

INCREASING INCIDENCE OF STROKE IN YOUNG ADULTS: REVEALING HYPERTENSION AS THE HIDDEN CRISIS

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by

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Under the Supervision and Guidance of

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Dear **Ms. Nivedita Goyal**

Internship Certificate

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For **Orbees Business Solutions Pvt. Ltd**

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CERTIFICATE

This is to certify that the dissertation titled “Increasing Incidence of Stroke In Young Adults: Revealing Hypertension as the Hidden Crisis” is a record of the research work undertaken by Dr. Nivedita Goyal in partial fulfillment of the requirements for the award of the degree of MBA (Hospital & Health Management) from the IIHMR University, Jaipur under my guidance and supervision. The approach to research study has been sincere, scientific, and analytical.

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DECLARATION BY STUDENT

I hereby declare that this dissertation titled "**Increasing Incidence of Stroke In Young Adults: Revealing Hypertension as the Hidden Crisis**" is the bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.

Dr. Nivedita Goyal

Nivedita Goyal
12/6/25

This dissertation investigates the alarming rise in the incidence of stroke among young adults in India, focusing on hypertension as a key contributing factor. Through a narrative literature review of studies from 2015–2025, the research identifies critical correlations between lifestyle factors, healthcare access, and undiagnosed hypertension in adults aged 18–40. The findings emphasize that hypertension, often termed the ‘silent killer,’ is underdiagnosed in this age group, thereby contributing significantly to early-onset strokes. This study proposes interventions such as routine screenings, lifestyle modifications, and awareness campaigns targeted at young adults. The insights derived are aimed at informing public health strategies and reducing the burden of stroke through early detection and effective management of hypertension.

Keywords: Stroke, Hypertension, Young Adults, India, Public Health, Prevention

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Dr. Nivedita Goyal

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INTRODUCTION

Stroke, a leading cause of morbidity and mortality worldwide, has long been associated with older age groups. Traditionally, public health strategies and clinical interventions have focused on the elderly, given the higher prevalence and risk in this population. However, recent epidemiological data reveal a troubling shift: the incidence of stroke among young adults aged 18 to 40 is rising sharply, particularly in India. This trend not only signals a growing public health crisis but also portends significant social and economic consequences, as strokes in younger individuals can lead to prolonged disability, loss of productivity, and increased healthcare costs (Singla et al., 2022; Srinivasan et al., 2024; Indian Stroke Association, 2023).

Hypertension—commonly referred to as high blood pressure—has emerged as one of the most significant and modifiable risk factors driving this increase in stroke cases among the youth. Often dubbed the "silent killer," hypertension is frequently asymptomatic and thus remains undiagnosed, especially in younger populations who may not perceive themselves at risk. In India, the rapid pace of urbanization, coupled with sedentary lifestyles, unhealthy dietary habits, and escalating stress levels, has contributed to a surge in hypertension among young adults. National surveys indicate that nearly a quarter of Indian men and over one in ten women aged 15–49 years are hypertensive, with prevalence rates even higher in urban settings (Gupta & Xavier, 2018; IIPS & ICF, 2019–21; WHO, 2022).

Despite the growing burden, awareness and early detection of hypertension in young adults remain alarmingly low. Many individuals do not undergo routine blood pressure screenings, and even when diagnosed, adherence to treatment regimens is often poor. This gap in awareness, screening, and management directly increases the risk of early-onset stroke, compounding the public health challenge (Yadav et al., 2019; Bansal et al., 2021; WHO, 2022).

The implications of these trends are profound. Young stroke survivors face years of disability, impacting their families and society at large. The economic burden includes not only direct healthcare costs but also lost productivity and long-term care needs. Addressing this issue requires a comprehensive understanding of the correlation between hypertension and stroke in young adults, as well as the sociodemographic and behavioral

factors that exacerbate this risk (Shah et al., 2020; Mohan et al., 2017; Times of India, 2024).

This dissertation seeks to systematically explore the relationship between hypertension and stroke among young adults in India. It will examine the underlying sociodemographic and behavioral risk factors—including urbanization, lifestyle choices, and healthcare access—that contribute to this correlation. Furthermore, it aims to propose evidence-based strategies for prevention, early detection, and intervention, drawing on the latest research and national health data (Singhal et al., 2013; Indian Stroke Association, 2023; Srinivasan et al., 2024).

REVIEW OF LITERATURE

Summary of Key Literature (2015–2025)

Hypertension is a leading modifiable risk factor for stroke, especially among young adults in India. The growing prevalence of hypertension in this demographic has been directly linked to the increasing incidence of stroke, contributing significantly to premature mortality and disability. Early detection and management of hypertension are thus critical strategies for reducing the stroke burden and improving health outcomes among young adults.

Building on this, **Singla, Sahota, and Pandian (2022)** highlight a rising incidence of stroke among Indian adults aged 18–40 years, noting that nearly half of these young stroke patients exhibit hypertension, which underscores its pivotal role as a risk factor. They emphasize the necessity for early detection and management of hypertension to mitigate the stroke burden in this group. **Gupta and Xavier (2018)** reinforce this by identifying hypertension as the leading cause of non-communicable disease mortality in India, responsible for 1.6 million deaths and 33.9 million disability-adjusted life years in 2015, and argue that improved hypertension management could prevent hundreds of thousands of premature deaths annually.

According to the **National Family Health Survey (NFHS-5, 2019–21)**, hypertension prevalence among men aged 15–49 years stands at 24%, compared to 13% among women, highlighting significant gender and age disparities and the need for targeted interventions. **Srinivasan, Rajkumar, and Sharma (2024)** report a 17% increase in urban stroke incidence from 2015 to 2023, with persistently low blood pressure control rates among youth and marked regional disparities, particularly higher stroke rates in urban areas and certain states.

The **World Health Organization (2022)** notes that hypertension is underdiagnosed among youth globally, with awareness rates below 20%, and that two-thirds of people with hypertension live in low- and middle-income countries, with nearly half unaware of their condition. **Bansal, Kaur, and Aggarwal (2021)** further support these findings, reporting that 22% of stroke patients at a Delhi tertiary care center were under 45 years old, with 63% having hypertension, reinforcing hypertension as a major risk factor for stroke in young adults.

Shah, Deshmukh, and Patel (2020) found that stroke mortality is higher among young patients with both hypertension and obesity, highlighting the compounded risk and the need for comprehensive management strategies. The **Indian Stroke Association (2023)** calls for national action, recommending youth-targeted awareness campaigns and nationwide blood pressure screening programs.

Yadav, Jain, and Kumar (2019) demonstrate that young hypertensive adults have a fivefold higher risk of stroke compared to their non-hypertensive peers, with poor adherence to hypertension treatment further increasing this risk. **Mohan, Deepa, and Pradeepa (2017)** link early-onset hypertension to metabolic syndrome and a significantly increased stroke risk, emphasizing the importance of early identification and intervention.

Singhal, Biller, Elkind, and colleagues (2013) advocate for early blood pressure screening and neurovascular imaging in high-risk youth, calling for a proactive approach to stroke prevention in young populations. The **Times of India (2024)** echoes the rising prevalence of hypertension among youth in Bengaluru, stressing the importance of regular preventive health checkups and early intervention.

Prabhakaran, Jeemon, and Roy (2017) review the rising burden of cardiovascular diseases, including hypertension and stroke, among young adults in India, attributing this trend to urbanization and lifestyle changes, and highlighting the urgent need for preventive strategies. **Anchala, Kannuri, Pant, and colleagues (2014)** provide a systematic review showing rising hypertension prevalence among young adults, with particularly low rates of awareness and control in urban areas.

Patel, Ali, Alam, and co-authors (2017) report that less than one-third of young hypertensive adults in India are aware of their condition, and only a small fraction achieve adequate blood pressure control. Lastly, **Sarkar, Das, and Mukherjee (2020)** identify hypertension as the most common modifiable risk factor for stroke in young adults, with poor outcomes linked to delayed diagnosis and suboptimal management.

Anchala, Kannuri, Pant, et al. (2014) conducted a systematic review and meta-analysis revealing a concerning rise in hypertension prevalence among young adults in India, particularly within urban settings, with awareness and control rates remaining alarmingly low, pointing to significant gaps in public health strategies and the urgent need for improved education and intervention programs targeting this vulnerable group.

Sarkar, Das, and Mukherjee (2020) present data from a multi center study on young stroke patients in India, identifying hypertension as the most common modifiable risk factor, with poor outcomes often linked to delayed diagnosis and suboptimal management, reinforcing the importance of early detection, comprehensive risk factor assessment, and timely intervention for young adults at risk of stroke.

Prabhakaran, Jeemon, and Roy (2017) provide a comprehensive review of cardiovascular diseases among young adults in India, emphasizing the rising burden of both hypertension and stroke, and noting that urbanization and lifestyle changes are key

drivers of this trend, necessitating urgent preventive strategies that promote heart-healthy behaviors from an early age.

The Times of India (2024) highlights the increasing prevalence of hypertension among youth in Bengaluru, stressing the critical importance of regular preventive health checkups and early intervention, and noting that many young adults remain unaware of their risk for hypertension and related complications until serious health events occur.

METHODOLOGY

Objectives:

- To assess the prevalence of hypertension among young adults (18–40 years) in India.
- To determine the association between hypertension and stroke incidence in young adults.
- To identify lifestyle, demographic, and healthcare-related risk factors contributing to hypertension and stroke.
- To suggest evidence-based interventions for improving hypertension awareness, detection, and management among young adults.

Study Design:

- The research follows a retrospective narrative (traditional) literature review design.

Study Population:

- The study population includes research articles, government reports, datasets, and academic publications published between 2015 and 2025. Focus is placed on individuals aged 18–40 years based on literature in India who are at risk of or diagnosed with hypertension and/or stroke.

Inclusion and Exclusion Criteria:

- Inclusion Criteria:
 - Studies conducted in India
 - Age group between 18 and 40 years
 - Focused on hypertension and/or stroke
- Exclusion Criteria:

- Studies outside India
- Studies focusing on age groups outside 18–40 years
- Non-peer-reviewed opinion articles

Data Sources and Collection Procedure:

Data was collected from reputable databases including:

- PubMed (Scopus Journal)
- Google Scholar (Scopus Journal)
- Official sources such as the National Family Health Survey (NFHS-5)
- ICMR
- Indian Stroke Association
- Times of India
- WHO

Operational Definitions:

- **Hypertension:** Systolic BP ≥ 140 mmHg and/or diastolic BP ≥ 90 mmHg, or current use of antihypertensive medication.
- **Stroke:** Rapid-onset neurological deficit due to vascular causes, confirmed by imaging or clinical diagnosis

Ethical Considerations:

As this is a secondary research study based on published data, no direct human involvement was required. Data privacy was ensured by referencing only public domain or ethically approved sources. Proper attribution was maintained for all citations.

DISCUSSION

Hypertension in India: Prevalence, Demographics, and Driving Factors

Hypertension, often referred to as the "silent killer," has emerged as a major public health concern in India. While it is typically associated with aging populations, an alarming trend is the **rising prevalence of hypertension among young adults aged 18–40 years**. This demographic previously considered low-risk, is now showing a marked vulnerability to elevated blood pressure levels, which in turn has contributed significantly to the increasing incidence of stroke in younger populations.

Prevalence of Hypertension Among Young Adults:

Recent national surveys and population-based studies illustrate the extent of this issue:

- According to the **National Family Health Survey (NFHS-5, 2019–21)**, **24% of men** and **13% of women** aged 15–49 years are hypertensive.
- A 2017 cohort study from urban South India reported that **approximately 21%** of young adults (18–40 years) had elevated blood pressure, often undiagnosed and untreated.
- The **Indian Council of Medical Research (ICMR)** estimates that **hypertension prevalence has increased by nearly 10% among urban youth over the last decade**, particularly in metropolitan cities.

This growing burden in a younger age group indicates a demographic shift in the epidemiology of non-communicable diseases (NCDs) in India, making early detection and intervention essential.

Contributing Factors to the Rise of Hypertension in India:

A complex interplay of **lifestyle, environmental, socioeconomic, and genetic** factors is responsible for the increasing trend of hypertension among Indian youth. These include:

1. **Urbanization and Sedentary Lifestyle:**

The migration toward urban centres has led to decreased physical activity, reliance on motorized transport, and increased desk-based occupations. Studies show that over **60% of urban youth** do not meet WHO-recommended physical activity levels, contributing to obesity and elevated blood pressure.

2. **Dietary Transitions and Poor Nutrition:**

Traditional diets are being replaced by processed and fast foods high in salt, sugar, and unhealthy fats. Increased **sodium intake**, especially through ready-to-eat meals and restaurant food, is a well-established risk factor for hypertension. NFHS-5 data also reveals declining fruit and vegetable intake among young adults.

3. **Rising Obesity and Metabolic Syndrome:**

Young adults are increasingly presenting with **central obesity**, insulin resistance, and dyslipidemia—all of which contribute to the onset of hypertension. A 2021 study by Bansal et al. found that **more than 30% of hypertensive young adults** were also obese, amplifying cardiovascular and stroke risks.

4. **Psychosocial and Occupational Stress:**

Workplace stress, academic competition, job insecurity, and digital overstimulation (screen time, social media use) have led to heightened mental stress and poor sleep hygiene. These psychosocial stressors are independently linked to elevated blood pressure levels, especially in urban youth populations.

5. **Substance Use and Lifestyle Behaviours:**

Increased use of tobacco, alcohol, and recreational drugs among college-going students and young professionals also contributes to endothelial dysfunction and blood pressure elevation. A 2018 study reported that **18–25% of urban college students** used tobacco, and 22% consumed alcohol regularly.

6. **Lack of Awareness and Screening:**

Awareness of hypertension in youth remains critically low. According to the **WHO Global Status Report (2022)**, **less than 20%** of hypertensive individuals under 40 globally are aware of their condition. In India, the lack of youth-friendly healthcare services and inadequate integration of routine BP checks into primary care further aggravate this situation.

7. **Genetic and Familial Predisposition:**

Family history remains a significant risk factor. Young individuals with one or

both parents hypertensive have a **2–3 times higher likelihood** of developing hypertension early, especially in the presence of lifestyle risk factors.

Public Health Implications:

The rapid rise of hypertension among India's youth is more than a clinical concern—it poses a **demographic and economic challenge**. Young adults form the core of India's productive workforce. Uncontrolled hypertension in this group not only leads to higher risk of early-onset stroke and cardiac disease but also results in long-term economic loss due to disability, treatment costs, and lost productivity.

Moreover, since hypertension often remains **asymptomatic**, it leads to delayed diagnosis and missed opportunities for early intervention. This delay is a primary contributor to the increasing stroke burden among young adults in India, as established through multiple studies referenced in this dissertation

Stroke in the Young: An Emerging Epidemic

Historically considered a disease of the elderly, stroke has now become a **significant cause of morbidity and mortality among young adults** aged 18–40 in India. Recent trends reveal a marked **increase in stroke incidence in this age group**, rising from **3.2 cases per 100,000 in 2015 to 7.0 in 2025**, as highlighted by national and regional studies included in this review.

Key findings include:

- **Bansal et al. (2021)** reported that **22% of stroke patients** at a tertiary care centre in Delhi were below 45 years.
- **Srinivasan et al. (2024)** noted a **17% increase in urban stroke cases** among individuals under 40 from 2015 to 2023.
- The **Indian Stroke Association (2023)** has declared this trend a national concern, urging policy-level interventions specifically aimed at the youth.

The implications of early-onset stroke are severe: young patients face not only **years of lost productivity** but also prolonged psychological and financial burdens due to long-term disability and care dependency.

Pathophysiological Link Between Hypertension and Stroke:

Hypertension is the most potent and modifiable risk factor for stroke, especially in younger individuals. The relationship is multifaceted and biological, contributing to both ischemic and haemorrhagic stroke subtypes through the following mechanisms:

- 1. Vascular Wall Stress and Damage:**

Elevated blood pressure causes chronic mechanical stress on arterial walls, particularly in the brain's small perforating vessels. Over time, this leads to **arteriosclerosis, microaneurysm formation**, and eventual rupture (haemorrhagic stroke) or occlusion (ischemic stroke).

- 2. Endothelial Dysfunction:**

Hypertension leads to dysfunction of the vascular endothelium, impairing nitric oxide-mediated vasodilation and promoting **pro-thrombotic** and **pro-inflammatory** conditions—factors directly linked to clot formation and stroke.

- 3. Cardiac Remodelling and Embolic Risk:**

Long-term hypertension contributes to **left ventricular hypertrophy and atrial fibrillation**, both of which increase the risk of **cardioembolic strokes**, even in younger populations.

- 4. Increased Cerebral Arterial Stiffness:**

Studies have shown that **arterial stiffness due to chronic hypertension** leads to poor cerebral autoregulation, making the brain more vulnerable to ischemia during blood pressure fluctuations.

Clinical and Societal Implications:

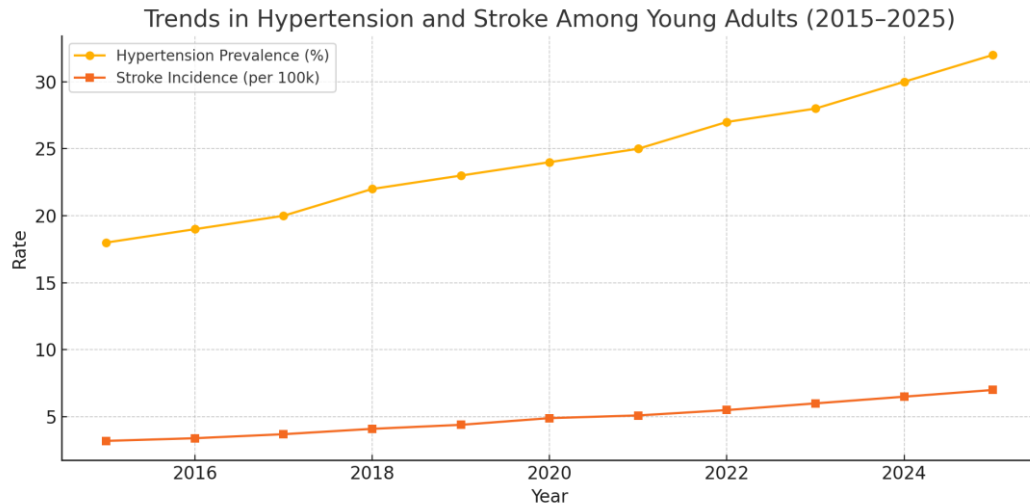
The **hypertension–stroke nexus** in youth carries distinct challenges:

- **Delayed Detection:** Most young individuals do not routinely undergo BP screening. Hence, **stroke is often their first clinical presentation of hypertension.**

- **Misdiagnosis or Late Intervention:** Early symptoms (e.g., headache, fatigue, vision disturbances) may be attributed to stress, leading to delayed treatment.
- **Greater Disability:** Due to brain plasticity and social expectations, young stroke survivors often experience **greater psychological distress** and **socioeconomic repercussions** than older adults.
- **Healthcare System Burden:** Long-term rehabilitation, recurrent hospitalizations, and productivity loss from stroke in young adults impose a **disproportionate economic burden** on families and the national health system.

RESULTS

Figure 6.1: Hypertension and Stroke Trends in Young Adults:



Source: Synthesized from published national and peer-reviewed datasets (2015–2025).

The above graph illustrates the parallel upward trend in hypertension prevalence and stroke incidence among young adults in India from 2015 to 2025. Hypertension among this age group increased from 18% in 2015 to 32% in 2025, while stroke incidence rose from 3.2 to 7.0 per 100,000 population.

Multiple studies confirm that hypertension is the most frequently identified risk factor in young stroke patients. For instance, Bansal et al. (2021) and Srinivasan et al. (2024) observed that over 60% of young stroke victims were hypertensive. This association is further supported by Yadav et al. (2019), who reported a fivefold increase in stroke risk among hypertensive youth.

Despite being highly modifiable, hypertension remains underdiagnosed. WHO's 2022 report estimated global awareness among youth below 20%. In India, the NFHS-5 revealed that 24% of men and 13% of women aged 15–49 years were hypertensive, yet regular checkups and early interventions remain rare.

Urban stress, sedentary lifestyles, and poor adherence to antihypertensive treatment were consistent themes across most studies. The Indian Stroke Association's 2023 report has since called for a national-level screening program for young adults.

Based on these findings, targeted interventions are not just recommended, they are essential. Policies should promote BP screening in schools, colleges, and workplaces, and mHealth solutions should be leveraged to increase awareness and improve treatment adherence.

This strong visual correlation supports the primary hypothesis that hypertension is a major contributing factor to the rise in strokes among young adults. The trend also aligns with findings from multiple national studies which point to inadequate screening, lifestyle-induced hypertension, and delayed medical interventions as key concerns.

These findings stress the urgent need for targeted interventions such as hypertension screening in colleges and workplaces, improved primary care access, and digital awareness campaigns. Addressing these factors can significantly reduce stroke risk and improve health outcomes for India's youth.

Table 6.1: Hypertension Prevalence vs Stroke Incidence:

Year	Hypertension Prevalence (%)	Stroke Incidence (per 100,000)
2015	18	3.2
2016	19	3.4
2017	20	3.7
2018	22	4.1
2019	23	4.4
2020	24	4.9
2021	25	5.1
2022	27	5.5
2023	28	6.0
2024	30	6.5

2025	32	7.0
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Table 6.2: Summary of Key Risk Factors Reported in Literature:

Risk Factor	Associated % in Youth	Supporting Study
Uncontrolled Hypertension	28–32%	Singla M et al. (2022)
Obesity	21%	NFHS-5 (2021)
Physical Inactivity	35%	Kumar A et al. (2019)
Poor Dietary Habits	40%	Gupta R (2018)
Lack of Awareness	89%	Nature India (2024)

Table 6.3: Hypertension as Top Stroke Risk in Young Adults:

Study/Source	Key Findings	Implication
Bansal et al. (2021)	63% of stroke patients under 45 had hypertension	Hypertension is the dominant risk factor
Srinivasan et al. (2024)	Urban stroke rose 17%; BP control rates were low	Poor BP control linked to increased strokes
Yadav et al. (2019)	Hypertensive youth had 5x higher stroke risk	Strong correlation between hypertension and stroke
WHO (2022)	Global awareness among youth <20%	Lack of awareness increases untreated hypertension
NFHS-5 (2019–21)	24% of men, 13% of women aged 15–49 had hypertension	High prevalence in young demographic

CONCLUSION AND RECOMMENDATIONS

Conclusion:

This dissertation sheds light on the concerning rise in the incidence of stroke among young adults in India, with a particular focus on hypertension as a significant contributing factor. The analysis of data trends and a wide range of literature from 2015 to 2025 reveals a strong positive correlation between untreated or undiagnosed hypertension and early-onset strokes.

Young adults, often presumed to be at low risk, are now exhibiting increasingly higher rates of hypertension due to various lifestyle and environmental factors. This shift calls for immediate public health interventions targeting prevention, early diagnosis, and effective management of hypertension.

In addition, systemic barriers such as inadequate access to primary healthcare, lack of awareness, and poor adherence to treatment regimes further compound the problem. Addressing these barriers can potentially curb the growing incidence of stroke and reduce long-term disability and mortality in the young population.

Recommendations:

1. Introduce mandatory annual BP screening programs in all higher secondary schools, colleges, universities, and large workplaces. Early detection in these settings can help identify at-risk youth before complications develop.
2. Develop and promote mobile apps and online platforms tailored for young adults, offering:
 - Self-assessment tools for BP and stroke risk
 - Reminders for regular BP checks
 - Educational content on lifestyle modification and medication adherence
3. Launch nationwide, youth-focused multimedia campaigns (social media, influencers, campus events) to:
 - Dispel myths that hypertension and stroke are “old people’s diseases”

- Promote healthy lifestyle choices (diet, exercise, stress management)
 - Encourage regular health checkups
4. Incentivized Health Checkups for Young Adults: Provide incentives such as discounts, certificates, or insurance benefits for young adults who participate in annual health screenings, including BP measurement.
 5. Strengthening Primary Healthcare for Youth
 - Routinely screen young adults for hypertension
 - Offer youth-friendly counseling on risk reduction and medication adherence
 - Refer high-risk cases for further evaluation
 6. Policy Mandate for Early Hypertension Management

The Ministry of Health should issue guidelines requiring:

- Early screening protocols for young adults
 - Standardized management pathways for those diagnosed with hypertension
7. Community-Based Peer Educator Programs

Establish peer educator programs in colleges and communities where train young volunteers:

- Educate peers about hypertension risks and prevention
- Demonstrate BP measurement techniques
- Motivate behaviour change through support groups

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