Available online at www.ijicr.com

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

INDIAN JOURNAL OF INNOVATIVE CLINICAL RESEARCH

Received 16 February 2025
Revised 27 February 2025
Accepted 5 March 2025

REVIEW ARTICLE

Hypertension Management in India: A Comprehensive Review of Current Strategies, Guidelines, and Challenges with Focus on Bihar and Medical College Settings

Taskeen Ahmad Reza, MD, Department of Medicine, KMCH (Katihar Medical College & Hospital), Bihar, India, taskeen84@gmail.com

Abstract

Background: Globally, a main cause of cardiovascular disease (CVD) is hypertension. With clear regional differences, India is suffering an increasing epidemic of hypertension. In states such as Bihar, disease frequency and control are influenced by socioeconomic elements as well as healthcare access. Emphasising epidemiology, treatment guidelines, and program strategies, this review synthesises current evidence (2015–2025) on hypertension management in India, with an eye towards Bihar and the function of medical college hospitals.

Methods: Using national data sources (ICMR, NFHS, Bihar Health Department), literature from PubMed, Google Scholars, and other sources, a narrative review was done spanning 2015 through 2025. Large-scale studies, national surveys, guidelines, and health program reports took front stage. Data were compiled thematically.

Results: Out of all the Indian adults, hypertension affects about 22–29%. Bihar claims a lower prevalence (~17%), but the disorder is still underdiagnosed and poorly managed. Only 37% of the hypertension patients identified by NFHS-5 (2019–21) were diagnosed, 18% treated, and just 8.5% had blood pressure under control. Emphasising lifestyle changes and affordable pharmacotherapy, the Indian Guidelines on Hypertension (2019) retain a diagnostic threshold of ≥140/90 mmHg. National strategies meant to increase outcomes include standardised treatment guidelines, primary care-based screening, and salt

Available online at www.ijicr.com

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

reduction. By means of simplified regimens, task-sharing, and enhanced drug supply, programs such as the India Hypertension Control Initiative (IHCI) and the NPCDCS have expanded hypertension treatment and achieved up to 43% control in program settings. Through research, training of medical professionals, and handling challenging cases, medical college hospitals significantly contribute.

Keywords: Hypertension; India; Bihar; Blood Pressure; Cardiovascular Risk; Guidelines; Hypertension Control Initiative; NPCDCS; Medical College Hospital; Epidemiology; Treatment; Review

INTRODUCTION

Hypertension is one of the most prevalent cardiovascular risk factors worldwide and a leading cause of morbidity and mortality. It is often termed the "silent killer" due to its asymptomatic progression and deadly complications like stroke, myocardial infarction, heart failure, and kidney disease(Mills et al., 2020). Globally, approximately 1.3 billion adults have hypertension, with low- and middle-income countries contributing a major share of this burden. India, the world's second most populous country, is experiencing a rapid epidemiological transition characterized by increasing non-communicable diseases (NCDs) including hypertension. (Ramakrishnan et al., 2019) According to the Global Burden of Disease and World Health Organization (WHO) estimates, raised blood pressure accounts for a significant proportion of CVD deaths in India (approximately 24–25% of coronary heart disease deaths and over 57–65% of stroke deaths). Nearly 63% of all deaths in India are due to NCDs, and 27% are attributed specifically to cardiovascular diseases, with hypertension being a key modifiable risk factor. Uncontrolled hypertension is estimated to kill more adults in India than any other cause, underscoring the imperative to improve its management.(Gupta, 2004)

Despite this recognition, hypertension control in India remains a challenge. Traditionally, a large fraction of India's hypertensive population has remained undiagnosed or inadequately treated due to low awareness, limited access to care, and gaps in long-term follow-up. Recent data indicate that only about one in three hypertensive individuals in India are aware of their condition and an even smaller fraction achieve blood pressure control with treatment. These care gaps are more pronounced in certain regions and populations. Bihar, an eastern state with predominantly rural population and constrained healthcare resources, exemplifies the challenges: while its hypertension prevalence is slightly lower than the national average, control rates are likely even poorer due to healthcare access issues and low awareness.(Amarchand et al., 2022)

Encouragingly, the past decade has seen intensified efforts in India to tackle hypertension – from updated clinical guidelines to nationwide initiatives integrating hypertension screening and management into primary healthcare. The Indian Council of Medical Research (ICMR), Ministry of Health & Family Welfare (MoHFW), and expert groups have

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

released consensus guidelines tailored to the Indian context. Programs like the National Health Mission's NPCDCS and the India Hypertension Control Initiative (IHCI) have targeted improvements in hypertension care delivery at community and facility levels. It is crucial to review and synthesize these developments to guide clinicians, especially in medical college hospitals and similar tertiary care settings, where the sickest patients are managed and future healthcare providers are trained.(Frieden et al., 2019)

Objectives: This review provides a comprehensive overview of hypertension management within the field of cardiology in India, with particular attention to strategies, data, and guidelines relevant to the Indian context. We place special emphasis on state-specific insights (with Bihar as a case example) and the role of medical college settings in implementing hypertension care. We discuss epidemiological trends, current guideline recommendations, therapeutic strategies (lifestyle and pharmacologic), health system initiatives, and the challenges and opportunities in achieving better blood pressure control in India. Ultimately, this review aims to inform clinicians and policymakers about the progress and gaps in hypertension management in India over the last decade, and to suggest pathways for improving outcomes in high-burden regions. The study utilizes data from the Longitudinal Study of Ageing in India, a nationally representative survey of more than 72,000 individuals (Bhatia et al., 2021).

METHODOLOGY OF REVIEW

Design: We performed a narrative literature review with an eye towards current evidence (2015–2025) on hypertension incidence and management in India. Both research studies and authoritative health guidelines were gathered using a broad search approach.

Data Sources and Search Strategy: Using keywords such "hypertension India," "blood pressure control India," "Indian hypertension guidelines," "hypertension prevalence Bihar," "hypertension management medical college," "NPCDCS hypertension," we searched scientific databases including PubMed, MEDLINE, and Google Scholars for peer-reviewed papers. We included English language and filters for publication years (limited to 2015 forward). High-quality studies including meta-analyses, meta-analyses, randomised trials (if any particular to India), and review papers were given particular focus. We also obtained official data sources: ICMR and Ministry of Health publications, World Health Organisation (WHO) reports particular to India, reports from the National Family Health Survey (NFHS-4, 2015–16 and NFHS-5, 2019–21). Bihar state health department statistical reports. We obtained the "Indian Guidelines on Hypertension (IGH) – IV, 2019" and pertinent WHO guidelines or statements on hypertension management in low- and middle-income countries for understanding of present clinical practice recommendations.

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

Inclusion Criteria: We included articles and reports that provided information on one or more of the following – (a) prevalence, awareness, treatment, or control of hypertension in Indian populations; (b) outcomes or complications related to hypertension in India; (c) management of hypertension, including pharmacological and non-pharmacological interventions, in studies or trials involving Indian cohorts; (d) guidelines or consensus statements by Indian health authorities or professional bodies; (e) descriptions or evaluations of hypertension control programs/policies in India (e.g. IHCI, NPCDCS, state-specific programs). We gave consideration both hospital-based and community-based research. Although the population most covered by guidelines and policies, adult hypertension, we also took into account data on younger adults (e.g., ≥15 or ≥18 years as in NFHS surveys) since India's demographic includes a sizable young population in which early hypertension is relevant.

Exclusion Criteria: We excluded studies older than 2015 (unless historically important for context), studies conducted entirely outside India without specific relevance to Indian management (e.g., trials of drug efficacy in other countries, unless such trials influenced Indian guidelines), and articles focusing on pediatric hypertension. We also excluded case reports or very small case series unless they illustrated a unique aspect of hypertension management in medical college settings.

Data Extraction and Synthesis: Studies older than 2015 (unless historically significant for context), studies conducted entirely outside India without specific relevance to Indian management (e.g., trials of drug efficacy in other countries, unless such trials influenced Indian guidelines), and papers on paediatric hypertension were not included. Unless they demonstrated a special feature of hypertension control in medical college environments, we also excluded case reports or very small case series.

From the sources obtained, we compiled important data points and findings: e.g., prevalence rates, risk factors identified, percentages for awareness/treatment/control, recommendations on treatment thresholds or drug choices, and outcomes of any intervention program. A narrative synthesis was selected considering the variety of sources, epidemiological studies against clinical recommendations vs. program reports. The review was arranged into thematic sections covering epidemiology, policies, management techniques, health system projects, etc. In every theme, we gave evidence from recent, extensive studies top priority.

Thematic Literature Review

1. Epidemiology of Hypertension in India and Bihar

India's hypertension prevalence has been rising steadily and today it approaches levels seen in many wealthy countries. With blood pressure readings for over 1.7 million adults, the most recent national survey, NFHS-5 (2019–21) revealed an overall hypertension prevalence of almost 22.6% in the population aged 15 and above. This was a rise from

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

the previous NFHS-4 (2015–16), which had indicated prevalence in a comparable age range of between 18–19%. Recent studies adjusted to standard adult age ranges show about 24% of men and 21% of women in India are hypertensive, a modest increase from 19% and 17% respectively just five years ago. Although younger persons are not spared, the burden of hypertension also rises sharply with age: NFHS-5 data show that almost half (about 48%) of Indians aged ≥60 years have hypertension. Indeed, a sizable fraction of adults between the ages of 40 and 49 are hypertensive, so stressing hypertension as a mid-life problem as well.(Singh et al., 2011)

The prevalence of hypertension varies somewhat regionally among the states and territories of India. Though there are exceptions, generally more urbanised and economically developed areas show greater frequency. The Northeastern state of Sikkim (~38%) had the highest frequency according to the NFHS-5 study; some of the lowest prevalence figures were found in Rajasthan (~16–17%), and areas of central India. Ranked among the lower-prevalence states, Bihar in the eastern region had an overall hypertension prevalence of about 17% (adults). Given limited resources in healthcare, this lower figure could indicate under-detection even if it may also reflect Bihar's younger demographic profile and historically lower urbanisation. Though still a major public health burden, "lower" prevalence is relative; nearly one in six adults in Bihar are hypertensive.(Gupta, 2015)

Urban-rural variations help to create these regional trends. Because of lifestyle factors including increased stress, sedentary behaviour, and dietary sodium intake, hypertension has historically been more common in urban areas in India overall; NFHS-5 confirms a prevalence of about 25% in urban vs. 21% in rural populations. Bihar, being mostly rural, fits this pattern with reduced overall frequency; but, urban areas within Bihar are catching up. Focussing on young adults (20–40 years), a local cross-sectional study conducted in an urban area of Bihar (Muzaffarpur) found 17.3% were already hypertensive (2% in Stage 2, 15.3% Stage 1) and more than half (52%), had pre-hypertension. (Chand & Shivika, 2023) This implies that the early phases of raised blood pressure are common even in a relatively younger cohort, suggesting a greater future burden as these people age. The study also found common risk factors – age (particularly 30–40 years), obesity, tobacco use (chewing or smoking), family history, and stress – as particularly significantly linked with higher blood pressure in this urban Bihar sample. These results reflect national risk factor trends; fast urbanisation and lifestyle changes are influencing even younger groups in states like Bihar.

Experts have observed some unique qualities of hypertension in India. The Indian Guidelines on Hypertension (IGH-IV, 2019) underlined that there is a clear rural-urban divide in prevalence and risk exposure and that hypertension usually starts rather earlier in Indians than in Western populations. Moreover, many times Indian patients show

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

clustering of several cardiovascular risk factors (e.g., co-existing diabetes, dyslipidaemia, central obesity), which increases general risk. India's varied climate has also shown seasonal fluctuations in blood pressure; colder months typically show higher values while hot, humid periods cause somewhat lower values. Most importantly, population studies repeatedly show low awareness and control rates (discussed in the next section), which is why target organ damage – including hypertension heart disease, stroke, and kidney impairment – often appears early in hypertension Indians, sometimes even before age 50, due years of undiagnosed or poorly managed high blood pressure.(Amarchand et al., 2022)

All things considered, hypertension is rather common in India, influencing about one-quarter of adults with some regional variation. Although Bihar's frequency (~17%) is somewhat lower than the national average, given the state's population size (more than 100 million), the absolute number of patients treated there still indicates great significance. The interaction of demographic transition (more older people), urbanisation, and ongoing rural health access gaps guarantees that hypertension will continue to be a rising problem. The next sections address what steps are in place to control this load and how well awareness and diagnosis are acknowledged.

2. Awareness, Treatment, and Control Gaps: The Hypertension Care Cascade in India

Management of hypertension depends critically on the "care cascade," the series of events from diagnosis to treatment to control. Historically, this cascade has had significant attrition at every level in India, leaving just a tiny minority of hypertension patients under control with regard to blood pressure. Planning treatments depends on knowing these gaps.

Large-scale recent data show the extent of the difficulty. With blood pressure readings and interviews, the NFHS-5 (2019–21) offers the most current nationally representative estimates. A thorough study of NFHS-5 released in 2023 indicates that although only roughly 1 in 3 hypertension sufferers (36.9%) had ever been diagnosed by a medical practitioner, more than 1 in 4 adults (28.1%) in India had hypertension. This implies almost two-thirds of them were ignorant of their condition, so creating a significant disparity in the first level of treatment. Among those who knew (diagnosed hypertension), the data revealed only 44.7% were on treatment with antihypertensive medication, which corresponds to just about 17.7% of all hypertensive individuals getting treatment. The drop-off suggests that a sizable portion of diagnosed patients, perhaps from poor access to drugs, cost, health beliefs, or insufficient follow-up, are not on treatment. Of those on treatment, 52.5% had their blood pressure under control (defined as 140/90 mmHg for adults under 80 years) – which equates to just 8.5% of all hypertension patients being controlled to target levels. Stated differently, over 90% of Indians with hypertension are

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

not under control mostly because they never seek treatment or drop out of it.(Kotwal & Joseph, 2023).

Though it still falls short, this NFHS-5 based care continuum (Diagnosis ~37%, Treatment ~18%, Control ~8%) shows a modest increase over past estimates. For adults 18–69 years, for example, an earlier National NCD Monitoring Survey (2017–18) revealed even lower awareness: just 27.9% of hypertensives knew of their status. According to that poll, among those who knew, 52.1% were on treatment and 44.4% had under control blood pressure. Reflecting the state just a few years ago, these numbers translate to roughly 14.5% of all hypertension sufferers on treatment and roughly 6.4% of all hypertension sufferers under control. Though methodology differences between surveys could also play a role, the improvement by 2019–21 (to ~17.7% treated, ~8.5% controlled) indicates some progress. Still, both studies highlight how most (70–75%) of Indian hypertensive patients go untreated, and population control rates are single digits percentage-wise.(Longkumer et al., 2023)

Furthermore present in the cascade are urban-rural differences. Usually because of more access to healthcare, urban areas historically had better awareness and treatment rates than rural areas. For instance, earlier studies found that just about 25% of rural hypertension sufferers knew they had hypertension, compared to almost 42% of urban hypertension sufferers.(Singh et al., 2017) Treatment rates also were roughly 25% in rural and 38% in urban areas; control rates roughly 10% rural versus 20% urban. As government health services reach rural areas, these differences may be somewhat closing, but rural patients still struggle with regular follow-up and medication availability. Given mostly rural states like Bihar, this suggests a lot of untreated hypertension. Analysis from NFHS-4 indeed revealed Bihar to have one of the highest rates of undiagnosed hypertension; one study found that 13.5% of men in Bihar had hypertension not previously diagnosed. Low awareness in such areas is caused in part by cultural elements, health literacy, and limited routine screening.

Gender adds still another layer of difference. Men have a somewhat higher prevalence of hypertension than women (24.1% vs 21.2%), according to NFHS-5 data; several studies have also found that men are less likely to have their blood pressure under control. In many studies, the Lancet Regional Health Meta-analysis (2022) on hypertension control in India noted poorer control among men than women. Men may be less compliant with treatment or less involved with health services, a pattern also observed worldwide. Conversely, post-menopausal elderly women show fast increasing hypertension prevalence, and women in India often have social obstacles to receive care. Thus, both sexes need targeted plans, maybe with different approaches to raise screening and adherence.

These cracks have significant ramifications. Low diagnosis rates mean that, before any intervention is in place, hypertension complications often show acutely (e.g., stroke, heart attack). Low rates of

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

treatment and control mean even those found lack sufficient protection from hazards. Even a small drop in average blood pressure could save many lives; for instance, a 2 mmHg mean systolic blood pressure drop in the population could yearly prevent almost 150,000 stroke deaths and almost 150,000 coronary deaths in India. Given India's vast population, this emphasises how much public health outcomes may change even slightly from bettering control rates. Sadly, only roughly 12% of all Indian hypertension sufferers had their blood pressure under control as of the late 2010s, so underscoring a significant preventative gap.

Particularly in Bihar, particular information on the treatment cascade is not often shared apart from the national surveys. Still, one can fairly deduce that awareness and treatment rates there are below the already poor national average. Less frequent regular health checks, a doctor-population ratio in Bihar among the lowest in India, and socioeconomic issues are among the contributing factors. The government's emphasis on wellness and health centres and screening initiatives, which will be discussed later, aims to increase rural diagnosis. Still, reducing the hypertension cascade in states like Bihar will call for overcoming obstacles in patient education and healthcare delivery.(Mathur et al., 2022) To give a picture of the state of affairs, Table 1 below lists important results from significant studies and surveys on hypertension prevalence and care indicators in India:

Table no.1: Key Studies on Hypertension Prevalence and Care Continuum in India (2015–2025)

Study / Data Source (Year)	Population and Setting	Hypertension Prevalence	Awareness (Diagnosed)	On Treatment	Controlled BP
NFHS-4 (2015–16)	National survey, adults 15–49 yrs, India (men and women)	~18.1% (combined) Men: ~19%, Women: ~17%	–	–	–
National NCD Monitoring Survey (2017–18)	National survey, adults 18–69 yrs, India	28.90%	27.9% of hypertensives aware	~14.5% of hypertensives (52.1% of aware)	~6.4% of hypertensives (44.4% of treated)
NFHS-5 (2019–21)	National survey, adults ≥18 yrs (up to 98), India (28 states, UTs)	28.1% overall Men: ~24%, Women: ~21%	36.9% of hypertensives	17.7% of hypertensives (44.7% of diagnosed)	8.5% of hypertensives (52.5% of treated)

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

		(age-standardized)			
NFHS-5 Bihar Subset (2019–21)	State-level survey data, adults ≥15 yrs, Bihar (rural/urban)	~17% (combined)	Not separately reported (likely low)	Not reported	Not reported (likely very low)
Lancet Systematic Review (2001–2020, pub. 2022)	Meta-analysis of 51 studies across India	–	–	–	Pooled control rate: 17.5% (2001–2020); ~22.5% in 2016–2020 sub-period; better in South & West India, worse in North & East
IHCI Early Phase Report (2018–2020)	26 districts across 5 states (Punjab, MP, Kerala, Maharashtra, Telangana); ~0.57 million patients in public clinics	– (program enrollees only)	~100% (screened in program)	Patients enrolled in care (after screening)	43% of patients under care achieved control in program clinics (Q1 2020); population-level control rose 3-fold (from ~2% to ~6%)

According to national polls, hypertension is rather common and increasing in India. The care cascade has significant gaps: less than half of those diagnosed are treated, and only roughly half of those treated are controlled, so producing less than 10% control at population level by 2020. Though India still far from the worldwide NCD target of 50% hypertension control, there has been some improvement over the

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

years (as shown by the rise in control rate from ~10% to ~17–22%). Bihar's data emphasises the need of better hypertension treatments since it indicates somewhat lower prevalence but probably even less awareness/treatment.

3. Current Guidelines and Recommendations for Hypertension Management in India

Standardising the diagnosis and treatment for hypertension depends much on guidelines. International and Indian national guidelines have changed over the past ten years to incorporate fresh data (such as landmark trials) and fit local settings. With an eye towards how they apply in Indian clinical practice and particularly in resource-limited areas like many parts of Bihar, this section reviews the main guidelines pertinent to India, including definitions of hypertension, recommended treatment thresholds, and target blood pressure goals.

3.1 Definition and Diagnosis

The global debate on what blood pressure level defines “hypertension” saw a significant shift in 2017 when the American College of Cardiology/American Heart Association (ACC/AHA) lowered the diagnostic threshold to 130/80 mmHg. But many other bodies, including the European Society of Hypertension (ESH) and the International Society of Hypertension – chose to keep the conventional cut-off of 140/90 mmHg for most of the population citing lack of evidence for treating lower ranges in all groups. India's policies have given this problem careful thought. Developed under the direction of the Association of Physicians of India and approved by ICMR, the Indian Guidelines on Hypertension (IGH) 2019 chose to keep defining hypertension as 140/90 mmHg in line with past Indian guidelines (IGH 2001, 2007, 2013). The context of limited resources and the need to concentrate on the vast pool of more severe hypertension drove this decision; the guidelines observed that while ACC/AHA's 130/80 definition may identify more people at risk, the priority in India is to detect and treat those above 140/90, many of whom remain unidentified. For adults in India aged at least 18 years, hypertension is therefore defined as SBP ≥140 and/or DBP ≥90 mmHg, measured on at least two different days, or on antihypertensive medication. Blood pressure in IGH-2019 falls into the traditional JNC-7 ranges: Normal <120/80; Pre-hypertension 120–139/80–89; Stage 1 HTN 140–159/90; Stage 2 ≥160/100.

Actually, these criteria imply that the action threshold used by Indian doctors and screening campaigns usually is 140/90. For simplicity also the WHO and national NCD program follow this definition. Though not labelled as hypertension in Indian practice, the "pre-hypertension" category (now often termed "elevated BP" or "high-normal") of 130–139/85–89 is recognised as at-risk and worthy lifestyle intervention. Given limited resources, this posture is pragmatic. Though risk accumulates over time, those with multiple risk factors or those who are younger

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

still deserve closer observation even if 130–139/85–89.

Diagnostic approach: Guidelines in India stress appropriate blood pressure measuring technique, a topic of issue since hurried measurements can lead to misdiagnosis. They advise averaging two or more readings taken two times using a standard calibrated instrument. Although not commonly used in India's public sector, home and ambulatory blood pressure monitoring are acknowledged tools for verifying diagnosis in suspected white-coat or masked hypertension, particularly in tertiary centres. But because cost and access restrict regular use of such devices in Bihar and similar environments, reliance is mostly on clinic measurements.

3.2 Treatment Initiation and Targets

According most international guidelines, drug therapy should start for persistent readings ≥140/90 (or even ≥130/80 in high-risk patients per ACC/AHA 2017). For uncomplicated hypertension, the Indian 2019 guidelines likewise advise beginning treatment at persistent blood pressure ≥140/90. Starting at lower thresholds (such as ≥130/80) can be taken into consideration in some high-risk groups (e.g., diabetes, chronic kidney disease, established CVD), but this is often on a case-by-case basis given the dearth of solid India-specific studies at those thresholds. Generally speaking, the target blood pressure under treatment is 140/90 mmHg for most patients; this level corresponds with international agreement that reaching below this level greatly lowers risk of heart disease and strokes. Targets can be tighter for patients with co-morbid conditions: for diabetics or those with proteinuric kidney disease, for example, aiming for 130/80 mmHg is often advised if it can be achieved without undue side effects. Individualised treatment is stressed since very aggressive targets (such as 120 systolic as tried in the SPRINT trial) may not be realistic or safe for all Indian patients – especially older patients. Particularly in octogenarians (age >80), given frailty issues, a somewhat relaxed target of 150/90 mmHg is acceptable.

Risk stratification: To guide intensity of treatment, both Indian and international recommendations stress assessing the whole cardiovascular risk profile – including elements like age, sex, smoking, diabetes, cholesterol, family history, etc. Risk stratification aids in the identification of patients in resource-limited environments who require more aggressive and urgent treatment (e.g., a young hypertensive smoker with left ventricular hypertrophy against an isolated mild hypertension in an otherwise healthy person). Indian recommendations advise using risk charts or scores (e.g., WHO/ISH risk charts tailored for South Asia) to determine whether lifestyle alone is sufficient initially or if immediate drugs are needed.

3.3 Lifestyle Modification

All recommendations agree that lifestyle changes form the cornerstone of hypertension control and

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

should be recommended to every patient, including those on medications. The "five basic" lifestyle choices underlined in Indian recommendations are: weight loss in overweight or obese people, consistent physical exercise, dietary salt reduction, smoking or tobacco cessation, and moderation of alcohol intake. Though implementation can be difficult, these low-cost, generally applicable policies are quite important. From a guideline standpoint, patients with pre-hypertension or borderline readings are usually managed with lifestyle changes for several months as a trial before considering drugs. In Bihar, public awareness of these policies, through community health workers and clinicians at all levels, is essential since conventional diets and lifestyles are veering in negative directions (e.g., more packaged salty foods, less physical labour due to mechanisation).

3.4 Pharmacological Treatment Guidelines

Global and Indian guidelines advise certain preferred drug classes as first-line therapy for primary hypertension: thiazide/thiazide-like diuretics, calcium channel blockers (CCBs), and angiotensin-converting enzyme inhibitors (ACEIs), or angiotensin receptor blockers (ARBs). Usually used in resistant hypertension or specific circumstances, mineralocorticoid receptor antagonists (spironolactone, etc.) are generally second-line unless there is a specific indication (e.g., ischaemic heart disease, certain arrhythmias, younger hypertensive women of childbearing age, etc.). Though they also consider availability and cost, the Indian recommendations reflect these decisions. Important points include:

• **Diuretics:** Long advised as cheap and effective, low-dose thiazide diuretics such as hydrochlorothiazide 12.5–25 mg Recent studies support either indapamide, with longer half-lives and perhaps improved outcome data, or thiazide-like diuretic chlorthalidone (12.5–25 mg). Many state protocols, including IHCI, list either HCTZ or chlorthalidone as options; Indian experts have also been increasingly advocates of chlorthalidone in government supply. One of the three basic drugs in the IHCI standard protocol, for example, is a thiazide diuretic, often chlorthalidone. In the Indian setting, diuretics are especially helpful since a significant portion of patients have a high salt intake and a volume-expanded hypertension; diuretics essentially reverse this. They are reasonably cheap as well. Monitoring electrolytes can be difficult in very resource-limited environments like some clinics in Bihar, thus that needs consideration (though low-dose thiazides hardly cause severe electrolyte problems).

• **Calcium Channel Blockers (CCBs):** Often advised and used as a first-line agent in India is amlodipine, a long-acting dihydropyridine CCB. It is appropriate for stroke prevention and works across many different ethnic groups. Crucially, it does not call for lab monitoring. Amlodipine is the first or second step medication used in many guideline-based protocols including the IHCI. Commonly

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

occurring in older patients with isolated systolic hypertension, CCBs also perform well. Although side effects like pedal oedema can arise in a hot environment, combination with an ARB usually helps to either manage or reduce them.

• **ACE Inhibitors / ARBs:** Indicated particularly for patients with diabetes (for kidney protection), heart failure, or post-myocardial infarction, these renin-angiotensin system blockers are Better tolerance makes ARBs such as telmisartan or Losartan more desirable than ACE inhibitors like enalapril or ramipril in Indian practice (ACE inhibitors can cause cough in up to 10% of patients). The IHCI standard protocol expressly chose telmisartan (an ARB) as one of its three drugs; the Indian guidelines list either ACEI or ARB as options given their once-daily dosing and generic availability. Though many of them are off-patent and manufactured generically in India at rather low cost, these medications can be somewhat more costly than diuretics or CCBs.

• **Beta-Blockers:** While no longer first-line for uncomplicated hypertension (due to somewhat less protective effect against stroke compared to other classes, except in some young patients), beta-blockers like metoprolol or atenolol are used in patients with coexistential coronary artery disease, tachyarrhythmia, or younger hypertension (especially women who might become pregnant, as ACEi/ARBs are contraindicated in pregnancy). In cases of resistant patients or if particular indications exist, Indian doctors sometimes add beta-blockers as a fourth medication. Beta-blockers remain valuable agents according to local guidelines, but they are not the first treatment recommended without strong indication.

• **Other agents:** Guidelines advise adding a fourth drug such spironolactone (which has shown benefit in resistant cases) or higher-dose diuretic, or beta-blocker if not already used for resistant hypertension (uncontrolled on three drugs). Rarely used except in men with coexistent benign prostatic hyperplasia, alpha-blockers, such as prazosin, can help with urinary symptoms. Usually handled at tertiary centres, direct vasodilators (hydralazine, minoxidil) are last-resort treatments for severe refractory hypertension. While the primary care level would hardly start such medications or evaluation for secondary causes of hypertension (like renal artery stenosis, endocrine hypertension), a few resistant cases may call for such drugs or evaluation in Bihar's medical schools.

Combination Therapy: A major change in the way hypertension is treated in recent years is the support of initial combination therapy for many patients. Studies reveal that using two low-dose drugs can reduce blood pressure more effectively with less side effects than optimising one drug. If baseline blood pressure is more than 20/10 mmHg above target, international guidelines, such as ESH 2018 and ACC/AHA 2017, recommend beginning with a combination pill (usually ACE/ARB + CCB or ACE/ARB + diuretic). Combining therapy is also

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

encouraged in India, particularly given monotherapy control rates have been inadequate. Taking one pill with two (or even three) drugs helps to improve adherence, thus the idea of a single-pill combination (SPC) appeals especially. To support this approach, the WHO included several SPC antihypertensives to its list of essential medications for 2019. Gradually, Indian practice is using several low-cost generic two-drug combinations (such as amlodipine+telmisartan, amlodipine+atenolol, Losartan+HCTZ, etc.). These are routinely prescribed. Rather than a protracted single-agent titration, the IGH-2019 advises use of combination therapy when BP is >150/100 or if the patient has multiple risk factors. In crowded clinics, particularly in tertiary centres, doctors sometimes start patients on two medications from the beginning to reach quicker control. Still, in primary centres doctors may start one medication at a time, partly out of habit and caution.

Treatment in Special Populations: Indian recommendations avoid orthostatic hypotension and start low and go slow for elderly people. ACEi/ARB is underlined in diabetes or chronic kidney disease because of its effects on kidneys. Drugs advised in pregnancy-induced hypertension include labetalol, methyldopa, and nifedipine (with ACE/ARBs contraindicated). Medical college hospitals in Bihar sometimes handle such special cases (e.g., severe preeclampsia in obstetric units). Although the guidelines match international recommendations, treating hypertension events like eclampsia or malignant hypertension mostly depends on the availability of IV labetalol or hydralazine in emergency conditions. Part of following guidelines is making sure these are kept in wards and emergency rooms.

With an emphasis on pragmatic and cost-effective approaches, use 140/90 as the treatment threshold, aim for 140/90 in most cases, insist on lifestyle changes always, and treat with readily available drugs (diuretic, CCB, ARB) often in combination to achieve control. Indian hypertension guidelines basically parallel global best practices. The main difficulty is not knowing what to do, but rather applying these rules over the large and diverse healthcare environments all around India. With an eye towards the scenario in medical college hospitals and in states like Bihar, the next section examines how these approaches are being implemented through health system initiatives and what outcomes have been noted.

4. Management Strategies: Lifestyle Interventions and Pharmacotherapy in Practice

First-line recommendations for treatments are always lifestyle ones. Many patients with mild hypertension or pre-hypertension may find that they are sufficient to postpone or avoid medication; for those on medication, they increase the BP-lowering effect and provide other health benefits.

• **Dietary Salt Reduction:** India's salt consumption is much above advised limits. Although exact numbers vary depending on the study, a systematic

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

review calculated an average daily salt intake of around 11 grammes, more than twice the WHO advised of 5 g. More recent ICMR surveys point to a modest improvement, with an average of ~8 g/day still much above ideal. High salt intake, from salted pickles, papad, sauces, packaged snacks, and added salt in cooking, helps to explain the frequency of hypertension. Consequently, the main lesson in all educational resources is to cut salt consumption. Patients should limit high-salt foods, avoid adding extra salt at the table, and substitute spices and herbs for taste instead of salt. Certain Indian states have launched public campaigns using "Eat Less Salt, Live Longer" kind of slogans. Although research on salt substitution, using low-sodium salt or potassium-enriched salt, cost and acceptability can be problems among low-income groups. Dietitians especially advise patients on hidden salt sources in medical college dietary clinics and NCD clinics. Given cultural practices, progress is slow but even a 10-15% cut in salt intake could greatly affect population blood pressure.

• **Diet and Weight Management:** India's urban population in particular is seeing increasing obesity. Even 5-10% weight loss in overweight hypertension patients can cause appreciable blood pressure drops. Clinics check waist circumference and body-mass index; patients with central obesity, common even at lower BMI in Indians, are advised on calorie control. Encouraged is the adoption of a heart-healthy diet akin to the DASH (Dietary Approaches to Stop Hypertension) diet rich in fruits, vegetables, low-fat dairy, whole grains, and low in saturated fats. Traditional Indian diets can fit this (e.g., using dal, vegetables, and fruits liberally, while cutting down on ghee, palm oil, fried treats). Often stressed is increasing potassium intake from vegetables and fruits (such as bananas), since higher potassium lessens the impact of sodium on blood pressure.

• **Physical Activity:** A risk factor that has become common with urban white-collar jobs and even rural mechanisation is sedentary lives. Guidelines suggest on most days of the week at least 30 minutes of moderate-intensity exercise, such as brisk walking. Compliance is difficult, though; many people say they lack time or a safe place to walk. While many people in rural Bihar work physically, among the middle class urbanites sedentary behaviour is prevalent. With specific goals (e.g., "walk five days a week for thirty minutes"), doctors in clinics prescribe exercise like a medicine. Some medical schools have started yoga or cardiac rehabilitation programs for cardiac and hypertension patients, drawing on culturally acceptable techniques that can lower stress and increase fitness.

• **Tobacco and alcohol:** Particularly in men, tobacco use, that of smoking and chewing, is rather common in India. For instance, smokeless tobacco (chewing tobacco) use is rather high in Bihar. Since smoking greatly raises cardiovascular risk in addition to directly affecting blood pressure (acute rises), quitting is highly stressed. Where suitable, doctors send patients to tobacco cessation programs.

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

Regarding alcohol, although a rather smaller percentage of Indians drink regularly (Bihar notably has a state policy of prohibition on alcohol sales), those who do are advised moderation (no more than 1-2 standard drinks a day, though abstinence is ideal for blood pressure control). Since too much alcohol has been linked to cardiomyopathy and hypertension, part of lifestyle counselling is addressing this.

• **Stress Management:** Although difficult to measure, high blood pressure is recognised as being caused in part by stress. Chronic stress can come from urban living, job demands, even agricultural misery. Whether it's traditional meditation, yoga, deep-breathing exercises, or just making sure they get enough sleep, patients with hypertension are often advised to include relaxation techniques. In clinics, doctors may talk about stress particularly in cases where medication cannot help to control blood pressure. Like everywhere else, Bihar's population can experience major psychosocial stresses (financial, etc.), thus community support and mental health integration into NCD treatment is quite important.

Changing lifestyles can be challenging. Doctors often have limited time per patient in medical college hospitals, thus a multidisciplinary approach helps: dieticians, physiotherapists, and counsellors (if available) reinforce the advice. Frontline health workers (ASHAs and ANMs) are also being taught under NPCDCS to spread messages on a good lifestyle during their community visits. Among the innovations are group diet and exercise classes in rural areas and the establishment of "hypertension clubs" whereby patients may share stories of changed lifestyles.

4.2 Pharmacotherapy in Practice

Once the patient decides to begin antihypertensive medication, the objective is to select a suitable, safe, reasonably priced schedule specifically for them.

• **Initial Monotherapy vs Combination:** Many Indian doctors still start a newly diagnosed Stage 1 hypertension patient with monotherapy, e.g., amlodipine 5 mg daily or telmisartan 40 mg daily, then titrate up or add a second medication if targets aren't met in a few weeks. Early combination therapy is nevertheless becoming more and more popular, particularly in Stage 2 hypertension (BP >160/100). Available as a single tablet at low cost (many Indian pharmaceutical companies manufacture generics), amlodipine plus telmisartan is rather popular. Alternatively one of those is combined with a diuretic such as hydrochlorothiazide or chlorthalidone. Usually starting with amlodipine, the IHCI protocol demonstrated a simple stepwise combination approach: if not controlled, add telmisartan; if still not controlled, add a diuretic (HCTZ or chlorthalidone). Now used in many government clinics, this process guarantees most patients end up on two to three drugs as needed for control and simplifies physician decision-making. Early studies revealed that in a

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

rather short period of time, this method provides control in over 40% of patients.

• **Follow-up and Titration:** To check BP response and side effects, follow-up within 4–6 weeks is ideal once therapy starts. Follow-up intervals in crowded government facilities may be longer or patients may default. Specialised NCD clinics, where follow-up is more regimented, sometimes even run by postgraduates or nurses who track patients, often give medical college hospitals an advantage. Until the BP target is reached or the regimen is maximised, dose titration, that is, increasing the dosage of a medication, or adding medication is done. If on amlodipine 5 mg, for instance, it may be uptitrated to 10 mg if BP is still above target and no side effects such as ankle oedema cause problems. Alternatively an ARB dose could range from telmisartan 40 to 80 mg.

• **Adherence problems:** Regular medication intake by patients presents one of the most pragmatic difficulties. When patients in India feel well, as many with hypertension do, they could start to show non-adherence. Once BP normalises, some people also believe they are "cured" and stop using drugs; only later will BP spike result from this. Doctors and other medical professionals have to inform patients that hypertension is a lifetime illness needing ongoing treatment. In some urban environments, fixed-dose combination pills help lower pill burden; other approaches including monthly refill visits or telephonic reminders are under trial. To increase adherence in rural Bihar, some innovative strategies including calendar packs of pills, involving family members in monitoring, or community-based follow-up by ASHAs are being used.

• **Side Effect Management:** Luckily, first-line antihypertensives are usually tolerated rather well. If not addressed, side effects can, however, compromise adherence. Leg swelling brought on by amlodipine can be treated by doctors lowering the dosage and either adding a diuretic or switching to ARB. ACE inhibitors can induce dry cough; usually, switching to an ARB fixes that. Taking diuretics in the morning and, if at all possible, checking electrolytes will help to prevent increased urination or, rarely, weakness resulting from an electrolyte imbalance. Beta-blockers are saved for when absolutely necessary; they can cause sexual dysfunction or tiredness. Usually for patients on diuretics or ACEi/ARB (because of kidney function), a medical college clinic has facilities to monitor basic labs (glucose, potassium, creatinine). Simple regimens free of intense monitoring (like amlodipine + ARB) are usually preferred in main centres in Bihar since simple regimens are less frequent there.

• **Management of Comorbidities:** Many of the patients with hypertension also have other diseases. Diabetes is rather common; roughly one-third of Indian hypertensives could have it. Under these circumstances, ARBs or ACE inhibitors take front stage for kidney protection. Guidelines advise lipid-lowering therapy (statins) for hypertension at

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

moderate-high cardiovascular risk; hence, many patients should be on a statin in addition to blood pressure medication since dyslipidaemia coexists usually. Though this is changing with generic statins and revised guidelines, cost and awareness have kept statin use in primary prevention rather low in India. Generally speaking, medical college hospitals do risk stratification and prescribe statins or aspirin where appropriate (e.g., for hypertension with past stroke should be on both BP control and antiplatelet). Often in rural practice, only the blood pressure is taken care of unless the patient sees a higher centre.

- **Hypertensive Urgencies/Emergencies:** Depending on the scenario, IV medications, for example, IV nitroglycerine, sodium nitroprusside, or IV labetalol, manage hypertension emergencies (BP >180/120 with organ damage signs like encephalopathy, pulmonary oedema, etc.). In tertiary care, including medical college hospitals, this is done. Although this goes beyond outpatient treatment, quick control in an emergency helps to avoid fatal results. Such patients require rigorous oral regimen and follow-up once they have stabilised. While district hospitals might have limited capacity, medical college hospitals in Bihar, including the cardiac care units set under NPCDCS, are ready to manage these crises.

- **Monitoring and Targets in Practice:** Usually requiring 1-3 months of changes, target BP 140/90 is achieved. Though most people tolerate low blood pressure well, patients are taught to identify symptoms of too low blood pressure, including dizziness and others. Doctors stress the need of keeping those levels by continuing drugs even beyond target. For those who can afford it, some proactive doctors urge home blood pressure monitoring to include patients in management. This guarantees control all day or helps detect white-coat effect. Others only monitor by means of routine clinic visits. Every patient's blood pressure at visits is recorded in IHCI-implementing clinics using an information system, often the Simple app, a digital BP tracking tool. This lets one track control rates and send reminders, a habit that has been found to especially help follow-up and control.

4.3 Adapting Strategies for Bihar and Similar Settings

As in many low-resource environments, Bihar's core strategies are the same but with adaptations: give low-cost drugs top priority, guarantee drug availability in public facilities, and involve community-level health workers for follow-up and lifestyle counselling. Following national recommendations, Bihar's Health Department has been increasing the antihypertensive drug availability at main medical facilities. Essential antihypertensives including atenolol, diuretics, amlodipine, enalapril (or telmisartan), and diuretics are supplied under the Free Drug Service program. Sometimes supply chain problems cause stock-outs, though, which disrupt treatment. For the few IHCI districts in Bihar, IHCI's strategy of working with state officials to sustain a

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

consistent drug supply has been one answer. Key is also teaching primary care doctors, such as those at community health centers, the standard treatment approach and the use of combination therapy; medical college experts often help by organising CME (continuous medical education) events and creating simplified local protocols.

Lifestyle changes implemented in Bihar make use of the current community networks. For instance, Bihar's rural health mission has mobilised ASHA workers to perform population-based screening for diabetes and hypertension in those >30 years and during these visits, they counsel families about diet (like reducing salt in traditionally salted pickles or hand-made snacks) and periodically checking blood pressure. Culturally, using community leaders and local dialect will help to increase acceptance of lifestyle recommendations.

All things considered, the key to controlling hypertension in India is to encourage better living and use sensible drugs. These approaches are relevant from rural clinics to metropolitan speciality hospitals with suitable adaptation. Implementation at scale is the main responsibility; hence, we will next look at health system projects and the particular contribution tertiary medical college hospitals can make.

5. Health System Initiatives and the Role of Medical College Hospitals in Hypertension Control

From national policies to community-level initiatives, India's approach to enhance hypertension outcomes is multi-tiered health system strengthening. While improving capabilities at higher centres for sophisticated case management, there has been a deliberate push in recent years to include hypertension screening and management into primary care. Here we go over important projects and how medical college hospitals, like KMCH in Bihar, help to support them.

5.1 National Health Programs (NPCDCS and Ayushman Bharat)

Recognising the NCD load, the Indian government started the National Program for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS) in 2010 and carried on over the next ten years. Infrastructure for NCD treatment at several levels has been built under NPCDCS; as of early 2020s, there are 640 dedicated District NCD Clinics and over 5,000 NCD Clinics at the Community Health Centre (CHC) level throughout India. Furthermore established at district hospitals are 193 Cardiac Care Units. Among other NCDs, these units are supposed to offer screening, diagnosis, and management of hypertension (along with closer proximity to the community). For example, Bihar is bolstering CHC clinics and has NCD sites in most of its districts. These clinics allow patients to obtain medication refills at secondary-level facilities instead of all flocking to tertiary centres and have their blood pressure checked.

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

Under the Ayushman Bharat project, which upgrades 150,000 sub-centers and primary health centres across the country to "Health and Wellness Centres" (HWCs), a major push comes. These HWCs stress thorough primary care, including NCD screening. In many states, people above 30 are methodically screened for hypertension and diabetes through house-to--house campaigns or village camps as part of this. For validation and management, those found with high blood pressure are connected to HWCs, or PHCs. For states like Bihar where past opportunistic screening rates were low, this is absolutely vital. Early estimates show better screening coverage; one study projected that, although Bihar was still catching up (as per a national report, Bihar's hypertension screening was ~80% of expected, compared to ~94% in best performing states). As HWCs develop, more undiagnosed hypertension will likely be found and treated, so improving the first stage of the cascade.

5.2 India Hypertension Control Initiative (IHCI)

The IHCI, a cooperative effort of MoHFW, ICMR, WHO-India, and Resolve to Save Lives, is maybe the most focused program for hypertension. Beginning in late 2017, IHCI aims to demonstrate a workable model to speed public healthcare system hypertension control. As mentioned above, its basic approaches are a standard treatment plan, continuous drug supply, team-based care (task-sharing with nurses or health workers), patient-centric services (such as convenient follow-ups, BP monitoring), and an IT system tracking.

Beginning in 26 pilot districts spread over five states, IHCI demonstrated amazing early success. Their average 43% control rate among registered patients within roughly a year was achieved by emphasising simplicity (three drugs protocol) and responsibility (regular monitoring of clinic performance), so significantly improving from baseline. Though essentially from very low baseline (~1-2% to ~4-6%), the program also tracked that the fraction of all hypertension in those districts with controlled BP (as recorded in public clinics) tripled. Inspired by this, IHCI was expanded. It was adopted in 101 districts spread over 19 states by Dec 2021, registering over 2 million people in over 13,000 health facilities. Bihar joined IHCI during this scale-up; four districts starting the initiative by 2021. IHCI now boasts over 110 districts spread over 23 states by mid-2022. Although local data has not yet been fully published in Bihar's IHCI districts, similar models, PHC doctors implementing the protocol, frequent review meetings tracking patient control, etc., are being used there. These concentrated efforts are expected to greatly increase control rates in those areas and act as models for the rest of the state.

From the health system standpoint, IHCI's approach solves known bottlenecks: it empowers nurses to follow up patients (team-based care), guarantees drugs are always in stock (previously, patients often left due to medication unavailability), and uses a simple app for recording each patient's blood pressure and visits (improving data and enabling targeted reminders). This approach simplifies current

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

primary care rather than depending on costly technology or experts, so it fits rather well in environments with limited resources. Given one of the issues observed in Bihar, where one quarter or more of patients drop out of follow-up within a year, if IHCI expands could significantly improve continuity of care. IHCI works to lower that by means of improved follow-up systems and counselling.

5.3 Role of Medical College Hospitals

For several reasons, tertiary care teaching hospitals such as KMCH in Bihar are absolutely vital in the whole ecosystem for the control of hypertension:

• **Referral and Management of Complicated Cases:** For their area, medical college hospitals typically rank highest in referrals. They handle complex hypertension cases including endocrine problems, renal artery stenosis, etc., resistant hypertension (uncontrolled despite three drugs), or hypertensive emergencies. A young patient with hypertension refractory to treatment, for instance, might be referred to KMCH; there, experts can check for disorders like pheochromocytoma or coarctation of aorta, which might be missed at primary level. These centres lower morbidity by finding and treating secondary causes. They also treat hypertension crises with IV therapy and ICU treatment, so possibly preventing mortality. Underlining the need of specialist input for a subset of patients, a small Indian study found ~18% prevalence of resistant hypertension among patients in a tertiary hospital hypertension clinic. Medical colleges thus offer that better degree of treatment.

• **Training and Capacity Building:** Medical colleges equip the next generation of doctors, including general practitioners and specialists, as intellectual institutions. Including the most recent hypertension recommendations into medical courses guarantees that newly hired doctors follow advised procedures. Under faculty supervision, postgraduate trainees in medicine and cardiology often run speciality hypertension or cardiology clinics, so learning practical management of hypertension. When these trainees graduate and work in private practice or smaller towns, they bring this knowledge with them. Every new doctor who is well-versed in treating common diseases like hypertension is a benefit in areas like Bihar, where shortages of healthcare personnel exist. Under national initiatives, medical college faculty members also regularly lead training courses for peripheral doctors. Faculty members might lead sessions for NPCDCS, for example, teaching PHC doctors from all around the district how to apply IHCI techniques or how to understand policies in the local context.

• **Research and Local Data Generation:** Medical schools are centres of research, which could offer insightful local knowledge. They can look at community-wide hypertension prevalence, patient adherence studies, or intervention trials meant to increase control. Local research this kind can direct state health policies. For instance, a medical college

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

in Patna might examine results of a cohort of hypertension patients in its NCD clinic to find causes of default; such results can then be applied to create better follow-up systems all around. Indeed, we mentioned earlier a study on hypertension in young adults from a medical college field practice area in Bihar; this kind of information is quite helpful in guiding public health messages (such as emphasising youth). Medical colleges can also confirm the effectiveness of national programs in their catchment – e.g., auditing how many referred from community screening really achieve control after a year at the medical college clinic.

• **Policy and Guideline Development:** National guideline committees or state NCD cells frequently include doctors and professors from respected medical colleges. They bring to these forums frontline expertise. For example, members of the prestigious medical institute AIIMS participated in developing the IGH-2019 rules. Senior doctors from Patna Medical College or another university may counsel Bihar on NPCDCS application. Academic input guarantees, then, that guidelines remain sensible and focused on on-the-ground reality.

• **Model Clinical Practices:** A tertiary hospital can act as a guide on efficient running of a hypertension clinic. At KMCH, the Medicine department might set up a weekly hypertension clinic where every patient's risk factors are thoroughly addressed, structured lifestyle counselling is given, and follow-up is rigorous. By proving better results, say, KMCH achieves 60% control in its clinic population by careful management, it sets a standard and motivates smaller centres. Furthermore, creative ideas can be tested, such as family involvement in care or group counselling sessions, and, should they prove successful, these can be advised for more general use.

• **Community Outreach:** Rural health training centres housed in many medical colleges feature departments in social medicine and preventive medicine. These might be used for health education campaigns in surrounding towns or community hypertension screening camps. Referring those with hypertension to the college or district hospital, a medical college might, for example, set up a village to regularly check blood pressures and educate the residents. This kind of outreach helps to strengthen the link between primary and tertiary care.

5.4 State Initiatives – Focus on Bihar

Following national models, Bihar's state health department has established NCD cells, trained medical professionals, and included hypertension control into its yearly health system targets. The Bihar 2021 Health Dossier shows focus on NCD indicators, including rates of blood pressure control. Although Bihar has low public health expenditure per capita and less doctors, there have been improvements: the number of functional HWCs in Bihar is increasing, which directly relates to more screening events and basic management at the

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

community level. Additionally helping to increase awareness is Bihar's participation in the national "India Get Your BP Checked" campaign during World Hypertension Day. Maintaining consistent follow-up in a population where migration and socioeconomic elements cause discontinuity in treatment remains difficult.

The state also attempts to use technology; some districts track patient BPs using the Simple app (from IHCI) even outside of the official IHCI, and efforts are under way to include NCD modules into the state's health management information system (HMIS). Policies like prohibiting alcohol (enacted in Bihar in 2016) might also indirectly help to control hypertension by lowering alcohol-related hypertension, although the effect is difficult to measure and alcohol use was not as common as other risk factors in the first place.

5.5 Challenges in Implementation

Notwithstanding these strong policies, several issues still exist, particularly in underprivileged and rural areas. Long-term medication adherence is challenging; patients may stop their medications either because of misinformation or because they feel well. The health system seeks to minimise this by counselling and occasionally involving family members (such as a spouse or child reminding the patient to take pills). Healthcare access and workforce are problems: Bihar has less healthcare providers per capita, thus even if procedures are perfect, if the doctor-to---patient ratio is low, patients might not get enough attention. One fix IHCI employs is task-sharing, training nurses or care-coordinators following up. Patients may avoid allopathic treatments depending on alternative systems (such as Ayurveda or homoeopathy); hence, it is often advisable to bridge traditional beliefs with modern treatment by polite communication. Digital solutions are being introduced gradually to change this; some clinics may not have accurate records of how many hypertensioners they have or their control rates, thus it is difficult to audit progress. Data monitoring systems are still under development.

Medical colleges can help to overcome some of these by supporting training, providing specialist assistance for challenging cases (so primary doctors are not discouraged by failures), and modelling proper data and patient management.

DISCUSSION

In India, especially in states like Bihar, hypertension control sits at the junction of ongoing disparities and hopeful improvement. Policymakers, healthcare providers, and to some degree the public have become increasingly aware of the issue over the past ten years. This has resulted in the development of national policies and the implementation of ambitious initiatives (such as NPCDCS and IHCI) especially aiming at better control of hypertension. Our analysis reveals that these initiatives are starting

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

to show results: rates of diagnosis and control are trending towards improvement; successful pilot models (IHCI in some districts) show that India can overcome the historically low hypertension control rates with targeted intervention.

The study also makes clear, though, that major obstacles still stand in the way of achieving ideal hypertension control generally. The sheer number of India's hypertensive population, an estimated 220 million people have hypertension in the nation, is one basic problem. Managing such volume calls for a strong primary healthcare system and consistent patient involvement, which is where present shortcomings most show themselves (Gupta et al., 2024). Bihar is a prime example of these difficulties: a sizable population with widespread poverty and lower health literacy; healthcare infrastructure that is improving but still catching up; and limited human resources. Therefore, even if national averages on awareness or treatment may rise, states like Bihar may lag and hence widen health inequalities unless especially addressed.

Integration into Primary Care: Integration of hypertension screening and treatment into primary care by Health and Wellness Centres is a good development. Bringing services closer to people's homes helps to lower obstacles to access into the hypertension treatment cascade. In Bihar, where doctors are few, the approach of task-sharing, empowering nurses and community health workers to measure blood pressure and even start or titrate medication under protocol, is especially pertinent. Based on data from IHCI pilots, patients are open to non-physician healthcare providers when the treatment is free and readily available; moreover, nurses can monitor follow-ups with efficiency. The health system level of the conversation should centre on sustainable scaling of these models. Beyond first pilot stages, funding for ongoing medication supplies, health worker training, and digital tools for tracking must be budgeted and kept maintained.

Adherence and Cultural Factors: Our study shows that just about half of those diagnosed and treated reach control. This captures problems with adherence and maybe inadequate treatment. Side effects, difficult regimens, forgetfulness, and fatalistic attitudes all affect adherence. Culturally customised counselling is required; for instance, some groups believe that drugs can be stopped once blood pressure is within normal range. Bihar's healthcare providers note that patients sometimes seek alternative treatments (herbal, etc.), or give treatment of symptomatic diseases top priority over an asymptomatic condition like hypertension. Fighting this calls for ongoing education, something that regular interaction with the health system can help to strengthen. The success of the IHCI in enhancing follow-up adherence by straightforward interventions (such as phone calls or ASHA house visits for those who miss appointments) should be extended. Including family members in patient counseling, a common practice in India's collectivist society, can also help adherence by, say, teaching a patient's spouse or child the value of the medication schedule.

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

Guideline Implementation vs. Clinical Inertia: While guidelines clearly state what should be done, it is difficult to apply them in hectic, resource-limited clinics. Clinical inertia Various reasons can cause clinical inertia, a resistance to intensify treatment when BP is above target: time restrictions, side effect fear, lack of training. This could be lessened by regular capacity building and maybe audit-feedback loops, whereby doctors get input on the control rates of their patients. Medical college hospitals can set an example: if district doctors observe that the hypertension clinic of the medical college follows protocol and achieves high control rates, they might be more driven to follow the same. Telemedicine or tele-mentoring could also help peripheral doctors: e.g., a virtual case discussion forum where challenging hypertension cases from district hospitals are reviewed by a medical college specialist, so offering advice on additional management. Other chronic diseases management (such as the ECHO model for hepatitis) has benefited from this kind of mentoring; states like Bihar could apply it for hypertension.

Resource Considerations: If the poorest must purchase from private pharmacies, cost of drugs, though low in India compared to many countries, can still be a barrier. Government free drug provision is therefore absolutely vital. Effective programs are mostly dependent on keeping a continuous supply of drugs, the review observed. Policymakers have to make sure that procurement and distribution systems are effective as well as that key antihypertensive medications stay on the free drugs list. Any stock-out might cause patients to stop their treatment, undoing benefits. Higher investment in NCD care is needed in Bihar, which allocates rather low budget per capita for health, to sustain supplies and extend services.

Outcomes and Future Targets: Reducing cardiovascular events and mortality is the ultimate goal of hypertension control. Future targets Although our study concentrated on process indicators, such as control rates, it is interesting to note projections. Should India's hypertension control plans prove successful, heart attacks and strokes should be less common. For instance, reaching even a 25% relative improvement in control by 2025, the WHO "25 by 25" target for NCDs, may help to avert countless CVD deaths. To assess the actual impact, monitoring systems should ideally track not only BP readings but also outcomes like hospitalisation for hypertension emergencies, stroke frequency, etc., at least in sampled populations. Medical college hospitals can help by keeping stroke registries or coronary event registries that, with time, show changes in trends maybe related to improved risk factor control.

Special Populations and Equity: To guarantee fair management, one also has to take into account groups including women, rural people, and the economically poor. Women, for example, might have somewhat better control rates than men (as some studies indicate), maybe due in part to their increased interaction with health services, through reproductive health, etc. But they might also ignore their health because of family obligations. To prevent leaving

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

areas of population behind, attention in hypertension programs must be given to men as well as women, all castes and communities. Working with local Panchayats (village councils) and Self-Help Groups in Bihar could enable one to reach people who might not give visiting a clinic top priority.

Role of Medical Colleges – Continued: Medical colleges play a continuous, vital role as discussed in relation to their hospitals. One area of focus for debate is the need of including strategies for managing hypertension in regular treatment recommendations at the level of hospitals. Having a hospital clinical pathway for hypertension, for example, helps to simplify treatment in outpatient departments and wards (e.g., how to control very high blood pressure in a patient admitted for another reason)? Furthermore, these hospitals frequently receive patients who have failed management elsewhere; hence, aggressive management can help to turn those failures into success stories and provide a teaching tool distributed via seminars or publications. As that adds to the collective knowledge base and confidence that hypertension can be managed in India with available tools, we urge medical colleges to publish their experiences, even case series of effectively managing resistant hypertension, in Indian journals.

Technology and Innovation: The conversation should highlight how quickly technology, cellphones for self-monitoring, SMS-based reminders, etc., is becoming relevant. Even in rural Bihar, India boasts a great mobile phone penetration. Using this to send reminders for appointments or drugs could be expanded. An idea that might be tested more generally is some Indian districts running WhatsApp groups of hypertension patients under nurse supervision whereby patients report their home readings and receive advice. Tracking patients across several tiers of treatment also becomes simpler as digital health records proliferate (ensuring someone referred from a camp to a PHC and then to a medical college doesn's lost to follow-up (Vegesna et al., 2016).

CONCLUSION

Driving most of India's cardiovascular morbidity and death, hypertension is a serious public health issue in the nation. This review highlights significant developments in our approach to hypertension over the past ten years: we have better knowledge on its epidemiology, clearer, locally tailored recommendations for its management, and creative initiatives proving that better control is feasible even in environments with limited resources. One can summarise important results as follows:

• **High Burden with Regional Nuances:** Rising in prevalence among Indian adults, hypertension affects (~1 in 4 adults). Although areas like Bihar show somewhat less frequency (~17%), they nevertheless bear a notable absolute burden. Public health initiatives must thus be localised as well as national (e.g., addressing higher salt intake in some diets, or enhancing rural outreach in states like Bihar).

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

• **Awareness and Control Gaps:** Most Indians with hypertension remain not sufficiently diagnosed, treated, or under control. According to most recent estimates, nationally only about 37% awareness, 18% treatment, and 8–9% control of hypertension. Men especially and in rural areas show more of these gaps. The hypertension care cascade must be strengthened; every stage, from screening to ongoing treatment, needs reinforcement.

• **Guideline-Driven Management:** Indian expert consensus and international data both direct present hypertension treatment approaches in India. Defining hypertension at ≥140/90 mmHg, encouraging risk stratification, and advising a mix of lifestyle change and reasonably priced pharmacotherapy, the Indian Guidelines on Hypertension 2019 reaffirmed a pragmatic approach. Emphasising proven drug classes (thiazide diuretics, CCBs, ACEi/ARBs) and the use of combination therapy to meet goals, The difficulty is not a lack of rules but rather guaranteeing their consistent application in several healthcare environments.

• **Preventive Emphasising Lifestyle:** Long-term control will be elusive without lifestyle changes, as is well known. Essential to hypertension control are efforts to lower dietary salt (currently ~8–11 g/day in India, well above recommendations), improve diets, boost physical activity, and cut tobacco use. These have to be included not only in individual counselling but also in more general public health campaigns and community initiatives.

• **Health System Initiatives Showing Promise:** Better detection and management have been laid by the growth of NCD clinics under NPCDCS and the integration of hypertension screening into primary care (Ayushman Bharat HWCs). With its consistent treatment guidelines and patient tracking, the India Hypertension Control Initiative (IHCI) has offered a successful model that achieves over 40% blood pressure control in enrolled patients. Especially important will be scaling up such models and maintaining them inside state health systems. India wants a 25% relative decrease in uncontrolled hypertension by 2025, which will mean keeping the momentum of these programs moving forward.

• **Focus on Bihar and Similar Settings:** Given the large population and currently poor indicators in states like Bihar, bettering hypertension management can dramatically improve general health outcomes. Increasing community awareness (so that people get their BP checked regularly), making sure drugs are freely and regularly available at public facilities, and using the network of health workers for follow-up rank as top priorities. Although Bihar's involvement in IHCI (with initial districts) is encouraging, spreading those lessons around the state will help to close the disparity between Bihar and other better-performing states.

• **Medical College Hospitals as Key Players:** Serving as centres of excellence setting standards for hypertension treatment and offering advanced treatment for complex cases, tertiary care institutions including medical college hospitals play a dual

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

function. By means of policy advocacy, research, and training, these organisations can affect practice in the larger geographical area. Following guideline-driven treatment and recording outcomes in their own clinics helps to microcosmize what is realistically possible. It is imperative that postgraduate courses and ongoing medical education stress hypertension so that newly graduated doctors have great skills in treating this common illness when they enter the field.

Beyond the health sector, multi-sectoral initiatives including food industry policies for salt, urban planning for physical activity, etc. will help to prevent and control hypertension. Still a major factor determining success is government political will and financial commitment. The consistent increases in health indicators observed in NFHS-5 relative to NFHS-4 show that, with concerted efforts, development is evident even within five-year spans.

Ultimately, lowering hypertension in India, more especially, in states like Bihar, is a medical as well as a system-level problem. The road forward calls for consistent application of what we now know works: regular screening, early diagnosis, lifetime lifestyle commitment, and adherence to sensible therapy. Millions of lives will be saved and quality of life improved if this is accomplished at scale by lowering avoidable strokes, heart attacks, and kidney failures. With improved primary care, digital health innovations, and community involvement, the next few years could mark a turning point in India's hypertension narrative. Maintaining an evidence-based, patient-centered approach and advocating for resources and policies that support their patients' long-term health is the responsibility of clinicians, especially those in leadership and academic positions. The ambitious target of a notable decrease in uncontrolled hypertension in India is within reach with combined and relentless efforts, so transforming the "silent killer" into a vanquished enemy.

LIMITATION

Though thorough, this review is not without restrictions. We used published data; local initiatives or unpublished program data from Bihar might not have been included. Furthermore, given India's diversity, not every conclusion holds true for all states; what works in Kerala, a state with far higher health indicators, might not be exactly applicable to Bihar without modification. Still, the overall approaches are always applicable.

FUTURE DIRECTIONS

Constant effort will be needed to reach better hypertension control by 2030 (in line with the Sustainable Development Goals, which include lowering premature NCD death). Among the future directions are legislative measures for salt reduction (such as urging industry to cut salt in processed foods), better urban planning for physical activity (more parks, etc.), and integration of hypertension treatment with other programs (for example, treating tuberculosis or COVID-19 patients, also check and manage BP – as co-morbid management). More community involvement is also needed; transforming

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

hypertension control into a social movement similar to India's polio eradication or Swachh Bharat (cleanliness) campaign could influence standards regarding medication adherence and health check-ups.

In conclusion of the discussion, , it is clear that although hypertension still presents a difficult problem in India, it is one that can be solved. Countries with far less resources have made progress in blood pressure management; some Latin American nations have high control rates via primary care networks. India now knows what has to be done; the next years should concentrate on doing it on a mass basis. Experiences in low-resource, high-burden environments like Bihar – if they can change their hypertension care environment – will evidence effective cardiovascular risk reduction. Medical schools, hospitals, public health officials, and the community all have a part to contribute to this group effort to control the "silent killer."

REFERENCES

- Amarchand, R., Kulothungan, V., Krishnan, A., & Mathur, P. (2022). Hypertension treatment cascade in India: results from National Noncommunicable Disease Monitoring Survey. Journal of Human Hypertension, 37(5), 394–404. https://doi.org/10.1038/s41371-022-00692-y
- Chand, V., & Shivika. (2023). Unveiling the Risk Factors of Non-Communicable Diseases in India: A Comprehensive Analysis of NHFS-5 (2019-20) data. International Journal of Health Sciences and Research, 13(7), 167–176. https://doi.org/10.52403/ijhsr.20230724
- Frieden, T. R., Varghese, C. V., Kishore, S. P., Campbell, N. R., Moran, A. E., Padwal, R., & Jaffe, M. G. (2019). Scaling up effective treatment of hypertension, A pathfinder for universal health coverage. Journal of Clinical Hypertension, 21(10), 1442–1449. https://doi.org/10.1111/jch.13655
- Gupta, R. (2004). Trends in hypertension epidemiology in India. Journal of Human Hypertension, 18(2), 73–78. https://doi.org/10.1038/sj.jhh.1001633
- Gupta, R. (2015). Convergence in urban–rural prevalence of hypertension in India. Journal of Human Hypertension, 30(2), 79–82. https://doi.org/10.1038/jhh.2015.48
- Gupta, R., Gaur, K., Ahuja, S., & Anjana, R. M. (2024). Recent studies on hypertension prevalence and control in India 2023. Hypertension Research, 47(6), 1445–1456. https://doi.org/10.1038/s41440-024-01585-y
- Kotwal, A., & Joseph, P. (2023). Conquering the Silent Killer: Hypertension Prevention and management in India. Indian Journal of Community Medicine, 48(1), 1–3. https://doi.org/10.4103/ijcm.ijcm_1000_22
- Longkumer, I., Yadav, S., Rajkumari, S., & Saraswathy, K. N. (2023). Trends in hypertension prevalence, awareness, treatment,

e-ISSN: 3048-9814 (Online)
Vol. 2 No. 3 (2025)
March 2025 Issue

and control: an 8-year follow-up study from rural North India. Scientific Reports, 13(1). https://doi.org/10.1038/s41598-023-37082-4

- Mathur, P., Leburu, S., & Kulothungan, V. (2022). Prevalence, awareness, treatment and control of diabetes in India from the countrywide National NCD Monitoring Survey. Frontiers in Public Health, 10. https://doi.org/10.3389/fpubh.2022.748157
- Mills, K. T., Stefanescu, A., & He, J. (2020). The global epidemiology of hypertension. Nature Reviews Nephrology, 16(4), 223–237. https://doi.org/10.1038/s41581-019-0244-2
- Ramakrishnan, S., Zachariah, G., Gupta, K., Rao, J. S., Mohanan, P., Venugopal, K., Sateesh, S., Sethi, R., Jain, D., Bardolei, N., Mani, K., Kakar, T. S., Kidambi, B., Bhushan, S., Verma, S. K., Bhargava, B., Roy, A., Kothari, S. S., Gupta, R., . . . Mathew, C. (2019). Prevalence of hypertension among Indian adults: Results from the great India blood pressure survey. Indian Heart Journal, 71(4), 309–313. https://doi.org/10.1016/j.ihj.2019.09.012
- Singh, R. B., Fedacko, J., Pella, D., Macejova, Z., Ghosh, S., De, A. K., Begom, R., Tumbi, Z. A., Memuna, H., Vajpeyee, S. K., De Meester, F., Sergey, C., Agarwal, R., Muthusamy, V. V., & Gupta, A. K. (2011). Prevalence and risk factors for prehypertension and hypertension in five Indian cities. Acta Cardiologica, 66(1), 29–37. https://doi.org/10.1080/ac.66.1.2064964
- Singh, S., Shankar, R., & Singh, G. P. (2017). Prevalence and associated risk factors of Hypertension: A Cross-Sectional Study in Urban Varanasi. International Journal of Hypertension, 2017, 1–10. https://doi.org/10.1155/2017/5491838
- Vegesna, A., Tran, M., Angelaccio, M., & Arcona, S. (2016). Remote Patient Monitoring via Non-Invasive Digital Technologies: A Systematic review. Telemedicine Journal and e-Health, 23(1), 3–17. https://doi.org/10.1089/tmj.2016.0051