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Diabetes among adults in Bangladesh: changes in prevalence and risk factors between two cross-sectional surveys

Muhammad Abdul Baker Chowdhury ,[1] Mirajul Islam ,[2] Jakia Rahman ,[3] Md Jamal Uddin ,[4,5] Md. Rabiul Haque [6]

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MJU and M.RH are joint senior authors.

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For numbered affiliations see end of article.

Correspondence to
Mr Muhammad Abdul Baker Chowdhury ;
mchow023@fiu.edu

ABSTRACT

Objective/research question To investigate the change in the prevalence and risk factors of diabetes among adults in Bangladesh between 2011 and 2018.

Design The study used two waves of nationally representative cross-sectional data extracted from the Bangladesh Demographic and Health Surveys in 2011 and 2017–2018.

Setting Bangladesh.

Participants 14 376 adults aged ≥35 years.

Primary outcome Diabetes mellitus (type 2 diabetes).

Results From 2011 to 2018, the diabetes prevalence among adults aged ≥35 years increased from 10.95% (880) to 13.75% (922) (p<0.001), with the largest-relative increase (90%) among obese individuals. Multivariable logistic regression analysis identified age and body mass index (BMI) were the key risk factors for diabetes. Adults who were overweight or obese were 1.54 times (adjusted OR (AOR): 1.54, 95% CI: 1.20 to 1.97) more likely to develop diabetes than normal-weight individuals in 2011, and 1.22 times (AOR: 1.22, 95% CI: 1.00 to 1.50) and 1.44 times (AOR: 1.44, 95% CI: 1.13 to 1.84) more prone to develop diabetes in 2018. Other significant risk factors for diabetes were marital status, education, geographical region, wealth index and hypertension status in both survey years.

Conclusion A high prevalence of diabetes was observed and it has been steadily increasing over time. To enhance diabetes detection and prevention among adults in Bangladesh, population-level interventions focusing on health education, including a healthy diet and lifestyle, are required.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ We estimated the change in prevalence and risk factors of diabetes among Bangladeshi adults between 2011 and 2018.
⇒ Data were obtained from nationally representative two cross-sectional surveys including the most recent one.
⇒ Our study uniquely investigates the risk factors of diabetes among adults.
⇒ Anthropometric and diabetes data were collected using the WHO-recommended guidelines.
⇒ Unavailability of information on some important risk factors was the major data limitation.

INTRODUCTION

Diabetes mellitus or type 2 diabetes is one of the most common chronic and preventable diseases affecting 463 million individuals worldwide in 2019.[1 2] By 2045, the International Diabetes Federation predicts 700 million people will have diabetes worldwide, a 51% increase from 2019.[2] This preventable disease is linked to heart disease, stroke, renal failure and blindness, as well as morbidity, mortality and poor quality of life.[3–5] Moreover, diabetes causes a huge financial burden on the patient and the healthcare system of the country which is expected to continue to grow. Global health expenditure on diabetes is estimated to reach US$825 billion by 2030 and US$845 billion by 2045 compared with US$760 billion in 2019.[2 6]

Low-income and middle-income countries have seen a faster increase in diabetes prevalence than high-income countries, with more than two-thirds of the population suffering from the disease.[7–10] Bangladesh, like many other countries, is transitioning from communicable to non-communicable diseases due to improved socioeconomic status and unplanned but rapid urbanisation.[11] Bangladesh is also going through a nutritional transition from traditional eating habits to a fast-food diet and sedentary lifestyle, which is contributing to the rise of non-communicable diseases like diabetes.[12] These reasons may lead Bangladesh to endure increased diabetes prevalence in the future. A systematic review of published studies between 1994 and 2013 found that diabetes prevalence in Bangladesh ranged from 4.5% to 35.0%.[13] Furthermore, the number of patients with diabetes in Bangladesh is estimated to be 13.7 million by 2045.[14]

Several studies on diabetes conducted in Bangladesh confirmed that diabetes prevalence among adults is rising steadily.[15 16]

People in Bangladesh who live in urban areas, belong to higher-income households, are older, have more education and have hypertension get a higher prevalence of diabetes.[17–24] Systematic review study on the prevalence of diabetes and pre-diabetes in Bangladesh mentioned that the prevalence of diabetes was significantly higher in urban areas compared with rural areas, while there was no significant gender difference.[19]Another cross-sectional study found that longer duration of diabetes, use of insulin and presence of diabetes complications were significantly related to the average annual cost per patient in Bangladesh.[18] People with lower socioeconomic status are less aware as well as spend less on the care of diabetes. However, most of those studies were confined to urban–rural communities or some other specific groups (eg, slum residents), which did not consider a wide range of correlates of diabetes for the entire country. While an upward trend in the prevalence of diabetes is evident, very few population-based studies also reported the prevalence of diabetes, which are outdated. Despite the rising literature on diabetes research in Bangladesh, no study has identified trends in the prevalence of diabetes and its related risk factors or made a comparison of its risk factors over the years.

In this study, we explored whether the overall prevalence of type 2 diabetes among adults in Bangladesh changed between 2011 and 2018 and to what extent it changed by socioeconomic and demographic characteristics of individuals. We also examined the factors that potentially contribute to the risk of diabetes among the studied population and make comparisons among them. It is important to recognise changes in diabetes prevalence by population subgroups to ensure access to and use of available treatment required for the population living with diabetes.

METHODS

Data source

We used two waves of cross-sectional data from the Bangladesh Demographic and Health Survey (BDHS) from 2011 and 2017–2018 to estimate the prevalence of diagnosed diabetes among the non-institutionalised Bangladeshi population aged 35 and older. Diabetes testing and related questionnaires were included only in the 2011 and 2018 surveys. The BDHS was designed to collect data to monitor and evaluate the population health and nutritional status of the country using two-stage stratified cluster sampling from non-institutionalised households. The details of the sampling procedure and sample selection are published elsewhere.[25 26]

The National Institute of Population Research and Training Ethics Review Board approved the data collection of the BDHS with the requirement of documented consent from all study participants. Our study was exempt from the ethical review approval because we used freely available de-identified data.

Biomarker measurements including blood pressure and blood glucose were collected only in 2011 and 2018 BDHS. A total of 23 541 adults were eligible for blood glucose measurements in both surveys. After exclusion of non-responses and individuals with missing data and pregnant women, 19 584 adults comprised the study population for both survey years. Of the total included study participants 14 376 (7556 in 2011 and 6820 in 2018) were aged 35 years or over.

Outcome variable

The outcome variable for this study was the prevalence of diabetes for both survey years. Diabetes status was measured by fasting blood glucose values greater than or equal to 7.0 mmol/L or self-reported use of blood glucose-lowering medication during the interview.[27]

Demographic and other covariates

Demographic, household and community-level characteristics were included to assess the prevalence and risk factors of diabetes by survey years. Individual-level characteristics were participant's age (grouped into 35–44, 45–54, 55–64, 65–74 and 75+ years of age), sex, marital status (currently married, not currently married), educational level (no education, primary, secondary, higher), body mass index (BMI) and hypertension status. The BMI was calculated as weight in kilograms divided by height in metres squared. We used BMI classifications for Asian population: underweight (<18.5), normal weight (18.5 to 23.0), moderate risk/overweight (23.0 to <27.5) and high risk/obese (≥27.5).[28] Household and community characteristics were socioeconomic status (wealth index), place of residence (urban, rural) and geographical region (division).

Statistical analysis

The full sample of each survey was used for descriptive analysis of individuals' demographic and socioeconomic characteristics. X^2 tests were performed to check the bivariate association between each characteristic and diabetes status. We also used independent proportion tests to know whether the prevalence of diabetes between the two surveys was changed significantly and calculated the relative changes between the survey periods. For the adjusted analysis in each survey year, we performed multivariable logistic regression models to identify the associated risk factors of diabetes in Bangladesh by entering the variables that were significantly associated with the outcome in the univariate logistic regression analysis. Before entering the models, tests for multicollinearity between explanatory variables were performed. To select the best model, we checked the values of −2 log likelihood ratio test, Akaike information criterion (AIC) and the area under the receiver operating characteristic curve. The best model had lower values of −2 log likelihood ratio test and lower AIC value.

To make an appropriate comparison between the two homogeneous groups for study periods, adjusted ORs

(AORs) were calculated for both 2011 and 2018 BDHS data of the study participants aged 35 years and older. Moreover, we performed sensitivity analysis by splitting the data sets into rural and urban as well as men and women. We used p<0.05 at two-sided statistical significance for all analyses. Data management and statistical analyses were performed using Stata V.15 (StataCorp, College Station, Texas, USA). We considered the sample weights, primary sampling units and Strata using the 'SVY' command of Stata considering the complex nature of the survey design. Comparisons by different groups were drawn using the 'svysubpop' command.

RESULTS

Diabetes prevalence

Table 1 shows the socio-demographic characteristics of participants with age ≥35 years in Bangladesh. The highest percentage of individuals came from the age group 35–44 in 2011 (35.77%) and 2018 (36.03%). In both years' men and women percentages are approximately 50%, and a similar decreasing trend in education level was observed. Urban individuals were higher than rural in both years. We observe that the lowest percentages of individuals came from overweight (12.97%) in 2011 but from obese (13.36%) in 2018.

The diabetes prevalence in 2011 and 2018 with relative ratios are presented in table 2. The overall prevalence of diabetes among adults ages ≥35 years increased from 10.95% in 2011 to 13.75% in 2018. The relative highest increase (38%) in diabetes prevalence was found among individuals with age 65–74 and the second-highest increase rate (36%) was found among the age group 45–54. The prevalence rate of diabetes among women increased significantly from 11.25% in 2011 to 13.81% in 2018 whereas this increment among men is not significant. The relative increase in diabetes prevalence over time among married, currently not working individuals and rural areas were 30%, 42% and 28%, respectively. A significant increase in diabetes prevalence was also observed among adults with no education and secondary education. The highest-relative increase (54%) in diabetes prevalence was in the Dhaka region followed by 53% in the Khulna region. Diabetes prevalence among middle, richer and the richest individuals increased significantly by 48%, 41% and 33%, respectively. The prevalence of diabetes increased by 90% among obese individuals, this rate decreased by 9% among overweight adults.

Risk factor analysis

The adjusted results from multivariable logistic regression analysis are reported in table 3. The likelihood of diabetes was the highest (AOR: 2.11, 95% CI: 1.58 to 2.83) among adults ages 55–64 in 2011 whereas this rate was highest (AOR: 1.67, 95% CI: 1.21 to 2.30) in the age group 65–74 in 2018 compared with adults ages 35–44. There was no significant difference in the odds of having diabetes among men and women in both periods. Although

Table 1 Socio-demographic characteristics of the study sample by survey year, Bangladesh Demographic and Health Surveys

Variables	2011, n (%)	2017–2018, N (%)
Age group		
35–44	2703 (35.77)	2457 (36.03)
45–54	2236 (29.59)	1721 (25.23)
55–64	1292 (17.1)	1394 (20.44)
65–74	809 (10.71)	809 (11.86)
75+	516 (6.83)	439 (6.44)
Sex		
Female	3823 (50.6)	3510 (51.47)
Male	3733 (49.4)	3310 (48.53)
Marital status		
Not married	1214 (16.07)	1140 (16.72)
Married	6342 (83.93)	5680 (83.28)
Wealth index		
Poorest	1346 (17.81)	1380 (20.23)
Poorer	1351 (17.88)	1328 (19.47)
Middle	1463 (19.36)	1353 (19.84)
Richer	1584 (20.96)	1278 (18.74)
Richest	1812 (23.98)	1481 (21.72)
Educational level		
No education	3424 (45.31)	2663 (39.07)
Primary	2082 (27.55)	2175 (31.91)
Secondary	1403 (18.57)	1314 (19.28)
Higher	647 (8.56)	664 (9.74)
Place of residence		
Urban	5071 (67.11)	4514 (66.19)
Rural	2485 (32.89)	2306 (33.81)
Geographical region		
Dhaka	1316 (17.42)	1608 (23.58)
Barisal	866 (11.46)	748 (10.97)
Chittagong	1116 (14.77)	865 (12.68)
Khulna	1205 (15.95)	1034 (15.16)
Rajshahi	1067 (14.12)	890 (13.05)
Rangpur	1066 (14.11)	924 (13.55)
Sylhet	920 (12.18)	751 (11.01)
Body mass index		
Underweight	1594 (21.1)	1188 (17.42)
Normal weight	2424 (32.08)	2711 (39.75)
Overweight	980 (12.97)	2010 (29.47)
Obese	2558 (33.85)	911 (13.36)
Currently working		
No	3901 (51.64)	2367 (34.71)
Yes	3653 (48.36)	4453 (65.29)

Continued

Table 1 Continued

Variables	2011, n (%)	2017–2018, N (%)
Hypertension		
No	5534 (73.24)	4036 (59.18)
Yes	2022 (26.76)	2784 (40.82)

marital status was highly insignificant (p value=0.572) in 2011, this variable was found as marginally insignificant (p value=0.057) in 2018.

The findings of the study also suggest that adults with primary, secondary and higher education had 31%, 32% and 87% higher odds of having diabetes, respectively, than adults with no education in 2011. However, education was not a significant factor for diabetes among adults in 2018. Place of residence had no significant effect on diabetes in both periods. Compared with the Dhaka division, individuals living in Barisal and Chittagong divisions had a 43% and 44% higher likelihood of having diabetes, respectively, in 2011. On the other hand, there exists no significant difference in having diabetes among adults in Barisal, Chittagong, Dhaka, Rajshahi and Sylhet divisions in 2018. Regarding economic status, only the richest individuals had a significantly higher likelihood (96%) of diabetes in 2011 compared with the poorest individuals. However, both the richer and richest adults had more likelihood of diabetes (AOR: 1.84 and 3.09) than the poorest adults in 2018.

Higher BMI was a significant factor in both 2011 and 2018. For example, overweight and obese adults compared with normal-weight adults had 54% and 51% more likelihood of diabetes, respectively, in 2011, and 22% and 44% higher likelihood of diabetes in 2018. Moreover, the odds of having diabetes among working adults in 2018 was lower (AOR: 0.80, 95% CI: (0.65 to 0.99)) than in non-working adults. Since there exists a strong relationship between diabetes and hypertension, individuals having hypertension had 51% and 57% more likelihood of diabetes, respectively, in 2011 and 2018 compared with individuals without hypertension.

Subgroup analysis

Subgroup analysis of diabetes by sex and place of residence were also performed and the results of this analysis are presented in online supplemental tables S1 and S2. Men with higher education had 99% higher risk of diabetes compared with men with no education in 2011 whereas no significant difference in the risk of diabetes among them was observed in 2018. However, the odds of having diabetes between a man with primary education and no education was not significantly different (p=0.236) in 2011. The opposite scenario (AOR: 1.48 ((1.06, 2.06), p=0.022) was observed in 2018. Urban men had less likelihood (AOR: 0.71, 95% CI: 0.55 to 0.93) of diabetes than rural men in 2018 whereas there was no difference in the likelihood of diabetes among them in 2011.

Marital status was found to be a significant factor (p=0.043) of diabetes among rural adults in 2018 only. Richer individuals had no significant difference (p>0.05) in having diabetes compared with the poorest individuals except in rural areas in 2018 (p=0.019). Currently working individuals had 31% (AOR: 0.69, 95% CI: 0.49 to 0.99) and 27% (AOR: 0.73, 95% CI: 0.57 to 0.95) lower odds of having diabetes than non-working rural individuals, in 2011 and 2018, respectively. However, there was no significant difference in diabetes among working and non-working urban individuals for both periods.

DISCUSSION

We systematically analyse the prevalence and risk factors of diabetes among the adult population (aged ≥35 years) in Bangladesh using two waves of nationally representative survey data (2011 and 2018). The purpose of this study was to compare the prevalence of diabetes among people aged >35 years in 2018 with 2011 in Bangladesh. We found several remarkable findings linked to diabetes and its risk factors. One of the important findings was the identification of upward trends in the overall prevalence of diabetes and its distribution as per individual characteristics. The prevalence of diabetes increased by 26% between 2011 and 2018. During this period, the prevalence increased significantly not only among the overall population but also among different age groups, both sexes, married individuals, uneducated and secondary completed, rural areas, middle to richest wealth index group, obese individuals, unemployed and patients with hypertension. This finding is consistent with the reported prevalence of diabetes among the adult populations over the years.[29–31]

We found that the likelihood of diabetes increased with an increase of age. The odds of having diabetes was higher for older age individuals compared with younger adults. Similar to the previous studies in Bangladesh[32 33] and other developing countries,[34 35] the odds of having diabetes increased consistently for all age groups of older adults (≥35 years) in both data sets. In the future, the upward trend of having diabetes is likely to be a major public health concern in Bangladesh owing to changes in population age structure with lower fertility rate, steady socioeconomic growth and increased life expectancy. This process will sharply lead to an increase in the number of middle and older age population and diabetes prevalence in Bangladesh.[36] The prevalence of diabetes among the working-age population may be a concern because of the complex effects of diabetes on comorbidity and economic growth in Bangladesh, where about 12% of total households pay for diabetic care by selling household assets or borrowing money.[37–39]

We found a significantly higher relative increase in diabetes prevalence in rural areas compared with urban areas, indicating that diabetes is no longer confined to urban areas in Bangladesh because, in recent years, rural residents have adopted an unhealthy lifestyle, consuming

Table 2 Prevalence of diabetes among adults aged 35 years and older in Bangladesh, 2011–2018

Variables	Distribution 2011–2018, %	Diabetes 2011 BDHS, % (SE)	Diabetes 2018 BDHS, % (SE)	P value 2011 vs 2018	Ratio
All adults aged 35 years and older	100	10.95 (0.0048)	13.75 (0.0056)	<0.001	1.26
Age group					
35–44	35.99	8.82 (0.0065)	11.21 (0.0078)	0.081	1.27
45–54	27.43	10.86 (0.0079)	14.82 (0.01)	0.008	1.36
55–64	18.65	14.69 (0.012)	15.78 (0.0115)	0.6286	1.07
65–74	11.26	11.60 (0.0128)	15.97 (0.016)	0.1123	1.38
75+	6.68	12.11 (0.0174)	13.43 (0.0189)	0.793	1.11
Sex					
Male	48.98	10.65 (0.0061)	13.69 (0.0072)	0.091	1.29
Female	51.02	11.25 (0.006)	13.81 (0.0072)	0.003	1.23
Marital status					
Not married	15.88	12.13 (0.0112)	12.54 (0.0111)	0.953	1.03
Married	84.12	10.73 (0.0049)	13.98 (0.006)	<0.001	1.3
Educational level					
No education	44.8	8.39 (0.0058)	10.64 (0.0072)	0.021	1.27
Primary	29.07	11.10 (0.0078)	13.59 (0.009)	0.141	1.22
Secondary	18.15	13.03 (0.0108)	17.8 (0.0121)	0.015	1.37
Higher	7.98	21.79 (0.018)	20.27 (0.0185)	0.209	0.93
Place of residence					
Urban	23.91	16.08 (0.0106)	18.95 (0.0106)	0.129	1.18
Rural	76.09	9.39 (0.0051)	12.06 (0.0065)	0.003	1.28
Geographical region					
Barisal	5.79	12.54 (0.0117)	12.09 (0.0161)	0.975	0.96
Chittagong	16.45	14.28 (0.0125)	17.33 (0.0169)	0.087	1.21
Dhaka	38.99	11.26 (0.0107)	17.32 (0.0118)	0.002	1.54
Khulna	13.45	7.30 (0.007)	11.14 (0.0114)	0.002	1.53
Rajshahi	13.15	10.73 (0.01)	11.32 (0.0134)	0.664	1.05
Rangpur	9.26	8.59 (0.0111)	7.93 (0.0097)	0.667	0.92
Sylhet	2.91	11.85 (0.011)	12.71 (0.0169)	0.998	1.07
Wealth index					
Poorest	19.91	7.28 (0.0088)	7.26 (0.0091)	0.69	1.00
Poorer	19.74	7.35 (0.0084)	7.70 (0.0085)	0.891	1.05
Middle	20.19	7.56 (0.0075)	11.17 (0.01)	0.005	1.48
Richer	19.70	11.33 (0.0098)	16.01 (0.0128)	<0.001	1.41
Richest	20.46	20.49 (0.0122)	27.18 (0.0134)	0.006	1.33
Body mass index					
Underweight	19.87	7.27 (0.0081)	7.79 (0.0087)	0.437	1.07
Normal weight	36.10	9.59 (0.0071)	11.21 (0.0074)	0.343	1.17
Overweight	20.14	18.57 (0.0149)	16.95 (0.0095)	0.045	0.91
Obese	23.88	11.90 (0.0078)	22.56 (0.0156)	<0.001	1.9
Currently working					
No	43.63	12.11 (0.0064)	17.16 (0.0089)	<0.001	1.42
Yes	56.37	9.70 (0.0061)	12.00 (0.006)	0.10	1.24
Hypertension					
No	67.45	9.06 (0.0048)	10.55 (0.0063)	0.522	1.16
Yes	32.55	16.33 (0.0105)	18.57 (0.009)	0.178	1.14

BDHS, bangladesh demographic and health survey .

Table 3 Adjusted ORs for factors predicting diabetes among adults 35 years and older BDHS 2011–2018

	2011 BDHS		2017–18 BDHS	
Variables	OR (95% CI)	P value	OR (95% CI)	P value
Age groups				
35–44	Ref		Ref	
45–54	1.36 (1.07 to 1.72)	0.012	1.41 (1.13 to 1.76)	0.002
55–64	2.11 (1.58 to 2.83)	<0.001	1.58 (1.24 to 2.03)	<0.001
65–74	1.60 (1.13 to 2.27)	0.008	1.67 (1.21 to 2.30)	0.002
75+	1.77 (1.14 to 2.74)	0.011	1.32 (0.86 to 2.01)	0.202
Sex				
Male	Ref		Ref	
Female	0.78 (0.58 to 1.05)	0.104	0.92 (0.75 to 1.13)	0.435
Marital status				
Not married	Ref			
Married	0.93 (0.72 to 1.20)	0.572	1.28 (0.99 to 1.64)	0.057
Educational level				
No education	Ref		Ref	
Primary	1.31 (1.05 to 1.64)	0.017	1.23 (0.99 to 1.53)	0.059
Secondary	1.32 (1.01 to 1.73)	0.045	1.23 (0.96 to 1.57)	0.108
Higher	1.87 (1.35 to 2.60)	<0.001	1.15 (0.83 to 1.60)	0.397
Place of residence				
Urban	1.08 (0.87 to 1.33)	0.7	0.96 (0.79 to 1.16)	0.678
Rural	Ref		Ref	
Geographical region				
Barisal	1.43 (1.04 to 1.96)	0.027	0.75 (0.54 to 1.06)	0.103
Chittagong	1.44 (1.09 to 1.89)	0.010	0.88 (0.67 to 1.16)	0.369
Dhaka	Ref		Ref	
Khulna	0.66 (0.50 to 0.89)	0.007	0.60 (0.46 to 0.79)	<0.001
Rajshahi	1.17 (0.87 to 1.57)	0.309	0.74 (0.55 to 1.00)	0.054
Rangpur	1.00 (0.69 to 1.45)	0.986	0.56 (0.41 to 0.76)	<0.001
Sylhet	1.22 (0.91 to 1.63)	0.183	0.75 (0.53 to 1.06)	0.101
Wealth index				
Poorest	Ref		Ref	
Poorer	0.89 (0.62 to 1.27)	0.514	0.99 (0.70 to 1.40)	0.957
Middle	0.86 (0.62 to 1.19)	0.365	1.33 (0.94 to 1.88)	0.103
Richer	1.18 (0.84 to 1.65)	0.345	1.84 (1.29 to 2.61)	0.001
Richest	1.96 (1.40 to 2.76)	<0.001	3.09 (2.18 to 4.38)	<0.001
Body mass index				
Underweight	0.82 (0.61 to 1.10)	0.177	0.77 (0.58 to 1.01)	0.055
Normal weight	Ref		Ref	
Overweight	1.54 (1.20 to 1.97)	0.001	1.22 (1.00 to 1.50)	0.052
Obese	1.51 (1.16 to 1.97)	0.003	1.44 (1.13 to 1.84)	0.003
Currently working				
No	Ref		Ref	
Yes	0.77 (0.59 to 1.01)	0.056	0.80 (0.65 to 0.99)	0.039
Hypertension				
No	Ref		Ref	
Yes	1.51 (1.26 to 1.81)	<0.001	1.57 (1.32 to 1.87)	<0.001

BDHS, bangladesh demographic and health survey .

fast food with more carbs. Moreover, they are also less aware of the disease and seek medical attention at a later stage. Hira *et al*[40] found similar results in a study conducted in Bangladesh and Tripathy *et al*[41] found a similar trend in our neighbouring country India.

Our study also identified the greater prevalence of having diabetes among married people compared with unmarried people. This finding was significant in 2018 but was not found to be significant in 2011.[36] This result was broadly consistent with previous studies in which the presence of diabetes was also associated with greater marital stability and satisfaction.[32 41 42] Furthermore, this could be a proxy for age because married people are older than unmarried people, and married women who have children sometimes develop diabetes at a younger age.[43] Moreover, men being married was also associated with a higher risk of hypertension and type 2 diabetes.[44]

Although higher education and socioeconomic status are negatively associated with diabetes in developed countries, we have found the opposite results in Bangladesh for both survey periods. The richest 35-year-olds are three times more likely to have diabetes than the poorest wealth group . These findings are in line with the previous studies conducted in Asian and other developing countries.[32 45 46] The greater likelihoods of diabetes among people with no education and secondary education are likely to be associated with their less awareness about lifestyle, and may not consider it as a threat to their health.[47–50] The prevalence of diabetes varies also by region among individuals in Bangladesh. For example, people living in Rangpur and Khulna regions have experienced a significantly lower risk of having diabetes than those from Dhaka and other regions. People in these two divisions have a lower socioeconomic status than those in Dhaka, which may be linked to a lower risk of diabetes.[32 46] The rapid increase in the prevalence of diabetes in all regions, particularly in Dhaka and Khulna regions, in which it has increased by 54% and 53%, respectively, between 2011 and 2018, is plausibly associated with the rapid growth of urbanisation and its consequences on healthy lifestyles.[9 51] High BMI and hypertension are important factors of diabetes reported in most of the previous studies.[8 11 32 37 39 52 53] Our study findings also pointed out that with higher BMI have a greater likelihood of having diabetes compared with normal-weight adults in both 2011 and 2018.[54–57]

One of the major strengths of our study is the use of nationally representative cross-sectional survey data of the two waves, including the most recent one which is released in December 2020. Data of these surveys related to anthropometrics and diabetes were not self-reported but rather collected by trained and experienced health workers such as nurses, midwives and health assistants using the WHO-recommended guidelines. To our knowledge, this study for the first time estimated the national diabetes prevalence and its risk factors among adults in Bangladesh. Another important strength is that we compared changes in estimates of diabetes predictors between 2011 and 2018 surveys along with subgroups analyses, by sex and by place of residence. Despite having some strengths, our study is not beyond the limitations. Due to the lack of diabetes data for younger adults (<35 years) in previous surveys, we could not compare their current diabetes prevalence. Moreover, the unavailability of data on some important correlates like the types of diet, intake of fast food, intake of calories, physical exercise including the nature of work, family history of diabetes and cholesterol level of diabetes was the major limitation of these data sets. As a cross-sectional survey, blood sugar level was measured for 1 day only and thus we do not have follow-up and or longitudinal data on diabetes and its correlates. Due to the nature of survey data, this study identified the risk factors of diabetes only rather than causality.

The study shows that among Bangladeshi adults, there is a high prevalence of diabetes and it is escalating over time. The study also reports a significant portion of younger adults with diabetes. Age and overweight/obesity are the two most important risk factors for diabetes for all adults, irrespective of sex, residence, educational attainment and wealth index. There is evidence of an increase in the magnitude of diabetes over time and in the younger population; indeed, age increases the chances of developing diabetes mellitus significantly. These findings, together with an increase in the prevalence of type 2 diabetes among Bangladeshi adults, underscore the need for primary (awareness campaign about the adversity of fast food habit and impotence of physical mobility/work/exercise) and secondary (incorporate the issue text on the causes and consequences of diabetes and non-communicable diseases in school level curriculum) prevention efforts tailored to age-specific populations.

Author affiliations
[1]Department of Neurosurgery, University of Florida, Gainesville, Florida, USA
[2]Department of Statistics, University of Dhaka, Dhaka, Bangladesh
[3]Department of Mathematics and Natural Sciences, BRAC University, Dhaka, Bangladesh
[4]Department of Statistics, Shahjalal University of Science and Technology, Sylhet, Bangladesh
[5]Department of General Educational Development (GED), Daffodil International University, Dhaka, Bangladesh
[6]Department of Population Sciences, University of Dhaka, Dhaka, Dhaka District, Bangladesh

Twitter Muhammad Abdul Baker Chowdhury @bakerchowdhury

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Contributors MABC conceptualised the study, designed the analytical approach, managed and performed the analysis, interpreted the results and drafted the manuscript. MI helped with the analysis, interpreted the results and drafted the manuscript. JR and MJU reviewed, edited and updated the manuscript. MRH and MJU reviewed, edited and supervised the study. MC is acting as the guarantor.

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Ethics approval All BDHS surveys received ethical approval from ICF Macro Institutional Review Board, Maryland, USA, and National Research Ethics Committee of Bangladesh Medical Research Council (BMRC), Dhaka, Bangladesh. Informed consent was obtained from each participant of the survey before enrolling in the survey by using the Introduction and Consent form of the survey. It was also explained that the information will be kept strictly confidential and will not be shared with anyone except members of the survey team. Participants gave informed consent to participate in the study before taking part.

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ORCID iDs
Muhammad Abdul Baker Chowdhury http://orcid.org/0000-0002-2145-0938
Mirajul Islam http://orcid.org/0000-0002-3443-4486
Jakia Rahman http://orcid.org//0000-0003-3421-8182
Md Jamal Uddin http://orcid.org/0000-0002-8360-3274
Md. Rabiul Haque http://orcid.org/0000-0001-7015-8493

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