Application of country-specific Globorisk score to estimate next 10 years risk of cardiovascular diseases and its associated predictors among postmenopausal rural women of Bangladesh: A cross-sectional study in a primary care setting

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Abstract
Introduction: Risk of cardiovascular disease (CVD) among postmenopausal Bangladeshi women has not yet been evaluated using a country-specific tool. Hence, we prompted to estimate the risk and identify the predictors that were not typically included in any CVD risk assessment tool.

Methods: This cross-sectional study used a web version of country-specific lab-based Globorisk calculator to estimate the risk of CVD among 265 postmenopausal women who visited a primary healthcare centre in a rural area of Bangladesh. The centre was selected purposively and the participants were recruited using a convenient sampling technique. Data were collected using a modified STEP-wise approach to surveillance of non-communicable disease risk factors questionnaire of the World Health Organization. The risk levels were presented using descriptive statistics and the associated predictors were identified using adjusted multiple linear regression analysis.

Results: Overall, 56.7% of the subjects were identified as ‘at risk’ of future CVD events. After adjusting the confounders, CVD risk factors including age of onset of menopause ($\beta = 0.441, p < 0.001$), duration of menopause ($\beta = 0.603, p < 0.001$), smokeless tobacco use ($\beta = -1.047, p = 0.003$), added salt intake ($\beta = 1.081, p = 0.002$), waist–hip ratio ($\beta = 0.094, p = 0.03$) and diastolic blood pressure ($\beta = 0.145, p = 0.001$) were identified as significant predictors of CVD risk.

Conclusion: This finding suggests screening program among postmenopausal women for early detection of CVD risk and efforts to control the associated predictors.

KEYWORDS
cardiovascular risk, Globorisk, postmenopausal women

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1 | INTRODUCTION

Cardiovascular diseases (CVDs) are the major cause of death globally and the burden is also higher among the Bangladeshi population. Regarding gender specificity, mortality from CVD is again rising among women and it has already higher than their counter-part men. In women, the clean-cut difference in CVD mortality has been observed between pre-menopausal and postmenopausal age groups. The global incidence rate of CVD among postmenopausal women is equal in men who are 10 years younger. So all of these have suggested that men to women and pre- to postmenopausal differences in CVD mortality are possibly due to menopause, the permanent cessation of menstruation in women’s lives. However, this issue is still inconclusive and exact causes need to be fully elucidated through systematic research, especially in developing countries such as Bangladesh.

A recent study showed that Bangladeshi women in rural areas had higher mortality (47-fold) from CVD than men (30-fold). From the perspective of Bangladesh, two factors are important, life expectancy in women and the age of onset of menopause. Based on these two factors, it has been evidenced that Bangladeshi women pass one third of their life in the postmenopausal stage as their life expectancy is 70.3 years and the usual age of menopause is 45–55 years. Although Bangladeshi women pass a considerable part of their life in the postmenopausal stage, they are less likely to identify their CVD risk and participate in the screening program. Thus, their cardiovascular health is becoming a neglected issue here and merely addressed by the policymakers.

Currently, in Bangladesh, there is no initiative to tackle the burden of CVDs among postmenopausal women. The easiest way is to detect future CVD events using a risk prediction tool and appropriate intervention based on the estimated risk. Previously, we reported that World Health Organization/International Society of Hypertension (WHO/ISH) ‘without cholesterol’ risk chart predicted CVD risk effectively among postmenopausal women and highly agreed with Framingham risk score (FRS). However, both the tools were either based on external population (United States of America) or region based (Southeast Asia [SEA]). In Bangladesh, no country-specific CVD risk prediction tool has applied, and predictors not included in a tool have examined CVD risk. Hence, this study had two objectives: (1) to estimate next 10 years risk of CVD using country-specific risk prediction tool and (2) to find out the predictors of CVD risk that are not typically included in the conventional risk prediction tool.

2 | METHODS

This was a cross-sectional study conducted in 2016 among 265 postmenopausal women, aged 40–70 years, who visited a rural primary healthcare centre of Bangladesh. The centre was selected purposively and data were collected conveniently through a face-to-face interview. We used a pre-tested questionnaire adapted from STEP-wise approach to Surveillance (STEPS) of non-communicable diseases risk factors of World Health Organization (WHO) with appropriate modifications. Details of study design, data collection procedures, physical measurement, tools and technique and quality assurance issues were described elaborately in previous papers. In brief, we included those participants who were categorized as having ‘no CVDs’ based on the self-reported statement, clinical history and medical records’ review. We excluded the participants presented with an acute illness, psychological illness or who showed unwilling to participate. Menopausal status was defined as no menstrual bleeding for at least 12 months and no other clinical condition causing amenorrhea. The pre-tested questionnaire collected data on non-modifiable (age, age at menopause, duration of menopause), behavioural (tobacco use, added salt intake, physical inactivity, oral contraceptive pill use) and intermediate-risk factors of CVD (generalized obesity, central obesity, diabetes, hypertension and abnormal lipid profile). Their physical activity level was measured using Estimated Energy Requirement (EER) equation of the Dietary Reference Intakes (DRIs) Committee. The generalized obesity, central obesity and hypertension were determined using body mass index (BMI), waist–hip ratio (WHR) and ‘Seventh Report of the Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7)’ as described in the ‘Noncommunicable disease risk factors survey Bangladesh 2010’, respectively. We diagnosed diabetes using WHO criteria (fasting plasma glucose ≥ 7.0 mmol/L or 2-h plasma glucose ≥ 11.1 mmol/L) and self-statement of a person as known diabetic or on anti-diabetic medication. Lipid abnormality (hypercholesterolaemia, hypertriglyceridaemia, low high-density lipoprotein [HDL] and high low-density lipoprotein) was detected using Adult Treatment Panel III (ATP III) guideline.

2.1 CVD risk estimation using country-specific Globorisk score

Globorisk is the first CVD risk score that predicts the risk of heart attack or stroke in healthy individuals (those who have not yet had a heart attack or stroke) for all countries globally. Previously formulated CVD risk tools were based on the data of developed or high-income countries; however, the burden of CVD mortality is higher among low-income countries. The Globorisk uses information on a person’s country of residence, age, gender, smoking, diabetes, blood pressure and cholesterol to predict the chance that they would have a heart attack or stroke in the next 10 years. It has two versions: lab-based version and office-based version. If the person does not have recent blood glucose or total cholesterol (TC) test, they can use the office-based version of Globorisk which is based on body weight and height instead. This unique feature makes it possible to apply the tool in a low-resource setting where blood cholesterol measurement and/or blood glucose measurement is not possible. The CVD risk can be calculated using the web version of risk calculator or risk charts. To achieve our objective, we used the web version of lab-based Globorisk calculator that expresses CVD risk as a percentage. The Globorisk tool has no categorical risk classification as like as other existing CVD risk classification system. Hence, we categorized the risk as low (<10%), moderate (10%–19.9%), high (20%–29.9%) and very high (≥30%). For intervention purpose, we
Data processing and analysis

Further re-categorized the CVD risk as dichotomized variable such as ‘at risk’ and ‘no risk’. Here, ‘at risk’ population comprised those who were at either moderate or high or very high risk.

2.2 Ethical approval

The study’s purpose, the necessity of invasive procedures and data safety issues were explained to the participants. Data were collected after written informed consent was obtained. The study was conducted according to the Declaration of Helsinki. The protocol was approved by the Ethical Review Committee of Bangladesh University of Health Sciences (Identification number: BUHS/ERC/EC/16/024 (1/1)) on 28 January 2016.

2.3 Data processing and analysis

All questionnaires were reviewed thoroughly for consistency and completeness. For this, data were cleaned, edited and verified to exclude any error or inconsistency before coding and entering them into the Microsoft Excel database. The final Excel datasheet was transferred to the software Statistical Product and Service Solutions (SPSS) version 20.0 for Windows (SPSS, Inc. Chicago, IL, USA). All the analysis was computed using SPSS and outputs were then tabulated. Descriptive statistics (frequency and percentage) was used to present CVD risk categories. All the estimates of precisions were presented at a 95% confidence interval. The predictors of CVD risk were determined using multiple linear regression analysis and the risk factors (age, gender, smoking, diabetes, systolic blood pressure, TC) considered for estimation of CVD risk using Globorisk score were excluded from this analysis to exclude bias. We also excluded height, weight and their derivative BMI as they were considered for office-based Globorisk score and other well-known non-laboratory-based CVD risk prediction tools (FRS-BMI, WHO/ISH ‘without cholesterol’ risk chart, etc.). In the adjusted model, several confounders (age of menarche, oral contraceptive pill use and the metabolic equivalent of tasks) were controlled to identify the predictors. The findings were considered statistically significant at the threshold of \( p < 0.05 \).

3 RESULTS

3.1 Reproductive and risk factors profile of the study population

The mean age of the study population was 53.51 ± 7.5 years and three fourth of them were at high-risk age groups (≥50 years) of CVD. Their mean age of onset of menopause and duration of menopause was 44.83 ± 5.22 and 8.79 ± 6.45 years, respectively. Among the behavioural risk factors, more than half (58.1%) were physically inactive, 44.9% used smokeless tobacco and 44.5% used to take added salt with a meal. Majority of the study population were centrally obese (73.2%), hypertensive (41.9%) and had an abnormal lipid profile (59.6%) (Table 1).

3.2 Risk of CVD among postmenopausal women using Globorisk score

Highest proportion of study population was classified as low risk (43.3%, confidence interval [CI]: 37.4–49.4) followed by moderate (28.7%, CI: 23.3–34.2) and high risk (≥20%) category (28%, CI: 2.6–33.4) (Table 2). Overall, 56.7% of the postmenopausal women were categorized as ‘at risk’ of future CVD events.

3.3 Predictors of CVD risk among study population

After adjusting the confounders, CVD risk factors including age of onset of menopause (β = 0.441, \( p < 0.001 \)), duration of menopause (β = 0.603, \( p < 0.001 \)), smokeless tobacco use (β = −1.047, \( p = 0.003 \)), added salt intake (β = 1.081, \( p = 0.002 \)), WHR (β = 0.094, \( p = 0.03 \)) and diastolic blood pressure (DBP) (β = 0.145, \( p = 0.001 \)) were identified as significant predictors of CVD risk (Table 3).

4 DISCUSSION

Application of country-specific tool, the Globorisk score, detected more than half of the postmenopausal women (56.7%) resided in a rural area of Bangladesh were at risk (moderate and high) of a CVD event in next 10 years. This finding was much higher than the previous study that used World Health Organization/International Society of Hypertension (WHO/ISH) ‘with’ and ‘without’ cholesterol risk charts and FRS in the same population.7 Other than postmenopausal women, there are few studies conducted among the rural population of Bangladesh to estimate the next 10 years risk of CVD and their finding was much lower than the current finding.17–19 In the current study, around 28% participants were at high risk (≥20%) which was 5.5% and 2.2% for Fatema et al.17 and Cravedi et al.19 among rural Bangladeshi population, respectively. Evidence on CVD risk assessment among postmenopausal women in SEA region is lacking.

Moreover, we did not find any study that applied Globorisk score to predict risk among the Asian postmenopausal women. In consideration of the women participants, the current study detected more participants as at high CVD risk compared to countries of Indian sub-continent (India, Pakistan, Nepal and Sri Lanka) and other parts of Asia (Cambodia, Malaysia and Mongolia).20–22 The difference in CVD risk is possibly due to applying different tools, variation in sociodemographic factors, cultural background, environmental factors and genetics of the participant. In this regard, country-specific CVD risk prediction tool has broader applicability than the universally applied CVD risk tool due to less chance of overestimation or underestimation. From our study perspective, gender is another concern as some tools underestimate
TABLE 1
Reproductive and CVD risk factors profile of the study population (n = 265)

| Risk factors | Mean ± SD | Median (IQR) | n (%) |
|--------------|-----------|--------------|-------|
| **Non-modifiable** | | | |
| **Age** | 53.51 ± 7.5 | 52 (49–60) | 198 (74.7) |
| At high risk (≥50 years) | | | |
| At low risk (<50 years) | | | 67 (25.3) |
| **Age at menopause** | 44.83 ± 5.22 | 45 (40–48) | 114 (43) |
| Early menopause (<45 years) | | | |
| Menopause at optimum age (≥45 years) | | | 151 (57) |
| **Duration of menopause** | 8.79 ± 6.45 | 7 (3–13) | 116 (43.8) |
| ≥6 years | | | |
| <6 years | | | 149 (56.2) |
| **Behavioural** | | | |
| Smoking | | | 4 (1.5) |
| Smokeless tobacco use | 119 (44.9) | | |
| Added salt intake | 118 (44.5) | | |
| Physical activity METs/week | 4762 ± 2881 | | |
| Physical inactivity | 154 (58.1) | | |
| Oral contraceptive pill use | 91 (34.3) | | |
| **Intermediate** | | | |
| Generalized obesity (BMI ≥ 30 kg/m²) | 20 (7.5) | | |
| Central obesity (WHR > 0.85) | 194 (73.2) | | |
| Diabetes | 53 (20) | | |
| Hypertension | 111 (41.9) | | |
| Abnormal lipid profile | 158 (59.6) | | |
| Hypercholesterolemia | 68 (25.7) | | |
| Hypertriglyceridaemia | 112 (42.3) | | |
| High low-density lipoprotein (LDL-C) | 55 (20.8) | | |
| Low high-density lipoprotein (HDL-C) | 70 (26.4) | | |
| High atherogenic index of plasma (AIP) | 141 (53.2) | | |

Abbreviations: CVD, cardiovascular disease; MET, metabolic equivalent Task.

TABLE 2
Next 10-years risk of CVD among postmenopausal rural women of Bangladesh in a primary care setting (n = 265)

| CVD risk levels | n (%) | 95% Confidence interval |
|----------------|-------|-------------------------|
| Low (<10%) | 115 (43.4) | 37.4–49.4 |
| Moderate (10%–19.9%) | 76 (28.7) | 23.3–34.2 |
| High (20%–29.9%) | 45 (17) | 12.5–21.5 |
| Very high (≥30%) | 29 (10.9) | 7.2–14.7 |

Abbreviation: CVD, cardiovascular diseases.

CVD risk among women. The application of country-specific risk tool has public health importance as most of the CVD risk prediction tools were based on the data of European descent populations in developed countries, whose background CVD risk may be significantly different from that in developing countries. An assessment of a CVD risk tool in terms of country specificity and gender specificity, FRS is the example that overestimated risk among the external population with a lower background of CVD risk and underestimated risk among women. Considering all of these critiques, it has been suggested recalibrating the CVD risk tools using local or country-specific data as it improved predictability among the external population. Hence, we may assume that our estimated CVD risk among postmenopausal women using country-specific Globorisk score is significant and provided better estimation than the previous one.

Over 300 CVD risk factors have been discovered and only a few of them used to predict CVD risk. Most CVD risk prediction tools include age, gender, smoking, TC, HDL cholesterol and systolic blood pressure as a determinant of the CVD risk score. The current study assessed the link of several risk factors with risk of CVD that were not typically included in a risk prediction tool; in this case, the Globorisk score. Among the detected predictors, age of onset of menopause (β = 0.441, p < 0.001) and duration of menopause (β = 0.603, p < 0.001) were two non-modifiable risk factors that showed highly significant associations with CVD risk.
A significant proportion of Bangladeshi postmenopausal rural women were classified as ‘at risk’ of next 10 years CVD event that demands screening program and prevention effort for this neglected population to reduce the future burden of CVD. Highly significant association with the predictors not included in a risk tool indicated the necessity of recalibration with these factors to better predict CVD risk in postmenopausal women of Bangladesh.

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CONFLICT OF INTEREST
The authors declare no conflict of interest.

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DATA AVAILABILITY STATEMENT
Data are available on request from the authors.

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