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Religious disparities in health in Bangladesh–the case of hypertension and diabetes: evidence from two nationally representative cross-sectional surveys

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ABSTRACT

Objectives Religious affiliation, beliefs, and practices shape lifestyles and disease risks. This study examined Hindu–Muslim differences in the prevalence and management of hypertension and diabetes in Bangladesh, a religiously plural country with 91% Muslims and 8% Hindus.

Design, settings and participants We used the nationally representative 2011 Bangladesh Demographic and Health Survey (BDHS) and 2017–2018 BDHS data. The 2011 BDHS collected blood pressure (BP) data with an 89% response rate (RR) and fasting blood glucose (FBG) data (RR 85%) from household members aged 35 years and above. The 2017–2018 BDHS collected BP and FBG data from household members aged 18 years and above with 89% and 84% RRs, respectively. We analysed 6628 participants for hypertension and 6370 participants for diabetes from the 2011 BDHS, 11 449 for hypertension and 10 744 for diabetes from the 2017–2018 BDHS.

Methods We followed the WHO guidelines to define hypertension and diabetes. We used descriptive statistics and multiple logistic regression to examine the Hindu–Muslim differences in hypertension and diabetes, and estimated predicted probabilities to examine the changes in hypertension and diabetes risk over time.

Results Nine in 10 of the sample were Muslims. About 31% of Hindus and 24% of Muslims were hypertensive; 10% of both Hindus and Muslims were diabetic in 2017–2018. The odds of being hypertensive were 45% higher among Hindus than Muslims (adjusted OR: 1.45; 95% CI: 1.23 to 1.71; p<0.001). The levels of awareness, medication and control of hypertension were similar between the religious groups. Between the 2011 and 2017–2018 BDHS, the Hindu–Muslim difference in the prevalence of hypertension increased non-significantly, by 3 percentage points.

Conclusions Further studies on religious-based lifestyles, Hindu–Muslim differences in diet, physical activity, stress, and other risk factors of hypertension and diabetes are needed to understand Hindus' higher likelihood of being hypertensive, in contrast, not diabetic compared with Muslims.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This paper is the first-ever study assessing religious disparities in hypertension and diabetes in Bangladesh.
⇒ The study used data from two rounds of well-recognised, nationally representative Bangladesh Demographic and Health Survey (BDHS) conducted by the Demographic and Health Survey Program.
⇒ The statistical analyses ensured robust estimates by using survey weights appropriate for the complex survey designs of the BDHS.
⇒ However, due to the cross-sectional design, and unavailability of data on diet, lifestyle and stress—the primary causes of these health conditions—the study cannot conclude causality between religious affiliation and hypertension and diabetes.

INTRODUCTION

Shifting disease burden

Similar to other low/middle-income countries (LMICs), the burden of diseases in Bangladesh has been transitioning from communicable to non-communicable diseases (NCDs). The transition is primarily driven by population ageing, urbanisation, lifestyle changes, social stress, and control of immunisable and other infectious diseases.[1 2] The Matlab Health and Demographic Surveillance System (HDSS) found that around half of the deaths were due to infectious diseases in the 1980s and a smaller proportion (~10%) was due to non-communicable health conditions. These proportions were reversed by the 2000s.[1 3] The HDSS recorded that three-fourth of the deaths in 2018 were due to NCDs.[4] At the individual level, NCD risk factors are consistent across countries. They include consuming foods high in saturated and trans-fats, salt and sugar; physical inactivity; alcohol and tobacco consumption;

and stress.[5] Cardiovascular diseases are among the top four NCDs globally. Hypertension, a primary chronic condition, is one of the most significant risk factors for other NCDs, such as cardiovascular diseases, cerebrovascular and kidney diseases, and mortality. Hypertension is defined as a persistent elevation of blood pressure (BP) that can lead to fatal conditions, such as stroke and heart failure. A great concern is that the prevalence of hypertension in LMICs is growing, with an estimated increase in prevalence to approximately 29% by 2025.[6] On the other hand, diabetes is one of the four major NCDs contributing to the major burden of global morbidity, disability and mortality.[7 8] More than 422 million people globally have diabetes and the majority of them live in LMICs.[9] A total of 1.5 million deaths were directly related to diabetes in 2019.[9] In 2013, the International Diabetes Federation reported that more than 72 million adults in the seven South Asian countries had diabetes. The number is estimated to rise to more than 135 million by 2035.[10]

Determinants of hypertension and diabetes

There is growing literature on the role of social determinants of hypertension.[11 12] Reduced psychological well-being, anxiety and depression are higher among people with hypertension; it is unclear whether they are the causes or the consequences.[13 14] Other studies suggest that depression is an independent risk factor for the condition.[15 16] Studies highlight the positive correlation between stress and hypertension[17] and the inverse relationship between education and hypertension.[18] Due to comorbidities, greater healthcare use is positively associated with hypertension detection and control.[19]

Similarly, stress, anxiety and depression that disrupt mental well-being[20] are common among adults with type 2 diabetes mellitus.[21 22] A recent systematic review concluded that depression was associated with a 41% greater chance of acquiring diabetes mellitus and 32% greater likelihood of having type 2 diabetes.[23] However, the study mentioned that the details on how this relationship works remain unclear. A study based on a large nationally representative Turkish sample identified that overweight/obesity, elevated BP and low levels of education were independently related to a higher incidence of diabetes.[24] Other studies found that nutritional status and hypertension were significantly associated with type 2 diabetes in Bangladesh.[7]

Religion and health

The effects of religion on morbidity and mortality have been extensively studied globally because some religious groups are known to have lower rates of disease and death than others.[25] Religious affiliation, beliefs and practices determine lifestyles. NCDs, such as hypertension and diabetes are, to a large extent, lifestyle diseases.[26–28] Affiliation with a specific religion and faith influences food habits, level of physical activity and patterns of healthcare use, which may influence a person's health. Studies on cardiovascular diseases have included indicators related to religion.[29 30] Research has also found religiosity to be inversely associated with BP and positively associated with mental well-being.[29 31] A study of South Asian immigrants in the USA suggested that religiosity among Hindus and Sikhs was associated with obesity—a risk factor for cardiovascular diseases, including hypertension.[30] However, this association was not observed in the study on a Muslim community.[32]

Hypertension and diabetes in Bangladesh

According to the 2017–2018 Bangladesh Demographic and Health Survey (BDHS), more than 1 in 4 people were hypertensive and 1 in 10 were diabetic in the population aged 18 years and above.[33] The BDHS conducted in 2011 and 2017–2018 also observed a rapid increase in the two health conditions in the population aged 35 years and above.[33 34] Existing literature on hypertension and diabetes in Bangladesh primarily focuses on factors of heterogeneity, such as age, geographical location (rural/urban), gender, occupation, education and health markers (body mass index (BMI)) rather than by religious groups.[12 35 36] Although the 165 million people in the country comprise a plural society, including Muslims (90%), Hindus (9%) and others (1%), the magnitude of hypertension and diabetes in different religious groups remains unexplored.[37]

Bangladesh currently lacks a population-based disease surveillance system to track the cause-specific morbidity burden of its people and generally relies on national and other surveys. Data scarcity is more prominent for emerging disease burdens. Non-communicable chronic diseases, including hypertension and diabetes, are the two major emerging health concerns in the adult population. Several studies have explored their burden in different population subgroups at the national level. However, the burden of cause-specific mortality is unknown due to the unavailability of population-based cause of death data at the national level. The International Centre for Diarrhoeal Disease Research, Bangladesh operates the 55-year-old Matlab HDSS in a 0.24 million rural population, which examines the cause of death for each death using the standard WHO verbal autopsy tools.[38] In 2018, 75% of the 1753 deaths examined were due to NCDs, and a large proportion was associated with hypertension and diabetes.[39] The 2011 and 2017–2018 BDHS collected biomarker samples (BP measures and a fasting blood glucose (FBG) sample) and several other background characteristics and health information. The surveys allowed the analysis of the risk of hypertension and diabetes by religion, and by household and individual-level attributes, such as age, sex, education, nutritional status, urban–rural residence, geographical area, socioeconomic status, etc.

Objectives of the study

The objectives of this paper were twofold:

1. To compare the prevalence and management of hypertension and diabetes among adult Muslims and Hindus at two different points in time in the 2010s.

2. To examine the change in the Hindu–Muslim difference in the risk of hypertension and diabetes between the two points in time.

MATERIALS AND METHODS

Study design, data and participants

The Demographic and Health Survey (DHS) Program conducts nationally representative surveys in more than 90 countries to collect data on health, population and nutrition.[40] The National Institute of Population Research and Training, under the Ministry of Health and Family Welfare, has been implementing the nationally representative cross-sectional BDHS in collaboration with the DHS Program periodically (about every 3 years) since 1993.[34] The 2011 and 2017–2018 BDHS collected biomarker data, including BP and FBG. Our study used data from the 2011 BDHS (conducted from 8 July 2011 to 19 January 2012) and the 2017–2018 BDHS (conducted from 24 October 2017 to 15 March 2018). Stratified two-stage cluster design was used in both surveys to sample households.[34 40 41] A list of enumeration areas (EAs) prepared for the 2011 Bangladesh Population and Housing census was used as the sampling frame for selecting the primary sampling unit. Each EA comprised about 120 households, on average.

In the first stage, 600 EAs in 2011 and 675 EAs in 2017–2018 were selected with probability proportional to size. In both surveys, from each selected EA, an average of 30 households were systematically selected in the second stage. The household response rate was above 98%. The 2011 BDHS randomly selected a subsample, including one-third of the total sampled households, collecting biomarker data from all members aged 35 years and above living in the households. The 2017–2018 BDHS randomly selected a subsample, including one-fourth of the total sampled households, and collected biomarker data from a wider age range of household members aged 18 years and older. The response rate for the BP measurement was 89% in both surveys and it was around 85% for the FBG measurement.[34 41] The sociodemographic characteristics of the non-response group differed little from the response group and, therefore, the differences were unlikely to introduce unignorable biases in the estimates of hypertension and diabetes.[35 42]

Neither BDHS collected information on the religious affiliation of the biomarker sample individuals. However, the surveys interviewed all ever-married women aged 15–49 years living in the sampled households and recorded their religious affiliation. Apart from rare circumstances, in Bangladesh, it is common for all household members to be affiliated with the same religion. We therefore considered it safe to assume that the religion of all household members was the same as that of the woman interviewed in the household. Under this assumption, we matched the religion of the people sampled for BP and FBG. Figure 1 presents a detailed data flow.

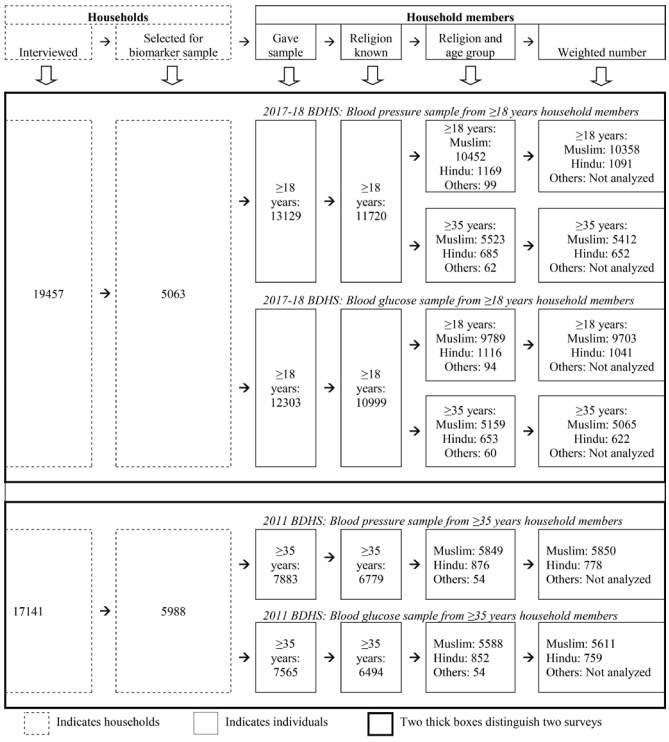

Figure 1 Flow chart of biomarker samples, by religion and age groups, 2011 BDHS and 2017–2018 BDHS. BDHS, Bangladesh Demographic and Health Survey.

Outcome measures

Hypertension and diabetes: WHO guidelines were followed to define an individual as hypertensive or as diabetic.[43 44] The 2011 and 2017–2018 BDHS reports thoroughly documented the measurement instruments, methods and sample collection procedures.[34 41]

For measuring BP, the LIFE SOURCE UA-767 Plus Blood Pressure Monitor model was used in both surveys. The UA-767 is a recommended instrument for home BP measurement.[45] A health technician took three BP measurements, with about a 10-minute interval between measurements, and the average of the last two measurements was recorded as the participant's BP value at the time of the survey. Participants with a systolic BP ≥140 mm Hg or a diastolic BP ≥90 mm Hg, or both, or who were on medication, were considered to be hypertensive.

HemoCue 201+ and HemoCue 201 RT were used for measuring FBG in the 2011 and 2017–2018 BDHS, respectively. Several studies found the portable instruments providing results comparable with many common clinical laboratory methods.[46 47] After wiping the first two drops of blood, the third drop was taken for FBG measurement. Participants with an FBG ≥7 mmol/L or who were on medication were considered to be diabetic.[43 44]

Awareness of, medication for and control of hypertension: Participants were considered 'aware of hypertension' if they were diagnosed and informed by a physician or any health worker before the survey visit that they had elevated BP. Participants with hypertension who reported taking antihypertensive medication on the day of the

survey were considered 'under medication'. Participants with hypertension with systolic BP <140 mm Hg and diastolic BP <90 mm Hg while taking antihypertensive medication on the day of the survey were considered to have 'controlled hypertension'.

Awareness of, medication for and control of diabetes: Participants were considered 'aware of diabetes' if they were diagnosed and informed by a physician or any health worker before the survey visit that they had elevated blood glucose. Participants with diabetes were considered 'under medication' if they reported taking any antidiabetic drugs on the survey day. Participants with diabetes with FBG <7 mmol/L while taking antidiabetic medications on the day of the survey were considered to have 'controlled diabetes'.

Covariates

The religious group was the main covariate of interest. The analysis excluded other religious groups besides Muslim and Hindu because they comprise a marginal proportion of the national population and of the 2011 and 2017–2018 BDHS samples. These small samples were not sufficient to provide robust estimates.

We assessed Muslims and Hindus separately for BP and FBG samples by their health, demographic and socioeconomic characteristics. We termed these characteristics together as background characteristics. The background characteristics were: age in 5-year groups (except groups 18–24 years and 70+ years); sex (male, female); completed years of schooling (none, <5, 5, 6–9, ≥10); residence (urban, rural); wealth quintiles (lowest, second, middle, fourth, highest); geographical region (western: Khulna, Rajshahi and Rangpur divisions; central: Dhaka, Barishal and Mymensingh divisions; eastern: Sylhet and Chattogram divisions); and BMI-based nutritional status (underweight: BMI <18.5; normal: BMI ≥18.5 and BMI <25; overweight or obese: BMI ≥25.0). We define overweight or obese as overweight throughout the paper.

Despite using age as a continuous variable, we categorised in 5-year groups to minimise the effect of heaping in age reporting in the surveys. This also helped understand the stages where the outcome started to change sharply. Moreover, it will help policymakers take action using a targeted approach. For example, the Bangladesh government currently recommends that its citizens go to a health facility nearby to assess BP if aged 40 years and above.[48] In their recent policy brief, Streatfield *et al* recommended reducing the age to 35 years.[48] Such an evidence-based recommendation is possible if age is analysed categorically. In addition, the non-linear relation of the outcome to age becomes visible if age is categorised. BMI was categorised to explain how overweight/obesity affects the outcome. The continuous BMI score makes sense to neither non-technical readers nor to policymakers.

Statistical analysis

Analysis under objective 1

We estimated the risk of hypertension and diabetes as a measure of prevalence and compared Hindus and Muslims for their background characteristics. We conducted this estimation and comparison separately for adults aged 18 years and above using the 2017–2018 BDHS data, and for adults 35 years and above using the 2011 and 2017–2018 BDHS data. The risks of hypertension in the two religious groups were adjusted for the background characteristics in the logistic regression models. We reported the model-based adjusted ORs (AORs) and 95% confidence interval (CI) as the measure of association. Equation 1 shows the model specifications.

Using equation 2, we examined whether the Hindu–Muslim difference in the risk of developing hypertension varies across males and females. We estimated predicted probabilities of being hypertensive among the Muslim and Hindu men and women 18 years and above using delta methods.[49]

$$logit(\pi_i) = \ln\left(\frac{\pi_i}{1-\pi_i}\right) = a + bR_i + g_k X_{ki} + \varepsilon_i \quad (1)$$

$$logit(\pi_i) = \ln\left(\frac{\pi_i}{1-\pi_i}\right) = a + bR_i + cS_i + d\left(R_i \times S_i\right) + g_k X_{ki} + \varepsilon_i \quad (2)$$

$$logit(\pi_i) = \ln\left(\frac{\pi_i}{1-\pi_i}\right) = a + bR_i + eT_i + f\left(R_i \times T_i\right) + g_k X_{ki} + \varepsilon_i \quad (3)$$

Notations in equations 1, 2 and 3: The outcome of interest is a dichotomous variable. Its value of 1 indicates hypertensive status and 0 shows others. The π is the probability of being hypertensive (ie, Y_i=1). R_i is the religion of individual *i*. S_i is the sex of individual *i*. $R_i \times S_i$ shows the interaction of religion and sex. $R_i \times T_i$ shows the interaction of religion and survey, 2011 BDHS and 2017–2018 BDHS. X_{ki} is a vector of background covariates that may influence the outcome and ε_i is the residual for individual *i*. Corresponding coefficients: *a* is the intercept; *b* for R_i; *c* for S_i; *d* for $R_i \times S_i$; *e* for T_i; *f* for $R_i \times T_i$; and g_k for X_{ki}.

Management of hypertension and diabetes: To examine the second part of the first objective, we looked at religion-specific awareness of, medication for, and control of hypertension and diabetes using descriptive statistics (eg, percentages). We also used Chi-square test to examine the statistical significance of Hindu–Muslim differences in awareness of, medication for, and control of hypertension and diabetes.

The complex survey designs of the 2011 and 2017–2018 BDHS made weighted analysis essential. The DHS Program-provided survey weights in the data set were used to avoid sampling bias and to generalise the results for Bangladesh. As the non-response rate for biomarker sample and missing religious affiliation cases was minimal and not solely systematic, it is unlikely that the non-response bias would affect the generalisability of the results. Above this, the analytical sample size was quite large to produce precise estimates, even after excluding those who did not participate in the survey and whose religion was unknown. Thus, rather than performing missing value imputation analyses, this study excluded

the missing cases. Besides these, one of the important covariates, BMI, had missing information. Instead of dropping it from the analysis, we have added the missing information as a 'missing BMI' category. We assume that the missing observations were random. As the proportions of 'missing BMI' observations were similar in the two religious groups, the biases introduced by them were likely to be eliminated during the Hindu–Muslim comparison.

Analysis under objective 2

We examined the Hindu–Muslim hypertension differences in 2011 and 2017–2018 for the population aged 35 years and above. We also analysed the interaction of religion and time (survey year), using a multiple logistic regression that adjusted possible differences in background characteristics between the two religious groups. The regression model is specified in equation 3. We then estimated predicted probabilities of being hypertensive among the Muslim and Hindu groups 35 years and above in 2011 and 2017–2018 using the delta method.[49] Last, we calculated the Hindu–Muslim difference in the predicted probabilities in 2011 and 2017–2018. This double difference showed whether there was any change in Hindu–Muslim inequality to be hypertensive.

The BDHS has separate survey weights for a specific survey. Pooling two or more survey data together requires adjustment in the survey weight to take care of normalisation done in a survey for the total population in the country in that survey year. There were pooled data in the 2011 BDHS and 2017–2018 BDHS for the individuals aged 35 years and above in the sample, and we took care of this necessary readjustment in the survey weights. Table 1 presents the weight adjustment details.

We analysed data using STATA V.15. STATA *svy* command with cluster and strata specification was used for the weighted analysis.

Patient and public involvement

Patients and/or the public were not involved in the design, conduct, reporting or dissemination plans for this research.

RESULTS

Background characteristics of the sample individuals

Hindus and Muslims aged 18 years and older were not vastly different in the 2017–2018 BDHS for the BP sample (table 2). The male–female ratio was lower for Hindus, with 46% male and 54% female compared with 42% male and 58% female for Muslims. Hindus were slightly older than Muslims: 40% of Muslims were aged 40 years and above compared with 47% of Hindus. Muslims had less secondary or higher-level education, at 18%, compared with 24% for Hindus. A lower proportion of Hindus lived in urban areas (20%), compared with 28% of Muslims. Last, for the wealth quintiles, relatively more Hindus belonged to lower wealth quintiles—26% of Hindus were from the lowest wealth quintile compared with 17% of Muslims. In terms of nutritional status, the two religious groups were very similar. The FBG sample exhibited largely identical characteristics. The background characteristics of Hindu and Muslim adults aged 35 years and above were identical to those in the 2017–2018 BDHS (both BP and FBG sample) (table 3).

Findings under objective 1

Hypertension among population aged 18 years and above in 2017–2018

Figure 2A shows the prevalence of hypertension among adults 18 years and above in the 2017–2018 BDHS. About one-third or 34% of Hindus were hypertensive compared with 25% of Muslims, meaning that Hindus were 36% more likely to be hypertensive than Muslims. Hindus were more likely to be hypertensive across sex, age groups, education, urban–rural residence, wealth quintiles, geographical regions and nutritional status. The prevalence of hypertension was 5 percentage points higher among Hindu women than Muslim women, and 13 percentage points higher among Hindu men than Muslim men. The lowest difference between the two groups (1 percentage point) was observed in the age group 18–24 years; the highest was in the age group 45–49 years (21 percentage points). Across the years of education, Hindus consistently had a higher prevalence of hypertension. The prevalence was higher among those with no years of schooling than among those with 10 years

Table 1 Adjustment of survey weights for pooled data analysis of the 2011 BDHS and 2017–2018 BDHS

Index (i)	Survey	Total population in the country* (million)	Proportion of population ≥35 years†	Total population ≥35 years in the country (million)	Individuals ≥35 years interviewed	Proportion of population ≥35 years interviewed	Population ≥35 years to be interviewed in survey i to have same proportion of population ≥35 years interviewed in survey 1	Factors to be multiplied by weight for individual respondents
(1)	(2)	(3)	(4)	(5) =(3)×(4)	(6)	(7) $=((6)\div(5))\times10^6$	(8) $=((7)_1\div(7))\times(6)_i$	(9) =(8)÷(6)
1	2017–2018	161	0.34	54.74	8111	0.000148	8111	1.000000
2	2011	149	0.31	46.19	8835	0.000191	6844	0.774660

*Source of total population: United Nations World Population Prospects 2022 (https://population.un.org/wpp/Download/Files/1_Indicators(Standard)/EXCEL_FILES/1_Population/WPP2019_POP_F01_1_TOTAL_POPULATION_BOTH_SEXES.xlsx).
†Sources of ≥35-year-old population proportion: 2011 BDHS and 2017–2018 BDHS.
BDHS, Bangladesh Demographic and Health Survey.

Table 2 Background characteristics of individuals 18 years and above who gave BP measures and FBG sample, 2017–2018 BDHS

	BP sample		FBG sample	
	Muslim	Hindu	Muslim	Hindu
Characteristics	N (%)	N (%)	N (%)	N (%)
Sex				
Male	4368 (42.2)	500 (45.8)	4060 (41.8)	475 (45.6)
Female	5990 (57.8)	591 (54.2)	5643 (58.2)	566 (54.4)
Age				
18–19	766 (7.4)	62 (5.7)	718 (7.4)	56 (5.3)
20–24	1455 (14.0)	123 (11.3)	1363 (14.1)	116 (11.1)
25–29	1391 (13.4)	127 (11.6)	1290 (13.3)	124 (11.9)
30–34	1336 (12.9)	128 (11.7)	1267 (13.1)	124 (11.9)
35–39	1243 (12.0)	143 (13.1)	1176 (12.1)	138 (13.2)
40–44	953 (9.2)	119 (10.9)	894 (9.2)	110 (10.5)
45–49	919 (8.9)	112 (10.2)	857 (8.8)	106 (10.2)
50–54	485 (4.7)	59 (5.4)	446 (4.6)	56 (5.4)
55–59	483 (4.7)	54 (4.9)	451 (4.6)	52 (5.0)
60–64	474 (4.6)	43 (4.0)	448 (4.6)	42 (4.0)
65–69	250 (2.4)	34 (3.1)	231 (2.4)	34 (3.2)
70+	603 (5.8)	88 (8.0)	563 (5.8)	85 (8.1)
Years of schooling				
None	2524 (24.4)	251 (23.0)	2364 (24.4)	237 (22.7)
<5	2090 (20.2)	187 (17.1)	1971 (20.3)	178 (17.1)
5	1071 (10.3)	95 (8.7)	1000 (10.3)	90 (8.7)
6–9	2774 (26.8)	300 (27.6)	2609 (26.9)	290 (27.9)
≥10	1899 (18.3)	257 (23.6)	1758 (18.1)	246 (23.7)
Residence				
Urban	2937 (28.3)	212 (19.4)	2676 (27.6)	203 (19.5)
Rural	7422 (71.7)	879 (80.6)	7028 (72.4)	838 (80.5)
Wealth quintiles				
Lowest	1800 (17.4)	279 (25.6)	1709 (17.6)	266 (25.6)
Second	2034 (19.6)	182 (16.6)	1922 (19.8)	166 (16.0)
Middle	2122 (20.5)	228 (20.9)	2016 (20.8)	219 (21.1)
Fourth	2116 (20.4)	219 (20.1)	1978 (20.4)	212 (20.3)
Highest	2287 (22.1)	183 (16.8)	2078 (21.4)	177 (17.0)
Nutritional status				
Underweight	1645 (15.9)	175 (16.0)	1563 (16.1)	167 (16.1)
Normal	6030 (58.2)	647 (59.3)	5656 (58.3)	613 (58.9)
Overweight	2556 (24.7)	259 (23.7)	2371 (24.4)	254 (24.4)
Missing	128 (1.2)	10 (0.9)	114 (1.2)	7 (0.7)
Region				
Western	3618 (34.9)	342 (31.4)	3440 (35.4)	318 (30.6)
Central	3816 (36.8)	362 (33.1)	3493 (36.0)	352 (33.9)
Eastern	2925 (28.2)	387 (35.5)	2771 (28.6)	371 (35.6)
Total	10358 (100.0)	1091 (100.0)	9703 (100.0)	1041 (100.0)

BDHS, Bangladesh Demographic and Health Survey; BP, blood pressure; FBG, fasting blood glucose.

Table 3 Background characteristics of Muslims and Hindus 35 years and above who gave BP measure and FBG sample, 2011 BDHS

	BP sample		FBG sample	
	Muslim	Hindu	Muslim	Hindu
Characteristics	N (%)	N (%)	N (%)	N (%)
Sex				
Male	2938 (50.2)	404 (51.9)	2812 (50.1)	393 (51.8)
Female	2912 (49.8)	374 (48.1)	2800 (49.9)	365 (48.2)
Age				
35–39	1262 (21.6)	148 (19.0)	1199 (21.4)	147 (19.3)
40–44	1169 (20.0)	146 (18.8)	1124 (20.0)	141 (18.6)
45–49	1017 (17.4)	139 (17.9)	976 (17.4)	136 (17.9)
50–54	707 (12.1)	104 (13.4)	683 (12.2)	101 (13.4)
55–59	419 (7.2)	58 (7.4)	401 (7.1)	57 (7.5)
60–64	399 (6.8)	54 (7.0)	385 (6.9)	51 (6.7)
65–69	271 (4.6)	44 (5.7)	263 (4.7)	44 (5.8)
70+	606 (10.4)	85 (10.9)	580 (10.3)	82 (10.8)
Years of schooling				
None	2747 (47.0)	272 (35.0)	2635 (47.0)	266 (35.1)
<5	1325 (22.6)	177 (22.7)	1266 (22.6)	170 (22.4)
5	565 (9.7)	102 (13.1)	537 (9.6)	101 (13.3)
6–9	711 (12.1)	128 (16.4)	687 (12.2)	126 (16.6)
≥10	502 (8.6)	99 (12.7)	487 (8.7)	95 (12.5)
Residence				
Urban	1454 (24.9)	153 (19.6)	1399 (24.9)	148 (19.6)
Rural	4395 (75.1)	625 (80.4)	4213 (75.1)	610 (80.4)
Wealth quintiles				
Lowest	1024 (17.5)	111 (14.3)	982 (17.5)	109 (14.4)
Second	1118 (19.1)	139 (17.9)	1066 (19.0)	135 (17.8)
Middle	1169 (20.0)	168 (21.6)	1121 (20.0)	165 (21.8)
Fourth	1246 (21.3)	187 (24.0)	1199 (21.4)	181 (23.9)
Highest	1292 (22.1)	173 (22.3)	1244 (22.2)	169 (22.3)
Nutritional status				
Underweight	1122 (19.2)	146 (18.8)	1082 (19.3)	145 (19.1)
Normal	2252 (38.5)	319 (41.0)	2142 (38.3)	310 (40.9)
Overweight	423 (7.2)	61 (7.8)	401 (7.2)	59 (7.7)
Missing	2053 (35.1)	252 (32.4)	1974 (35.3)	245 (32.3)
Region				
Western	2258 (38.6)	381 (49.0)	2164 (38.6)	375 (49.4)
Central	2292 (39.2)	197 (25.3)	2223 (39.6)	190 (25.0)
Eastern	1299 (22.2)	201 (25.8)	1225 (21.8)	194 (25.6)
Total	5850 (100.0)	778 (100.0)	5611 (100.0)	759 (100.0)

BDHS, Bangladesh Demographic and Health Survey; BP, blood pressure; FBG, fasting blood glucose.

or above of education. We found the highest prevalence of hypertension among those in the highest wealth quintile for both Hindus and Muslims. In the underweight group, the prevalence of hypertension among Hindus was higher, by 2 percentage points, than among Muslims. However, in the overweight group, the difference was 11 percentage points, with a higher rate among Hindus.

Although we found that Hindus tended to be more hypertensive across all background characteristics, the differences were not significant in a few categories: age

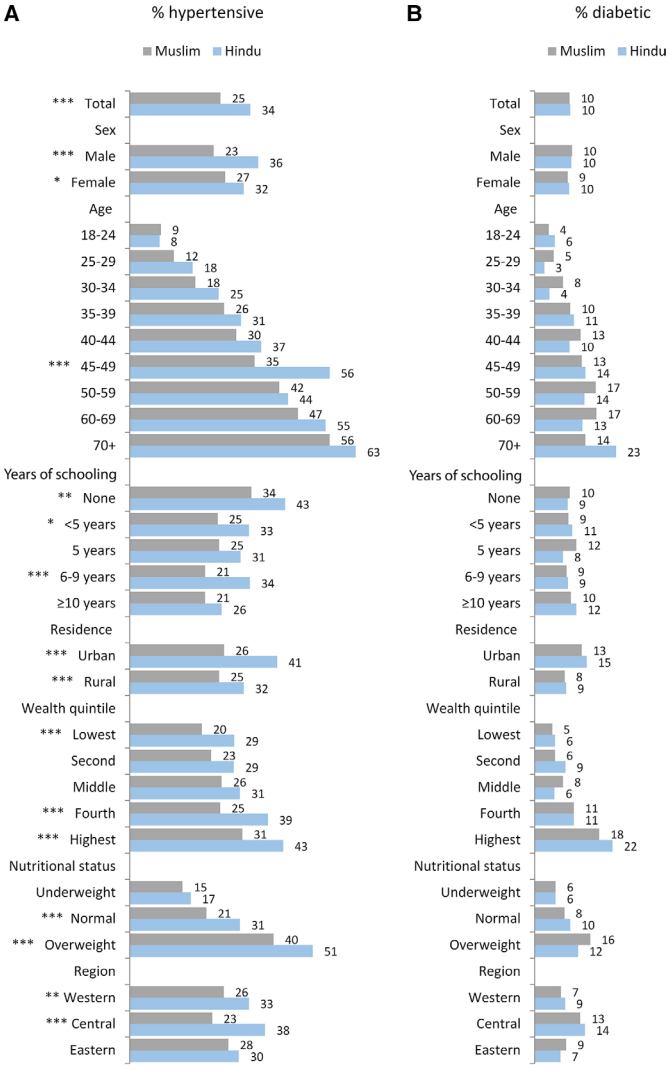

Figure 2 (A) Hypertension and (B) diabetes among Muslims and Hindus 18 years and above, by background characteristics, 2017–2018 BDHS. ***P<0.001; **p<0.01; *p<0.05; p values are from Chi-square test; no asterisk sign reflects insignificant association; hypertension and diabetes among missing nutritional status not presented. BDHS, Bangladesh Demographic and Health Survey.

Table 4 Multiple logit-based AORs of hypertension among men and women aged 18 years and above, 2017–2018 BDHS

	AOR	P value	95% CI
Hindu (ref: Muslim)	1.45	<0.001	1.23 to 1.71
Female (ref: male)	1.37	<0.001	1.22 to 1.54
Age (ref: 18–24 years)			
25–29	1.34	0.010	1.07 to 1.68
30–34	2.01	<0.001	1.60 to 2.53
35–39	3.39	<0.001	2.69 to 4.26
40–44	4.23	<0.001	3.38 to 5.30
45–49	5.88	<0.001	4.61 to 7.49
50–59	8.81	<0.001	6.98 to 11.12
60–69	12.02	<0.001	9.34 to 15.47
70+	18.30	<0.001	13.92 to 24.05
Years of schooling (ref: none)			
<5	1.03	0.720	0.88 to 1.20
5	1.16	0.152	0.95 to 1.43
6–9	1.15	0.080	0.98 to 1.35
≥10	1.06	0.565	0.88 to 1.27
Rural (ref: urban)	0.97	0.679	0.85 to 1.11
Wealth quintiles (ref: lowest)			
Second	1.04	0.685	0.87 to 1.24
Middle	1.12	0.222	0.93 to 1.34
Fourth	1.13	0.176	0.95 to 1.35
Highest	1.24	0.029	1.02 to 1.49
Nutritional status (ref: underweight)			
Normal	1.98	<0.001	1.69 to 2.31
Overweight	4.89	<0.001	4.06 to 5.89
Missing	2.26	0.001	1.43 to 3.58
Region (ref: Western)			
Central	0.93	0.298	0.81 to 1.07
Eastern	1.13	0.077	0.99 to 1.29
Constant			
Observations used	11621	–	–

AORs, adjusted ORs; BDHS, Bangladesh Demographic and Health Survey.

groups below 45 years and above 49 years; schooling 5 years and 10 years or above; second and middle household wealth quintiles, the underweight group, and Eastern region.

The results of the regression analysis confirmed the higher likelihood of Hindus being hypertensive (table 4). The odds of being hypertensive were 45% higher among Hindus than Muslims (AOR 1.45; 95% CI: 1.23 to 1.71). A 2.6-fold higher difference in the prevalence of hypertension between Hindu and Muslim men than between Hindu and Muslim women (figure 2A: (36–23=13)/(32–27=5)=2.6) motivated further analysis of sex and religion-specific risk of hypertension. Table 5 presents multiple logistic regression-based results on sex and religion-specific risks of being hypertensive after controlling for background characteristics. It reveals that Muslim women, and Hindu men and women were similar and more likely to have hypertension than Muslim men (table 5B and figure 3).

The analysis of the levels of medication of, awareness for and control of hypertension found similarities between the two religious groups, with insignificant lower levels among Hindus (figure 4A). In both religious groups, we found overall low levels of awareness of hypertension (around 40%), use of medication for hypertension (1 in 3) and control of hypertension (close to 1 in 10).

Hypertension among populations 35 years and above in 2011 and 2017–2018

Figure 5 shows the prevalence of hypertension among the population 35 years and above in the 2011 BDHS (figure 5A) and the 2017–2018 BDHS (figure 5B). Hindus had a higher risk of being hypertensive compared with Muslims in the two time points. For example, the

Table 5 Examination of religion and sex interaction: multiple logit-based AORs of being hypertensive, 2017–2018 BDHS

	(A) AORs and their corresponding p value and 95% CI		
	AOR	**P value**	**95% CI**
Hindu (ref: Muslim)	1.79	<0.001	1.42 to 2.25
Female (ref: male)	1.43	<0.001	1.27 to 1.62
Religion×Sex (interaction)			
Hindu female	0.68	0.014	0.50 to 0.92
Age (ref: 18–24 years)			
25–29	1.35	0.009	1.08 to 1.68
30–34	2.01	<0.001	1.61 to 2.54
35–39	3.41	<0.001	2.72 to 4.30
40–44	4.23	<0.001	3.40 to 5.35
45–49	5.89	<0.001	4.64 to 7.53
50–59	8.81	<0.001	7.05 to 11.24
60–69	12.10	<0.001	9.39 to 15.58
70+	18.39	<0.001	13.99 to 24.18
Years of schooling (ref: none)			
<5	1.03	0.721	0.89 to 1.20
5	1.16	0.153	0.95 to 1.43
6–9	1.15	0.084	0.98 to 1.35
≥10	1.06	0.567	0.88 to 1.27
Rural (ref: urban)	0.97	0.671	0.85 to 1.11
Wealth quintiles (ref: lowest)			
Second	1.03	0.710	0.86 to 1.24
Middle	1.11	0.238	0.93 to 1.33
Fourth	1.13	0.190	0.94 to 1.35
Highest	1.23	0.033	1.02 to 1.49
Nutritional status (ref: underweight)			
Normal	1.97	<0.001	1.69 to 2.31
Overweight	4.88	<0.001	4.05 to 5.88
Missing	2.24	0.001	1.41 to 3.55
Region (ref: Western)			
Central	0.93	0.300	0.81 to 1.07
Eastern	1.13	0.082	0.98 to 1.29
Constant	0.03	<0.001	0.02 to 0.04
Observations used	11621	–	–
	(B) Predicted probability and its corresponding p value and 95% CI		
	Predicted probability	**P value**	**95% CI**
Religion×Sex			
Muslim men	0.22	<0.001	0.21 to 0.24
Muslim women	0.28	<0.001	0.27 to 0.29
Hindu men	0.32	<0.001	0.28 to 0.36
Hindu women	0.31	<0.001	0.28 to 0.35

AORs, adjusted ORs; BDHS, Bangladesh Demographic and Health Survey.

prevalence of hypertension was 31% among Hindus in 2011 and 24% among Muslims, with a Hindu–Muslim difference of 7 percentage points. Six years later, the 2017–2018 BDHS found that 45% of the Hindus and 38% of the Muslims were hypertensive, for a 7 percentage point Hindu–Muslim difference.

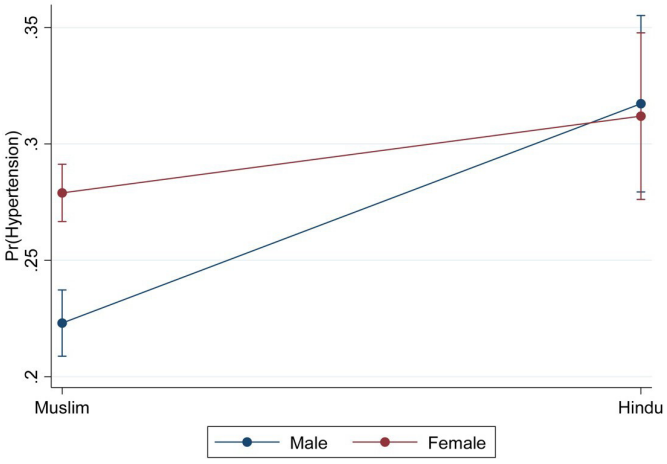

Figure 3 Multiple logit-based predicted probabilities of being hypertensive among men and women 18 years and above, by religion, 2017–2018 BDHS. Adjusted for age, years of schooling, residence, wealth quintiles, nutritional status and region (table 5). BDHS, Bangladesh Demographic and Health Survey.

The regression analyses found that Hindus had higher risks of being hypertensive in 2011 (AOR: 1.44; 95% CI: 1.18 to 1.77; model 1 in table 6), and also in 2017–2018 (AOR: 1.50; 95% CI: 1.25 to 1.82; model 2 in table 6).

Diabetes among population 18 years and above in 2017–2018

Hindus and Muslims had the same risk of being diabetic (around 10%), similar across most background characteristics (figure 2B). Where there were differences, they were not statistically significant. Therefore, we did not conduct any further analyses (e.g., multiple logistic regression analysis). In both religious groups, we found

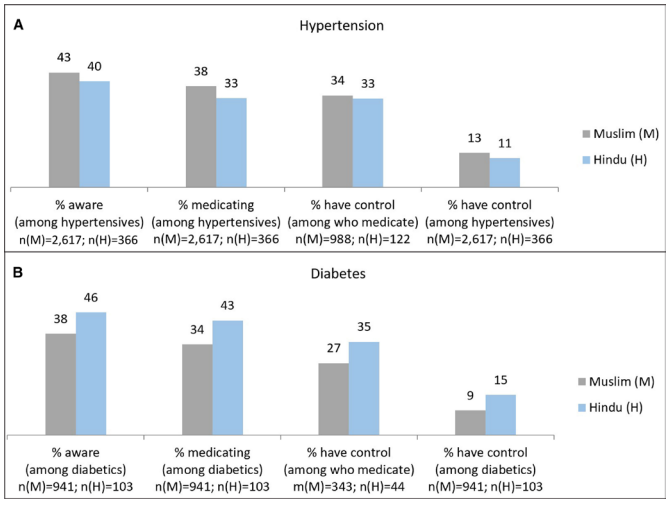

Figure 4 Awareness, medication, and control of hypertension among Muslims and Hindus 18 years and above, 2017–2018 BDHS. ***P<0.001; **p<0.01; *p<0.05; p values are from Chi-square test; no asterisk sign reflects insignificant association. BDHS, Bangladesh Demographic and Health Survey.

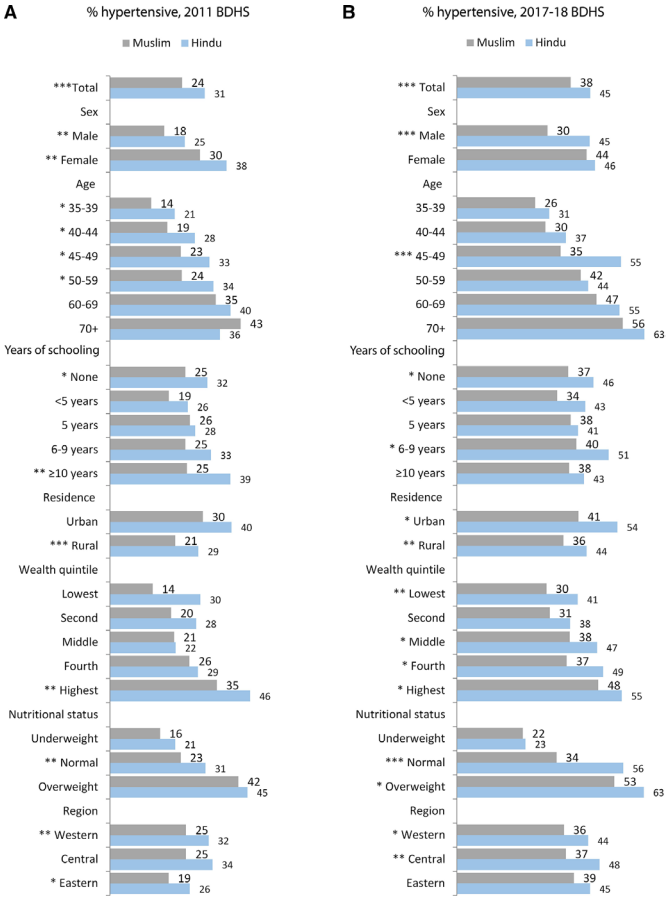

Figure 5 Hypertension among Muslims and Hindus 35 years and above, by background characteristics, 2011 BDHS and 2017–2018 BDHS. ***P<0.001; **p<0.01; *p<0.05; p values are from Chi-square test; no asterisk sign reflects insignificant association; hypertension among missing nutritional status not presented. BDHS, Bangladesh Demographic and Health Survey.

overall low levels of awareness of medication for control of diabetes, with a little higher level among Hindus (not significant) (figure 4B).

Diabetes among population 35 years and above in 2011 and 2017–2018

One in 10 Hindus and Muslims had diabetes in 2011 (figure 6A), and one in seven in 2017–2018 (figure 6B). There were no significant Hindu–Muslim differences in any of the background characteristics. Therefore, we did not do any regression analyses.

Findings under objective 2

Among those aged 35 years and above, Hindus were 7 percentage points more hypertensive than Muslims in the 2011 BDHS (Muslim: 24%; Hindu: 31%) and the 2017–2018 BDHS (Muslim: 38%; Hindu: 45%) (figure 5). There were slight Hindu–Muslim differences in sociodemographic characteristics (tables 2 and 3). Therefore, we conducted a multiple logistic regression analysis (table 7) adjusted for these characteristics. Although the analysis yielded a 3 percentage point increase in the disparity, with a higher level of hypertension among Hindus, the difference was not statistically significant (figure 7).

DISCUSSION

Main findings

Religious beliefs shape behaviour and practices that affect morbidity and mortality.[26–28] Our study found that hypertension was significantly higher among Hindus compared with Muslims in Bangladesh. The risk of hypertension significantly increased in both religious groups between 2011 and 2017–2018, but the disparity remained unchanged. However, the two religious groups were identical for diabetes. Moreover, they performed similarly in terms of their awareness, use of medication and control of the two health conditions.

Findings in context

Religious-based lifestyles and the minority status of Hindus may partly explain the higher levels of hypertension among Hindus in Bangladesh. The basis of this hypothesis is certain traits observed among Hindus. They are less urban and belong to lower wealth quintiles than their Muslim counterparts; however, the difference remained after controlling for these factors. Various studies have established the relative demographic and socioeconomic differences between Hindus and Muslims in Bangladesh.[50 51] To establish a close comparative example of the 'minority status' argument, we looked at the religious variation of hypertension in India overall and in a few provinces (eg, Uttar Pradesh, neighbouring districts in Central India, West Bengal), given their cultural, social, demographic and environmental similarities.[52–55] Muslims are the largest minority group in India. We found that the minority status argument primarily held among Muslim women. The most recent National Family Health Survey report showed that Muslims had a lower prevalence of hypertension in India, similar to our findings in Bangladesh.[56]

Explanations for the prevalence and risks of hypertension among subgroups in various settings and countries are contextual and cannot be strictly generalised. However, in Bangladesh, the observed higher prevalence of hypertension among Hindus may be attributable to their minority status. Religious or other racial minority status of a population in their country of residence often causes vulnerability to a 'cluster of disadvantages', including less hygienic environmental conditions, reduced access to quality healthcare and less stable employment opportunities in LMICs.[57] Moreover, minority communities in West Bengal, India are more prone to poorer mental health and to chronic stress because they face greater direct and indirect discrimination, stigma and violence.[50] Although Hindus in Bangladesh do not face discrimination in education and employment,[58] popular suspect is that they are more prone to anxiety, depression and similar adverse mental health conditions. However, a lack of scientific evidence of Hindu–Muslim differences in mental health

Table 6 Multiple logit-based AORs of being hypertensive among population 35 years and above

	Model 1, 2011 BDHS			Model 2, 2017–2018 BDHS		
	AOR	P value	95% CI	AOR	P value	95% CI
Hindu (ref: Muslim)	1.44	<0.001	1.18 to 1.77	1.50	<0.001	1.25 to 1.82
Female (ref: male)	2.08	<0.001	1.70 to 2.55	1.71	<0.001	1.50 to 1.96
Age (ref: 35–49 years)						
40–44	1.50	<0.001	1.19 to 1.88	1.27	0.020	1.04 to 1.56
45–49	2.06	<0.001	1.64 to 2.59	1.78	<0.001	1.44 to 2.20
50–59	2.88	<0.001	2.20 to 3.76	2.81	<0.001	2.31 to 3.42
60–69	4.91	<0.001	3.67 to 6.57	3.87	<0.001	3.12 to 4.80
70+	7.30	<0.001	5.37 to 9.91	5.91	<0.001	4.57 to 7.63
Years of schooling (ref: none)						
<5	0.81	0.027	0.68 to 0.98	1.05	0.575	0.89 to 1.23
5	0.99	0.957	0.78 to 1.26	1.23	0.095	0.96 to 1.57
6–9	1.25	0.055	0.99 to 1.57	1.36	0.002	1.12 to 1.65
≥10	1.33	0.052	0.10 to 1.77	1.03	0.782	0.82 to 1.30
Rural (ref: urban)	0.86	0.066	0.72 to 1.01	0.91	0.278	0.78 to 1.07
Wealth quintiles (ref: lowest)						
Second	1.32	0.037	1.02 to 1.71	0.88	0.241	0.72 to 1.09
Middle	1.25	0.090	0.97 to 1.61	1.08	0.481	0.87 to 1.33
Fourth	1.51	0.002	1.17 to 1.94	0.91	0.402	0.74 to 1.13
Highest	2.21	<0.001	1.68 to 2.92	1.16	0.214	0.92 to 1.46
Nutritional status (ref: underweight)						
Normal	1.87	<0.001	1.54 to 2.29	2.24	<0.001	1.87 to 2.68
Overweight	3.40	<0.001	2.53 to 4.57	5.27	<0.001	4.23 to 6.56
Missing	2.12	<0.001	1.58 to 2.85	2.38	<0.001	1.46 to 3.86
Region (ref: Western)						
Central	0.86	0.074	0.74 to 1.01	0.97	0.685	0.83 to 1.13
Eastern	0.57	<0.001	0.47 to 0.68	1.05	0.562	0.89 to 1.24
Constant	0.04	<0.001	0.03 to 0.06	0.08	<0.001	0.06 to 0.11
Observations used	6725			6206		

AORs, adjusted ORs; BDHS, Bangladesh Demographic and Health Survey.

limits the discussion of mental health as a differential of the Hindu–Muslim difference in hypertension in Bangladesh. Minority Muslims in neighbouring India also experience similar minority-based violence and are likely to have poorer mental health.[59–61] However, the lower prevalence of hypertension among the minority Muslims in India and Hindu–Muslim similarity in hypertension in a few areas weaken the minority status hypothesis.[53–55] Moreover, no observed differences in the management of hypertension and in the prevalence of diabetes by the religious groups showed that minority Hindus in Bangladesh were not necessarily more vulnerable to some other illnesses.

The Hindu–Muslim similarity in diabetes prevalence in Bangladesh further weakens the minority hypothesis that Hindus are more prone to be hypertensive due to their minority status. This is because the risk factors of hypertension and diabetes are quite similar—broadly—diet and lifestyle. Evidence of similarity in diabetes (type 2) prevalence between majority of Hindus and minority Muslims in West Bengal and a higher level of diabetes among minority Muslims in Karnata in India complicate the minority hypothesis of vulnerability to hypertension and diabetes in this study.[62 63] Moreover, according to our analysis, Hindu men and women are similarly hypertensive. The difference in the gender differentials in hypertension between the religious groups remains unexplainable based on the data we used in this study and previous studies we cited.

Using Matlab HDSS data, studies established that adult mortality is persistently higher among Hindus than Muslims.[3 64 65] The higher observed mortality rates among Hindus are not very well understood. One of the possible explanations seems to be their minority status in

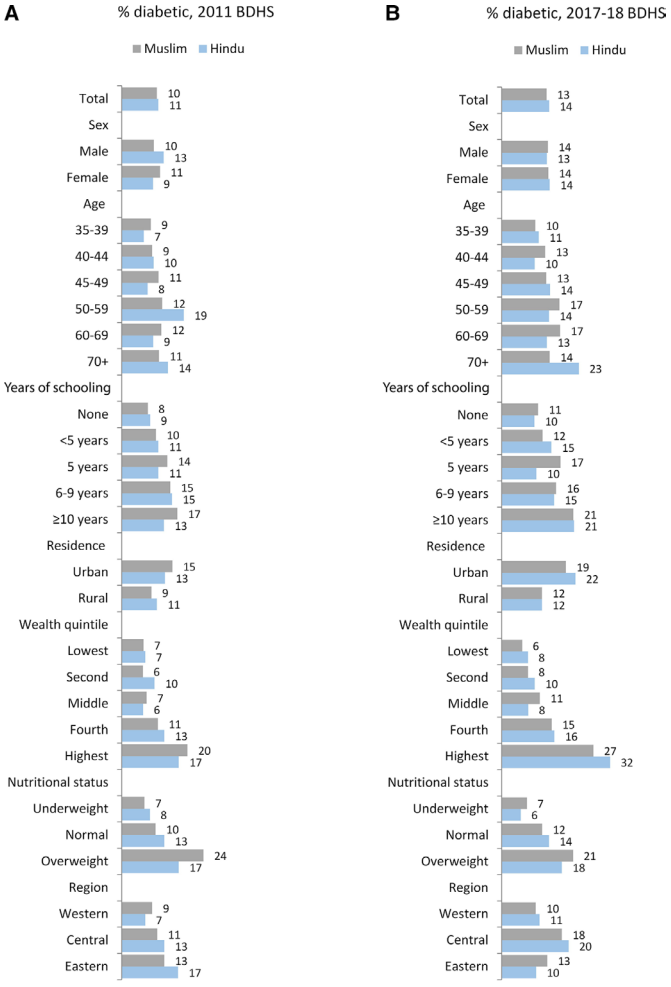

Figure 6 Diabetes among Muslims and Hindus 35 years and above, by different characteristics, 2011 BDHS and 2017–2018 BDHS. ***P<0.001; **p<0.01; *p<0.05; p values are from Chi-square test; no asterisk sign reflects insignificant association; diabetes among missing nutritional status not presented. BDHS, Bangladesh Demographic and Health Survey.

the country.[51] Another explanation may be their higher emigration rate compared with Muslims, which means that Hindus living in the country are less healthy due to the continuous emigration of healthy Hindus over a long period of time.[51 66] What is perplexing is that many studies document that Hindus in Bangladesh fare better on such indicators as contraceptive use and fertility rate, and that they seek healthcare for maternal and reproductive health.[51 67–69] Little is known about the levels and patterns of healthcare use among adult men, both Muslim and Hindu. National statistics and surveys suggest that educational attainment is relatively higher among Hindus,[70] which is consistent with our findings. The above evidence makes the Hindu–Muslim differences in hypertension in Bangladesh puzzling.

To explain Hindu–Muslim differentials in hypertension, several arguments related to diabetes appear as both hypertension and diabetes have common risk factors like obesity, inflammation, oxidative stress, physical activity,

Table 7 Examination of religion and survey year interaction: multiple logit-based AORs of being hypertensive among adults aged 35 years and above from the 2011 BDHS and 2017–2018 BDHS

	(A) AOR and corresponding p value and 95% CI		
	AOR	**P value**	**95% CI**
Hindu (ref: Muslim)	1.43	0.001	1.17 to 1.75
Female (ref: male)	1.86	<0.001	1.67 to 2.07
2017–2018 BDHS (ref: 2011 BDHS)	1.73	<0.001	1.53 to 1.94
Religion×BDHS year (interaction)			
Hindu 2017–2018 BDHS	1.09	0.564	0.82 to 1.43
Age (ref: 18–24 years)			
25–29	–	–	–
30–34	–	–	–
35–39	Ref	–	–
40–44	1.36	<0.001	1.17 to 1.58
45–49	1.86	<0.001	1.59 to 2.17
50–59	2.77	<0.001	2.37 to 3.22
60–69	4.12	<0.001	3.48 to 4.87
70+	6.23	<0.001	5.17 to 7.52
Years of schooling (ref: none)			
<5	0.96	0.493	0.85 to 1.08
5	1.14	0.127	0.96 to 1.36
6–9	1.34	<0.001	1.16 to 1.56
≥10	1.14	0.175	0.94 to 1.37
Rural (ref: urban)	0.88	0.040	0.78 to 0.99
Wealth quintiles (ref: lowest)			
Second	1.02	0.845	0.87 to 1.19
Middle	1.12	0.173	0.95 to 1.31
Fourth	1.07	0.409	0.91 to 1.26
Highest	1.46	<0.001	1.23 to 1.74
Nutritional status (ref: underweight)			
Normal	2.07	<0.001	1.82 to 2.37
Overweight	4.48	<0.001	3.77 to 5.32
Missing	2.43	<0.001	2.01 to 2.93
Region (ref: Western)			
Central	0.93	0.195	0.83 to 1.04
Eastern	0.85	0.011	0.75 to 0.96
Constant	0.05	<0.001	0.04 to 0.06
Observations used	12931	–	–
	(B) Predicted probabilities and corresponding p value and 95% CI		
	Predicted probability	**P value**	**95% CI**
Religion×BDHS year			
Muslim 2011	0.26	<0.001	0.24 to 0.27
Muslim 2017–2018	0.36	<0.001	0.34 to 0.37
Difference over year	0.10	<0.001	0.08 to 0.12
Hindu 2011	0.32	<0.001	0.28 to 0.35
Hindu 2017–2018	0.45	<0.001	0.41 to 0.49

Continued

Table 7 Continued

	(A) AOR and corresponding p value and 95% CI		
	AOR	P value	95% CI
Difference over year	0.13	<0.001	0.08 to 0.18

AORs, adjusted ORs; BDHS, Bangladesh Demographic and Health Survey.

diet, substance abuse, environmental pollution, etc.[12 71 72] One of the pathways of diabetes causing hypertension is that diabetes affects the kidneys. Kidney damage causes salt retention in the body, which may eventually cause hypertension. However, the low prevalence of diabetes is unlikely to affect hypertension prevalence significantly through this pathway. In our study, the similarity of diabetes prevalence among Hindus and Muslims complicates the finding of the higher prevalence of hypertension among Hindus, which has already been discussed.

By contrast, hypertension causes insulin resistance and increases the chance of a person being diabetic.[73] This further complicates the findings because the higher rates of hypertension among Hindus could be expected to yield higher prevalence of diabetes. However, the rates of diabetes in these two religious groups were similar in our study. Further, the higher adiposity, subscapular skinfold thickness, waist-to-hip ratio or central obesity, and abdominal fat typified in South Asian phenotype have been contributing factors to the development of type 2 diabetes in South Asian people.[74–76] We suspect that the effect of the South Asian phenotype on diabetes is stronger than the effect of hypertension on it, which kept the two religious groups at the same level for diabetes.

The comparison of Hindu–Muslim metabolic, behavioural, mental and environmental conditions could help explain the Hindu–Muslim difference in hypertension and similarity in diabetes. But the evidence gap in these areas limits the scope of related discussion. Further studies are essential to understand whether there are physiological, mental and behavioural differentials among

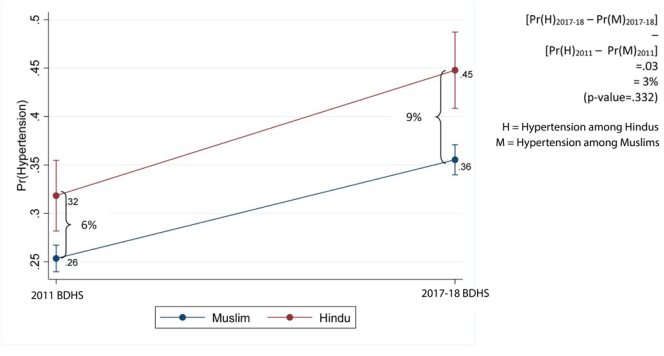

Figure 7 Multiple logit-based predicted probabilities of hypertension among Muslims and Hindus 35 years and above, by survey. Adjusted for sex, age, years of schooling, residence, wealth quintiles, nutritional status and region (table 7). BDHS, Bangladesh Demographic and Health Survey.

Hindus and Muslims that cause the Hindu–Muslim difference in hypertension and similarity in diabetes, or any other religious beliefs or practices that served as the sources of the differences.

Strengths

The study's main strength is its novelty—no study in Bangladesh has ever examined the religious differences in hypertension and diabetes. The study has also discussed a plot for further studies in this critical field. The other strengths are: it used well-recognised nationally representative survey data, used appropriate statistical methods, took care of complex survey design in analysis, etc.

Limitations

The sociodemographic characteristics of the non-response group who refused to provide biomarker samples differed little from the response group.[35 42] Therefore, the differences were unlikely to abruptly distort the generalisability of hypertension and diabetes estimates. Religious affiliation of around 10%–15% of the biomarker sample individuals remained unknown. This was because religion information was not collected in hypertension and diabetes sections. Ever-married women aged 15–49 years living in the surveyed household were interviewed using a separate questionnaire that collected data on religious affiliation. We assumed that the religious affiliation of the woman was the same as that of other household members, then, imported religious information to hypertension and diabetes section from the ever-married women section. Thus, religion information of the members in a household where there was no ever-married women aged 15–49 years remained unknown. It is unlikely to exist reasons for sociodemographic or biological differentials among biomarker sample individuals with and without an ever-married reproductive-aged female household member. Therefore, the exclusion of unknown religious affiliation cases from the analytical sample is unlikely to yield potential bias.

The major limitations remain in explaining the Hindu—Muslim difference in hypertension and similarity in diabetes. Neither data source used in this study had data on major risk factors of these two adverse health conditions, nor were there other data sources available on the risk factors, nor was there scientific evidence of Hindu—Muslim differentials in those risk factors. The World Bank-supported WHO STEPwise approach to NCD risk factor surveillance 2018 conducted by the National Institute of Preventive and Social Medicine collected hypertension and diabetes risk factor data[77]; however, we did not get access to the data to include in this study.

Policy implications

The prevalence of hypertension is high and increasing in Bangladesh, whereas levels of awareness, treatment, and control of both hypertension and diabetes continue to be low, especially among specific subgroups.[34 41] There are pertinent policy implications for Bangladesh, given the importance of addressing the rise in NCDs at a young age. Our paper

highlights the need to strengthen the health system to enable a targeted approach for preventing and managing hypertension and diabetes in Bangladesh among subgroups, such as religious minorities who are at higher risk. Effective prevention and management of hypertension in vulnerable groups will help lower morbidity and mortality rates in the long run. However, further research is needed to better understand the reasons for the higher observed risk of hypertension among the minority Hindus in Bangladesh, but not necessarily for other illnesses, such as diabetes, before a targeted approach can be effective.

CONCLUSION

Hindus are more hypertensive than Muslims in Bangladesh, but rates were similar for diabetes in both religious groups. Both religious groups had a similar rate of increase in hypertension prevalence between 2011 and 2017–2018. Religious minority status does not explain the higher level of hypertension in Hindus compared with Muslims because Hindus are more hypertensive in many Muslim-minority provinces in Hindu-majority India. The Hindu—Muslim health disparity calls for further research.

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Contributors MMH conceptualised the research problem. MIB compiled data and performed the formal analysis under the guidance of MMH. MMH and NK prepared the original draft. MMR and NA critically reviewed and provided constructive comments. MMH revised and edited the final draft. SHK provided useful comments. MMH, MMR, MIB and SHK responded to reviewers' comments. All authors reviewed the final draft and approved the final version. MMH takes responsibility for this study as guarantor.

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Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not required.

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