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Prevalence of risk factors for non-communicable diseases and its association with hypertension among young adults in urban Meghalaya: a cross sectional study

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Abstract

Objectives: Non-communicable diseases (NCDs), including cardiovascular conditions such as hypertension, are increasingly affecting young adults. Elevated blood pressure (BP) in this age group is often overlooked despite its potential to cause long-term health consequences. This study aimed to assess the prevalence and determinants of elevated blood pressure among urban college-going young adults in Meghalaya.

Methods: An analytical cross-sectional study was conducted among college students aged 18–25 years in a selected college in Shillong, representing the urban population of Meghalaya. A total of 274 participants were included. Data were collected using a semi-structured WHO STEPs-based questionnaire, followed by anthropometric and blood pressure measurements. BP was classified using JNC-8 criteria. Descriptive statistics and logistic regression analyses were performed using SPSS v25.

Results: The mean age of participants was 19.9 (±1.2) years; 55.8 % were female, and 38.0 % belonged to below poverty line (BPL) households. The prevalence of elevated BP was 17.9 % (95 % CI: 13.6–23.0 %). In multivariable analysis, non-BPL status (AOR: 5.4; 95 % CI: 2.1–14.1), obesity (AOR: 3.9; 95 % CI: 1.5–9.8), and smoking (AOR: 2.1; 95 % CI: 1.1–4.0) were significantly associated with elevated BP.

Conclusions: Elevated blood pressure was prevalent among nearly one-fifth of urban young adults, with socioeconomic status, obesity, and smoking emerging as significant determinants. These findings highlight the need for early screening and targeted interventions to mitigate cardiovascular risk among youth in urban India.

Keywords: elevated blood pressure; young adults; non-communicable diseases; urban population; cross-sectional study

Introduction

Noncommunicable diseases (NCDs), also referred to as chronic illnesses, are characterized by long-term duration and are caused by a combination of genetic, physiological, environmental, and behavioral factors. These diseases, such as cardiovascular diseases, hypertension, cancers, and diabetes, pose a significant burden on the global population and require immediate attention and action from the international community [1]. In 2021, 18 million people died from an NCD before age 70 years; 82 % of these premature deaths occur in low- and middle-income countries. Of all NCD deaths, 73 % are in low- and middle-income countries [2].

Even though NCDs are often perceived as lifestyle illnesses, the youth population is not immune to their effects. According to findings from The Lancet Commission on adolescent health and wellbeing, individuals aged 10–24 years experienced a substantial burden of disease primarily attributed to Non-Communicable Diseases (NCDs). In 2016, NCDs constituted a significant portion, contributing to 56 % of global disability-adjusted life-years (DALYs) within this age group [3]. Furthermore, in the year 2019, NCDs were responsible for a considerable share, accounting for 86·4 % (with a 95 % uncertainty interval of 83·5–88·8) of all Years Lived with Disability (YLDs) and 38·8 % (with a range of 37·4–39·8) of total deaths among adolescents aged 10–24 years in the European Union [4]. Thus, it is crucial to make efforts to evaluate their health status, prevent diseases, and promote lifestyle modifications [5].

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Childhood behaviors and conditions can lead to premature deaths in adulthood, with millions of young people engaging in risky habits such as smoking, inadequate physical activity, and heavy drinking [6]. To combat this concerning trend, it is crucial that young people comprehend the risks associated with these diseases and their contributing factors. Several factors contribute to the rising prevalence of NCDs in this age group, warranting attention and intervention. Firstly, lifestyle choices play a pivotal role in the development of NCDs among young adults. Unhealthy behaviors such as poor dietary habits, sedentary lifestyles, excessive alcohol consumption, and tobacco use are prevalent among this demographic. These factors contribute to an increased risk of NCDs. Secondly, stress and mental health issues are prominent contributors to NCDs among young adults. Pressures related to education, career, relationships, and financial responsibilities often lead to chronic stress, anxiety, and depression [7, 8].

Environmental factors also contribute significantly to Non-Communicable Diseases (NCDs) in young adults, exposing them to pollutants indoors and outdoors, leading to respiratory issues and potential cancers. Additionally, limited healthcare access and awareness hinder early NCD detection, as young adults may not prioritize check-ups due to financial constraints or the perception of being unaffected by NCDs at a young age [9].

Addressing the increasing prevalence of Non-Communicable Diseases (NCDs) among young adults necessitates a comprehensive strategy. This includes initiatives to encourage healthy lifestyles through educational campaigns, the implementation of policies fostering environments supportive of physical activity and nutritious diets, the provision of accessible mental health assistance, efforts to reduce environmental pollution, and the assurance of affordable healthcare services. Therefore, it has become crucial to assess the burden of risk factors associated with non-communicable diseases, particularly focusing on the prevalence of elevated blood pressure among young adults aged 18–25 years in selected urban colleges in Meghalaya.

Materials and methods

An analytical cross sectional study was conducted among the college students aged 18–25 years in a selected college of Shillong to represent urban Meghalaya. Prior to commencement, necessary ethical approvals were obtained from the institute's ethics committee (NEIGR/IEC/M11/F7/2023), and permission was obtained from the college principal. Students who were absent on the day of the data collection were excluded from the study. The study was conducted in the selected college of Shillong as a representation of urban Meghalaya.

Sample size and sampling

Based on the prevalence of four or more risk factors of NCDs as 44 % [8] at 6 % absolute precision at 95 % confidence interval, the sample size is estimated to be 263 young adults using nMaster 2.0 (Sample size estimation for single proportion). All the eligible students form the selected college were selected based on our convenience.

Data collection procedure

After explaining the purpose of study to the eligible students for their verbal consent, the students were administered with semi structured questionnaire consisting of socio-demographic and behavioural characteristics, history of risk factors for NCDs adopted from whom STEPs Questionnaire and their health seeking behaviours, followed by which anthropometry and blood pressure were measured.

Blood pressure was recorded using sphygmomanometer and classified according to Joint Nation Commmitte-8 (JNC-8) classification. Weight was recorded to nearest 100 g using digital weighing machine and height was measured to nearest 0.1 cm using stadiometer. Waist circumference was measured to nearest 0.1 cm using a measuring tape.

Data analysis

Data was analysed using SPSS V25 for Windows. Categorical variables are presented as frequency and percentages. Continuous variables are presented as mean and standard deviation. The prevalence of elevated blood pressure among young adults is presented as percentage with 95 % confidence interval (95 %. CI). Univariate and multivariable logistic regression analyses were performed to identify predictors of elevated blood pressure among young adults, with results presented as odds ratios (ORs) and 95 % confidence intervals (CIs), considering variables such as age, gender, socioeconomic status, BMI category, family history of NCDs, smoking, alcohol consumption, physical activity, and dietary habits. A p value of <0.05 was considered statistically significant.

Results and observations

Of the total 294 students, data was collected for 274 participants with a response rate of 93.2 %. The mean age of the participants was 19.9 years with a standard deviation of 1.2 years. More than half of the participants were females (55.8 %). A notable proportion of participants (38.0 %) belonged to below poverty line (BPL) households. Regarding family history of non-communicable diseases (NCDs), only 20.4 % reported a positive history. In terms of body mass index (BMI) based on the WHO Asia-Pacific classification, a majority of participants (61.7 %) had a normal BMI (18.5–22.9 kg/m^2), while 19.7 % were underweight, 8.0 % were overweight, and 10.6 % were categorized as obese (Table 1).

Behavioral and dietary patterns

Among the participants, 26.3 % had ever smoked, and of them, 72.2 % were current smokers (i.e., smoked in the last 3 months). Among the current smokers, over half (53.8 %) smoked daily, while 46.2 % smoked intermittently. Smokeless tobacco use was reported by 14.2 %, and exposure to passive smoking was common at home (19.7 %) and at institutes (14.2 %), with 66.1 % having no exposure.

Regarding alcohol consumption, 56.0 % of the participants reported use of alcohol. Other substance use (including marijuana, LSD, codeine, etc.) was reported by 5.5 % of participants. Physical activity was reported as adequate in 70.4 % of participants and only 23.4 % reported having healthy dietary habits (Table 2).

Table 1: Socio-demographic characteristics of the study participants (n=274).

Variables	Frequency, n	Percentage
Age in years [mean, SD]	19.9 (1.2)	
Gender		
Male	121	44.2
Female	153	55.8
Socioeconomic status (below poverty line)		
Yes	104	38.0
No	170	62.0
Family history of NCD		
Yes	56	20.4
No	218	79.6
BMI category in kg/m^2 (WHO Asia Pacific classification)		
Underweight (<18.5)	54	19.7
Normal (18.5–22.9)	169	61.7
Overweight (23.0–24.9)	22	8.0
Obese (≥25.0)	29	10.6

Table 2: Behavioural and dietary habits among the study participants (n=274).

Variables	Frequency, n	Percentage
Smoking (ever smokers)		
Yes	72	26.3
No	202	92.7
Smoking (current smokers)[a] (n=72)		
Yes	52	72.2
No	20	27.8
Frequency of smoking among the current smokers (n=52)		
Everyday	28	53.8
Periodic/Intermittent	24	46.2
Smokeless tobacco		
Yes	39	14.2
No	235	85.8
Exposure to passive smoking		
Home	54	19.7
Institute	39	14.2
None	181	66.1
Alcohol consumption		
Yes	153	56.0
No	121	44.0
Other substance use[b]		
Yes	15	5.5
No	259	94.5
Physical activity		
Adequate	193	70.4
Inadequate	81	29.6
Dietary habits		
Healthy	64	23.4
Unhealthy	210	76.6

[a]Current smokers-smoking in the past three months [b]Other substances include Weed, Heroine, LSD, Perk, Codeine, Marijuana, Vape etc.

Prevalence of elevated blood pressure

The prevalence of elevated blood pressure among the study participants was 17.9 % (95 % CI: 13.6–23.0 %) (Table 3).

Predictors of elevated blood pressure

In the univariate logistic regression analysis, male gender, non-BPL status, obesity, and smoking were significantly associated with elevated blood pressure. Specifically, males

Table 3: Prevalence of elevated blood pressure among the study participants (n=274).

Elevated blood pressure	Frequency, n	Percentage (95 % CI)
Yes	49	17.9 (13.6–23.0)
No	225	82.1 (76.9–86.4)

Table 4: Univariate and multivariable logistic regression for the predictors of elevated blood pressure (n=274).

Variables	Unadj. OR (95 %, CI	Unadj. p-Value	Adj. OR (95 %, CI	Adj. p-Value
Age	1.1 (0.8–1.4)	0.546	1.1 (0.8–1.5)	0.516
Gender				
Males	1.9 (1.1–3.5)	0.045	1.4 (0.7–2.9)	0.321
Females	**Reference**		**Reference**	
Socioeconomic status (below poverty line)				
Yes	**Reference**		**Reference**	
No	5.5 (2.3–13.5)	<0.001	5.4 (2.1–14.1)	0.001
Family history of NCD				
Ye8	1.5 (0.7–3.1)	0.246	0.9 (0.4–2.2)	0.965
No	**Reference**		**Reference**	
BMI category in kg/m^2				
Underweight	1.0 (0.4–2.4)	0.997	1.4 (0.6–3.6)	0.466
Normal	**Reference**		**Reference**	
Overweight	0.9 (0.2–3.3)	0.885	0.9 (0.2–3.4)	0.844
Obese	4.7 (2.0–10.9)	<0.001	3.9 (1.5–9.8)	0.004
Smoking				
Yes	2.3 (1.2–4.4)	0.012	2.1 (1.1–4.0)	0.045
No	**Reference**		**Reference**	
Alcohol consumption				
Yes	1.8 (0.9–3.5)	0.076	1.4 (0.6–2.9)	0.408
No	**Reference**		**Reference**	
Physical activity				
Adequate	**Reference**		**Reference**	
Inadequate	0.5 (0.2–1.0)	0.162	0.7 (0.3–1.6)	0.366
Dietary habits				
Healthy	**Reference**		**Reference**	
Unhealthy	1.1 (0.5–2.2)	0.868	1.1 (0.5–2.5)	0.822

Variables used in the equation: Age, gender, socioeconomic status, BMI, category, family history of NCD, Smoking, alcohol consumption, physical activity, dietary habits.

had 1.9 times higher odds (95 % CI: 1.1–3.5; p=0.045) of elevated BP compared to females. Participants from non-BPL households had 5.5 times higher odds (95 % CI: 2.3–13.5; p<0.001). Obese participants had significantly higher odds (OR=4.7; 95 % CI: 2.0–10.9; p<0.001), and smokers had 2.3 times the odds (95 % CI: 1.2–4.4; p=0.012) of elevated BP compared to non-smokers (Table 4).

In the multivariable logistic regression analysis, non-BPL status (Adjusted OR: 5.4; 95 % CI: 2.1–14.1; p=0.001), obesity (AOR: 3.9; 95 % CI: 1.5–9.8; p=0.004), and smoking (AOR: 2.1; 95 % CI: 1.1–4.0; p=0.045) remained statistically significant predictors of elevated blood pressure. Other factors, including age, gender, BMI (underweight or overweight), alcohol consumption, physical activity, and dietary habits were not significantly associated with elevated BP after adjustment for confounders (Table 4).

Discussion

The growing burden of non-communicable diseases (NCDs), particularly hypertension, is no longer limited to middle-aged and older adults. Increasingly, elevated blood pressure is being recognized among adolescents and young adults, reflecting a concerning shift in the epidemiological landscape. Early onset of elevated blood pressure has significant public health implications, as it increases the lifetime risk of cardiovascular and renal complications and imposes a prolonged burden on healthcare systems. Urbanization, lifestyle changes, rising obesity, and increased substance use among youth are key contributors to this trend. In this context, our study examined the prevalence and determinants of elevated blood pressure among urban college-going young adults.

Our study found that 17.9 % of young adults had elevated blood pressure. This figure underscores that a substantial proportion of apparently healthy young people are already experiencing blood pressure levels above the normal range. Comparable prevalence rates have been reported in similar age groups: for instance, a community survey in urban India found a hypertension prevalence of 17.9 % among 20-40 year-olds [10]. An epidemiological study in South India noted that roughly one in eight young adults (aged 20–39) had hypertension, with an additional one-third classified as pre-hypertensive [11]. On the contrary, studies by Kumar U et al. [12] in Rajasthan and Debbarma A et al. [13] in Tripura had shown a higher prevalence of elevated blood pressure among young adults. Globally, hypertension is emerging earlier in life; a systematic review across Asian countries observed adolescent hypertension prevalence ranging from under 1 % in some settings to as high as 24.5 % in others with urban areas generally showing higher rates [14]. A meta-analysis by Pinto E et al. had concluded that 20 % of young adults had elevated blood pressure [15]. Our result falls toward the higher end of this spectrum, likely reflecting the urban, college environment and lifestyle of our participants. This finding is concerning because even mildly elevated blood pressure in adolescence or early adulthood can portend future cardiovascular risk. Prior longitudinal research has shown that young adults with blood pressure even in the pre-hypertensive range have a significantly higher risk of developing clinical hypertension and cardiovascular events by middle age [16]. Thus, the nearly one-fifth prevalence in the sample highlights an important public health issue with young adults facing a risk of hypertension and its complications in later life.

One notable predictor of elevated blood pressure in our study was higher socioeconomic status. This finding contrasts with the patterns observed in many high-income countries, where lower socioeconomic status (SES) is usually linked to greater hypertension risk in youth and adults [17]. For instance, an adolescent survey in Poland documented a clear socioeconomic gradient, with adolescents from lower SES families having higher prevalence of elevated blood pressure than their high-SES counterparts [17]. Similarly, in the United States, young adults with hypertension have been found more often among those with food insecurity, lack of insurance, or low income [18]. The contradictory finding in our study likely reflects the context of a rapidly urbanizing, middle-income setting. In many developing or transitional societies, higher SES is associated with lifestyle factors that can increase blood pressure: greater consumption of energy-dense processed foods, more sedentary behaviour, and perhaps higher perceived stress of competitive urban living [10]. These factors can outweigh any healthcare access advantages that wealth confers, at least in the young adult age group. Indeed, epidemiological transition in epidemiology shows that the burden of non-communicable diseases like hypertension initially falls on the more affluent as they adopt Westernized lifestyles, and only later shifts towards lower SES groups as the entire population undergoes nutrition and lifestyle changes [19]. Our findings thus support this the epidemiological transition, which is also supported by an Indian study which have similarly observed higher rates of hypertension or obesity in middle and upper socioeconomic strata, attributing this to lifestyle differentiation [10]. However, in another study from Kerala, there was no significant association for socioeconomic status with elevated blood pressure, suggesting that SES effects can vary regionally and may be moderated by other factors such as cultural dietary patterns or public health interventions [11].

Not surprisingly, obesity emerged as one of the strong predictors of elevated blood pressure in our study. This is strongly supported by existing literature: excess adiposity in youth is one of the most consistent risk factors for higher blood pressure. Adipose tissue fosters hypertension through multiple mechanisms – including activation of the renin-angiotensin-aldosterone system, sympathetic overactivity, endothelial dysfunction, and inflammation – leading even young individuals with obesity to display blood pressure elevation [20–22]. Numerous studies have documented the tight linkage between BMI and blood pressure in adolescents and young adults. For instance, a study by Mishra S [23] had concluded that high BMI was significantly associated with a 2-fold increased risk for hypertension. In a systematic review on risk factors associated with Hypertension in young adults by Meher M et al. [24] smoking, drinking, being overweight, and eating too much salt were identified as the primary risk factors for hypertension. To further support this, a recent data indicate that as adolescent obesity rates climb, so do youth hypertension rates in tandem [14]. Hence, it warrants interventions like promoting physical activity, improving healthy diets and reducing sugar and salt intake are critical to curb this trend. It is worth mentioning that while our study identified obesity as the significant factor, other lifestyle variables are likely involved and interrelated. Physical inactivity, for example, often accompanies obesity and independently contributes to higher blood pressure by impairing vascular function. Psychosocial stress may be another factor in college settings – academic pressures and urban stressors could elevate sympathetic drive and blood pressure, even in young adults [10]. Although our study did not observe any significant association for diet, physical activity, or stress, these undoubtedly underpin the observed associations. The implication is that a holistic lifestyle approach – encompassing healthy eating, regular exercise, stress management, and weight control – should be a cornerstone of interventions for blood pressure control in this demographic.

Tobacco smoking was another significant predictor of elevated blood pressure in our study. This result is consistent with several epidemiological and clinical findings, though the relationship between smoking and blood pressure has been complex in past research. Nicotine acutely raises heart rate and blood pressure via sympathetic stimulation, and chronic smoking contributes to arterial stiffness and endothelial injury, which would intuitively promote hypertension. Prospective evidences also confirms that young smokers are at higher risk of developing sustained hypertension. For example, a large cohort study among young Hispanic adults in the US found that current smokers had a 40 % higher relative risk of incident hypertension over 6 years compared to never-smokers [25]. This suggests that the physiological harm from tobacco – oxidative stress, inflammation, and vascular dysfunction – can manifest in measurably higher blood pressure by the college years. Surprisingly, alcohol consumption, another modifiable risk factor for non-communicable diseases did not show any association for elevated blood pressure in our study.

In summary, our study's findings of a 17.9 % elevated blood pressure prevalence and its associations with higher economic, obesity, and smoking must be viewed against the backdrop of global trends and multifactorial causation. They corroborate the growing evidence that hypertension is no

longer a disease of older adults alone – modern lifestyle changes are bringing risk factors to the fore at younger ages. The strong impact of obesity and smoking on blood pressure in this group reinforces classic prevention targets: weight management and tobacco control are as crucial for young adults as for older ones. While many of our results are supported by recent studies and align with available literature, some stand in contrast to patterns seen elsewhere, offering potential ground for further research.

Limitations

The study's cross-sectional design inherently limits the ability to establish causality between identified risk factors – such as smoking, obesity, and socioeconomic status – and elevated blood pressure since the potential for reverse causation cannot be ruled out. Therefore, longitudinal studies are warranted to track blood pressure trajectories over time and evaluate the impact of early interventions on modifiable risk factors. The use of convenience sampling could also affect the generalizability of our study findings. Additionally, the reliance on self-reported data for behavioral variables introduces a risk of social desirability bias, which may have led to underreporting of unhealthy behaviors such as tobacco or alcohol use. This could have influenced the observed associations. The study also did not capture several potentially important confounders, such as dietary salt intake, psychosocial stress, sleep quality, and family health history beyond NCDs. These unmeasured or hidden variables may have contributed to residual confounding in our analyses. Hence, future research should adopt prospective, multi-centric designs with objective measurements and broader variable inclusion to better understand the dynamics of early-onset hypertension, broader insights into regional and cultural determinants of hypertension in youth. and inform targeted public health interventions for young adults.

In the interim, our findings argue for proactive measures in college and community health programs – routine BP screening for youth, lifestyle counseling, and addressing social determinants – to curb the silent creep of hypertension in early life. By interpreting our results in light of both supporting and opposing evidence from the literature, we gain a fuller understanding that can inform a balanced public health strategy to protect the cardiovascular health of adolescents and young adults.

Research ethics: This study was performed in line with the principles of the Declaration of Helsinki. Necessary Ethical Approval was obtained from the NEIGRIHMS Institute Ethics Committee (NEIGR/IEC/M11/F7/2023).

Informed consent: Informed consent was obtained from all individual participants included in the study.

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