Heliyon 10 (2024) e33428

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

Research article

Religious minority status and risk of hypertension in women: Evidence from Bangladesh

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ARTICLE INFO

Keywords:
Religious minority
Communal violence
Collective trauma
Hypertension
Bangladesh

ABSTRACT

Discrimination based on religion and communal violence against religious minorities have been on the rise worldwide. Despite growing incidences of violence against religious minorities, little is known on the relationship between minority status and population health outcomes in the low-and-middle income countries (LMICs). This study intends to fill this gap by assessing the prevalence of hypertension among religious minority women in Bangladesh, a South Asian country with high levels of social hostilities involving religion. Using data from the Bangladesh Demographic and Health Survey (BDHS) 2017–18, we examined whether religious minority women had a differential risk of having hypertension. We estimated logistic regression models to obtain the odds in favor of being hypertensive among women aged 18–49 years and compared the odds for religious minority women with that of their non-minority counterparts. We then estimated linear regression models to examine how average systolic- and diastolic-blood pressure measures differ across minority and non-minority women. We found that the odds of being hypertensive for minority women were 1.43 (95 % CI: 1.14–1.79) times that of their non-minority counterparts. The adjusted odds ratio was very similar, 1.45 (95 % CI: 1.14–1.84), when various sociodemographic and other risk factors were accounted for. The conditional average SBP and DBP levels were respectively 3.42 mmHg (95 % CI: 1.64–5.20) and 1.44 mmHg (95 % CI: 0.37–2.51) higher among minority women. Thus, we found evidence that religious minority women in Bangladesh had a disproportionately higher risk of having hypertension compared to their non-minority peers. These results call for further research on psychological distress from systematic discrimination and collective trauma among religious minorities in Bangladesh.

1. Introduction

Hypertension is one of the major risk factors for cardiovascular diseases (CVD) [1], the leading cause of premature deaths worldwide [2]. In recent decades, the burden of hypertension has been gradually increasing in many low-and-middle income countries (LMICs) [3]. The shift of the burden from high-to low-income countries resulted in widening of global disparities in population level hypertension management entailing screening, awareness, treatment, and control [4,5]. Further, social vulnerabilities and region-specific challenges such as wars, conflict, migration, etc. contributed to the growing inequities and disparities in hypertension

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https://doi.org/10.1016/j.heliyon.2024.e33428
Received 8 February 2023; Received in revised form 14 June 2024; Accepted 21 June 2024
Available online 22 June 2024
2405-8440/

outcomes in these countries [6,7]. As such, vulnerable groups and marginalized communities within a country or region may have a differential risk of hypertension compared to that in the general population. While evidence on the racial and ethnic disparities in hypertension in the United States and in other developed countries is well documented [8,9], our knowledge is limited on the hypertension risk among marginalized populations in the LMICs.

Religious minorities around the world can be regarded as vulnerable groups as they often face various forms of persecution and social exclusion [10]. Discrimination based on religion and acts of violence against religious minorities have been on the rise – intensifying social hostility in many countries across the globe [11]. In recognition of the intolerance and violence against religious minorities around the world, the United Nations General Assembly designates August 22 as the "International Day Commemorating the Victims of Acts of Violence Based on Religion or Belief" [12]. Despite growing incidences of violence against religious minorities, little is known on the relationship between religious minority status and population health outcomes in the LMICs. This study intends to delve into this issue by assessing the prevalence of hypertension among religious minority women in Bangladesh, a South Asian country with high levels of social hostilities involving religion [13].

The major religions in Bangladesh are Islam, Hinduism, Buddhism, and Christianity. Muslims constitute more than 90 % of population, while nearly 9 % are Hindus, and the rest are Buddhists and Christians [14]. Religious minorities thus constitute around 10 % of the population, majority of whom are Hindus. Bangladesh was born as a secular state in 1971 and "secularism" was one of the four fundamental principles of the original constitution of Bangladesh. In 1979, the constitution was amended to remove the fundamental principle of secularism; and in 1988, Islam was declared as the state religion [15]. Following these constitutional changes, two widescale events of communal persecution against Hindus occurred in Bangladesh in 1990 and 1992 [16]. Since then, the religious minorities in Bangladesh have been suffering from systematic discrimination in forms of violence, oppression, and threats/incitement – exacerbated by police malpractice and judicial failure [17].

The rise of Islamic extremism in mid-1990's and early 2000's resulted in organized and persisted violence against religious minorities in Bangladesh [18]. In the aftermath of the 2001 general election, religious minorities, especially Hindus, were victims of post-election violence and communal atrocities that include being beaten up and terrorized, looting of households, and rape and abduction of women [19,20]. Religious minorities have been ousted from their houses and lands, and their places of worship were attacked and vandalized on regular basis [21,22]. Spreading rumors and disinformation in social media for agitating the mob against religious minority communities further intensified the episodic violence against minority people in Bangladesh in recent years [23]. Further, victims reported ineffectiveness of the government in preventing these incidents [24] and denial of justice in prosecuting the perpetrators [25].

Being victims of such systematic discrimination and collective trauma can create psychological distress [26], which could increase the risk of chronic conditions [27] in religious minorities. As such, the aim of this study is to examine whether religious minority women in Bangladesh had a differential risk of being hypertensive compared to their majority counterparts. The premise of our investigation is that the differential odds could be potentially due to the exposure to elevated psychological distress associated with the religious minority status. While we could not directly assess the link between hypertension and religious minority status in relation to discrimination and collective trauma, we wanted to assess whether the differential risk in the minority group persisted after accounting for other socioeconomic, demographic, and health risk factors of hypertension. In other words, we sought to eliminate other potential risk factors of hypertension than psychological distress due to discrimination and collective trauma, so that the differential odds for religious minority status could supposedly be ascribed to religious suppression.

In doing so, we considered two approaches. First, we assessed the relationship between religious minority status and hypertension with accounting for other cardiometabolic risks, namely diabetes and obesity, along with demographic and socioeconomic attributes. These two cardiometabolic conditions are major risk factors for hypertension [28]. Measures of diabetes and obesity are also closely tied with diet and other lifestyle behaviors [29]. As such, these conditions, together with other sociodemographic attributes, serve as proxies to lifestyle factors impacting hypertension outcome in women. In the first approach, we asserted that if a positive association between religious minority status and hypertension is observed after accounting for cardiometabolic risks and other socioeconomic and demographic factors, the relationship is likely to be driven by psychological distress potentially emanating from religious suppression [30]. Second, we examined whether religious minority status was independently associated with the risk of diabetes and obesity. In this approach, we asserted that if religious minority status is not associated with diabetes and obesity, its relationship with hypertension is channeled through some other avenues than lifestyle factors related to religious minority status after accounting for socioeconomic and demographic attributes. Psychological distress emanating from collective trauma could be one such avenue [31] directing this relationship in the study population.

Of note, extant evidence on the risk factors of hypertension among Bangladeshi adults identified age, overweight and obesity, and diabetes comorbidity as key determinants of hypertension in the Bangladeshi population [32,33]. In terms of socioeconomic inequalities, hypertension was reported to be more prevalent among wealthier individuals living in urban areas in certain geographic parts of the country [34]. Our approach that accounts for diabetes and obesity along with age as a demographic attribute, and household wealth, geographic location, and urban/rural residence as socioeconomic attributes, therefore, covers all key observed determinants of hypertension in the Bangladeshi population. As such, any remaining association between religious minority status and hypertension, after adjusting for these key risk factors, can be considered attributable to other differences between minority and non-minority women. For Hindu, Buddhist, and Christian women of Bangladesh, based on current evidence, that most visible difference appears to be exposure to religious suppression in various forms [35].

A recent study reported that Muslim females, and Hindu -males and -females had greater odds of hypertension, compared to that of Muslim males in Bangladesh [36]. While the study showed Hindu-Muslim disparities in hypertension outcome, it didn't bring the issue of religious suppression to the forefront by assessing the relationship net of other risk factors. Neither did the study include Buddhist and Christians, who along with Hindus experience religious discrimination and violence in Bangladesh [37]. Further, having both males and females in the same analysis tangled religious identity with persistent gender bias against women in Bangladesh [38], which complicated the interpretation of religious disparity in that study. In contrast, our approach in the current study aims to offer a clearer assessment of the relationship between religious minority status and hypertension outcome among Bangladeshi women by focusing on the elephant in the room, which is discrimination and violence against Hindus, Buddhists, and Christians.

2. Methods

2.1. Conceptual framework

The conceptual framework of our analysis is presented in Fig. 1. Religious minorities often experience different forms of violence and religious discrimination [10,39]. Such events could contribute to collective trauma via direct and indirect exposure [40,41], causing psychological distress in the minority population [42,43]. As such, religious minority status can impact cardiometabolic risks (e.g., hypertension, high blood glucose, dyslipidemia, obesity, etc.) through adverse mental health conditions [44]. Psychological distress can impact health behaviors as well, [45] which can influence cardiometabolic risks [46,47]. Additionally certain cardiometabolic conditions, namely diabetes and obesity are regarded as risk factors for hypertension [28]. All together, religious minority status can be associated with hypertension through a direct channel of psychological distress and/or through an indirect channel of other cardiometabolic risks or morbidity. This essentially assumes that the influence of lifestyle behaviors on hypertension is primarily mediated by the other cardiometabolic risks that are risk factors for hypertension. The remaining influence of lifestyle factors, if any, are absorbed by the sociodemographic attributes. As such, controlling for the measures of cardiometabolic risks related to hypertension (e.g., fasting blood glucose level categories and body mass index categories), and sociodemographic correlates (e.g., age, education, income, urban/rural residence, etc.) in the model, will deliver an estimate of the association between hypertension and religious minority status, which can be deemed attributable to psychological distress causing from the latter.

2.2. Study population and design

In this observational study, we used cross-sectional data from the Bangladesh Demographic and Health Survey (BDHS) 2017–18. The BDHS is a nationally representative survey that provides various sociodemographic and health indicators of ever married women aged 15 to 49, with a 98.8 % response rate [48]. Our study sample included data on 5138 women aged 18–49 years, for whom valid systolic and diastolic blood pressure measures were reported. We used anonymized publicly available secondary data for analyses. The survey protocols of the BDHS were approved by the ICF and Bangladesh Medical Research Council institutional review boards. Participation in the survey was voluntary and informed consent was obtained prior to each interview [48].

2.3. Measures

The BDHS reports respondent's religion. A respondent was determined as religious minority if reported religion was Hinduism, Buddhism, or Christianity. A respondent was determined as not religious minority if reported religion was Islam. Our exposure variable thus was a binary variable indicating minority status.

Respondent's systolic and diastolic blood pressures were measured three times during one visit with approximately 10 min interval between each measurement, using the LIFE SOURCE® UA-767 Plus BP monitor. Respondents were also asked if they were taking any anti-hypertensive medication. The average blood pressure measures were recorded as follows: average of the second and third measure if both were available; the third measure if the second was missing; the second measure if the third was missing; and the first measure if both second and third measures were missing. Respondents were classified as hypertensive if the average systolic blood pressure (SBP)

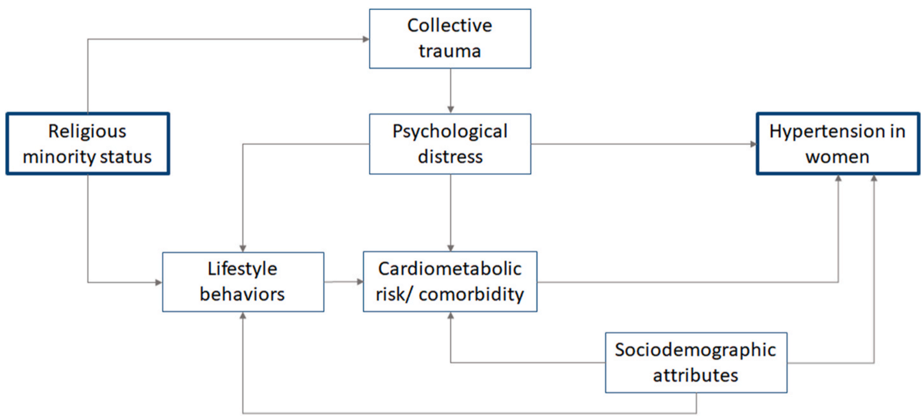

Fig. 1. Conceptual framework of the relationship between hypertension and religious minority status.

was greater or equal to 140 mmHg, or the diastolic blood pressure (DBP) was greater than or equal to 90 mmHg, or the respondent was taking anti-hypertensive medication at the time of the survey [48]. Our primary outcome variable thus was another binary variable indicating respondent's hypertension status. We also utilized continuous SBP and DBP measures as secondary outcomes.

Respondent's blood glucose was measured by obtaining capillary whole blood from middle or ring finger after overnight fasting. The third drop was taken for measurement after first two drops were wiped away. The blood sample was analyzed using HemoCue 201 RT analyzer. In accordance with the World Health Organization cut-off points, a respondent was classified as having diabetes if fasting plasma glucose (FPG) value $\geq$ 7.0 mmol/L [29]. The BDHS also collects respondent's height and weight measures and reports the Body Mass Index (BMI). A respondent was determined to be obese if BMI $\geq$30.0 kg/m^2. Like our primary outcome measure, variables indicating diabetes and obesity conditions were also binary variables. In addition, like secondary outcomes, continuous FPG and BMI measures were also assessed.

2.4. Statistical analysis

We estimated logistic regression models to obtain the odds in favor of being hypertensive for religious minority status. We compared the odds in favor of being hypertensive for religious minority women with that of their non-minority counterparts. We then estimated linear regression models to examine how average SBP and DBP measures differed across minority and non-minority women. A positive and statistically significant estimate ($p < 0.05$) of the minority-status indicator variable in these specifications is indicative of higher risk of hypertension among minority women.

Next, we estimated three multivariable specifications both for the logistic and the linear models – controlling for various socio-demographic and anthropometric correlates. In model-I, we controlled for individual level characteristics including age; educational attainment - primary or no education (reference category), secondary, and higher; employment status – not employed (reference

Table 1
Sociodemographic characteristics of the study participants and prevalence of hypertension by minority status.

	Demographic characteristics			Hypertension prevalence		
	All	Not minority	Minority	All	Not minority	Minority
	Share (%)			Share (%)		
Education						
No education	17.205	17.029	18.854	30.882	29.670	41.132†
	(0.681)	(0.710)	(2.337)	(1.805)	(1.880)	(5.338)
Primary	31.215	31.688	26.781	23.374	22.715	30.668
	(0.789)	(0.820)	(2.594)	(1.181)	(1.228)	(4.371)
Secondary	38.653	39.055	34.895	18.909	18.413	24.107
	(0.849)	(0.899)	(2.361)	(0.959)	(0.988)	(3.347)
Higher	12.927	12.228	19.470†	16.978	16.616	19.107
	(0.637)	(0.604)	(2.797)	(1.482)	(1.584)	(3.860)
Employment						
Not employed	48.326	49.157	40.547†	22.068	21.813	24.953
	(1.198)	(1.280)	(3.641)	(0.951)	(0.992)	(3.381)
Employed	51.674	50.843	59.453†	22.155	21.145	30.248†
	(1.198)	(1.280)	(3.641)	(0.914)	(0.945)	(3.055)
Marital status						
Married	94.275	94.275	94.277	21.847	21.106	28.794†
	(0.349)	(0.372)	(1.010)	(0.674)	(0.710)	(2.167)
Widowed/divorced/separated	5.725	5.725	5.723	26.485	27.531	16.685
	(0.349)	(0.372)	(1.010)	(2.855)	(3.067)	(6.542)
Wealth Index Quintiles						
1st (poorest)	19.072	18.073	28.426†	18.77	17.483	26.433†
	(0.964)	(0.963)	(3.587)	(1.472)	(1.623)	(3.819)
2nd (poorer)	19.673	19.818	18.311	20.354	19.563	28.367
	(0.807)	(0.864)	(2.225)	(1.389)	(1.435)	(5.110)
3rd (middle)	19.932	20.009	19.212	21.842	21.347	26.667
	(0.769)	(0.805)	(2.421)	(1.442)	(1.507)	(5.271)
4th (richer)	20.065	20.458	16.385	22.869	22.457	27.689
	(0.847)	(0.904)	(2.268)	(1.456)	(1.536)	(4.965)
5th (richest)	21.258	21.642	17.665	26.28	25.742	32.449
	(0.955)	(0.998)	(3.547)	(1.445)	(1.497)	(5.034)
Residence						
Rural	72.083	71.449	78.016	21.625	21.041	26.629†
	(0.568)	(0.707)	(3.723)	(0.808)	(0.863)	(2.499)
Urban	27.917	28.551	21.984	23.373	22.555	33.324†
	(0.568)	(0.707)	(3.723)	(1.162)	(1.200)	(3.243)
Observations	5138	4617	521	5138	4617	521

Note: Linearized standard errors are in parenthesis. Estimates were obtained using complex survey weights. † refers to statistically significant ($p < 0.05$) difference between non-minority and minority group.

category) and employed; and marital status – married (reference category) and widowed/divorced/separated. In model-II, in addition to the individual level correlates, we controlled for the following household level characteristics: household size – ≤ 3 (reference category), 4 to 5, 6 to 9, and 10+; household wealth index quintiles – 1st - poorest (reference category), 2nd - poorer, 3rd - middle, 4th - richer, and 5th - richest; and region of residence – rural (reference category) and urban. We also controlled for administrative division fixed effects to account for regional differences in diet and other behavioral factors.

In model-III, along with individual and household characteristics, we controlled for two cardiometabolic risks associated with hypertension as follows: i) body mass index (BMI) categories – normal: BMI 18.5–24.9 kg/m^2 (reference category), thin: BMI <18.5 kg/m^2, overweight: BMI 25.0–29.9 kg/m^2, and obese: BMI ≥30.0 kg/m^2; and ii) fasting blood glucose level categories – normoglycemia (3.9–6.0 mmol/L) (reference category), hypoglycemia (<3.9 mmol/L), intermediate hyperglycemia (6.1–6.9 mmol/L), and elevated hyperglycemia (≥7.0 mmol/L). Additionally, we controlled for other risk factors for hypertension in women, namely, parity (i.e., number of births) – 0 (reference category), 1, 2, and 3+; and pregnancy status – not pregnant (reference category) and pregnant. Of note, we did not intend to assess these correlates as predictors of hypertension or SBP and DBP, rather we accounted for these correlates to obtain the association between hypertension and religious minority status attributable to the psychological distress as per the proposed conceptual framework.

Lastly, we estimated the logistic regression models for the following outcomes: i) diabetic and ii) obese; and the linear regression models for the following outcomes: i) FPG level and ii) BMI. An estimate of the minority-status indicator variable, in each of these specifications, which is not statistically significant ($p > 0.10$), is suggestive of no association between minority status and the respective conditions. All models were estimated using complex survey weights that entail the two-stage stratified sampling framework of the BDHS.

3. Results

3.1. Descriptive results

About one in ten women in our sample was religious minority. Average age of women in our sample was 31.7 years. Average age was 33.2 years and 31.7 years respectively among minority and non-minority women. Other sociodemographic characteristics of the study population and hypertension prevalence by sociodemographic characteristics are presented in Table 1. Minority women had a greater concentration in the poorest wealth quintile than their non-minority counterparts. However, minority women were more likely to have higher educational attainment and being employed than non-minority women.

The overall prevalence of hypertension among married women in our study population was 22.1 %. While the prevalence was 21.5 % among non-minority women, it was 6.6%-points higher ($p < 0.01$) among minority women. However, no such difference was observed for diabetes prevalence (8.4 % among non-minority vs. 7.9 % among minority, $p = 0.71$) or obesity prevalence (7.0 % among

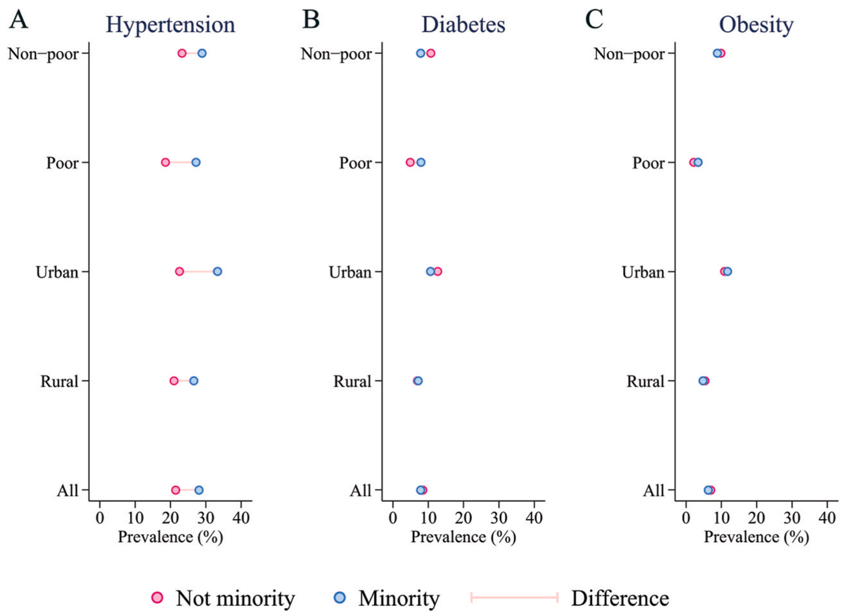

Fig. 2. Prevalence of hypertension and other cardiometabolic conditions by religious minority status. (A) Hypertension prevalence. (B) Diabetes prevalence. (C) Obesity prevalence. Note: Estimates were obtained using complex survey weights. The differences in hypertension prevalence between minority and not-minority women were statistically significant ($p < 0.05$) for all groups expect for non-poor ($p > 0.05$). The differences in diabetes prevalence and obesity prevalence between minority and not-minority women were not statistically significant ($p > 0.1$) for any of the groups.

non-minority vs. 6.3 % among minority, $p = 0.59$). The statistically significant differences in hypertension prevalence among non-minority and minority women were evident across non-poor and poor, and rural and urban subgroups (Fig. 2).

On the contrary, no significant differences in diabetes or obesity prevalence among non-minority and minority women were observed in any sub-groups. However, in line with the existing evidence, both diabetes and obesity were found significantly associated with hypertension in our sample. Hypertension prevalence among diabetic women in the sample was 39.0 %, significantly higher than that of 20.5 % in women who were not diabetic. Similarly, hypertension prevalence was significantly higher among women who were obese compared to women with BMI less than 30.0 kg/m^2 (40.3 % vs. 20.7 %).

Fig. 3 illustrates the distribution of SBP and DBP, as well as FPG and BMI by non-minority and minority group. The average (arithmetic mean) SBP among minority women was 121 mmHg, which was 4 points higher ($p < 0.01$) than that among non-minority women. Similarly, the average DBP among minority women was 82 mmHg–2.0 points higher ($p < 0.01$) than that in non-minority women. The average FPG, on the other hand, was 5.7 mmol/L among both non-minority and minority women, and the average BMI was respectively 23.4 kg/m^2 and 23.1 kg/m^2 among non-minority and minority women. We further performed two-sample Kolmogorov–Smirnov tests, separately for SBP, DBP, FPG, and BMI, to test the equality of distributions by minority status. For FPG and BMI, we could not reject the hypothesis that the two samples are equal (p-values for the combined test were 0.928 and 0.204 respectively). Conversely, the hypothesis of equality of distributions were rejected for SBP and DBP (p-values for the combined test were <0.01) suggesting that the distributions were different across minority and non-minority women.

3.2. Regression results

The unadjusted and adjusted odds ratios in favor of being hypertensive are presented in Table 2. The odds of being hypertensive for minority women were 1.43 times that of their non-minority counterparts. The crude odds increased with age and were higher among women with overweight and obesity, and elevated hyperglycemia. The crude odds were also higher for women from wealthier households and among women who gave birth multiple times. When these sociodemographic correlates, along with measures of cardiometabolic risks, were accounted for, the adjusted odds in favor of being hypertensive for minority status were found to be 1.45 –

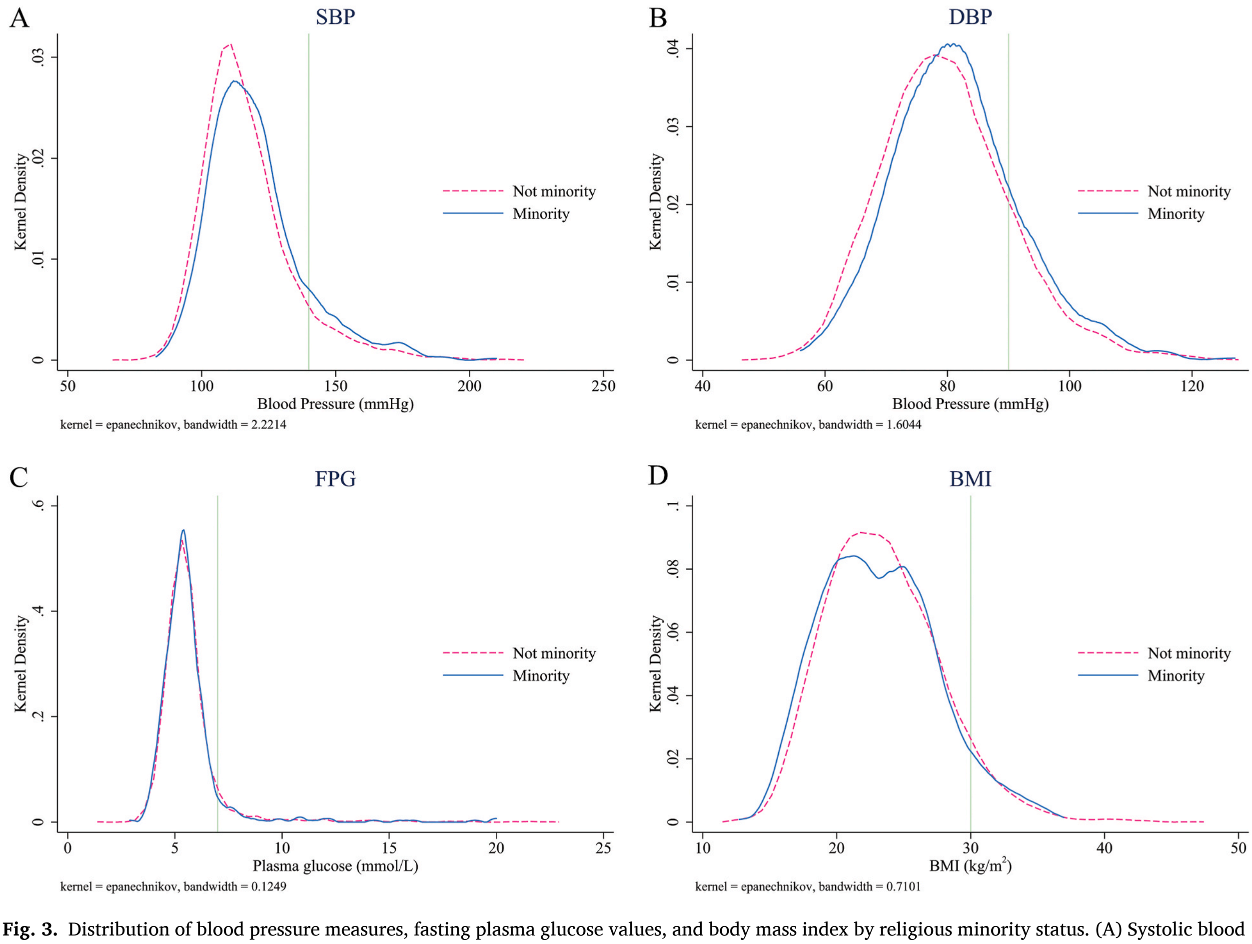

Fig. 3. Distribution of blood pressure measures, fasting plasma glucose values, and body mass index by religious minority status. (A) Systolic blood pressure. (B) Diastolic Blood Pressure. (C) Fasting plasma glucose. (D) Body mass index. Note: Hypertension status is determined as SBP ≥140 mmHG or DBP ≥90 mmHG. Diabetes status is determined as FPG ≥7.0 mmol/L. Obesity status is determined as BMI ≥30.0 kg/m^2.

Table 2
Crude and adjusted odds ratios in favor of being hypertensive.

	Crude Odds Ratio	Adjusted Odds Ratio		
		Model I: Individual Characteristics	Model II: Individual-, Household Characteristics	Model III: Individual-, Household Characteristics, Risk factors
Religious minority	1.429**	1.321*	1.340*	1.445**
	(1.144, 1.785)	(1.045, 1.670)	(1.070, 1.677)	(1.137, 1.836)
Age	1.091***	1.098***	1.092***	1.073***
	(1.081, 1.101)	(1.088, 1.109)	(1.082, 1.103)	(1.059, 1.088)
Education				
No education	Ref.	Ref.	Ref.	Ref.
Primary	0.683***	1.089	1.023	0.874
	(0.555, 0.839)	(0.871, 1.362)	(0.811, 1.290)	(0.688, 1.111)
Secondary	0.522***	1.288*	1.073	0.910
	(0.430, 0.634)	(1.031, 1.610)	(0.843, 1.366)	(0.702, 1.180)
Higher	0.458***	1.117	0.806	0.756
	(0.352, 0.596)	(0.827, 1.507)	(0.578, 1.124)	(0.528, 1.083)
Employment				
Not employed	Ref.	Ref.	Ref.	Ref.
Employed	1.005	0.799**	0.834*	0.919
	(0.866, 1.166)	(0.680, 0.938)	(0.705, 0.987)	(0.764, 1.106)
Marital status				
Married	Ref.	Ref.	Ref.	Ref.
Widowed/divorced/separated	1.289	0.874	0.838	0.897
	(0.964, 1.724)	(0.638, 1.197)	(0.607, 1.158)	(0.636, 1.266)
Household size				
3 or less	Ref.		Ref.	Ref.
4 to 5	0.875		0.852	0.750*
	(0.725, 1.055)		(0.699, 1.039)	(0.599, 0.940)
6 to 9	0.746**		0.764*	0.703**
	(0.612, 0.910)		(0.615, 0.950)	(0.552, 0.895)
10 or more	0.575**		0.668	0.682
	(0.383, 0.863)		(0.423, 1.055)	(0.424, 1.098)
Wealth index quintiles				
Poorest	Ref.		Ref.	Ref.
Poorer	1.106		1.109	1.117
	(0.849, 1.441)		(0.833, 1.474)	(0.820, 1.521)
Middle	1.209		1.271	1.254
	(0.940, 1.556)		(0.963, 1.676)	(0.936, 1.681)
Richer	1.283*		1.512**	1.359
	(1.011, 1.629)		(1.143, 2.001)	(0.993, 1.861)
Richest	1.543***		1.769***	1.233
	(1.217, 1.956)		(1.299, 2.409)	(0.872, 1.744)
Residence				
Rural	Ref.		Ref.	Ref.
Urban	1.106		1.032	1.117
	(0.944, 1.295)		(0.856, 1.244)	(0.917, 1.361)
BMI				
Normal (18.5–24.9)	Ref.			Ref.
Thin (<18.5)	0.545***			0.528***
	(0.395, 0.751)			(0.373, 0.748)
Overweight (25.0–29.9)	2.584***			2.263***
	(2.176, 3.069)			(1.863, 2.748)
Obese (≥30.0)	3.395***			2.622***
	(2.618, 4.402)			(1.978, 3.476)
FPG level				
Normoglycemia	Ref.			Ref.
Hypoglycemia	0.566			0.921
	(0.281, 1.140)			(0.416, 2.039)
Intermediate Hyperglycemia	1.155			0.928
	(0.899, 1.485)			(0.703, 1.224)
Elevated Hyperglycemia	2.382***			1.590***
	(1.854, 3.061)			(1.213, 2.085)
Parity				
0	Ref.			Ref.
1	0.927			0.811
	(0.634, 1.355)			(0.518, 1.269)
2	2.042***			1.024

(*continued on next page*)

Table 2 (*continued*)

	Crude Odds Ratio	Adjusted Odds Ratio		
		Model I: Individual Characteristics	Model II: Individual-, Household Characteristics	Model III: Individual-, Household Characteristics, Risk factors
	(1.472, 2.834)			(0.685, 1.530)
3+	3.360***			1.225
	(2.417, 4.671)			(0.781, 1.923)
Pregnancy status				
Not pregnant	Ref.			Ref.
Pregnant	0.256***			0.543*
	(0.152, 0.429)			(0.310, 0.950)
Observations	5138	5138	5138	4695

Note: 95 % confidence intervals are in parenthesis. ***p < 0.001, **p < 0.01, *p < 0.05. Estimates were obtained using complex survey weights. BMI measures were not available for 15 respondents. FPG measures were not available for 431 respondents.

very similar to the unadjusted estimate.

Results for the SBP and DBP measures are presented in Table 3. The average SBP and DBP levels were respectively 4.19 mmHg and 1.90 mmHg higher among minority women. These estimates remained significant but slightly smaller – 3.42 mmHg and 1.44 mmHg respectively, when the sociodemographic correlates and measures of cardiometabolic risks were accounted for.

Estimates for the diabetes and obesity outcomes are presented in Table 4. Neither the unadjusted nor the adjusted odds in favor of being diabetic or being obese were different for the minority women than that of their non-minority counterparts. Neither of the unadjusted or adjusted average marginal effects for FPG or BMI were statistically significant for the minority indicator variable. Thus, unlike the hypertension outcome, no differences in diabetes or obesity outcomes were observed between the non-minority and minority group.

4. Discussion

In this study, we found evidence that minority women in Bangladesh had a disproportionately higher risk of being hypertensive compared to their non-minority counterparts after accounting for demographic, socioeconomic, and cardiometabolic risk factors. No differences between minority and non-minority women, however, were observed for the risk of being diabetic and obese – two conditions that are closely tied to hypertension.

Obesity is a major cause of essential or primary hypertension [49]. Prevalence of hypertension is also common among patients with diabetes [50]. Our findings, that the risk of obesity and diabetes among non-minority women was not different from that in minority women, suggested an interesting inference on the increased risk of hypertension in the latter group. It indicated that the difference in hypertension prevalence between the two groups was not potentially due to differential cardiometabolic risks, and thereby not potentially due to different behavioral and lifestyle factors. Given the known risk factors of hypertension in the Bangladeshi population [32,33], cardiometabolic conditions along with demographic and socioeconomic attributes could be considered as a reasonable proxy for lifestyle factors impacting hypertension outcomes. As such, the difference in hypertension prevalence appeared to be due to some factors beyond lifestyle differences between the minority and non-minority population. In this context, persistent and systematic religious discrimination, and violence against religious minorities, which by far are the most evident differences between the two groups, seemed to play a critical role in shaping the differential risks of hypertension.

Under our proposed framework, these results are supportive of the assertion that psychosocial distress, a risk factor for elevated blood pressure [51,52], could be a potential pathway of the relationship between hypertension and minority status in Bangladesh. The mechanism may entail a direct pathway of activation of the sympathetic nervous system and hypothalamic pituitary adrenal axis, as well as indirect pathways of unhealthy lifestyles as coping mechanism for stress [53]. Religious minorities in Bangladesh have been facing various forms of discrimination and persecution, which could cause chronic stress as well as many other psychological disorders [54,55]. As such, victims of structural violence and persecution could be vulnerable to the heightened risk of developing hypertension.

Evidence from extant literature suggests a strong association between psychological distress and perceived racism or racial discrimination [56,57]. Racial-related adversities are also related to suppressed feeling and anxiety [58,59], which could play a role in developing hypertension [60]. As such, exposure to racial discrimination in forms of negative attitudes and differential treatment has links to high stress and hypertension among racial minorities [61–63]. Similar analogy may explain the higher risk of hypertension among religious minorities in Bangladesh after accounting other known risk factors. Of note, the largest effect size of racial discrimination was previously reported in night-time SBP and DBP recordings [51]. Our results, by picking up notable differences in office blood pressure recordings, suggest a significant association between religious discrimination and hypertension in the study population.

Our findings thus add to the large body of literature documenting the negative relationship between racial discrimination and health outcomes [64–67]. Most of these studies, however, were conducted in the developed countries and the association in the LMICs were less visited. We expand the literature by evaluating the relationship between religious minority status and hypertension outcome

Table 3
Regression results for systolic and diastolic blood pressure measures.

	Systolic Blood Pressure		Diastolic Blood Pressure	
	Unadjusted	Adjusted	Unadjusted	Adjusted
Religious minority	4.189***	3.416***	1.897***	1.437**
	(2.226, 6.152)	(1.637, 5.195)	(0.772, 3.023)	(0.368, 2.505)
Age	0.711***	0.613***	0.379***	0.255***
	(0.650, 0.772)	(0.520, 0.706)	(0.343, 0.416)	(0.199, 0.310)
Education				
No education	Ref.	Ref.	Ref.	Ref.
Primary	−3.751***	0.001	−1.797***	−0.216
	(−5.441, −2.060)	(−1.713, 1.715)	(−2.761, −0.833)	(−1.234, 0.803)
Secondary	−7.181***	−0.971	−3.380***	−0.702
	(−8.768, −5.593)	(−2.792, 0.850)	(−4.331, −2.430)	(−1.860, 0.456)
Higher	−8.278***	−2.793*	−3.589***	−1.246
	(−10.084, −6.472)	(−5.039, −0.547)	(−4.717, −2.462)	(−2.699, 0.207)
Employment				
Not employed	Ref.	Ref.	Ref.	Ref.
Employed	1.473**	−0.167	0.628*	−0.071
	(0.483, 2.464)	(−1.240, 0.906)	(0.002, 1.254)	(−0.744, 0.602)
Marital status				
Married	Ref.	Ref.	Ref.	Ref.
Widowed/divorced/separated	1.997	−1.968	0.716	−1.313*
	(−0.303, 4.297)	(−4.195, 0.259)	(−0.588, 2.021)	(−2.569, −0.057)
Household size				
3 or less	Ref.	Ref.	Ref.	Ref.
4 to 5	−0.839	−0.927	−0.331	−0.829*
	(−2.259, 0.580)	(−2.315, 0.460)	(−1.174, 0.511)	(−1.639, −0.018)
6 to 9	−2.639***	−1.625*	−1.516***	−1.528***
	(−4.095, −1.183)	(−3.072, −0.178)	(−2.409, −0.623)	(−2.414, −0.643)
10 or more	−4.708***	−1.388	−2.742***	−1.583*
	(−7.146, −2.270)	(−3.727, 0.951)	(−4.360, −1.125)	(−3.074, −0.091)
Wealth index quintiles				
Poorest	Ref.	Ref.	Ref.	Ref.
Poorer	−0.046	−0.147	0.132	−0.118
	(−1.781, 1.689)	(−1.757, 1.464)	(−0.982, 1.247)	(−1.189, 0.953)
Middle	0.281	−0.032	0.451	−0.021
	(−1.446, 2.008)	(−1.727, 1.663)	(−0.688, 1.589)	(−1.138, 1.096)
Richer	0.040	0.236	0.837	0.440
	(−1.679, 1.759)	(−1.588, 2.060)	(−0.299, 1.973)	(−0.749, 1.629)
Richest	1.515	0.154	2.072***	0.336
	(−0.086, 3.116)	(−1.848, 2.156)	(1.016, 3.128)	(−0.928, 1.600)
Residence				
Rural	Ref.	Ref.	Ref.	Ref.
Urban	0.197	0.367	0.688	0.464
	(−0.920, 1.315)	(−0.846, 1.579)	(−0.055, 1.431)	(−0.328, 1.257)
BMI				
Normal (18.5–24.9)	Ref.	Ref.	Ref.	Ref.
Thin (<18.5)	−4.996***	−4.989***	−3.891***	−3.864***
	(−6.458, −3.534)	(−6.434, −3.545)	(−4.920, −2.863)	(−4.933, −2.795)
Overweight (25.0–29.9)	6.998***	5.283***	5.273***	4.350***
	(5.718, 8.279)	(4.032, 6.534)	(4.534, 6.011)	(3.613, 5.086)
Obese (≥30.0)	7.878***	4.983***	6.870***	5.292***
	(5.821, 9.935)	(3.018, 6.947)	(5.570, 8.170)	(3.990, 6.593)
FPG level				
Normoglycemia	Ref.	Ref.	Ref.	Ref.
Hypoglycemia	−5.866**	−2.490	−3.473**	−0.748
	(−9.475, −2.257)	(−5.818, 0.837)	(−5.916, −1.030)	(−2.813, 1.318)
Intermediate Hyperglycemia	1.129	−0.579	0.848	−0.146
	(−0.577, 2.835)	(−2.211, 1.053)	(−0.234, 1.930)	(−1.174, 0.881)
Elevated Hyperglycemia	7.336***	3.503**	4.431***	1.942**
	(5.063, 9.609)	(1.414, 5.592)	(3.050, 5.813)	(0.632, 3.252)
Parity				
0	Ref.	Ref.	Ref.	Ref.
1	−0.611	−2.699**	0.223	−1.024
	(−2.325, 1.102)	(−4.344, −1.054)	(−0.867, 1.313)	(−2.113, 0.065)
2	4.633***	−2.939**	3.533***	−0.538
	(2.906, 6.360)	(−4.754, −1.124)	(2.459, 4.607)	(−1.681, 0.605)
3+	8.575***	−3.046**	5.662***	0.065
	(6.883, 10.267)	(−5.231, −0.861)	(4.586, 6.738)	(−1.261, 1.392)
Pregnancy status				

(*continued on next page*)

Table 3 (*continued*)

	Systolic Blood Pressure		Diastolic Blood Pressure	
	Unadjusted	Adjusted	Unadjusted	Adjusted
Not pregnant	Ref.	Ref.	Ref.	Ref.
Pregnant	−10.440***	−5.940***	−7.803***	−5.343***
	(−12.138, −8.742)	(−7.740, −4.140)	(−9.062, −6.545)	(−6.663, −4.023)
Observations	5138	4695	5138	4695

Note: 95 % confidence intervals are in parenthesis. ***p < 0.001, **p < 0.01, *p < 0.05. Estimates were obtained using complex survey weights. The multivariable specifications controlled for administrative division fixed effets. Average systolic blood pressure is 117 mmHg and the average diastolic blood pressure is 80 mmHg.

Table 4
Regression results for diabetes and obesity prevalence and fasting blood glucose level and body mass index.

	Diabetes prevalence		Fasting plasma glucose level	
	Unadjusted OR	Adjusted OR	Unadjusted ME	Adjusted ME
Religious minority	0.923	0.948	0.029	0.057
	(0.596, 1.431)	(0.609, 1.475)	(-0.180, 0.237)	(-0.143, 0.256)
Observations	4858	4846	4851	4839
	Obesity prevalence		**Body Mass Index**	
	Unadjusted OR	Adjusted OR	Unadjusted ME	Adjusted ME
Religious minority	0.902	1.010	−0.329	−0.204
	(0.607, 1.339)	(0.668, 1.526)	(-0.752, 0.094)	(-0.552, 0.143)
Observations	5123	4695	5123	4695

Note: 95 % confidence intervals are in parenthesis. Estimates were obtained using complex survey weights. The adjusted estimates were obtained by controlling for age, educational attainment, employment status, marital status, household size, household wealth index quintiles, urban/rural residence, current pregnancy status, division fixed effects, BMI group (for diabetes prevalence and fasting plasma glucose level outcomes only), and FPG group (for obesity prevalence and body mass index level outcomes only).

in a developing country setting. Of note, hypertension is a major risk factor for CVD [68]. A recent study that assessed 10-years cardiovascular risk in Bangladeshi population, reported that being non-Muslim women was associated with elevated risk of CVD [69]. Our findings that religious minority women in Bangladesh had a greater risk of hypertension thus, are in concordance with the extant evidence on the CVD risk in the Bangladeshi population.

4.1. *Strengths and limitations*

Our results, however, should be interpreted with some caution since many complex confounding factors may contribute to the differential risk of hypertension in the minority population. Though we controlled for a rich set of sociodemographic, socioeconomic, and health correlates in our analyses, we could not claim that this list was exhaustive.

A limitation of our analysis is that due to data unavailability we could not evaluate mental health conditions or stress outcomes in religious minority women. Future research using appropriate data may explore the link between religious minority status and psychological disorder among Bangladeshi women, which will further enhance our understanding of this issue. The hypertension and diabetes conditions in the BDHS were not clinically diagnosed. However, these estimates provide good approximations of the population level risk of these conditions. In the data, we could not identify whether a respondent was directly impacted by any specific violent event. Rather, we assessed the difference in hypertension prevalence attributable to collective trauma that would result from nation-wide discriminatory treatment and atrocities against religious minorities in Bangladesh [70]. Future research involving victims of specific incidents will provide stronger evidence on this relationship.

The strength of our analyses is that we used a nationally representative sample of women and compared not only the hypertension outcome but also diabetes and obesity outcomes in the study population. We showed that religious minority status was not associated with diabetes and obesity conditions, the two major risk factors for hypertension [32,33]. We also demonstrated the elevated risk of hypertension among religious minority women after adjusting for these cardiometabolic risks. Further, our estimates of the relationship between hypertension and religious minority status were adjusted for demographic and socioeconomic factors that were recognized in extant literature as risk factors for hypertension in the Bangladeshi population [32–34]. Together, we presented a case where the elevated risk of hypertension in minority women could be attributable to the collective trauma from religious violence and discrimination.

5. Conclusions

Discrimination against religious minorities in Bangladesh has been institutionalized through constitutional changes in late 1970s and 1980s. Communal persecution against the minorities has been intensified in recent years including sexual harassment and gender-based violence against religious-minority women and girls [37]. Against this backdrop, we found that religious minority women in Bangladesh had a disproportionately higher risk of hypertension compared to their majority counterparts. Acknowledgement of the fact that religious minorities in Bangladesh are at risk of adverse health outcomes, may create opportunities for policy actions to alleviate the burden. Our results, therefore, call for further scientific investigation on the population health outcomes of the religious minority groups to inform policies aimed at reducing religious disparities in health.

Ethics approval statement

The study used anonymized data from publicly available secondary source. The survey protocols were approved by the institutional review boards of ICF and Bangladesh Medical Research Council. Methods were carried out in accordance with the U.S. Department of Health and Human Services regulations for the protection of human subjects (45 CFR 46). Details of the ethical approval is available at: https://dhsprogram.com/Methodology/Protecting-the-Privacy-of-DHS-Survey-Respondents.cfm. Participation in the survey was voluntary and informed consent was obtained prior each interview.

Data availability statement

The dataset used in this study is freely available from the USAID's Demographic and Health Surveys (DHS) Program website (https://dhsprogram.com/data/).

CRediT authorship contribution statement

Biplab Kumar Datta: Writing – original draft, Software, Methodology, Formal analysis, Data curation, Conceptualization. **Sanjoy Kumar Chowdhury:** Writing – review & editing, Validation, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement

N/A.

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