

# Review Article

## Hypertension and Cardiovascular Trends in India

Ravikanth Garipalli, Mohammed Sadiq Azam

Department of Cardiology, Krishna Institute of Medical Sciences, Secunderabad, Telangana, India

### Abstract

HTN is found to have a high prevalence across various states in our country. Latest data have shown that 25–30% of population from urban areas and 10–20% of those in rural India are hypertensive. According to the 2011 census, there are around 95–100 million adults with HTN in India (of the total of 1.21 billion). Pre-HTN and Stage I HTN constitute a major chunk of the hypertensive population in India. There is a dearth of awareness, as well as very low rates of control and appropriate therapy in India, a fact with a rural preponderance. Lower socioeconomic status, living in rural areas and female gender are determinants of poor control and treatment.

**Key words:** Cardiovascular trends india, hypertension, hypertension trends

### Introduction

Cardiovascular diseases (CVDs) cause most of the death worldwide. Hypertension (HTN) leads to 57% of cerebrovascular accidents and 24% of all coronary artery disease-deaths in India.<sup>[1]</sup> According to the World Health Organisation, HTN is one of the leading causes of premature deaths around the globe.<sup>[2]</sup> The prevalence of CVD is increasing in alarming proportion in India and it accounts for 30% of all deaths. Increasing incidence of CV risk factors such as hypertension (HTN), diabetes mellitus, tobacco use, and metabolic syndrome leads to increasing CVD in India.

Apart from tobacco cessation, control of HTN forms the most important of the various treatment strategies to reduce CV mortality. HTN control is poor in developing countries. The Prospective Urban Rural Epidemiology study reported that control of HTN is about 50% in high-income countries and 10% in low- and lower middle-income countries.<sup>[3]</sup> Studies have reported better control of HTN rates in the past 50 years from Western Europe and the USA.<sup>[4]</sup> The National Health and Nutrition Examination Surveys from 1988 to 2008 and 1999 to 2012 have reported that the prevalence of HTN remained static at 30–35% during this period, whereas increasing rates of HTN treatment (from 60% to 75%) and its control (from 53% to 69%) were observed.<sup>[5]</sup> There is a linear relationship between elevation of blood pressure

(BP) and CV risk, as the BP rises above 115/75 mmHg.<sup>[6]</sup> The Global Burden of Diseases (GBD) 2015 analysis reveals that the estimated mortality rate per year associated with systolic BP (SBP) of at least 110–115 mmHg between 1990 and 2015 has risen from 135.6 to 145.2/100,000 persons.<sup>[7]</sup> Patel *et al.* have estimated that a decrease of 2 mmHg SBP in the population can prevent approximately 150,000 strokes and coronary artery disease (CAD) deaths in our country.<sup>[8]</sup> However, prospective data on HTN trends with respect to prevalence, awareness, and treatment from our country are scarce.

### Prevalence of HTN in India

Several Indian studies over the years have shown increasing prevalence of HTN in both urban and rural areas.<sup>[1,9-13]</sup> In the mid-1950s, epidemiological studies had employed older World Health Organization diagnostic definitions (SBP  $\geq$  160 mmHg and/or diastolic BP [DBP]  $\geq$  95 mmHg) and reported an urban prevalence of 1.2–4%. The urban prevalence of HTN has been steadily rising from around 3–4% in the early 1960s to 11–15.5% in the mid-1990s. The prevalence in rural areas though low has also shown a significant rise from <1% in the early 1960s to 5–7% in the late 1990s.<sup>[11]</sup>

### Address for correspondence:

Dr. Mohammed Sadiq Azam, Department of Cardiology, Krishna Institute of Medical Sciences, Secunderabad, Telangana, India.  
Phone: 9177618108, E-mail: drmdsadiq@gmail.com

Received: 26-04-2019; Accepted: 05-05-2019  
doi: 10.15713/ins.john.0163



**Table 1:** Prevalence studies in urban population<sup>[14]</sup>

Authors	Year	Place	Age group (years)	Sample size (n)	Prevalence (%)
Gupta <i>et al.</i>	1995	Jaipur	>20	2212	31
Anand <i>et al.</i>	2000	Mumbai	30–60	1662	34
Gupta <i>et al.</i>	2002	Jaipur	>20	1123	33
Shanthirani <i>et al.</i>	2003	Chennai	>20	1262	21
Gupta	2004	Mumbai	>35	88653	48
Prabhakaran	2005	Delhi	20–59	2935	30
Reddy <i>et al.</i>	2006	National	20–69	19973	27
Mohan <i>et al.</i>	2007	Chennai	>20	2350	20
Yadav <i>et al.</i>	2008	Lucknow	>30	1746	32
Gupta <i>et al.</i>	2012	National	>35	2616	48
Prince <i>et al.</i>	2012	Chennai	>60	1000	60
Joshi <i>et al.</i>	2012	National	49 (mean)	15662	46
Gupta <i>et al.</i>	2013	National	>20	6106	32
Bhansali	2014	National	>20	14059	26

**Table 2:** Prevalence studies in rural populations<sup>[14]</sup>

Authors	Place	Year reported	Age group (years)	Sample size (n)	Prevalence (%)
Gupta <i>et al.</i>	Rajasthan	1994	>20	3148	17
Kushima	Andhra	2004	>20	1316	21
Hazarika <i>et al.</i>	Assam	2004	>30	3180	33
Krishnan <i>et al.</i>	Haryana	2008	15–64	2828	9
Todkar <i>et al.</i>	Maharashtra	2009	>20	1297	7
Kinra <i>et al.</i>	All India	2010	20–69	1983	20
Gupta <i>et al.</i>	All India	2012	>35	4624	32
Prince <i>et al.</i>	Tamil Nadu	2012	>65	1000	29
Kalar <i>et al.</i>	Tamil Nadu	2012	25–64	10463	21
Borah <i>et al.</i>	Assam	2012	>30	916	55
Haddad <i>et al.</i>	Kerala	2012	18–96	1660	24
Meshram <i>et al.</i>	Kerala	2012	>20	4193	40
Bhagyalakshmi <i>et al.</i>	Gujarat	2013	15–64	1684	15

Later studies of prevalence employed the JNC-7 diagnostic criteria (known HTN or SBP  $\geq$ 140 mmHg and/or DBP  $\geq$ 90 mmHg).<sup>[12,13]</sup> There have been multiple studies (mostly regional) from urban [Table 1] and rural [Table 2] Indian populations.<sup>[14]</sup> These studies report varying prevalence rates of HTN, 20%–60% in urban areas and 7.2%–55.6% in rural areas. Among rural areas, Assam has a very high prevalence of HTN in tea plantation workers due to high salt intake, excess alcohol use, and Khaini use.

Anchala *et al.* in a review and meta-analysis reported the prevalence of awareness and control of HTN in urban/rural areas of different regions of India (North, East, South, and West).<sup>[12]</sup> HTN in India was prevalent in about 29.8% overall and about 33% of urban and 25% of rural population [Table 3].

**Table 3:** Prevalence of HTN region wise (rural vs. urban)<sup>[12]</sup>

Rural	Prevalence	Urban	Prevalence
North	16.7	North	33.5
East	33.17	East	33.28
West	18.22	West	34.89
South	28.27	South	33.12
Overall	27.61	Overall	33.81

HTN: Hypertension

### Awareness, Treatment, and Control

Only few prospective cross-sectional studies on HTN prevalence, awareness, and control were reported (Jaipur Heart Watch [JHW] study in urban population and National

**Table 4:** JHW studies – trends in age- and sex-adjusted HTN prevalence and awareness<sup>[15]</sup>

Number	JHW 1	JHW 2	JHW 3	JHW 4	JHW 5	JHW 6
	2212	1123	458	1127	739	1781
Years of study	1992–94	1999–2001	2003–04	2006–07	2010–11	2012–14
Crude prevalence rate	30.9	36.9	51.3	53.3	34.4	38.9
Age-/sex-adjusted prevalence	29.9	35.3	35.8	39.4	34.4	36
HTN awareness (% of total HTN cases)	13.2	43.8	49.1	44	49.2	56.1
Treatment	9	22	38	34	41	36
Control	2	14	13	18	21	21

HTN: Hypertension, JHW: Jaipur Heart Watch

Capital Region (NCR) study in urban and rural population). The JHW study [Table 4] is the only prospective cross-sectional HTN and other CV risk factor epidemiological studies in India which looked at HTN awareness and treatment over 25 years.<sup>[15]</sup>

There has been a steady rise in awareness (13% in the 1990s to >56% in the 2010s) of HTN despite the overall prevalence of HTN being varied from 30% to 50% in JHW studies [Table 4]. Even though awareness in urban area has increased to 56%, there is still a great need to increase awareness further to 70–80% as in most developed countries by screening of people for HTN and public education.

There has also been a phenomenal rise in HTN treatment through the years among all participants in the JHW studies. The rates of treatment have risen from 9% in JHW-1 to 36% in JHW-6. HTN control, however, remained low among participants, but there was an overall increase in control rates from 2% in JHW-1 to 21% in JHW-6 over 25 years.

Ambuj *et al.* conducted two representative cross-sectional surveys (Survey-1 from 1991 to 1994 and Survey-2 from 2010 to 2012) in the NCR of India. HTN prevalence was found to have risen from 23% to 42% and 11% to 29% in urban NCR and rural NCR of India, respectively [Table 5].<sup>[16]</sup>

Overall awareness, treatment, and control rates of HTN between the two surveys, however, remained the same. There was a rise in HTN prevalence with a rise in body mass index (BMI) as well as educational status in both urban and rural areas. Diabetic and pre-diabetic populations had the highest prevalence of HTN. There was a higher prevalence of HTN associated with ethanol consumption. This study has reported the highest increased prevalence of HTN in the youngest age group (35–44 years).

In a recent meta-analysis, Anchala *et al.* reviewed HTN awareness, treatment, and control studies and found that overall awareness was 42% for urban and 25% for rural population. Approximately 35% of urban population were aware of HTN in almost all studies, a fact reflected in the treatment and control rates (37.6% and 20.2%, respectively), while in rural populations, the treatment rate was 25.1% and control rate was 10.7%. The control rates, however, in urban and rural populations have remained low (11.6%–28.7% for urban and 6.5%–15% for

**Table 5:** Awareness, Treatment and Control trends in Indian hypertensive patients in two separate surveys (Survey 1: 1991–1994; Survey 2: 2010–2012)<sup>[16]</sup>

Demographic characteristic	Awareness		Treatment		Control	
	Survey 1%	Survey 2%	Survey 1%	Survey 2%	Survey 1%	Survey 2%
Total	38	39	32	32	14	13
Men	33	27	28	21	13	7
Women	42	51	35	44	16	19
Urban						
Total	49	46	49	40	16	16
Men	44	35	38	29	11	11
Women	53	57	45	50	20	20
Rural						
Total	7	27	7	20	8	8
Men	6	17	5	11	3	3
Women	9	40	9	9	15	15

HTN: Hypertension, NCR: National Capital Region

rural).<sup>[12]</sup> Our country has a high prevalence of HTN with low awareness, treatment, and control rates in both urban and rural populations. Poor control can be linked to myriad factors such as female gender, poverty, rural residence, and low educational status as well as obesity.<sup>[1]</sup>

### Trends of CVD in India

The India State-Level Disease Burden Initiative has reported a varied epidemiological transition among the states of India from 1990 to 2016 as part of the GBD, injuries, and risk factors study 2016. The investigators analyzed the prevalence and disability-adjusted life-years (DALYs) due to CVDs and the major component causes in the states of India from 1990 to 2016. They categorized states into four groups based on epidemiological transition level (ETL), which was defined using the ratio of DALYs from communicable diseases to those from non-communicable diseases and injuries combined, with a low ratio denoting high ETL and vice versa [Table 6]. The investigators found that CVDs were

**Table 6:** Prevalence and DALY rates of cardiovascular diseases as per ETL group<sup>[17]</sup>

ETL group	Ischemic heart disease		Stroke		Rheumatic heart disease	
	Prevalence (%)	DALYs (%)	Prevalence (%)	DALYs (%)	Prevalence (%)	DALYs (%)
<b>Low</b> (ratio 0.56–0.75)	39	46.7	1.9	44.1	–28.8	–4.3
Bihar						
Jharkhand						
Uttar Pradesh						
Rajasthan						
Meghalaya						
Assam						
Chhattisgarh						
Madhya Pradesh						
Odisha						
<b>Lower middle</b> (ratio 0.41–0.55)	39.4	58.5	4.1	61.3	–38	1.2
Arunachal Pradesh						
Mizoram						
Nagaland						
Uttarakhand						
Gujarat						
Tripura						
Sikkim						
Manipur						
<b>Higher middle</b> (ratio 0.31–0.40)	34.8	57.3	3.5	61.3	–37	3.3
Haryana						
Delhi						
Telangana						
Andhra Pradesh						
Jammu and Kashmir						
Karnataka						
West Bengal						
Maharashtra						
Other Union territories						
<b>High</b> (ratio<0.31)	33.6	68.7	–15.9	67.7	–42.6	–1.0
Himachal Pradesh						
Punjab						
Tamil Nadu						
Goa						
Kerala						
<b>India</b>	33.8	53	0.2	53.6	–33.1	–1.1

DALYs: Disability-adjusted life-years, ETL: Epidemiological transition level

**Table 7:** Percentage of total deaths and DALYs due to each cause under cardiovascular diseases by sex in India, 2016<sup>[17]</sup>

Demographic characteristic	Percentage of total deaths (%)		Percentage of total DALYs (%)	
	Men	Women	Men	Women
Total cardiovascular disease	29.2	26.7	15.8	12.2
Ischemic heart disease	19.6	15.6	10.4	6.6
Stroke	6.9	7.3	3.6	3.4
Hypertensive heart disease	1.1	1.6	0.6	0.7
Rheumatic heart disease	0.8	1.5	0.7	1.0
Atrial fibrillation and flutter	0.17	0.25	0.13	0.15

DALYs: Disability-adjusted life-years

responsible for 28% of overall mortality and 14% of DALYs in India in 2016 when compared to 15% and 7% in 1990. Men had a higher mortality burden from CAD, whereas the burden from cerebrovascular accidents was similar between men and women [Table 7]. Dietary risk factors which contributed to around 56%, HTN (54%), air pollutants (30%), dyslipidemia (29%), tobacco (19%), diabetes (17%), and elevated BMI (15%) were the leading CV risk factors in India [Table 8].<sup>[17]</sup>

In general, from 1990 to 2016, the prevalence rates of high SBP, high total cholesterol, and high fasting blood glucose have increased in India and all ETL state groups while the prevalence of smoking has reduced.

**Table 8:** Percentage contribution of major risk factors to ischemic heart disease DALYs in India<sup>[17]</sup>

Risk factor	DALYs	
	Men (%)	Women (%)
Dietary risks	71.5	68.9
High systolic blood pressure	54	54.3
Air pollution	37.5	36.1
High total cholesterol	44.7	43.2
Tobacco	27.2	11.4
High fasting plasma glucose	20.7	18.2
High body mass index	14.5	14.3

DALYs: Disability-adjusted life-years

## Conclusion

HTN is prevalent in about 30% of the urban and 25% of the rural populace of India. Only about 25% of the hypertensive population in rural areas are aware and receive therapy for HTN. In contrast, 42% of urban Indian hypertensive patients are aware and 38% receive therapy. However, probably, the point of major concern remains the disturbing fact that a significant minority of the urban (25%) as well as rural (10%) population have their BP at target, which exposes them to the associated morbidities and risk of mortality with uncontrolled HTN. The rising trends of CVD and the high prevalence of existing risk factors such as HTN, high BMI, smoking, as well as the emergence of new risk factors like air pollution, especially in the urban areas, are a sign of an impending epidemiological shift in the landscape of CVDs in India.

## References

- Gupta R. Trends in hypertension epidemiology in India. *J Hum Hypertens* 2004;18:73-8.
- Mackay J, Mensah G. Atlas of Heart Disease and Stroke. Geneva: World Health Organization; 2004.
- Chow CK, Teo KK, Rangarajan S, Islam S, Gupta R, Avezum A, *et al.* Prevalence, awareness, treatment and control of hypertension in rural and urban communities in high, middle and low-income countries. *JAMA* 2013;310:959-68.
- Poulter N, Prabhakaran D, Caulfield M. Hypertension. *Lancet* 2015;386:801-12.
- Egan BM, Li J, Hutchison FN, Ferdinand KC. Hypertension in the United States, 1999-2012: Progress towards healthy people

- 2020 goals. *Circulation* 2014;130:1692-9.
- Lewington S, Clarke R, Qizilbash N, Peto R, Collins R. Age-specific relevance of usual blood pressure to vascular mortality: A meta-analysis of individual data to one million adults in 61 prospective studies. *Lancet* 2002;360:1903-13.
- Forouzanbar MH, Liu P, Roth GA, Ng M, Biryukov S, Marczak L, *et al.* Global burden of hypertension and systolic blood pressure of at least 110 to 115 mm Hg, 1990-2015. *JAMA* 2017;317:165-82.
- Patel V, Chatterji S, Chisholm D, Ebrahim S, Gopalakrishna G, Mathers C, *et al.* Chronic diseases and injuries in India. *Lancet* 2011;377:413-28.
- Devi P, Rao M, Singamani A, Faruqui A, Jose M, Gupta R, *et al.* Prevalence, risk factors and awareness of hypertension in India: A systematic review. *J Hum Hypertens* 2013;27:281-7.
- Prabhakaran D, Jeemon P, Roy A. Cardiovascular diseases in India. *Circulation* 2016;133:1605-20.
- Gupta R, Al-Odat NA, Gupta VP. Hypertension epidemiology in India: Meta-analysis of fifty year prevalence rates and blood pressure trends. *J Hum Hypertens* 1996;10:465-72.
- Anchala R, Kannuri S, Pant H, Khan H, Franco OH, Di Angelantonio E, *et al.* Hypertension in India: A systemic review and meta-analysis of prevalence, awareness and control of hypertension. *J Hypertens* 2014;32:1170-7.
- Gupta R. Convergence of urban-rural prevalence of hypertension in India. *J Hum Hypertens* 2016;30:79.
- Gupta R, Gupta S. Hypertension in India: Trends in prevalence, awareness, treatment and control. *RUHS J Health Sci* 2017;2:40-6.
- Gupta R, Gupta V, Prakash H, Agrawal A, Sharma KK, Deedwania PC, *et al.* 25-years trends in hypertension prevalence, awareness, treatment and control in an Indian urban population: Jaipur heart watch. *Indian Heart J* 2018;70:802-7.
- Ambuj R, Praveen PA, Amarchand R, Ramakrishnan L, Gupta R, Kondal D, *et al.* Changes in hypertension prevalence, awareness, treatment and control rates over 20 years in National Capital Region of India: Results from a repeat cross-sectional study. *BMJ Open* 2017;7:e012639.
- Prabhakaran D, Jeemon P, Sharma M, Roth GA, Johnson C, Harikrishnan S, *et al.* The changing patterns of cardiovascular diseases and their risk factors in the states of India: Global burden of disease study 1990-2016. *Lancet Glob Health* 2018;6:E1339-51.

**How to cite this article:** Garipalli R, Azam MS. Hypertension and Cardiovascular Trends in India. *Hypertens* 2019;5(3):104-108.

**Source of support:** Nil, **Conflicts of interest:** None

This work is licensed under a Creative Commons Attribution 4.0 International License. The images or other third party material in this article are included in the article's Creative Commons license, unless indicated otherwise in the credit line; if the material is not included under the Creative Commons license, users will need to obtain permission from the license holder to reproduce the material. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/> © Garipalli R, Azam MS. 2019