

ORIGINAL ARTICLE

Hypertension prevention behavior and its predictors among rural adults in Bangladesh: A community survey using the theory of planned behavior

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ABSTRACT

Bangladesh faces a rising burden of non-communicable diseases (NCDs), with rural communities being particularly vulnerable due to limited healthcare access. Despite hypertension (HTN) being preventable, the disease is often overlooked in rural areas. This study aimed to assess health practices related to HTN prevention and its determinants among rural Bangladeshi adults using the theory of planned behaviour (TPB) and the World Health Organization's 4X4 NCD prevention model. A community-based survey was conducted with 355 rural participants selected via multi-stage sampling in the latter half of 2023. Data were collected through face-to-face interviews using a validated, pretested questionnaire. The average age of the respondents was 41.5 years, with 66.8% of them being male participants. The findings revealed inadequate knowledge, negative attitudes, and poor self-control regarding HTN prevention. Socioeconomic factors, including gender, income, education, and region, significantly influenced HTN prevention behaviors ($p < 0.05$), while knowledge, attitude, and self-control were strongly linked to HTN prevention practices ($p < 0.05$). The study's causal model based on the TPB demonstrated a good fit, showing that attitude ($\beta = 0.34$, $p < 0.001$), motivation ($\beta = 0.16$, $p < 0.05$), and self-control significantly influenced intention ($\beta = 0.34$, $p < 0.001$), which strongly predicted hypertension prevention practices ($\beta = 0.54$, $p < 0.001$). Rural populations displayed reluctance to adopt healthy practices for HTN prevention. Enhancing community awareness and promoting behavioral change, therefore, should be prioritized in policy development to improve HTN prevention practices in rural Bangladesh.

Keywords:

hypertension prevention; health practices; rural adults; theory of planned behavior

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INTRODUCTION

Non-communicable diseases (NCDs) have surpassed communicable diseases globally in recent decades. Hypertension (HTN), one of the four major NCDs, is a leading cause of premature death worldwide. Approximately 22% of the global population around 1.13 billion people suffers from HTN,¹ and HTN alone contributes to 17 million deaths annually due to cardiovascular diseases.² With modernization and lifestyle changes, HTN is rising rapidly in developing countries, including Bangladesh. About 80% of deaths in developing countries are linked to HTN and other NCDs.³ In Bangladesh, the prevalence of HTN is estimated at 26%, with a significant portion of the population remaining untreated and unaware of the condition.⁴

A study using a demographic survey of Bangladesh found that age, gender, and wealth status were associated with hypertension prevalence with higher prevalence among females, low wealth quintiles, and age groups of 35 years and above.⁵ Bangladesh is undergoing both demographic and epidemiological transitions alongside economic development. Numerous socio-demographic, behavioral, genetic, and biochemical factors have been associated with the increasing prevalence of HTN in Bangladesh and globally, including unhealthy diets, smoking, sedentary lifestyles, urbanization, industrialization, improved life expectancy, and ethnicity.^{4,6} The 4×4 model of the World Health Organization (WHO) for NCD prevention identifies four major NCDs, cardiovascular diseases, diabetes, cancer, and chronic respiratory disease, along with four shared modifiable risk factors, smoking, unhealthy diets, physical inactivity, and excessive alcohol consumption.⁷ Smoking, including secondhand exposure, causes 7.2 million deaths annually, while high sodium/salt intake results in 4.1 million deaths, physical

inactivity leads to 1.6 million deaths, and alcohol use accounts for over 3.3 million deaths.⁸

The prevalence of tobacco smoking in Bangladesh is 23.19%, with 48.28% of males identified as smokers.⁹ Tobacco has been found to be a major risk factor for cardiovascular diseases and a contributor to related deaths.¹⁰ Lifestyle modification factors, such as salt intake, tobacco use, and obesity have shown significant correlations with hypertension.¹¹ A nationally representative survey revealed that 56% of the population does not meet the WHO-recommended physical activity levels.¹² Although alcohol consumption is generally low in Bangladesh, abuse among existing users remains a concern.¹³ Community awareness is essential for global prevention of NCDs such as HTN.¹⁴ However, poor knowledge and practice regarding cardiovascular diseases and HTN were evident in rural areas of Bangladesh.¹⁵

The theory of planned behavior (TPB) posits that human behavior is influenced by three primary considerations: attitudes, subjective norms (or motivation), and perceived behavioral control, with actual behavior achieved through intention.¹⁶⁻¹⁸ The TPB has been widely used in psychological health and has proven effective in predicting behavioral changes for the prevention and control of various chronic diseases.¹⁹⁻²⁰ This study integrated the WHO's 4×4 model by aligning key risk behaviors (unhealthy diet, physical inactivity, tobacco use, and harmful alcohol use) with TPB constructs. Attitudes reflected beliefs toward healthy behaviors, while subjective norms captured social influences and motivation to comply, and perceived behavioral control addressed individuals' confidence in behavior change. These constructs predicted intention, which led to hypertension prevention behaviors. This integration enhanced both behavioral understanding and policy relevance in the rural context. The theoretical approach in explaining HTN prevention practice has

been hardly seen in the rural context of Bangladesh. The current study used TPB to explain the HTN prevention practice focusing on WHO's 4x4 model.

METHODS

Study Design and Population

The current cross-sectional study was conducted at the community level among rural people of three districts of Bangladesh. The participants eligible for inclusion criteria met the following criteria: (1) aged 18 years and older; (2) permanent residents of the selected rural areas; (3) no prior diagnosis of hypertension (HTN); and (4) expressed willingness to participate by providing informed consent. The exclusion criteria were participants who were severely ill at the time of data collection or had conditions that could impair their ability to respond during the interview process.

Sampling and Sample Size

Multi-stage random sampling was performed to select 355 rural participants. Munshiganj, Mymensingh, and Rangpur districts were selected in the first stage, and a random selection of an upazila was done. The respondents were randomly selected from the community of the particular upazila in the final stage. The required sample size for this study was determined based on methodological guidelines for the path analysis. A minimum sample size of 200 is typically recommended for models with moderate complexity,²¹ while more conservative guidelines suggest 10–20 cases per estimated parameter.²² Given that our model included approximately 13 parameters, a minimum of 300 participants was required. Thus, the sample of 355 participants in this study was considered sufficient to achieve robust and reliable estimates in the path analysis.

Research Instrumentation

The questionnaire was developed based on the TPB and relevant literature on HTN prevention and NCD control. The questionnaire consisted of seven parts: socio-demographic characteristics, knowledge, attitude, motivation, self-control (perceived behavioral control), intention, and HTN preventive practices. All TPB-related constructs were measured using a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree) except practice which was assessed through a Likert scale on frequency. Attitude (8 items), motivation (8 items), self-control (6 items), intention (4 items), and practice (6 items) were constructed with the items adapted from previous studies and WHO guidelines,^{4,15} and further modified, pretested and validated to fit the Bangladeshi rural context. Knowledge (12 items) was assessed through true/false items based on the WHO recommendations for HTN prevention.

Content validity was evaluated by a panel of three public health experts. Each item was rated for relevance, clarity, and representativeness. The Content Validity Index (CVI) for all items ranged from 0.8 to 1.0. The CVIs of knowledge and motivation were 0.8 and 1.0, respectively, while other scales were 0.9. A pre-test was conducted among 40 rural adults to ensure clarity and cultural appropriateness. In the pilot results, minor wording revisions were made. Internal consistency reliabilities of all scales were acceptable, with the values of the Cronbach's alpha ranging from 0.7 to 0.9. The Cronbach's alpha values for the scales of attitude, self-control, intention, and practice were 0.8. The Cronbach's alpha values for the knowledge and motivation scales were 0.7 and 0.9, respectively [Table 2].

Data Collection

Data were collected from October to December 2023. A total of three trained data collectors conducted face-to-face interviews after obtaining informed consent from participants and ensuring privacy and confidentiality. To ensure the reliability of data collection, all data collectors received a 2-day training on research objectives, interview techniques, and standardized questionnaire administration. Inter-rater reliability was assessed during a supervised pilot test involving 10 participants; the agreement rate across raters was above 0.90, indicating consistency.

The researchers obtained ethical approval from the Ethical Review Committee of Dhaka Medical College Hospital before initiating data collection. Permission was also obtained from local community leaders in the selected rural areas. After introducing the study and explaining its objectives and procedures, three trained data collectors conducted face-to-face interviews using a structured and pre-validated questionnaire. The interviews were conducted in private settings to ensure confidentiality, and each session took approximately 20–25 minutes.

Informed consent was obtained prior to each interview. The data collectors were trained to follow standardized procedures, and consistency was ensured through close supervision. A total of 355 completed interviews were obtained, with a response rate of 100%.

Data Analysis

Data were processed immediately after collection and analyzed based on the objectives using the Statistical Package for Social Sciences (SPSS) software version 23, which was licensed by BRAC University. Regression was done to identify significant behavioral determinants, and path analysis was designed to identify significant causal relationships. Knowledge, attitude, motivation, self-control, intention and practice were latent variables and were categorized into three groups based on scores: poor ($\leq 60\%$), fair (61–80%) and good ($>80\%$).²³ The causal model was developed using five latent variables in three blocks based on the TPB model. Attitude, motivation, and self-control were in the 1st block, and intention in the second block was directly connected with the third block of practice [Figure 1].

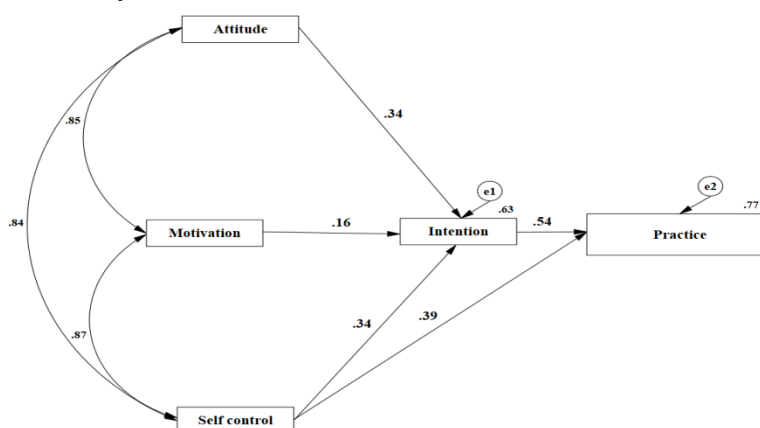


Figure 1. Path Relationships in the HTN Prevention Causal Model

RESULTS

The background issues of the rural people were described by focusing on

socioeconomic status. Most participants were men aged over 36 years. The mean age of the rural participants exceeded 40 years (Table 1).

Table 1. Distribution of Socio-demographic Factors of the Participants (n=355)

Socio-demographic factors	Number	Percentage
Age of the participants (years)		
≤25	13	3.7
26-35	114	32.1
≥36	228	64.2
$\bar{x} \pm SD = 41.5 \pm 10.3$ years (min-max: 19-70 years)		
Gender		
Male	237	66.8
Female	118	33.2
Religion		
Islam	301	84.8
Hindu	54	15.2
Monthly family income (Taka)		
≤10000	59	16.6
10001-20,000	177	49.9
>20,000	119	33.5
$\bar{x} \pm SD = 18,955 \pm 8,760$ min-max: 6000-70,000)		
Educational status		
Up to primary	125	35.2
Junior School Certificate (JSC)	86	24.2
Secondary School Certificate (SSC)	84	23.7
Higher Secondary Certificate (HSC) and above	60	16.9
Occupational status		
Agricultural worker	55	15.5
Day laborer	78	22.0
Housewife	72	20.3
Business	41	11.5
Factory and/or private sector worker	64	18.0
Government employee	29	8.2
Others	16	4.5
Family type		
Joint	219	61.7
Single	136	38.3

The majority (n=301,84.8%) of the participants worshipped Islam, and the rest were Hindus. Nearly half (n=177,49.5%) were in the middle-income group of 10,001 to 20,000 taka, and around one-third (n=119, 33.5%) were in a better economic state, having monthly incomes of >20,000 taka, while the remainder were very poor, having monthly incomes of up to 10,000 taka. Around 19,000 taka as an average monthly family income is reasonably sufficient in the rural context (Table 1).

Since the government made primary education compulsory, the illiteracy rate has remained relatively low over the past

few decades, currently standing at just 2.5%. Almost one-third of the rural respondents (n=125,32.7%) had primary-level educations, while less than 25% of the rural people were educated up to secondary school certificates (SSC), and around 17% were educated up to higher secondary certificates (HSC) and above. The respondents were involved in different occupations. Most respondents were day labourers (n=78,22%). More than 60% of the respondents lived in extended families (Table 1). The average family size was 4.5 with a standard deviation (SD) of ± 1 . Less

than 15% of the respondents had a family history of HTN.

The average health practice or HTN prevention behavior score was 14.3 (SD±3.7). Poor health practices were more

common (42.5%) and around 35% shared fair health practices (Table 2). The rest of the participants showed good health practices regarding HTN prevention at less than 25%.

Table 2. Category of HTN prevention behavior and its predictors with average scores

Characteristics	Category of scores			$\bar{x} \pm SD$	Min-Max	Cronbach's α
	Poor	Fair	Good			
Health practices	42.5	35.2	22.3	14.3(3.7)	7-22	0.8
Knowledge	43.4	34.9	21.7	8.4(2.4)	3-12	0.7
Attitude	47.0	33.6	19.4	28.5(5.5)	16-38	0.8
Motivation	45.4	36.3	18.3	24.5(5.9)	12-35	0.9
Self-control	49.3	34.4	16.3	20.2(4.0)	12-28	0.8
Intention	52.5	30.5	17.0	13.2 (4.3)	9-17	0.8

$\bar{x}$ = Mean, SD = Standard deviation

The mean score for knowledge was 8.4 (SD±2.4). Nearly half of the participants (43.4%) had poor knowledge of NCD prevention, and only one-fifth showed a good knowledge level. The average attitude score was 28.5 (SD±5.5), and a poor attitude towards HTN prevention was a common scenario. Nearly half of the respondents (47%) showed poor attitudes, and around one-third shared a fair attitude toward HTN prevention. The remainder (19.4%) showed good attitudes.

The rural people were less commonly motivated by health workers, and the average motivation score was 24.5 (SD±5.9). Nearly half of the participants (45.4%) were poorly motivated and around one-third (36.3%) were fairly motivated. The average score for self-control was relatively low (Mean 20.2; SD±4.0). Poor

self-control predominated (49.3%), and around one-third (34.4%) had a fair level of self-control. Poor intention was also common among the rural participants (52.5%), and less than one-third (30.5%) showed fair intention to engage in healthy practices. Only 17% showed good intentions to ensure healthy lifestyles related to HTN prevention.

Knowledge was determined to be a significant factor for healthy lifestyles ($p < 0.001$). The average score of practice was only 7.4 among the rural adults with poor knowledge. The mean score of health practices was higher (12.5) among the respondents with fair knowledge. The mean practice score for good knowledge was the highest (13.2). The score for health practices improved gradually with the rural community's knowledge level [Figure 2].

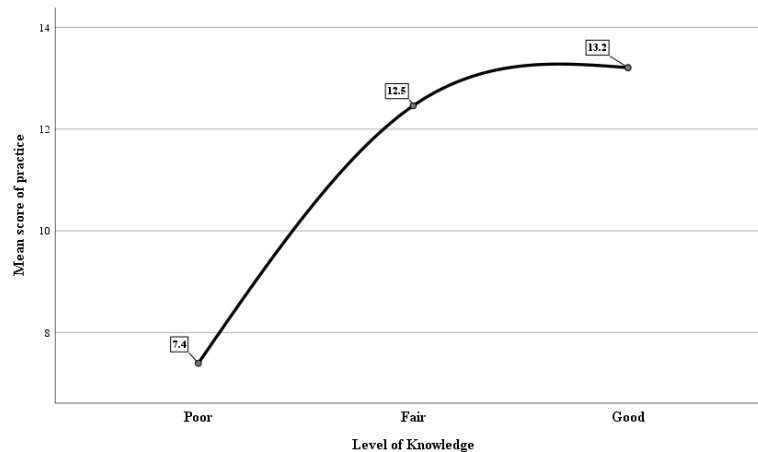


Figure 2. Relationship between knowledge and HTN prevention behavior

Two-step hierarchical regression was done to identify significant predictors regarding HTN prevention. Background factors were kept in the first step, and all the socioeconomic issues, except age and gender showed significance with outcomes at the primary stage. Knowledge, attitude, motivation and self-control were added in the second step. All the added factors in the second stage were determined as significant predictors of the outcomes except

motivation. Although gender did not show significance in the first step, it was determined at the second stage as a significant predictor in addition to other background issues. Among the latent variables added at the second step, attitude and self-control showed highly significant relationships ($p < 0.001$). Knowledge was also identified as a highly significant predictor ($p < 0.01$) for HTN prevention behavior (Table 3).

Table 3. Significant predictors regarding HTN prevention in hierarchical regression

Variable	Stage1			Stage2		
	<i>B</i>	<i>SE(B)</i>	β	<i>B</i>	<i>SE(B)</i>	β
Constant	8.24	0.74		-1.11	0.72	
Age	0.03	0.02	0.07	-0.01	0.01	-0.02
Gender	-0.24	0.34	-0.03	-0.78	0.24	-0.10*
Monthly income	0.01	0.01	0.30***	4.83×10^{-5}	0.01	0.11**
Educational status	3.29	0.37	0.42***	0.63	0.30	0.08*
Region	0.80	0.33	0.10*	0.78	0.22	0.10**
Knowledge				0.22	0.08	0.14**
Attitude				0.20	0.04	0.29***
Motivation				0.02	0.04	0.03
Self-Control				0.31	0.06	0.34***
R^2	0.40			0.73		
F for R^2 change	47.4***				102.5***	

^(†)Up to primary level education was chosen for literacy and references were chosen for other variables like region and gender. One star (*) for only significant ($p < 0.05$), two stars (**) for more importance ($p < 0.01$) and three stars (***) for very highly significant relationships ($p < 0.001$).

The causal model of HTN prevention practice consisted of five latent variables that were fit enough to conduct

the path analysis. Self-control directly ($\beta = 0.39$, $p < 0.001$) and indirectly ($\beta = 0.34$, $p < 0.001$) through intention affected health

practices regarding HTN prevention. In the causal model, attitude showed a significant path relationship with intention ($\beta=0.34, p<0.001$). Motivation ($\beta=0.16, p<0.05$) also had a significant relationship with intention. Intention was found to have a highly significant relationship with practice ($\beta=0.54, p<0.001$). The significant findings justified the causal model of HTN prevention based on the TPB.

DISCUSSION

The study explored HTN prevention practices and related factors within a rural community. Knowledge about HTN prevention and behavioral determinants such as attitude, motivation, and self-control were generally inadequate among the respondents. Increased knowledge was associated with improved HTN prevention practices. The causal model effectively explained how knowledge, attitude, and motivation influence HTN prevention practices through intention, demonstrating a highly significant path relationship with intention.

One significant finding of this study was the inadequate knowledge regarding HTN among nearly half of the population and the association between knowledge and HTN prevention practices. Similar findings have been reported in other studies.⁵ These findings highlight deficiencies in the current healthcare system's preventive services for HTN control. While the government has extended the NCD care to rural areas and primary care facilities, this study's findings on poor awareness and practices reflect a lack of health-seeking behavior and utilization of available government services. A Thai study has suggested a similar approach of modifying health behaviors to control HTN through a culturally sensitive innovative communication approach.²⁴ Issues such as poor quality of care, untrained caregivers, and prescriptions by nonclinical medical salespeople have also been identified as

major barriers to effective HTN management in rural settings.²⁵⁻²⁷

The study also identified significant associations between HTN control behaviors and factors such as gender, income, educational status, and area of residence. These findings underscore the need to design health programs targeted at vulnerable groups and tailor health messages to address economic, cultural, and regional differences among target groups. The pathway analysis conducted in this study further confirmed the logical progression of adopting health behaviors. Effective health programs should engage not only patients and high-risk groups but also community members, family, friends, and community leaders to motivate and support individuals in adopting healthy behaviors.²⁸

The WHO advocates for a comprehensive, multi-sectoral approach to combating NCDs, incorporating health in all policies and empowering communities to participate in preventive efforts.² The roles of families and communities in NCD prevention and control have been emphasized in multiple studies.²⁹⁻³¹ However, despite the establishment of NCD corners at primary healthcare facilities by the government of Bangladesh, health promotion regarding HTN prevention remains insufficient.³²

HTN is often referred to as a silent epidemic. Poor awareness of HTN within the general population results in a high proportion of undiagnosed cases, adding a significant burden to the existing healthcare system. While rural populations in Bangladesh generally lead more active lives than their urban counterparts, they often have lower socioeconomic status with limited education and income. These limitations hinder the ability to maintain a healthy lifestyle, including access to nutritious, balanced diets. Global literature has consistently linked obesity with HTN.¹⁴

The findings of this study have important policy implications. Bangladesh

should prioritize primary prevention strategies to control HTN cost-effectively. Health messages for rural adults should focus on maintaining healthy weights, adopting balanced diets, and reducing fat and salt consumption. Similar to India and the UK, standards for salt intake should be adopted.^{33,34} In addition to implementing legal measures, community engagement should be encouraged to combat smoking in public places and on public transport. Organizing health clubs in rural areas could promote fitness and raise awareness about NCDs.

As a cross-sectional survey, this study faced inherent limitations in determining causality. However, the use of multistage sampling minimized regional variations and improved representativeness. All data were self-reported through face-to-face interviews, which may be subject to social desirability and recall biases. The TPB model of the study used only major determinants; other potentially relevant psychological or contextual factors influencing hypertension prevention behaviors (e.g., access to healthcare, cultural beliefs, or economic constraints) were not included in the model. By incorporating determinants from the TPB model and aligning with the WHO's NCD prevention policy, this study provides a theoretical and practical framework for improving current health practices in HTN prevention.

CONCLUSION

Health practices regarding HTN prevention were not very satisfactory among rural people and the consistency of healthy practices was always a neglected issue. Apart from background issues, behavioral determinants were significant in predicting HTN prevention behavior. Inadequate knowledge of HTN prevention and poor attitudes of rural communities

could be significant issues in HTN prevention in the future. The findings from the causal model of HTN prevention behaviour have theoretical evidence for further work at home and abroad. Policymakers should give more focus on health awareness programs about the risk factors of HTN and lifestyle modifications in rural areas to make healthy practices more sustainable.

AUTHOR CONTRIBUTIONS

SAZ: Methodology, Writing - Original Draft and Supervision. MH: Methodology and Writing - Original Draft. MSI: Methodology and Writing - Original Draft. MAA: Formal analysis, Supervision and Writing - Review & Editing. SS: Formal analysis and Supervision. SP: Formal analysis and Writing - Review & Editing. HOAM: Writing - Review & Editing

ETHICAL CONSIDERATION

Ethical issues were strictly followed throughout the research process. The Ethical Review Committee of Dhaka Medical College Hospital approved the study as a community survey on 10th October 2023 (Ref: ERC-DMCH/002/C, 2023).

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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