

Research Article

The risk of developing cardiovascular disease in Bangladesh: does diabetes mellitus matter? Which socioeconomic status does it impact? A cross sectional study

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Abstract

The elevation of blood pressure levels has been recognized as a determinant of the risk for several common cardiovascular diseases. This work explores the evidence of disparities in the form of association between hypertension and diabetes mellitus in different socioeconomic statuses (SESs) at household level. A population sample of 7561 individuals aged ≥ 35 years from the 2011 Bangladesh Demographic Health Survey (BDHS) was used for this study. Concentration indexes are used to measure the disparities of myocardial infarction and diabetes mellitus with SES. A two-level hierarchical logit model was used to examine the effects of participants and household SES accompanied by other explanatory variables on having hypertension. Then, the analysis is stratified by SES groups to examine how the overall effect of diabetes mellitus on hypertension may vary with SES. Finally, predictive margins are determined to understand the predictive probability of diabetes and SES of having hypertension as a risk factor of developing cardiovascular disease. The descriptive summary measures of SES inequality indicate that prevalence of hypertension and diabetes was higher among high SES. The multivariate analysis covering all samples reveals that there is a strong association between diabetes and hypertension ($P < .01$). Likewise, after stratifying, it is evident that in high SES, there is a strong association between individuals with diabetes mellitus and hypertension development; they have around four-fold higher chance of being affected by hypertension in comparison to individuals with normal fasting plasma glucose ($P < .01$). Moreover, there are strong associations between individuals in low and medium SESs having diabetes and having hypertension ($P < .01$); the likelihood of having hypertension is almost double compared to individuals who have no diabetes. The result of this study also shed light on the chance of an increase in prevalence of hypertension in pre-diabetes individuals and in medium and high SES groups, although the association is statistically insignificant ($P > .05$). Finally, the predictive analysis reveals that the predictive margin of having hypertension is high among individuals belonging to the high SES (23%; CI, 20–23) and diabetic patients with high SES (37%; CI, 33–47). Contrary to other developed countries, hypertension in Bangladesh is prevalent among all SES, and the likelihood is high among diabetic patients in the medium and high SES. Hence, urgent preventive measures are needed to control the impending comorbidity of diabetes and developing cardiovascular disease risk. *J Am Soc Hypertens* 2016;■(■):1–9. © 2016 American Society of Hypertension. All rights reserved.

Keywords: Diabetes; hypertension; prediabetes; socioeconomic status.

Introduction

In the past 10 years, guidelines for the identification and management of cardiovascular disease (CVD) risk factors with diabetes mellitus have been published by multiple professional organizations, including the American Diabetes Association.^{1,2} Many of the leading causes of death and disability elsewhere are related to socioeconomic position. Indeed, there is a social gradient or dose—response

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relationship between SES and health status, with individuals at the highest levels of SES experiencing the best health, those at the next level having slightly worse health and so on, with the worst health seen among those at the lowest SES.³ Although this observation that health patterned by SES is very longstanding, it is important to note that the association between SES and various health outcomes has become a topic of study in its own right over the past three decades.⁴ Most of these studies, however, are from developed countries.^{5–7} In low-income and middle-income countries, there is a dearth of evidence on how the consequences of socioeconomic status may be disparate from that in the developed countries. Moreover, most of the earlier studies were based on local or regional data representing small sample sizes or unreliable samples, which may have been predisposed to selection bias.

In Bangladesh, CVD-related mortality (fatal and nonfatal stroke and myocardial infarction) is rapidly escalating from 11 per 10,000 people in 1986 to 411 per 10,000 in 2006.⁸ Likewise, the rise of diabetes in Bangladesh is also alarming: 4% in 1990 to 10% in 2011⁹ and is subject to develop a considerable comorbid diabetes and hypertension burden that creates vulnerable higher risk of CVD-related mortality. Despite the increase in diabetic patients and CVD-related mortality in Bangladesh, no studies have elucidated how varying levels of blood plasma glucose and SES affect hypertension.

Hence, this study evaluates whether the likelihood of having hypertension differs in patients with diabetes mellitus in different SES, along with other explanatory variables, answers the questions: (a) Is there evidence of between SES differences in the strength and form of association disparities between having hypertension and diabetes?; (b) Which SES is most prone to emerging hypertension?; and (c) What predictive margins of having hypertension are associated with diabetic patients at each SES?

Results reported herein represent a trustworthy approach to prove the potential effects of SES and diabetes mellitus on hypertension that are still neglected by the scientific literature. This portrayal might facilitate enhancing and furthering this information and fill the knowledge gaps by using the first nationally representative sample in Bangladesh. Moreover, as the burden of hypertension and diabetes is one of the key policy issues facing Bangladesh, the findings of this study are expected to contribute to furthering the policy-making process that would support programs to combat the complex anxiety of comorbid diabetes and CVD-related mortality and are expected to contribute in furthering the health policy of the country.

Methods

Sample

This study was carried out using a nationally representative household-based sample from the Bangladesh

Demographic Health Survey (BDHS) 2011, conducted by the National Institute for Population Research and Training of the Ministry of Health and Family Welfare of Bangladesh.¹⁰ The sampling was created in BDHS through a stratified, multistage cluster selection approach. The primary sampling units encompass 600 units, covering 207 from urban areas and 393 from rural areas. The primary sampling units were determined from the sampling frame created for the 2001 Bangladeshi census. From each primary sampling unit, households were selected randomly. The questionnaires were translated into Bangla, the national language of Bangladesh, from the original drafted English ones. Experts and volunteers reviewed the translations, and to validate the questionnaire, a pilot study was conducted. Face-to-face interviews were successfully completed with 17,141 households from the 17,964 selected households, that is, the response rate was around 98%. From the randomly selected one-third of the households, 8835 people (4311 women and 4524 men) aged ≥ 35 years were selected for a biomarker examination. The fasting process implemented before the plasma glucose test was instructed in detail to the respondents. Before taking the blood for glucose testing, the respondents were asked whether they had eaten or drunk anything at all (except water) from the time she or he had woken in the morning. A capillary blood sample was obtained from the middle or ring finger of the respondent if he or she was fasting; otherwise, an appointment was made for the next morning to collect and test a capillary blood sample after fasting as detailed above.

The blood pressure measurements and blood glucose tests of the selected respondents were conducted by trained biomarker staff. The measurements were successfully completed with 7566 respondents, that is, the response rate was around 86% (89% of women and 83% of men). Finally, a total of 7561 samples were nominated for this study after excluding subjects with missing data.

Dependent Variable

In this study, arterial hypertension was used as a proxy for risk of developing cardiovascular disease. The 2011 BDHS used the LIFE SOURCES UA-767 Plus Blood Pressure Monitor (A & D Medical, San Jose, CA) to assess hypertension as recommended by the World Health Organization in the right arm of seated participants. Three measurements of both systolic and diastolic blood pressure were taken at approximately 10-minute intervals. The average of the second and third assessments was reported. Respondents with systolic blood pressure ≥ 140 mm Hg and diastolic blood pressure ≥ 90 mm Hg were categorized as hypertensive or likely to developing cardiac disease risk, in accordance with the American Heart Association recommendations¹¹ or currently using blood pressure-lowering medications.¹⁰

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