Original article

Prevalence of and factors associated with prehypertension and hypertension among Bangladeshi young adults: An analysis of the Bangladesh Demographic and Health Survey 2017–18

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ARTICLE INFO

Keywords:

Young adults
Hypertension
Prehypertension
Prevalence
Risk Factors
Bangladesh

ABSTRACT

Background: Hypertension is the major cause of cardiovascular diseases and premature mortality worldwide. Emerging evidence shows that young adults are increasingly at risk of hypertension alongside the older population. Most of the previous studies reported the prevalence and risk factors of hypertension among the older population aged above 35 years.

Objective: We aimed to estimate the prevalence of prehypertension and hypertension with their correlates among young Bangladeshi adults aged between 18 and 34 years.

Methods: This study used data of 5394 young adults aged between 18 and 34 years from the most recent round (2017–18) of the Bangladesh Demographic and Health Survey. Prehypertension and hypertension were defined according to the Joint National Committee 7 cut-off points.

Results: The prevalence of prehypertension and hypertension was 33.4% and 9.7%, respectively. No difference was observed in the prevalence of hypertension among younger adults from rural and urban areas (9.7% vs. 9.6%). Hypertension was slightly more prevalent among males (10.6%) compared to females (9.2%). Relatively older age (25–30 years and 31–34 years), being male, and having a higher body mass index (i.e., overweight/obese) were identified as the risk factors associated with prehypertension and hypertension after adjusting for all confounders in multivariate logistic regression models.

Conclusions: One out of ten young Bangladeshi adults was hypertensive, while one out of three was prehypertensive. The findings of the present study warrant the need for early prevention, detection, and treatment of hypertension among young adults in Bangladesh.

1. Introduction

Hypertension or elevated blood pressure (BP) is the major risk factor

of cardiovascular diseases (CVDs) and chronic kidney diseases (CKDs), the leading cause of global deaths and disabilities.^{1–3} Of 17.9 million global deaths in 2016, 9.4 million were attributed to hypertension.^{4,5}

; BP, Blood pressure; CVDs, Cardiovascular diseases; CKDs, Chronic kidney diseases; LMICs, Low- and middle-income countries; NCDs, Noncommunicable diseases; CADs, Coronary artery diseases; BMI, Body mass index; BDHS, Bangladesh Demographic and Health Survey; EAs, Enumeration areas; PSU, Primary sampling unit; JNC7, Joint National Committee 7; WHO, World Health Organization; IQRs, Interquartile ranges; DHS, Demographic Health Survey; VIF, Variance inflation factor; SPSS, Statistical Package for Social Science.

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<https://doi.org/10.1016/j.cegh.2021.100912>

Received 22 July 2021; Received in revised form 8 November 2021; Accepted 14 November 2021

Available online 27 November 2021

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Worldwide, approximately 1.13 billion people have hypertension, and two-thirds of them live in low- and middle-income countries (LMICs), including Bangladesh.⁴ Due to the epidemiologic and demographic transitions, the prevalence of hypertension and other noncommunicable diseases (NCDs) has increased at an alarming rate in developing countries, particularly in Asia and Southeast Asia.^{1,2}

Both hypertension and prehypertension (relatively lower BP threshold than hypertension) has contributed to the global burden of disease.⁶ Prehypertension makes up nearly 60% of stroke and about 50% of ischemic heart disease.⁷ Prehypertensive individuals also suffer from renal diseases⁸; hypertension earlier in their lifespan also puts them at a greater risk of CVDs.^{9–11} Researchers also found an association between prehypertension with the occurrence of Coronary Artery Diseases (CADs)^{12,13} and CVD mortality (i.e., stroke mortality).^{11,14} Several studies also have established the relationship between prehypertension and CKDs.^{15–17} Evidence has also identified several modifiable risk factors of hypertension such as unhealthy diets, physical inactivity, consumption of tobacco and alcohol, high body mass index (BMI), poor socioeconomic condition as well as non-modifiable risk factors such as the family history of hypertension, age over 65 years, and co-existing chronic conditions such as diabetes or kidney disease.⁴

While previous research demonstrated that hypertension had been a major concern among adults aged 35 years and above,^{18–21} recent evidence suggests an increasing trend in the prevalence of hypertension among relatively younger adults aged less than 35 years due to epidemiologic and demographic transition.²² High BP in young adults may result in serious adverse effects in later life.^{23,24} There is inadequate evidence that earlier interventions and treatment of hypertension in young adulthood can decrease the risk of cardiovascular events or that adverse changes in the brain structure result in damage to subclinical organs early in its natural history.²³ Therefore, detecting hypertension at an earlier age is potentially beneficial, as this could guide specific treatment plans and potentially cure high BP in young patients, curbing the risks of later life complications.

Evidence suggests that individuals with hypertension below 34 years have lower awareness, slower diagnosis rates, and worse regulation of BP control than older people.²³ Unfortunately, despite the significance of the diagnosis and treatment of hypertension in young adulthood, there is insufficient evidence for the prevalence and determinants of hypertension among the 18–34 years age group. Epidemiological studies suggest that more research is required on early-life factors such as physical exercise, increasing physical activity, weight loss, and other lifestyle interventions in this young population, which can reduce further cardiovascular disease later in life by curbing the risk of developing hypertension.^{23–26}

Like other South Asian countries (such as India, Nepal, Bhutan, and Sri Lanka), hypertension remains the foremost NCD burden in Bangladesh.²⁷ Several studies from Bangladesh conducted among a sample aged 35 years or above have reported hypertension and prehypertension prevalence and its risk factors.^{28–30} A very few studies, to date, have assessed hypertension and prehypertension prevalence among young adults aged 18–34 years, even though Bangladesh has the highest proportion of young adults.³¹ This reflects the important evidence gap in the literature, and it is crucial to screen and treat hypertensive cases at an earlier age to avoid concomitant CVD events in the later life of young adults. Therefore, the present research was undertaken to assess the prevalence and risk factors of hypertension and prehypertension among the younger adults aged 18–34 years in Bangladesh.

2. Methods

2.1. Data sources

The current study analyzed the most recent (2017–18) round of Bangladesh Demographic and Health Survey (BDHS) data. BDHS data

are nationally representative and population-based survey conducted periodically and collects information on issues related to the demography and health of the people. The survey was carried out from October 2017 to March 2018 under the National Institute of Population Research and Training, Medical Education and Family Welfare Division, and Ministry of Health and Family Welfare. The survey's principal objective was to assess the health indicators and provide a detailed overview of population, maternal, and child health issues and the status of several NCDs such as hypertension and diabetes among adults.

2.2. Study population and survey design

The sampling frame used for the 2017–18 BDHS is the complete list of enumeration areas (EAs) covering the entire population residing in Bangladesh. The survey used a list of EAs provided by the Bangladesh Bureau of Statistics of the 2011 Population and Housing Census of the People's Republic of Bangladesh. The survey's primary sampling unit (PSU) is an EA covering, on average, 120 households. The BDHS 2017–18 was a multistage stratified cluster sample of households' survey, carried out in two and three stages in rural and urban settings. In the first stage of sampling, in rural areas, wards were selected, followed by PSUs, then households were selected from the PSUs. In urban areas, wards were selected through the PSUs technique, and one EA was taken from each PSU, then the households were taken from the selected EAs sample. A detailed description of the survey design, methodologies, sample size, questionnaires, and findings can be found in the final summary report of BDHS 2017–18.³² Anthropometric measurements and BP were measured systematically only from selected subsampled participants. The total sample size of the study was 20,160. Among them, 14,704 were selected for biomarker data collection. Our study encompassed all the younger adults aged 18–34 years (5394 participants) for whom the biomarker data are available. In our study settings, we only include 5394 participant's data (aged 18 to 34). The detailed flowchart for the selection of study participants is depicted in Fig. 1.

2.3. Outcome variables

The primary outcome of the study was hypertension and prehypertension. In this study, we followed the Joint National Committee 7 (JNC 7) cut-offs to define hypertensive participants. An individual was classified as hypertensive if his/her systolic BP was 120–139 mmHg or diastolic BP was between 80 and 89 mmHg, and if the person was not taking any BP-lowering drugs, was classified as prehypertensive. Participants' systolic and diastolic BP was measured using a digital oscillometric BP measuring device three times at 5 minutes time interval between each measurement, and the average of the last two measurements was then reported.³²

2.4. Independent variables

The independent variables included in the study were selected based on previous literature reporting the risk of developing hypertension in populations of LMICs.^{18,19,29,30,33–37} The household-level factors included: administrative division (Barisal, Chittagong, Dhaka, Khulna, Mymensingh, Rajshahi, Rangpur, Sylhet), place of residence (urban, rural), and wealth status (poor, middle, rich). Socioeconomic and individual-level factors were: sex of participants (male, female), age of participants in years (18–20, 21–24, 25–30, 31–34), education level (no education, primary, secondary, higher), and occupational status (not working, working). And behavioral characteristics included: smoking habit (no, yes) and BMI. The participants' BMI, height, and weight were measured using the World Health Organization (WHO) standard procedures and were classified accordingly.³⁸ The BMI was calculated by dividing body weight in kilograms by the square of height in meters (m²) and classified as follows, underweight (BMI <18.5 kg/m²), normal weight (BMI: 18.5–25.5 kg/m²), overweight (BMI: 25.5–29.9 kg/m²),

Fig. 1. Flowchart for selection of study participants.

and obese (BMI ≥ 30.0 kg/m²).³⁸

2.5. Statistical analyses

Before estimating the prevalence of prehypertension and hypertension, the normality of the continuous variables was investigated through their distribution and reported with medians and interquartile ranges (IQRs). The prevalence of prehypertension and hypertension was defined according to the definition of JNC 7, and estimated prevalence was presented by the overall population and background characteristics of the study participants. All variables were presented with frequencies and percentages. Along with this, the study utilized multivariate logistic regression models to identify the most potential associated factors with prehypertension and hypertension and interpreted the statistically significant results at p-values less than <0.05 . Before the analysis, the data were weighted by the Demographic Health Survey's (DHS) appropriate techniques to adjust the impact of clustered sampling design. Each of the independent variables were checked for multicollinearity with variance inflation factor (VIF). All the included independent variables were not highly correlated (as VIFs <2) with each other. Therefore, results of estimated odds ratios from the multivariate logistic regression model are plausible (Supplementary Table 1). The Statistical Package for Social Science version 26 (SPSS Inc., Chicago, USA) and R version 4.1.1 (Bell Laboratories, New Jersey, USA) were used for data analyses.

3. Results

Table 1 shows the background characteristics of the study participants. A total of 5394 participants' data was analyzed in this study, of which nearly one-fourth were from the Dhaka division, while more than two-thirds were female and from rural areas. The median age and BMI were 25 years (IQR: 21–30 years) and 21.70 kg/m² (IQR: 19.39–24.59 kg/m²). The majority of the participant's age bracket was 25–30 years (37.2%), while 42.3% of the participants had a secondary education level. The majority of the study participants (56.0%) were working in different occupations.

Table 2 shows the prevalence with 95% confidence intervals (CIs) of prehypertension and hypertension by background characteristics of the study participants. The overall prevalence of prehypertension was 33.35% (95% CI: 32.09%–34.61%), while 9.70% (95% CI: 8.91%–10.49%) of them were hypertensive. The prevalence of hypertension was almost the same in rural (9.71; 95% CI: 8.77%–10.64%) and urban (9.67; 95% CI: 8.21%–11.14%) areas, whereas the prevalence of hypertension was slightly higher among males (10.63%; 95% CI: 9.26%–12.01%) compared to females (9.17%; 95% CI: 8.21%–10.14%). Prevalence of hypertension increased with participants' age, with the highest value in the 31–34 age group (16.89%; 95% CI: 14.53%–19.26%). Prevalence of hypertension was found almost similar among overweight (20.28%; 95% CI: 17.80%–22.76%) and obese (18.72%; 95% CI: 13.35%–24.09%) respondents. Young adults belonging to rich households (10.91%; 95% CI: 9.63%–12.18%) had a greater prevalence of hypertension compared to those from middle income (9.17%; 95% CI,

Table 1

Background characteristics of the study participants: BDHS 2017–18 (N = 5394).

Background Characteristics	Total (N = 5394), N (%)	Prehypertension (n = 1799), n (%)	Hypertension (n = 523), n (%)	Normal BP (n = 3072), n (%)
At Household-level				
Administrative Division				
Barisal	272 (5.0)	88 (4.9)	27 (5.2)	157 (5.1)
Chittagong	995 (18.5)	356 (19.8)	110 (21.0)	529 (17.2)
Dhaka	1351 (25.0)	418 (23.2)	98 (18.7)	835 (27.2)
Khulna	585 (10.9)	206 (11.5)	63 (12.0)	316 (10.3)
Mymensingh	415 (7.7)	141 (7.8)	29 (5.5)	245 (8.0)
Rajshahi	774 (14.4)	254 (14.1)	83 (15.9)	437 (14.2)
Rangpur	628 (11.6)	216 (12.0)	87 (16.6)	325 (10.6)
Sylhet	374 (6.9)	120 (6.7)	26 (5.1)	228 (7.4)
Place of Residence				
Urban	1561 (28.9)	547 (30.4)	151 (28.9)	864 (28.1)
Rural	3833 (71.1)	1252 (69.6)	372 (71.1)	2208 (71.9)
Wealth Status				
Poor	1990 (36.9)	632 (35.1)	171 (32.7)	1187 (38.6)
Middle	1112 (20.6)	393 (21.8)	102 (19.5)	618 (20.2)
Rich	2292 (42.5)	774 (43.0)	250 (47.8)	1267 (41.2)
At Socioeconomic and Individual-level				
Sex of Participants				
Male	1928 (35.7)	789 (43.9)	205 (39.2)	934 (30.4)
Female	3466 (64.3)	1010 (56.1)	318 (60.8)	2138 (69.6)
Age of Participants (years)				
Median (IQR)	25 (21–30)	26 (22–30)	29 (25–32)	24 (20–29)
18–20	1204 (22.3)	331 (18.4)	63 (12.0)	810 (26.4)
21–24	1218 (22.6)	396 (22.0)	86 (16.5)	736 (24.0)
25–30	2007 (37.2)	715 (39.7)	211 (40.3)	1081 (35.2)
31–34	965 (17.9)	357 (19.9)	163 (31.2)	445 (14.4)
Education Level				
No Education	377 (7.0)	121 (6.7)	39 (7.5)	217 (7.0)
Primary	1494 (27.7)	492 (27.3)	137 (26.2)	865 (28.2)
Secondary	2284 (42.3)	774 (43.1)	211 (40.3)	1299 (42.3)
Higher	1239 (23.0)	412 (22.9)	136 (26.0)	691 (22.5)
Occupational Status				
Not Working	2372 (44.0)	711 (39.5)	224 (42.8)	1438 (46.8)
Working	3022 (56.0)	1088 (60.5)	299 (57.2)	1634 (53.2)
Behavioral Characteristics				
Smoking Habit				
No	5056 (93.7)	1693 (94.1)	493 (94.3)	2870 (94.4)
Yes	338 (6.3)	106 (5.9)	30 (5.7)	202 (6.6)
BMI Level				
Median (IQR)	21.70 (19.39–24.59)	22.61 (20.08–25.25)	24.37 (21.56–26.88)	20.89 (18.91–23.65)
Underweight (<18.5 kg/m ²)	878 (16.3)	210 (11.7)	44 (8.4)	624 (20.3)
Normal (18.5–24.9 kg/m ²)	3302 (61.2)	1107 (61.5)	236 (45.1)	1958 (63.7)
Overweight (25.0–29.9 kg/m ²)	1011 (18.7)	383 (21.3)	205 (39.2)	422 (13.7)
Obesity (≥30.0 kg/m ²)	203 (3.8)	99 (5.5)	38 (7.3)	68 (2.2)

IQR: Inter-quartile range; BMI: Body mass index.

7.48%–10.87%) or poor households (8.59%; 95% CI: 7.36%–9.82%). Furthermore, the administrative division-wise prevalence of prehypertension and hypertension is presented in Fig. 2.

The results of multivariate logistic regression analyses are summarized in Table 3. The participants' age, sex, and BMI were significant determinants of prehypertension and hypertension, while the respondents' geographic location was a significant predictor of hypertension only. Participants from the Rangpur division had greater odds of being hypertensive (AOR: 2.46, 95% CI: 1.49–4.07, $p < 0.001$). Male participants had a higher likelihood of having both prehypertension (AOR: 2.06, 95% CI: 1.79–2.38, $p < 0.001$) and hypertension (AOR: 2.22, 95% CI: 1.76–2.80, $p < 0.001$). After adjusting for all the variables, people with 31–34 years of age had nearly 4-folds higher odds of having hypertension (AOR: 3.63, 95% CI: 2.57–5.11, $p < 0.001$) and 1.71-folds greater odds of having prehypertension (AOR: 1.71, 95% CI: 1.39–2.10, $p < 0.001$). Participants aged 25–30 years also had significantly higher odds of being prehypertensive (AOR: 1.37, 95% CI: 1.15–1.63, $p < 0.001$) and hypertensive (AOR: 2.00, 95% CI: 1.45–2.75, $p < 0.001$). Overweight and obese individuals had greater odds of having prehypertension and hypertension than underweight individuals, while individuals with normal BMI had 1.72-fold higher odds of having prehypertension (95% CI: 1.43–2.05, $p < 0.001$).

4. Discussion

The present study investigated the prevalence of hypertension and prehypertension among young Bangladeshi adults aged 18–34 years by analyzing the most recent round of data from BDHS. To the best of our knowledge, this is the first study from Bangladesh that assessed the prevalence of hypertension and prehypertension among young adults in Bangladesh.

In the current study, the prevalence of hypertension and prehypertension among young Bangladeshi adults was 9.70% and 33.35%, respectively. A previous study in 2015 showed a 17.9% prevalence of hypertension among adults age 18–60 years or more²⁶, while according to a recent systematic review and meta-analysis, the overall pooled prevalence of hypertension was estimated to be 20.0%.³⁹ A recent study found that the prevalence of prehypertension among Bangladeshi individuals aged 25 years and above is 31.9%.²⁰ Therefore, although most previous studies reported that older age groups have higher odds of having prehypertension and hypertension than their younger counterparts,^{19,26,33,36,37} the current study proves the prevalence of hypertension and prehypertension among young adults are not as low as generally predicted. Our study shows that the prevalence of hypertension and prehypertension among young adults aged 31–34 years is

Table 2

Prevalence of prehypertension and hypertension with their 95% confidence interval, according to background characteristics (N = 5394).

Background Characteristics	Prehypertension (n = 1799) Prevalence (95% CI)	Hypertension (n = 523) Prevalence (95% CI)
Overall Prevalence		
Prehypertension	33.35 (32.09–34.61)	–
Hypertension	–	9.70 (8.91–10.49)
At Household-level		
Administrative Division		
Barisal	32.35 (26.79–37.91)	9.93 (6.37–13.48)
Chittagong	35.78 (32.80–38.76)	11.06 (9.11–13.00)
Dhaka	30.94 (28.48–33.40)	7.25 (5.87–8.64)
Khulna	35.21 (31.34–39.08)	10.77 (8.26–13.28)
Mymensingh	33.98 (29.42–38.53)	6.99 (4.54–9.44)
Rajshahi	32.82 (29.51–36.12)	10.72 (8.54–12.90)
Rangpur	34.39 (30.68–38.11)	13.85 (11.15–16.56)
Sylhet	32.09 (27.35–36.82)	6.95 (4.37–9.53)
Place of Residence		
Urban	35.04 (32.67–37.41)	9.67 (8.21–11.14)
Rural	32.66 (31.18–34.15)	9.71 (8.77–10.64)
Wealth Status		
Poor	31.76 (29.71–33.80)	8.59 (7.36–9.82)
Middle	35.34 (32.53–38.15)	9.17 (7.48–10.87)
Rich	33.77 (31.83–35.71)	10.91 (9.63–12.18)
At Socioeconomic and Individual-level		
Sex of Participants		
Male	40.92 (38.73–43.12)	10.63 (9.26–12.01)
Female	29.14 (27.63–30.65)	9.17 (8.21–10.14)
Age of Participants (years)		
18–20	27.49 (24.97–30.01)	5.23 (3.97–6.49)
21–24	32.51 (29.88–35.14)	7.06 (5.62–8.50)
25–30	35.63 (33.53–37.72)	10.51 (9.17–11.86)
31–34	36.99 (33.95–40.04)	16.89 (14.53–19.26)
Education Level		
No Education	32.10 (27.38–36.81)	10.34 (7.27–13.42)
Primary	32.93 (30.55–35.31)	9.17 (7.71–10.63)
Secondary	33.89 (31.95–35.83)	9.24 (8.05–10.43)
Higher	33.25 (30.63–35.88)	10.98 (9.24–12.72)
Occupational Status		
Not Working	29.97 (28.13–31.82)	9.44 (8.27–10.62)
Working	36.00 (34.29–37.71)	9.89 (8.83–10.96)
Behavioral Characteristics		
Smoking Habit		
No	33.48 (32.18–34.79)	9.75 (8.93–10.57)
Yes	31.36 (26.41–36.31)	8.88 (5.84–11.91)
BMI Level		
Underweight (<18.5 kg/m ²)	23.92 (21.10–26.74)	5.01 (3.57–6.45)
Normal (18.5–24.9 kg/m ²)	33.53 (31.91–35.14)	7.15 (6.27–8.03)
Overweight (25.0–29.9 kg/m ²)	37.88 (34.89–40.87)	20.28 (17.80–22.76)
Obesity (≥30.0 kg/m ²)	48.77 (41.89–55.64)	18.72 (13.35–24.09)

CI: Confidence interval; BMI: Body mass index.

almost similar to that among older adults.

The determinants of hypertension and prehypertension observed in the present study were almost similar. Sex, age, BMI, and wealth status were significant predictors of hypertension and prehypertension. The administrative division of respondents was identified as a significant determinant for hypertension only. An earlier study in Bangladesh also found that hypertension and prehypertension risk factors among the adult Bangladeshi population are pretty similar, which coincides with the present study.²⁰

Young males had significantly higher odds of having prehypertension and hypertension than their female counterparts, which is in line with previous studies in India⁴⁰ and Nepal.^{36,41} Several earlier studies reported that hypertension is more common in women than men in older age.^{42,43} However, most of the previous epidemiological studies documented that during middle age, hypertension is more prevalent in men than women.⁴⁴ Different biophysical mechanisms (such as endogenous estrogen as a protective factor among females until menopause), various behavioral and lifestyle factors (such as low physical activity,

extra time in screening, smoking habit and junk foods, etc.) among young males may be responsible for this higher odds of hypertension.⁴⁰

Overweight and obesity emerged as significant determinants associated with developing prehypertension and hypertension in our study, which has also been reported by previous studies in different parts of the world.^{34,36,40,45–47} Activation of the sympathetic nervous system, the amount of intra-abdominal and intra-vascular fat, sodium retention leading to an increase in renal reabsorption, and the renin-angiotensin system are considered important functions in the pathogenesis of overweight/obesity-related hypertension.⁴⁸ Bangladesh is undergoing through nutritional transition with the prevalence of overweight and obesity on the rise, especially among the younger generation.⁴⁹ Therefore, it is likely that the prevalence of hypertension will increase in the upcoming years. Therefore, lifestyle interventions targeting younger adults are essential to reduce the overweight/obesity burden and curb the prevalence of hypertension and prehypertension.

Age is considered as a non-modifiable risk factor for hypertension and prehypertension.⁵⁰ The current study observed that the odds of hypertension and prehypertension increased significantly with age, and the prevalence was the highest among individuals aged 31–34 years. Bangladesh is currently going through a demographic transition, where most of the population is aged between 18 and 34 years. Evidence suggests that young adults in developing countries are habituated to adopt unhealthy lifestyles characterized by physical inactivity, unhealthy diet, and smoking habit^{51,52}; all of which are established risk factors of hypertension. There is evidence of poor adherence to the physical activity recommendations,⁵³ unhealthy dietary habit,⁵⁴ and high prevalence of tobacco use⁵⁵ among the young adult population in Bangladesh. Therefore, this study urges an emergency action to be incepted to make aware of this vast population of future complications associated with hypertension.

The people living in the Rangpur division had greater odds of being hypertensive. An earlier study also found a higher risk of hypertension among the adult population in Rangpur than people of other administrative divisions,¹⁸ which supports the present study's finding. This difference may be due to factors like more intake of raw salt, poverty, malnutrition, and dietary habits.^{56,57} Besides, inequities in the development of public infrastructures like hospitals, low connectivity with urban centers, living in limited resource settings⁵⁸ might impede earlier detection and treatment of elevated BP among young adults from Rangpur and thus increase their risk of developing hypertension.

The present study has several notable strengths. One of the major strengths is that the study used the most recent round of nationally representative BDHS data, covering rural and urban areas in all administrative divisions. This extensive coverage provided a nationally representative sample, which has made the results generalizable for adults aged 18–34 years from all over Bangladesh. Besides, the study utilized the widely validated research instruments that further increased the authenticity of our results. To the best of our knowledge, this is the first study in Bangladesh exploring the prevalence and risk factors of hypertension and prehypertension among young adults using nationally representative data.

This study has certain limitations as well. As the data were cross-sectional, causality could not be established because of a lack of temporal evidence of associations. Moreover, some factors such as dietary habits, physical activity, salt intake, and family history of hypertension were not considered due to the absence in the primary survey data.

4.1. Policy implications

Our findings may be of wider public health interest and can guide decision-makers to direct specific treatment and lifestyle management strategies for young adults in Bangladesh to combat the burden of hypertension among the studied population. The National Guidelines for Management of Hypertension in Bangladesh were developed to provide country-specific guidelines for effective management and control of

Fig. 2. Prevalence of prehypertension and hypertension among young Bangladeshi adults aged between 18 and 34 years by administrative division of Bangladesh as per BDHS 2017–18.

hypertension, which calls for detection of hypertension and referral at the primary care level by physicians and trained health assistants.⁵⁹ However, this management guideline has not included any age-specific hypertension strategies, especially targeting the young adults aged 18–34 years. The findings of the present study highlight the significance of screening and detecting prehypertension and hypertension at an earlier age and calls for developing age-specific policy to reduce the burden of hypertension in the younger population. Findings of this study would be of great use in evidence-based modification in ongoing strategies; and will help the pertinent stakeholders to design effective strategies targeting specific vulnerable groups of young adults. Interventions should be designed to encourage young adults for earlier screening, as previous research shows that younger adults are more likely to be less caring and uninterested in timely checkups and BP measurement.²³

5. Conclusion

The unprecedented high prevalence of prehypertension and hypertension among young adults in Bangladesh urges policymakers and public health practitioners to direct specific treatment and lifestyle management strategies for young adults. One out of ten young

Bangladeshi adults is hypertensive, while one out of three is prehypertensive. The findings of the present study thus warrant urgent policy actions targeting this age group for early hypertension prevention, detection, and treatment. Therefore, screening strategies for prehypertension and hypertension should be initiated at an early age in the community to reduce short-term and later life CVDs and CKDs risk among them. Evidence generated in this study may be of great use in designing a community-based study to understand the modifiable (such as dietary habits, physical activity, salt intake, stress, physical environment, etc.) and non-modifiable factors (such as poverty, family history of hypertension, etc.) to hypertension and prehypertension among young adults.

Ethics approval and consent to participate

The study used publicly accessible secondary data from the DHS Program; thus, there was no need for further ethical approval. Details of the ethical procedures followed by the DHS Program can be found in the BDHS report.³²

Table 3

Estimated odds ratios from multivariate logistic regression for factors associated with prehypertension and hypertension: BDHS 2017–18 (N = 5394).

Independent Variables	Prehypertension Vs. Normal BP				Hypertension Vs. Normal BP			
	UOR (95% CI)	p-value	AOR (95% CI)	p-value	UOR (95% CI)	p-value	AOR (95% CI)	p-value
At Household-level								
Administrative Division								
Sylhet	Ref.	–	Ref.	–	Ref.	–	Ref.	–
Barisal	1.05 (0.75–1.48)	0.772	1.03 (0.72–1.47)	0.877	1.52 (0.85–2.71)	0.155	1.47 (0.80–2.70)	0.210
Chittagong	1.27 (0.98–1.65)	0.069	1.22 (0.93–1.60)	0.146	1.84 (1.16–2.90)	0.009	1.64 (1.01–2.64)	0.044
Dhaka	0.95 (0.74–1.22)	0.669	0.87 (0.67–1.13)	0.293	1.04 (0.66–1.64)	0.882	0.84 (0.52–1.36)	0.487
Khulna	1.23 (0.93–1.63)	0.150	1.16 (0.86–1.56)	0.323	1.75 (1.08–2.86)	0.024	1.62 (0.97–2.70)	0.067
Mymensingh	1.09 (0.81–1.48)	0.571	1.08 (0.79–1.49)	0.622	1.07 (0.61–1.86)	0.826	1.12 (0.62–2.01)	0.708
Rajshahi	1.10 (0.84–1.44)	0.505	1.03 (0.78–1.36)	0.849	1.68 (1.05–2.68)	0.032	1.58 (0.96–2.58)	0.072
Rangpur	1.26 (0.95–1.66)	0.111	1.24 (0.93–1.67)	0.149	2.38 (1.48–3.80)	<0.001	2.46 (1.49–4.07)	<0.001
Wealth Status								
Middle	Ref.	–	Ref.	–	Ref.	–	Ref.	–
Poor	0.84 (0.72–0.98)	0.030	0.92 (0.78–1.09)	0.339	0.88 (0.67–1.14)	0.325	1.01 (0.76–1.34)	0.962
Rich	0.96 (0.82–1.12)	0.619	0.94 (0.79–1.10)	0.426	1.20 (0.94–1.54)	0.152	1.12 (0.85–1.47)	0.413
At Socioeconomic and Individual-level								
Sex of Participants								
Female	Ref.	–	Ref.	–	Ref.	–	Ref.	–
Male	1.79 (1.59–2.02)	<0.001	2.06 (1.79–2.38)	<0.001	1.48 (1.22–1.79)	<0.001	2.22 (1.76–2.80)	<0.001
Age of Participants (years)								
18–20	Ref.	–	Ref.	–	Ref.	–	Ref.	–
21–24	1.32 (1.10–1.57)	0.002	1.23 (1.02–1.48)	0.031	1.51 (1.07–2.12)	0.018	1.35 (0.94–1.93)	0.100
25–30	1.62 (1.38–1.90)	<0.001	1.37 (1.15–1.63)	<0.001	2.53 (1.88–3.40)	<0.001	2.00 (1.45–2.75)	<0.001
31–34	1.96 (1.62–2.37)	<0.001	1.71 (1.39–2.10)	<0.001	4.23 (3.46–6.47)	<0.001	3.63 (2.57–5.11)	<0.001
Occupational Status								
Working	Ref.	–	Ref.	–	Ref.	–	Ref.	–
Not Working	0.74 (0.66–0.84)	<0.001	0.99 (0.86–1.14)	0.861	0.85 (0.71–1.03)	0.093	1.26 (1.00–1.59)	0.053
Behavioral Characteristics								
BMI Level								
Underweight (<18.5 kg/m ²)	Ref.	–	Ref.	–	Ref.	–	Ref.	–
Normal (18.5–24.9 kg/m ²)	1.68 (1.41–2.00)	<0.001	1.72 (1.43–2.05)	<0.001	1.71 (1.22–2.38)	0.002	1.60 (1.14–2.26)	0.007
Overweight (25.0–29.9 kg/m ²)	2.69 (2.19–3.32)	<0.001	2.90 (2.32–3.63)	<0.001	6.86 (4.85–9.72)	<0.001	6.22 (4.28–9.03)	<0.001
Obesity (≥30.0 kg/m ²)	4.29 (3.03–6.07)	<0.001	4.92 (3.41–7.10)	<0.001	7.62 (4.60–12.62)	<0.001	7.00 (4.06–11.96)	<0.001

BP: Blood pressure; UOR: Unadjusted odds ratio; CI: Confidence interval; p-value: Probability value; AOR: Adjusted odds ratio; Ref.: Reference category; BMI: Body mass index.

Results were considered statistically significant at a p-value<0.05.s.

Consent for publication

Not applicable.

Availability of data and materials

This study used publicly available DHS datasets of Bangladesh, which can be freely obtained from <https://dhsprogram.com/>. As third-party users, we do not have permission to share the data publicly on any platform.

Funding

Not applicable.

Author contributions

MAR has access to the data and validated all statistical analyses. MAR and HRH conducted the formal analyses and drafted the original manuscript. SKM and MP helped in drafting the original manuscript. SKM, MP, HRH, and UNY reviewed the manuscript and writing critically. SKM supervised the whole study.

Declaration of competing interest

All authors declare no conflict of interest.

Acknowledgments

The authors thank the DHS Program for providing the survey data

free of cost.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.cegh.2021.100912>.

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