

## Assessment of Prehypertension in Medical Students and its Importance as a Cardiovascular Risk Factor

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### Abstract:

**Background:** Prehypertension is a significant risk factor for both hypertension and cardiovascular disorders. It is characterised by a systolic blood pressure of 120–139 mm Hg or a diastolic blood pressure of 80–89 mm Hg. Prehypertension is very common in medical students because of their stressful academic environment. This study seeks to determine the cardiovascular risk factors linked to prehypertension and its incidence among medical students.

**Methods:** One hundred fifty medical students participated in a cross-sectional study. Blood pressure, body mass index, smoking status, and family history of cardiovascular disease were noted for each participant. A regular procedure was followed in order to assess blood pressure. Using SPSS version 21.0, the data were analysed. Significant prehypertensive predictors were found using logistic regression, and descriptive statistics were used to summarise the data.

**Results:** The incidence of prehypertension was found to be 30%, with 10% of students classified as hypertensive. Higher BMI, smoking, and family history of cardiovascular diseases were significantly associated with prehypertension. Logistic regression analysis revealed that BMI, smoking, and family history of cardiovascular diseases were independent predictors of prehypertension.

**Conclusion:** A substantial proportion of medical students were found to have prehypertension, highlighting the need for regular health monitoring and early intervention. Addressing modifiable risk factors such as BMI and smoking is crucial for preventing the progression to hypertension and improving cardiovascular health in this population.

**Recommendations:** Regular health screenings, promoting healthy lifestyles, and targeted interventions are recommended to manage and mitigate risk factors for prehypertension among medical students. Institutions should implement wellness programs to support the health and well-being of their students.

**Keywords:** Prehypertension, Medical Students, Cardiovascular Risk Factors, BMI, Smoking, Blood Pressure.

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### Introduction

Prehypertension is an increasingly recognized health concern, particularly among young adults, including medical students. Defined by the Joint National Committee 7 (JNC 7) guidelines as a systolic blood pressure of 120-139 mm Hg or a diastolic pressure of 80-89 mm Hg, prehypertension is a precursor to hypertension, which significantly elevates the risk for cardiovascular diseases (CVDs) such as coronary artery disease and stroke [1]. The incidence of prehypertension among young adults has been documented in various studies, highlighting its importance as a public health issue.

Recent research has underscored the significance of prehypertension as a cardiovascular risk factor among medical students. In a study conducted at a medical college in Vietnam, the prevalence of prehypertension among freshmen was found to be 33.5%, with several risk factors such as elevated BMI, smoking, and familial history of hypertension being significantly associated with prehypertensive states [1]. This aligns with findings from a similar study in India, where 35.2% of medical students were identified as pre-hypertensive, further reinforcing the high prevalence of this condition in

academic settings where stress levels are typically high [2].

The implications of pre-hypertension extend beyond the immediate risk of progression to hypertension. It serves as an early warning sign for potential cardiovascular complications if not managed proactively. [3] Lifestyle factors such as poor diet, physical inactivity, and high stress are prevalent among medical students, contributing to the development of prehypertension. A study highlighted the economic and health burdens of hypertension and emphasized the cost-effectiveness of early detection and management of prehypertension to prevent long-term cardiovascular complications [4].

Understanding the prevalence and risk factors of pre-hypertension in medical students is crucial for implementing preventive strategies. Medical students, due to their rigorous academic schedules and high stress, are particularly vulnerable to developing prehypertension. This demographic is also significant as future healthcare providers; thus, their health and well-being are paramount. Addressing prehypertension through lifestyle modifications and regular health monitoring can not only improve their health outcomes but also set a precedent for their future practice in promoting cardiovascular health.

The aim of this study was to assess the prevalence of pre-hypertension among medical students and identify its associated cardiovascular risk factors.

### Methodology

**Study Design:** A cross-sectional observational study.

**Study Setting:** The research was conducted at Bhagwan Mahavir Institute of Medical Sciences Pawapuri, spanning from June 2021 to August 2021.

**Participants:** A total of 150 medical students participated in the study.

**Inclusion and Exclusion Criteria:** Inclusion criteria encompassed medical students aged 18-25 years, who provided informed consent. Students with known cardiovascular diseases, hypertension, diabetes, or those on antihypertensive medication were excluded from the study.

**Sample Size:** To calculate the sample size for this study, the following formula was used for estimating a proportion in a population:

$$n = \frac{Z^2 \times p \times (1-p)}{E^2}$$

Where:

- n = sample size
- Z = Z-score corresponding to the desired level of confidence
- p = estimated proportion in the population
- E = margin of error

**Bias:** To minimize selection bias, participants were randomly selected from different academic years. Information bias was reduced by using standardized and calibrated equipment for blood pressure measurement.

**Variables:** The primary variable was blood pressure, categorized into normal, prehypertension, and hypertension levels according to standard guidelines. Other variables included age, gender, BMI, smoking status, and family history of cardiovascular diseases.

**Data Collection:** Data were collected through a structured questionnaire and direct measurements. After the subjects had rested for a minimum of five minutes, their blood pressure was assessed using a calibrated sphygmomanometer. Blood pressure was measured in the right arm in a sitting posture. Each participant's BMI was calculated from their height and weight measurements.

**Procedure:** The questionnaire, which asked about medical history and demographics, was completed by the participants. Their BMI and blood pressure were then assessed. To ensure privacy, the data were anonymized and recorded.

**Statistical Analysis:** SPSS version 21.0 was used to enter and analyse the gathered data. To compile the data, descriptive statistics were employed. Prehypertension prevalence was determined, and chi-square tests and logistic regression analysis were used to examine the relationship between the condition and other risk variables. At  $p < 0.05$ , statistical significance was established.

**Ethical Considerations:** The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

### Result

Out of, the 150 medical students, 60 (40%) were male and 90 (60%) were female. The mean age was  $21.4 \pm 1.8$  years. The prevalence of smoking among the participants was 10% (15 students), and 20% (30 students) had a family history of cardiovascular diseases.

**Table 1: Blood Pressure Distribution**

Blood Pressure Category	N (%)
Normal	90 (60%)
Prehypertension	45 (30%)
Hypertension	15 (10%)

The distribution of blood pressure categories among the participants is presented in Table 1. A total of 45 students (30%) were found to have prehypertension, 15 students (10%) had hypertension, and 90 students (60%) had normal blood pressure.

**Table 2: Association of Prehypertension with Risk Factors**

Risk Factor	Prehypertension (n=45)	Normal BP (n=90)	p-value
Mean BMI (kg/m <sup>2</sup> )	24.3 ± 3.2	22.1 ± 2.5	<0.01
Smoking (%)	8 (17.8%)	7 (7.8%)	0.05
Family History of CVD (%)	12 (26.7%)	12 (13.3%)	<0.05
Gender (Male, %)	25 (55.6%)	35 (38.9%)	0.04

The association between prehypertension and various risk factors is shown in Table 2. Among the students with prehypertension, 25 (55.6%) were male, and 20 (44.4%) were female. The mean BMI of students with prehypertension was 24.3 ± 3.2 kg/m<sup>2</sup>, compared to 22.1 ± 2.5 kg/m<sup>2</sup> for those with normal blood pressure.

**Table 3: Logistic Regression Analysis**

Variable	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
BMI	1.25	1.10-1.42	<0.01
Smoking	2.50	1.10-5.70	0.03
Family History of CVD	2.20	1.05-4.60	0.04
Gender (Male)	1.50	0.75-2.90	0.08

A logistic regression analysis was conducted to determine the independent predictors of prehypertension. The results are summarized in Table 3. BMI, smoking status, and family history of cardiovascular diseases were significant predictors of prehypertension among medical students.

### Discussion

The study assessed the incidence of prehypertension among medical students and identified associated risk factors. The analysis included 150 participants, with a higher proportion of females (60%) compared to males (40%). The mean age was 21.4 years. Notably, 30% of the students were found to have prehypertension, while 10% were hypertensive, highlighting a significant prevalence of elevated blood pressure in this population.

The results indicated a clear association between prehypertension and several risk factors. Students with prehypertension had a notably higher mean BMI (24.3 kg/m<sup>2</sup>) compared to those with normal blood pressure (22.1 kg/m<sup>2</sup>), suggesting that increased body weight is a critical factor in the development of prehypertension. Additionally, smoking was more prevalent among students with prehypertension (17.8%) compared to those with normal blood pressure (7.8%), indicating a significant relationship between smoking and elevated blood pressure. Family history of cardiovascular diseases also emerged as a significant predictor, with 26.7% of

prehypertensive students reporting a family history, compared to 13.3% of those with normal blood pressure.

Logistic regression analysis further reinforced these findings, identifying BMI, smoking, and family history of cardiovascular diseases as independent predictors of prehypertension. Specifically, each unit increase in BMI was correlated with a 25% rise in the odds of having prehypertension. Similarly, smokers were 2.5 times more likely to have pre-hypertension compared to non-smokers, and students with a family history of cardiovascular diseases had more than double the risk of developing prehypertension.

These findings emphasize the importance of addressing modifiable risk factors such as body weight and smoking habits among medical students to prevent the progression to hypertension and subsequent cardiovascular diseases. Regular health screenings and targeted interventions could be beneficial in managing and mitigating these risk factors, ultimately promoting better cardiovascular health in this demographic. The study underscores the need for awareness and proactive measures in managing blood pressure among young adults, particularly those in demanding academic environments like medical schools.

Recent studies have focused on the prevalence, predictors, and cardiovascular risk implications of prehypertension in medical students. A study found that pre-hypertension was more widespread among male students (36%) compared to female students

(7%). The study identified significant predictors including higher body mass index (BMI), smoking, and male gender. These findings emphasize the need for early lifestyle modifications to reduce prehypertension risk [4].

Research involving students from various disciplines in Chennai revealed that 55.6% of medical students were prehypertensive. High levels of stress and anxiety were significantly associated with prehypertension, highlighting the psychological burden faced by these students [5].

A study among adolescents found that 20.8% of participants were prehypertensive. Significant predictors included age, sex, ethnicity, and obesity. The study suggests the importance of early intervention in school settings to manage prehypertension and its risk factors [6].

A study examining the association of prehypertension with obesity and lipid parameters in medical students found a prevalence of 38%. Pre-hypertension was significantly related to higher BMI and dyslipidemia, indicating the role of metabolic factors in its development [7].

Research found that sociodemographic factors such as gender, age, occupation, smoking history, and urban residence were significantly associated with prehypertension. The study underlines the importance of targeted interventions based on sociodemographic profiles [8].

A study comparing various anthropometric measures found that BMI, body roundness index (BRI), waist circumference (WC), and waist-to-height ratio (WHtR) were effective in predicting prehypertension. BMI showed the highest predictive value among these indices [9].

Another study reported that 52.1% of female and 58.8% of male medical students were prehypertensive. The study identified obesity, family history, sedentary lifestyle, and high salt intake as significant risk factors [10].

### Conclusion

This study revealed a notable prevalence of prehypertension among medical students, with significant associations with higher BMI, smoking, and a family history of cardiovascular diseases. These findings highlight the urgent need for regular health screenings and targeted interventions to address modifiable risk factors. By promoting healthier lifestyles and early intervention strategies, we can mitigate the risk of progression to hypertension and improve cardiovascular health outcomes in this young and potentially high-risk population.

**Limitations:** The limitations of this study include a small sample population who were included in this

study. Furthermore, the lack of a comparison group also poses a limitation for this study's findings.

**Recommendation:** Regular health screenings, promoting healthy lifestyles, and targeted interventions are recommended to manage and mitigate risk factors for prehypertension among medical students. Institutions should implement wellness programs to support the health and well-being of their students.

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### List of Abbreviations:

BMI - Body Mass Index

BP - Blood Pressure

CVD - Cardiovascular Diseases

Hg - Mercury

JNC 7 - Joint National Committee 7

OR - Odds Ratio

CI - Confidence Interval

WC - Waist Circumference

WHtR - Waist-to-Height Ratio

BRI - Body Roundness Index

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