke more than females and people aged 40-64 years old smoked more compared to other age groups. The prevalence of smoking was higher among rural people than urban people, and higher among those who were educated up to secondary level comparing those who had no formal schooling or some college and above education. Married individuals were reported to smoke more than unmarried and separated/divorced/widow individuals. A higher prevalence of smoking was noted among self-employed participants. People in middle-income group were found to smoke more than both low- and high-income category (Table 2).

About 1.7% of the participants consumed alcohol in the past year. Only males were reported to consume alcohol. Highest alcohol consumption was noticed among people aged 40-64 years, rural inhabitants, having some college and above education, married people, unemployed individuals and people in middle-income category (Table 2).

Table 2. Proportion of participants with selected NCDs risk factors by socio-demographic characteristics.

	Current smoking	Alcohol consumption	Low physical activity	Insufficient fruit and vegetable intake	Overweight and obesity	Raised blood pressure
Gender						
Female	1.1 (0.03-2.2)	-	21.4 (17.1-25.7)	34.1 (29.2-39.0)	22.5 (18.2-26.9)	31.8 (27.0-36.7)
Male	27.6 (23.0-32.3)	1.7 (0.3-3.0)	23.1 (18.7-27.5)	49.0 (43.8-54.2)	19.2 (15.1-23.2)	25.1 (20.6-29.6)
Age (years)						
<40	6.2 (3.7-8.7)	0.3 (-0.3-0.8)	6.5 (3.9-9.0)	14.9 (11.2-18.6)	7.1 (4.4-9.7)	9.6 (6.5-12.6)
40-64	17.7 (13.8-21.7)	1.1 (0-2.2)	21.7 (17.4-26.0)	48.2 (43.0-53.4)	25.9 (21.4-30.5)	34.1 (29.2-39.0)
⩾65	4.8 (2.6-7.0)	0.3 (-0.3-0.8)	16.3 (12.5-20.2)	20.0 (15.8-24.2)	8.7 (5.8-11.7)	13.2 (9.7-16.8)
Residence						
Rural	18.9 (14.8-22.9)	0.9 (-0.1-1.8)	27.3 (22.7-32.0)	51.3 (46.1-56.5)	22.8 (18.5-27.2)	34.4 (29.4-39.3)
Urban	9.9 (6.8-13.0)	0.8 (-0.1-1.8)	17.2 (13.3-21.1)	31.8 (27.0-36.7)	18.9 (14.8-22.9)	22.5 (18.2-26.9)
Level of education						
No formal schooling	9.6 (6.5-12.6)	0.6 (-0.2-1.3)	15.8 (12.0-19.6)	29.3 (24.6-34.0)	10.4 (7.2-17.8)	18.0 (14.0-22.0)
Up to SSC	16.3 (12.5-20.2)	0.3 (-0.3-0.8)	21.4 (17.1-25.7)	42.3 (37.1-47.4)	23.4 (19.0-27.8)	29.3 (24.6-34.9)
Some college and above	2.8 (1.1-4.5)	0.8 (-0.1-1.8)	7.3 (4.6-10.0)	11.5 (8.2-14.9)	7.9 (5.1-10.7)	9.6 (6.5-12.6)
Marital status						
Unmarried	6.2 (3.7-8.7)	-	0.6 (-0.2-1.3)	2.8 (1.1-4.5)	1.1 (0-2.2)	1.4 (0.2-2.6)
Married	17.7 (13.8-21.7)	1.4 (0.2-2.6)	33.2 (28.3-38.1)	65.4 (60.4-70.3)	33.0 (28.1-37.8)	44.5 (39.3-49.7)
Separated/Divorced/Widow	4.8 (2.6-7.0)	0.3 (-0.3-0.8)	10.7 (7.5-13.9)	14.9 (11.2-18.6)	7.6 (4.8-10.4)	11.0 (7.7-14.2)
Occupation						
Unemployed	7.3 (4.6-10.0)	0.6 (-0.2-1.3)	25.6 (21.1-30.2)	43.9 (38.8-49.1)	22.0 (17.7-26.3)	29.6 (24.8-34.30
Government employee	2.0 (0.5-3.4)	0.5 (-0.2-1.3)	1.4 (0.2-2.6)	4.8 (2.6-7.0)	2.5 (0.9-4.2)	3.9 (1.9-6.0)
Non-government employee	3.9 (1.9-6.0)	0.3 (-0.3-0.8)	6.5 (3.9-9.0)	9.6 (6.5-12.6)	5.4 (3.0-7.7)	7.0 (4.4-9.7)
Self-employed	15.5 (11.7-19.3)	0.3 (-0.3-0.8)		24.8 (20.3-29.3)	11.8 (8.5-15.2)	16.3 (12.5-20.2)
Income						
Low-income	0.8 (-0.1-1.8)	0.3 (-0.3-0.8)	0.6 (-0.2-1.3)	1.4 (0.2-2.6)	0.3 (-0.3-0.8)	0.6 (-0.2-1.3)
Middle-income	27.6 (23.0-32.3)	1.4 (0.2-2.6)	40.3 (35.2-45.4)	76.9 (72.5-81.3)	38.0 (33.0-43.1)	53.2 (48.0-58.4)
High-income	0.3 (-0.3-0.8)	-	3.7 (1.7-5.6)	4.8 (2.6-7.0)	3.4 (1.5-5.3)	3.1 (1.3-4.9)

Data are prevalence (%) and 95% confidence interval.

Low physical activity was observed among 44.5% respondents. Higher proportion of males were involved in low physical activity than females. Participants aged 40-64 years, rural people, individuals educated up to secondary level, married, unemployed and having middle-income had a higher prevalence of low physical activity compared to others (Table 2).

More than four-fifth of the participants (83.1%) consumed insufficient fruits and vegetables according to WHO recommendations. Insufficient fruits and vegetables intake were noticed highly among males, 40-64 years old people, rural inhabitants, those having secondary education completed, married, unemployed and belonging to middle-income category than other groups (Table 2).

Around 42% of the respondents were found overweight and obese. However, overweight and obesity was more prevalent among females, respondents aged 40-64 years, living in rural areas, educated up to SSC, married, unemployed and middle-income people (Table 2).

More than half of the participants (56.9%) had elevated blood pressure. Higher prevalence of raised blood pressure was observed among females, those among 40-64 years old, rural people, having education up to secondary level, married, unemployed and middle-income earning people (Table 2).

Of 355 participants, only 6 (1.7%) were free from any selected NCDs risk factors while 280 (78.9%) had 1-3 three and 69 (19.4%) had 4-6 of the selected NCDs risk factors. A distribution of participants having number

of risk factors for NCDs is outlined in Figure 1. Male, respondents aged 40-64 years and urban dwellers had a greater number of risk factors compared to other groups.

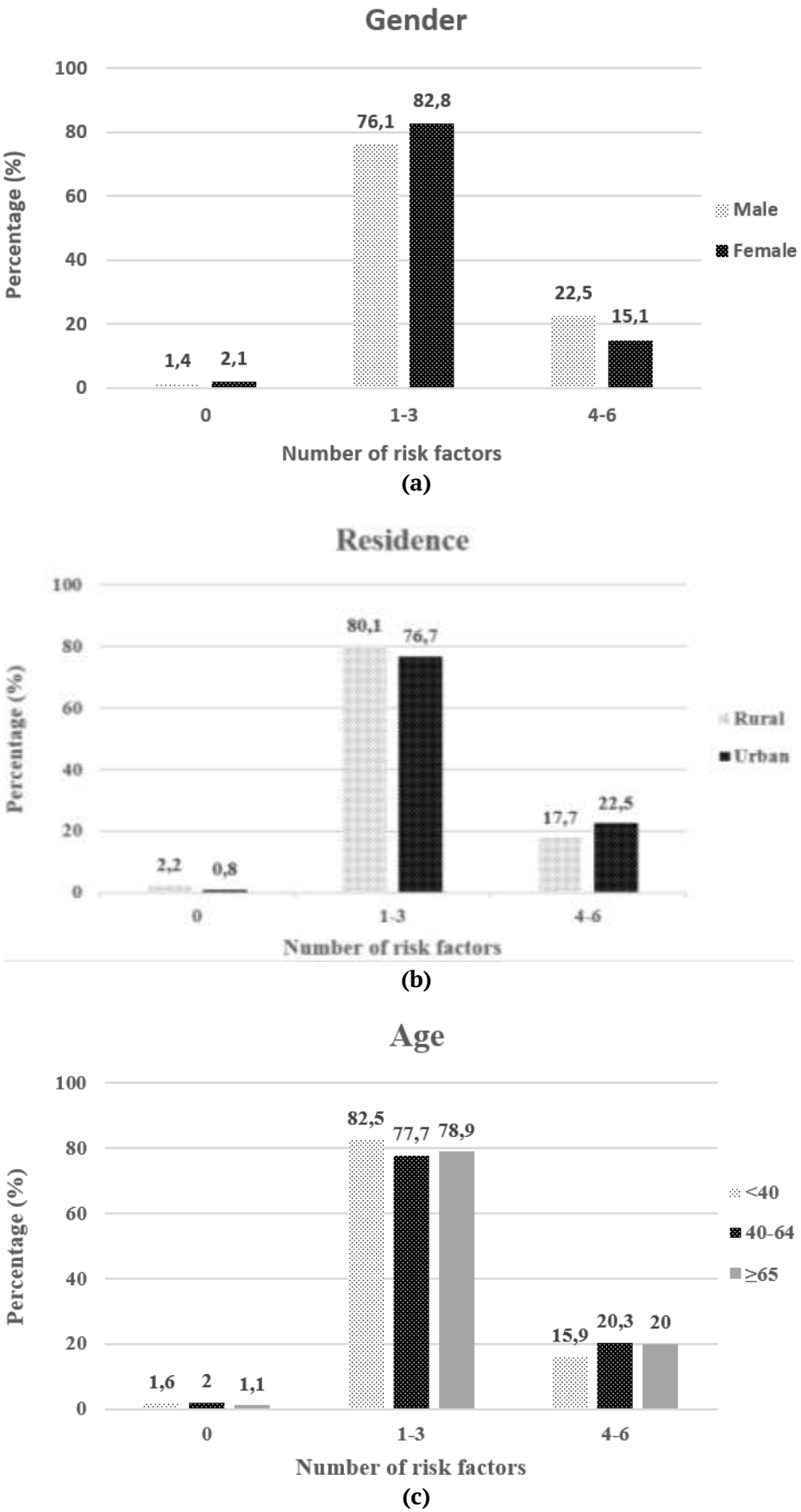

Figure 1. Percentage of participants with number of risk factors for NCDs according to gender (a), residence (b) and age (c).

Determinants of risk factors for NCDs

The results of multivariate logistic regression analyses of selected NCD risk factors by socio-demographic characteristics of the study population are summarized in Table 3. Among the participants, smoking (current) tendency was observed 32.2 times (P<0.001) more in male than female and among individuals having some college and above education 0.3 times (P=0.035) less than those with no formal schooling. Middle-income people consumed 0.1 times less (P=0.048) alcohol than low-income people. Participants aged above 65 years were 3.6 times (P=0.002) more likely to do less moderate and/or vigorous physical activity than participants whose age were below 40 years. Among the participants, urban dwellers were stated to consume 2.4 times less (P=0.028) fruits and vegetables than rural people. The individuals educated up to secondary level were 2.3 times (P=0.003) and those having some college and above education were 2.8 times (P=0.019) more prone to be overweight and obese than those with no formal schooling.

Table 3. Logistic regression (adjusted odds ratios) analyses of selected NCDs risk factors by socio-demographic characteristics of participants.

	Current smoking (95% CI)	Alcohol consumption (95% CI)	Low physical activity (95% CI)	Insufficient fruit and vegetable intake (95% CI)	Overweight and obesity (95% CI)	Raised blood pressure (95% CI)
Gender						
Female	1	1	1	1	1	1
Male	32.2 (9.9-104.4)***	-	0.6 (0.4-1.2)	1.3 (0.6-2.9)	0.6 (0.3-1.1)	0.7 (0.4-1.2)
Age (years)						
<40	1	1	1	1	1	1
40-64	0.7 (0.3-1.6)	1.7 (0.1-22.5)	1.2 (0.6-2.3)	1.1 (0.5-2.4)	1.6 (0.8-3.0)	1.4 (0.7-2.5)
⩾65	0.5 (0.2-1.2)	1.2 (0.04-34.9)	3.6 (1.6-7.9)**	0.7 (0.3-1.9)	1.1 (0.5-2.5)	1.1 (0.5-2.3)
Residence						
Rural	1	1	1	1	1	1
Urban	1.2 (0.6-2.3)	0.6 (0.02-14.7)	1.2 (0.7-2.1)	2.4 (1.1-5.3)*	1.4 (0.8-2.4)	1.1 (0.6-1.8)
Level of education						
No formal schooling	1	1	1	1	1	1
Up to SSC	1.0 (0.5-1.9)	0.02 (0.01-4.0)	1.4 (0.8-2.3)	1.1 (0.6-2.2)	2.3 (1.3-3.9)**	1.6 (0.9-2.6)
Some college and above	0.3 (0.1-0.9)*	2.7 (0.1-99.0)	1.9 (0.8-4.6)	0.4 (0.1-1.3)	2.8 (1.2-6.8)*	2.1 (0.9-4.9)
Marital status						
Unmarried	1	1	1	1	1	1
Married	0.4 (0.1-1.9)	-	3.2 (0.6-16.4)	0.5 (0.06-4.5)	1.4 (0.4-5.2)	1.7 (0.5-6.1)
Separated/Divorced/Widow	0.6 (0.09-4.3)	-	4.0 (0.7-23.1)	0.4 (0.04-4.4)	1.4 (0.3-6.0)	1.9 (0.5-7.8)
Occupation						
Unemployed	1	1	1	1	1	1
Government employee	1.2 (0.04-3.9)	3.8 (0.2-66.3)	0.4 (0.1-1.4)	0.6 (0.1-23)	0.7 (0.2-2.0)	1.3 (0.4-3.7)
Non-government employee	1.4 (0.5-3.6)	1.3 (0.1-25.4)	1.8 (0.8-4.0)	0.7 (0.2-2.0)	0.9 (0.4-2.1)	1.2 (0.5-2.7)
Self-employed	1.6 (0.8-3.2)	0.2 (0.01-3.3)	0.9 (0.5-1.8)	0.6 (0.2-1.3)	1.1 (0.6-2.1)	1.1 (0.6-2.1)
Income						
Low-income	1	1	1	1	1	1
Middle-income	0.7 (0.1-4.3)	0.1 (0.003-0.1)*	0.9 (0.2-5.6)	0.9 (0.1-8.0)	2.0 (0.2-18.6)	1.9 (0.3-11.1)
High-income	0.1 (0.006-1.4)	-	1.6 (0.2-12.0)	1.2 (0.1-16.3)	3.7 (0.3-41.6)	1.5 (0.2-10.7)

CI: Confidence interval, SSC: Secondary school certificate. *P<0.05, **P<0.01, ***P<0.001.

Discussion

Non-communicable diseases once envisaged as diseases of affluence, are now becoming a problem for the people living in developing countries that are still fighting with poverty-related diseases. Therefore, in the present study, an attempt has been made to evaluate the prevalence and determinants of both modifiable behavioral risk factors (current tobacco use, low consumption of fruits and vegetables, and low physical activity), and metabolic risk factors (raised blood pressure, and overweight or obesity) for NCDs among cardiovascular patients in Bangladesh. We found that most (98.3%) of the participants had at least one of the selected risk factors for NCDs.

Tobacco use both in the form of smoking cigarettes and the use of smokeless tobacco is recognized as a serious threat to health and leading causes of death from NCDs globally (WHO, 2018). Direct consumption of tobacco not only impose poor health outcomes to the consumer but also produce illness to nonsmokers exposed to second-hand smoking. Consequently, to lessen the health risk of tobacco worldwide, by 2025, a 30% relative reduction in current tobacco use among 15 years and above individuals was adopted by WHO (WHO, 2013). There exists high cultural admissibility of dual-use of tobacco in Bangladesh, i.e., using both smoking (cigarette, bidi, hookah etc.) and smokeless forms (zarda, gul, pan masala, etc.), particularly among males. Unlike males, females were hardly noticed to smoke cigarettes as smoking by the female is believed as an impolite behavior in society (Zaman et al., 2015). Based on the patients' self-reporting, around 50% male and 3% female were current cigarette smokers. Our study results support the earlier studies in Bangladesh (Ahmed et al., 2017; NCD, 2011; Razzaque et al., 2011; Zaman et al., 2016b) and some other countries (Hoang, Byass, Dao, Nguyen, & Wall, 2007; Ng et al., 2006). On the other hand, a higher proportion of females were recorded to consume smokeless tobacco as compared to males (49% vs. 40%). The findings of our study are in line with other studies in Bangladesh (Ahmed et al., 2017; Banik et al., 2018; Razzaque et al., 2011; Zaman et al., 2015; Zaman et al., 2016b) and other countries (Misra, Mini, & Thankappan, 2014). These statistics highlight the necessity of strict implementation and proper monitoring of the tobacco control laws existing in different countries including Bangladesh.

The cultural habits and religious beliefs (about 90% of Bangladeshi people are Muslim (Bangladesh Demographic and Health Survey [BDHS], 2014) and alcohol is prohibited in Islam) forbid the people of Bangladesh to sale and purchase alcohol in open markets. As a result, among the Bangladeshi population, alcohol use is very low and only 1.7% percent of individuals were reported to consume alcohol in the past 12 months of which all were male. This finding is comparable to some native research (Banik et al., 2018; NCD, 2011; Zaman et al., 2016b).

Research revealed that diet plays a crucial role both in the progression and inhibition of chronic diseases (Hasan & Sultana, 2017). Diets low in fruits and vegetables were found to be associated with an enhanced risk of many NCDs including CVDs. To prevent the devastating effect of NCDs, WHO has suggested at least five servings of fruits and vegetables eating every day (WHO, 2003b). About 98% of our study patients were observed to consume an insufficient amount of fruits and vegetables per day according to WHO recommendation. Our study finding corroborates other STEPS surveys in Bangladesh (Ahmed et al., 2017; Banik et al., 2018; NCD, 2011; Razzaque et al., 2011; Zaman et al., 2015; Zaman et al., 2016b). The low consumption of fruits and vegetables among participants could be due to the lack of consciousness and ignorance about the recommended daily intake. This calls for an immediate and sustained public health intervention program to raise awareness about WHO proposed '5 A Day' campaign and increased consumption of fruits and vegetables.

Low physical activity is deliberated as one of the major factors contributing to chronic NCDs. The present study indicated that females were involved in low physical activity more than males. A national STEPS survey (NCD, 2011) and some other research (Razzaque et al., 2011; Zaman et al., 2015; Zaman et al., 2016b) in Bangladesh noted a similar trend. Poorly planned urbanization and mechanization of life might be attributed to it. Mostly noticed physical activities among participants were related to their work or job and among women it was mainly household chores. Creating and improving recreational facilities like parks, playgrounds, sports centers, etc. may encourage people to involve more in leisure time activities. The present findings ask for innovative strategies to improve the level of physical activity, particularly for women, considering the social and religious norms.

Based on BMI, the prevalence of overweight and obesity (BMI $\geqslant$23 kg m^{-2}) among females was higher than males. The result is consistent with some national (NCD, 2011; Razzaque et al., 2011; Zaman et al., 2015;

Zaman et al., 2016b) and international (Aryal et al., 2015; Ng et al., 2006; Oguoma et al., 2015; Thakur et al., 2016) research. Rapid urbanization, upliftment of socio-economic condition, easy availability and accessibility to food, following a western diet (e.g., increasing consumption of fats and proteins instead of a balanced diet) and leading a more sedentary lifestyle may be the root causes of high obesity prevalence in developing countries like Bangladesh. So, the government should arrange more public awareness campaigns to confront the threat of having a fat nation.

High blood pressure has been acknowledged as a major risk factor for most of the death and disability among Bangladeshi people (Institute for Health Metrics and Evaluation [IHME], 2017). In the current study, the prevalence of hypertension among patients was 56.9% and females were noted to be more hypertensive than males. A similar pattern was recorded previously in Bangladesh (Ahmed et al., 2017; Banik et al., 2018; Razzaque et al., 2011; Zaman et al., 2015; Zaman et al., 2016b), and other countries (Baragou et al., 2012). This high proportion of hypertension might be because in most cases hypertension remains asymptomatic and people, particularly females are not cautious of the potential adverse effects of hypertension. Hence, measures to prevent and control hypertension are seriously needed. Dietary salt intake is very high (~17 g per day) among the people of Bangladesh (Zaman et al., 2017) and so, steps should be taken to reduce the consumption of extra salt. Hypertension detection and treatment, despite being very simple, are far from satisfactory in Bangladesh, and many cases remain unidentified and untreated. Therefore, the primary health care system should be strengthened to ensure proper identification and management of hypertension.

The present study revealed a substantially high percentage of patients with diabetes (about 35.5%). This signals to an upcoming epidemic since heart diseases, stroke and other major NCDs are closely connected to diabetes. This prevalence is very high compared to other observed researches in Bangladesh (Banik et al., 2018; Rahim et al., 2007; Zaman et al., 2016a) and many southeast Asian countries (Aryal et al., 2015; Jayawardena, Byrne, Soares, Katulanda, & Hills, 2013; Thakur et al., 2016). There are substantial pieces of evidence about the increment of diabetes prevalence in Bangladesh, perhaps due to the changes in lifestyle. A sedentary lifestyle with little or no physical exercise, eating lots of processed and fatty foods, and exposure to stressful modern life imposes a negative impact on health. Also, ignorance and reluctance to regular glucose monitoring and maintaining a proper diet and medication might contribute to this high prevalence of diabetes among participants. So, awareness building program needs to be organized frequently by the government and non-government organizations to make people understand the importance of regular blood glucose checking and the deleterious effect of diabetes.

The results of lipid profiles in the current study shows that about half of the patients had hypercholesterolemia and nearly two-thirds of the patients had hypertriglyceridemia. The reasons behind this might be many, for example, patients' dietary behavior, genetic susceptibility and other factors not assessed in this study. This alarming percentage signifies the necessity of further investigation. And, the prevalence of both of these conditions is high among males than females.

The present STEPS survey unveils that NCD risk factors are quite prevalent among cardiovascular patients, with about half having three or more selected risk factors. This represents a growing risk and potential epidemic of NCDs and indicates that the burden of NCDs is likely to increase in the future if it is not addressed promptly by the government and other stakeholders.

There are some limitations to the study that need to be addressed. First, the present study was conducted in five tertiary care hospitals in Bangladesh among cardiovascular patients, and hence, the results cannot be generalized to other populations. Second, being a cross-sectional study, the findings of the current study cannot be considered as more than a snapshot, and they do not allow any assessment of trends. Third, while comparing results from this study with those from other studies, some factors need to be considered including the age of the study subjects, place of residence, as well as concept and measurement instruments used during the survey etc.

Conclusion

The present study provides the first NCDs risk factor profile among cardiovascular patients seeking care at five tertiary care hospitals in Bangladesh. The prevalence of NCD risk factors is alarmingly high among patients. Hence, the present study demands a multisectoral approach to curtail the impact of NCDs on death and disability. Also, the current study findings can be used as baseline data to support the advocacy and formulation of a wide action plan by the government for both individual and population-level health interventions for implementation.

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