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**Review Paper**

# Understanding the Level of Hypertension among Indian Adults: A Systematic Review (Meta-Analysis)

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## ABSTRACT

**Background:** Non-communicable diseases (NCDs) account for 60 percent of all deaths in India, as mentioned in the report of National Family Health Survey (NFHS-4) of India. While the National Family Health Survey (NFHS-1) conducted in 1992-93, NFHS-2 conducted in 1998-99 and NFHS-3 conducted in 2005-06 did not bring out estimates of hypertension; the clinical, anthropometric and biochemical (CAB) component of NFHS-4 conducted in 2015-16 provided vital estimates of the prevalence of hypertension through a series of biomarker tests and measurements. Hypertension is one of the important risk factors for cardiovascular disease and is a significant health concern, especially in India. Analysis of worldwide data for estimation of the global prevalence of hypertension in 2005 highlighted the lack of a national study investigating the prevalence in India. **Objective:** This paper is an attempt to conduct a cross - sectional study to determine the prevalence of hypertension, who are aware of the condition, who take antihypertensive treatment and who are able to achieve control over the condition of hypertension. Possible actions to improve the Indian Public Health System for control of hypertension in India has also been assessed and presented in this paper. **Main Measure:** Hypertension has been defined as the condition where Systolic Blood Pressure (SBP) is greater than or equal to 140 mmHg; or Diastolic Blood Pressure (DBP) is greater than or equal to 90 mmHg; or when the person is on treatment for hypertension. **Methods and Statistical Analysis:** *Search Strategy***:** PubMed databases were searched for terms such as blood pressure, systolic blood pressure, diastolic blood pressure, high BP, hypertension and raised blood pressure which were combined with terms related to desired outcomes such as prevalence, disease burden, estimate, awareness, treatment and control among Indian adults. Web of Science databases were searched for terms such as hypertension with applied filter as Country/Region: INDIA. Of the total 3892 articles, 35 were included. *Statistical Analysis:* The statistical analysis has been done on the captured data that has been referred from PubMed and Web of Science databases. Some of the statistical analysis done are Mean, Quartile, Confidence Interval (CI) etc. **Conclusion:** The proportion of prevalence, awareness, treatment and control of Hypertension was calculated using the available data and it was found out that the overall prevalence for hypertension in India was 25.6% (95% confidence

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interval: 21.6 - 29.6). Effective policy starting from primary health care level will enable better control of hypertension in India.

***Keywords:*** *NFHS, National Family Health Survey; HTN, Hypertension; SBP, Systolic Blood Pressure; DBP, Diastolic Blood Pressure; CI, Confidence Interval*

Hypertension is the situation of elevated blood pressure. It is considered a harmful medical condition that prematurely increases the risks of eyes, kidneys, brain, heart and leads to complications such as stroke, aneurysm, heart failure, metabolic syndrome, myocardial infarction, dementia, chronic kidney disease, peripheral, to name a few (1). Blood pressure is generally written in terms of two value. The first value is known Systolic Blood Pressure and the second value is known Diastolic Blood Pressure. The risk of cardiovascular disease burden doubles for every 20-point increase or 10-point increase in Systolic Blood Pressure or Diastolic Blood Pressure respectively. In persons up to the age of 50 years, cardiovascular risk is associated with both Diastolic Blood Pressure and Systolic Blood Pressure; while in people above the age of 50 years, Systolic Blood Pressure is more associated. As mentioned by World Health Organization (WHO), an estimate of 1.13 billion people worldwide has hypertension. About two-thirds of those people are living in low- and middle-income countries. Fewer than 5 people suffering from hypertension had the problem under control. There is a high prevalence of hypertension, and 1 in 3 Indian adults gets affected. Hypertension is very common in a country like India, and it is common among underweight adults and those people of lower socioeconomic position as well. It has been found that the prevalence of hypertension in India is high, but the adults with hypertension who are aware of the diagnosis, undergoing treatment, and achieved control is low.

Hypertension has been a major challenge in rural as well as in urban India. About 33% and 25% for urban and rural Indian population respectively are hypertensive. Of those, 25% and 42% for rural and urban Indian population respectively were aware of their status of hypertension. And only 38% and 25% of urban and rural Indian population respectively are under treatment for hypertension. Even in the adult tribal Indian population, there was an ascending trend in the prevalence of hypertension across three decades.

The increasing trend of hypertension in India in the last 50 years post a serious warning to the health-care system of India. Hypertension (HTN) had been exerting a significant burden on Indian public health healthcare systems in India. It is prudent to develop Population centric control strategies for hypertension which are cost effective. Re-orientation of primary health care and programs for Health promotion to improve the detection, awareness, and management of hypertension through various government and personal intervention are of urgent need. The policy makers need to understand that by not addressing the issue of hypertension beforehand will cause significant economic and social distress.

***Objective***

This paper is an attempt to conduct a cross sectional study in order to calculate the hypertension prevalence among the Indians, who are aware of the condition, who take antihypertensive treatment and who are able to achieve control over the condition of hypertension. Possible actions to improve the Indian Public Health System for control of hypertension in India has also been assessed and presented in this paper.

## LITERATURE REVIEW

The existing literature provides ample datapoints from various regions of the country on hypertension on the various aspects related to hypertension viz. prevalence in the population, awareness among the population, whether undergoing treatment and whether control is being achieved. Variations have been reported in hypertension among states, age groups, gender, weight, rural urban residency, economic status, comorbidity etc.

However, the existing literature unanimously points out that the hypertension prevalence in India is high. The literature also pointed out the consistency of hypertension prevalence in India for the last 50 years with no appreciable decrease in prevalence. same is true for the awareness, its treatment and control for the last 50 years in India.

With respect to the steps undertaken to improve the situation, the government of India has taken numerous steps to improve the effectiveness of the measure to boost the awareness, treatment and control of hypertension. The NFHS-4 gave special treatment to hypertension with respect to collection of various data points and compilation of the same to come up with vital statistics on the issue of hypertension. The NFHS-4 has improved the understanding of the issue of hypertension among India population.

The commonly associated risk factors for the prevalence of hypertension that are mentioned in studies literature are high body mass index, abnormal blood lipids, tobacco use, unhealthy diets, smoking, addiction via self or peer pressure, diabetes, increasing age, extra salt intake, central obesity, impaired glucose tolerance/ diabetes, high education, standard of living, hereditary, physical inactivity, sedentariness, environmental factors, greater per cent body fat, to mention a few. Numerous other common and uncommon risk factors increase the burden of hypertension in India.

While some major risks require intervention by the public health system, there are many major risks factors which are modifiable in that they can be prevented, can be treated and can be easily controlled by personal efforts by the individuals. Some of such modifiable risk factors are terminating smoking, reducing cholesterol, consuming a healthy diet, decreasing sedentariness, decreasing tobacco usage, to mention a few. Some of the non-modifiable risk factors include age over 65 years, history of hypertension in the family and comorbidity with pre-existing diseases. Separate treatments are required for modifiable and non-modifiable risk factors of hypertension. The comorbidity of hypertension presents an even greater challenge for treatment of hypertension.

The common risk can be divided into the following classes: a) Social determinants such as Globalization, Modernization, Urbanization, Ageing, Income, Education, Housing; b) Behavioral factors such not having healthy diet, Frequency Tobacco consumption, sedentariness, over consumption of alcohol; c) Violation of normal limits of blood pressure, Obesity, condition of Diabetes, Raised blood limits; d) comorbidity factors such as Cardiovascular diseases such as Heart attack, Stokers, Heart failure, Chronic Kidney Disease.

While the risk factors for hypertension are plenty, most of the people with hypertension stay unaware of the condition of hypertension as hypertension may have no symptoms or warning signs. Thus, it is very necessary that blood pressure is measured regularly to detect hypertensive condition at an early stage. Hypertension is called a “silent killer”. While mild

hypertension presents some symptoms such as nosebleeds, vision changes, early morning headaches, buzzing in the ears, to mention a few; severe condition of hypertension can lead to various complications such as cause nausea, chest pain, etc. that would require immediate medical attention.

## METHODS

### *Search Strategy*

Publicly available PubMed database and Web of Science database have been searched for last ten years, from 2010 to 2020.

The following combination of search terms have been used in PubMed: (((((((blood pressure) OR (diastolic blood pressure)) OR (systolic blood pressure)) OR (high BP)) OR (hypertension)) OR (raised blood pressure)) AND ((((((prevalence) OR (disease burden)) OR (estimate)) OR (awareness)) OR (control)) OR (treatment))) AND (Indian adults) Filters: from 2010 – 2020. The following search term have been used in Web of Science: "hypertension". Filter: Country/Region: "INDIA"

### *Inclusion Criteria*

Some criteria have been adopted for selection of the studies obtained from the search database.

The studies were included if:

1. Studies used Cross-sectional study, case control, cohort or meta-analysis methods
2. Studies were conducted amount Indian Adults (age ≥ 18 years old).
3. Studies talk about prevalence of hypertension, its awareness, its treatment or its control or combination of the same or other various aspects of the same.
4. Studies considered Hypertension as DBP ≥ 90 mmHg or SBP ≥ 140 mmHg.
5. Studies written in English language.

The studies were excluded if:

1. The studies were not conducted in humans
2. The studies were clinical trails

### *Flow Diagram*

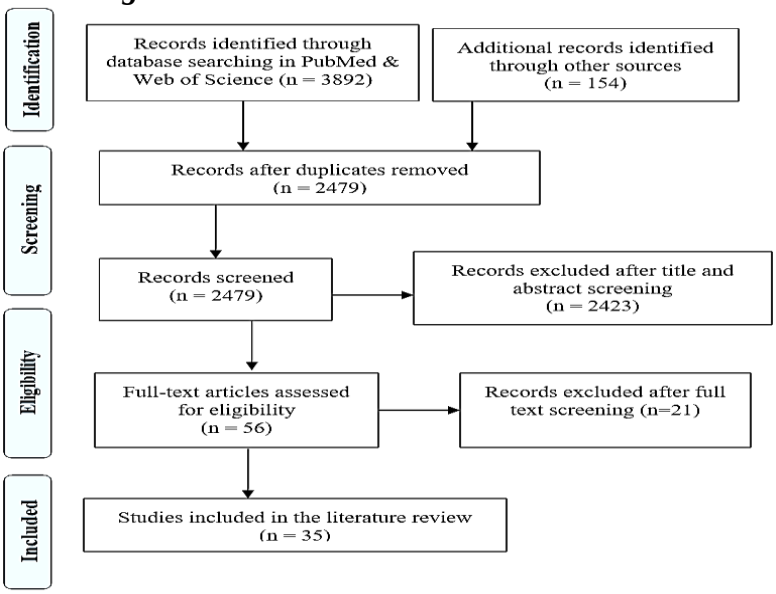


***Figure 1: Flow diagram as per PRISMA guidelines showing the steps for selection of studies for hypertension***

Out of the 3892 records identified through thorough searching in PubMed and Web of Science databases for a period of 10 years w.e.f. 2010 to 2020, 3836 records were excluded after initial title and abstract screening. The remaining 56 records were eligible for full text review. 21 records were excluded after full text screening and finally 35 records were included in the literature review for this paper. Care has been taken not to include any duplicate sources. All the aforementioned details have been shown in the Flow diagram as per PRISMA guidelines showing the steps for selection of studies for hypertension (Figure 1).

The list of included studies along with key highlight shown in the Table below.

***Table 1 Characteristics of Studies included in the Analysis***

| Characteristics of Studies included in the Analysis | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sl** | **Study** | **Region** | **Sample size (no)** | **Prevalence (%)** | **Awareness (%)** | **Treatment (%)** | **Control (%)** |
| **1** | Sivasubramanian Ramakrishnan et al(1) | All India | 180335 | 30.70 | NR | NR | NR |
| **2** | Kath A Moser et al(2) | All India | 12198 | 24 | NR | NR | NR |
| **3** | Jonas Prenissl et al(3) | All India | NR | 18.1 | 44.7 | 13.3 | 7.9 |
| **4** | Raghupathy Anchala et al(4) | All India | NR | 29.8 | 25.3 | 25.1 | 10.7 |
| **5** | S A Rizwan et al(5) | All India | 64674 | 16.1 | NR | NR | NR |
| **6** | R Gupta et al(6) | All India | NR | 15 | NR | NR | NR |
| **7** | Anne C Bischops et al(7) | All India | 2035662 | NR | NR | NR | NR |
| **8** | Souraja Datta et al(8) | South India | 394 | 26.20 | NR | NR | NR |
| **9** | Prasanta K Borah et al(9) | North-East India | 13458 | NR | NR | NR | NR |
| **10** | Ambuj Roy et al(10) | North India | 3048 | NR | NR | NR | NR |
| **11** | D Busingye et al(11) | All India | 277 | NR | 43 | 33 | 27 |
| **12** | Rajkumar Bharatia et al(12) | All India | 4725 | NR | NR | NR | NR |
| **13** | A K Soyibo et al(13) | All India | NR | NR | NR | NR | NR |
| **14** | Mangesh S Pednekar et al(14) | West India | 148173 | NR | NR | NR | NR |
| **15** | Prabhdeep Kaur et al(15) | South India | 10463 | 21.4 | NR | NR | NR |
| **16** | Saswata Ghosh et al(16) | East India | 27589 | 12.5 | NR | NR | NR |
| **17** | R Gupta(17) | All India | NR | 25 | NR | NR | NR |
| **18** | P Devi et al(18) | All India | NR | NR | 54 | NR | 25 |
| **19** | Jost B Jonas et al(19) | North India | 4711 | 22.1 | 20 | 8 | NR |
| **20** | Tanu Midha et al(20) | North India | 800 | 32.8 | NR | NR | NR |
| **21** | R Subburam et al(21) | South India | 406 | 33 | NR | NR | NR |
| **22** | S Yadav et al(22) | North India | 1746 | NR | NR | NR | NR |
| **23** | Geeta Yadav et al(23) | North India | 294 | 39.5 | 51.7 | 39 | 14.67 |
| **24** | V Mohan et al(24) | South India | 26001 | 20 | 32.8 | 70.8 | 45.9 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **25** | Manu G Zachariah et al(25) | South India | 314 | 54.5 | 39 | 29 | NR |
| **26** | C S Shanthirani et al(26) | South India | 1399 | 21.1 | NR | NR | NR |
| **27** | A K Gupta et al(27) | North India | 7630 | 33.22 | 22.05 | NR | NR |
| **28** | R Gupta et al(28) | West India | 2122 | 31.5 | NR | NR | NR |
| **29** | R Gupta et al(29) | All India | 3148 | 20.5 | NR | NR | NR |
| **30** | N Gopinath et al(30) | North India | 6543 | 30.9 | 7.9 | 2.97 | NR |
| **31** | S L Chadha et al(31) | North India | 13723 | 12.75 | NR | NR | 9 |
| **32** | S P Gupta et al(32) | North India | 4068 | NR | NR | NR | NR |
| **33** | Gautam K Kshatriya et al(33) | All India | 2156 | 11.75 | NR | NR | NR |
| **34** | Ramaswamy Premkumar et al(34) | Central India | 495 | 16.8 | NR | NR | NR |
| **35** | Jaya Prasad Tripathy et al(35) | North India | 5127 | 40.1 | NR | NR | NR |
| ***NR: Not Reported*** | | | | | | | |

### *Statistical Analysis*

The statistical analysis is being done on the captured data that has been referred from PubMed and Web of Science databases.

- Out of the total of 35 studies selected for this paper, 25 studies reported the prevalence of hypertension, 10 studies reported the awareness of hypertension, 8 studies reported the treatment of hypertension and 7 studies reported the control of hypertension. A graph showing the number of papers for each category is shown in Figure 2.
- Out of the 35 number of studies selected for this paper, 10 number of studies were based on data from North India, 6 numbers of studies were based on data from South India, 1 number is based on data from East India, 2 numbers of studies are based on data from West India, 1 number of study is based on data from Central India, 1 number of study is based on data from North-East India and 14 number of studies are based on data from All India. The region-wide distribution of the selected studies is shown in Figure 3.

Some of the statistical analysis done are Mean, Quartile, Confidence Interval (CI) etc.

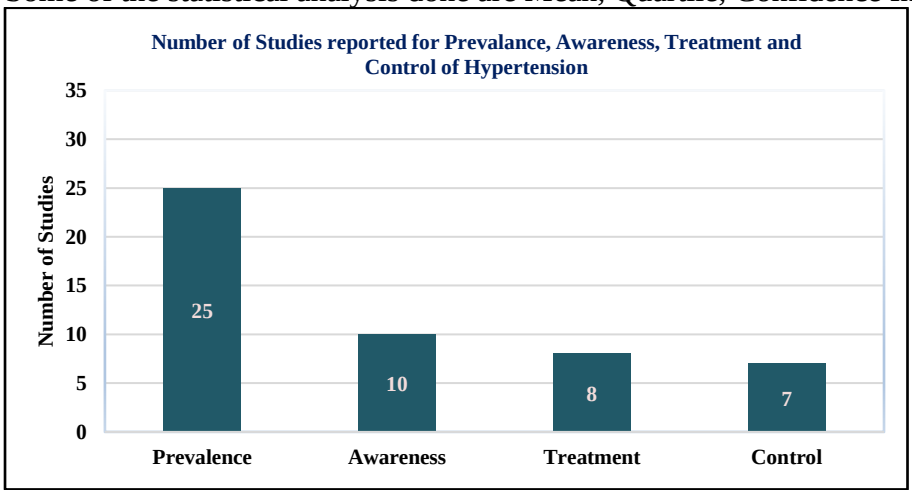


***Figure 2: Number of Studies reported for Prevalence, Awareness, Treatment and Control of Hypertension***

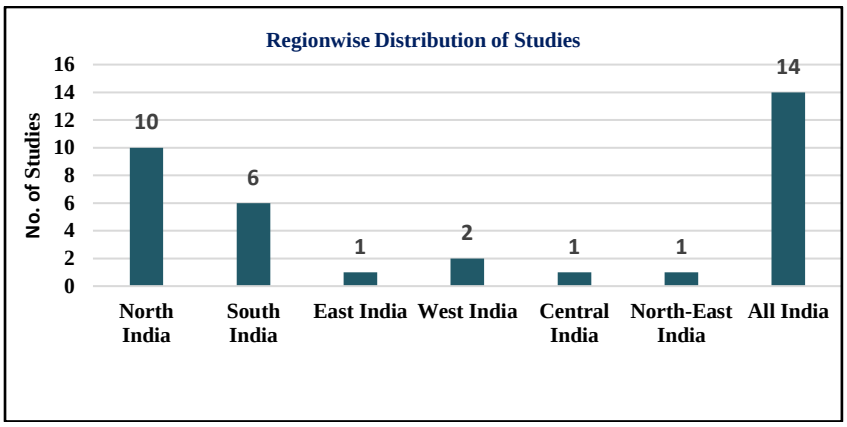


*Figure 3: Region-wise distribution of Studies*

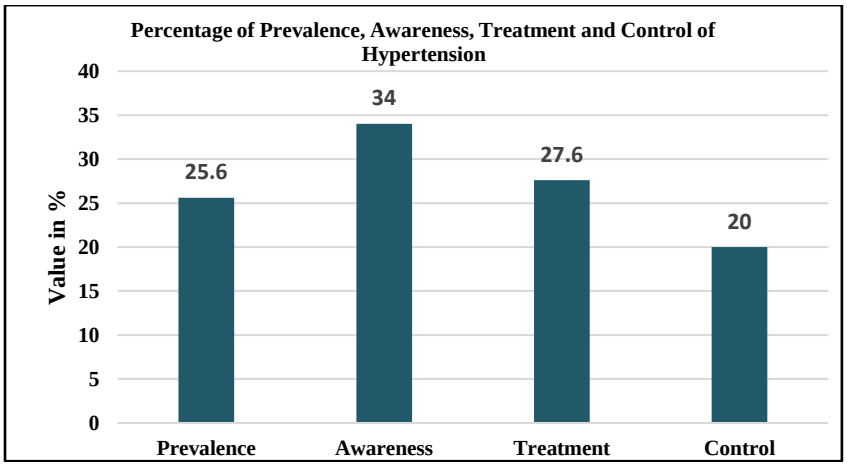


*Figure 4: Prevalence, Awareness, Treatment and Control of Hypertension*

## RESULTS

Microsoft Excel was used to perform Data entry and statistical analysis.

Total sample size across the studies was 2581679 with the following Quartile measures: Quartile 1 (Q1) = 1099.5, Quartile 2 (Q2) = 4711, Quartile 3 (Q3) = 13590.5, Xmin = 277, Xmax = 2035662, Interquartile Range = 12491

Overall prevalence for hypertension in India as per the data collected in this paper (from 2010 - 2020) was found out to be 25.6% (95% confidence interval: 21.6 - 29.6). For India, the awareness of hypertension was 34.0% (95% CI): 24.7 – 43.4). The treatment of hypertension was 27.6% (95% CI): 12.8 – 42.5) and overall control of hypertension was found out to be 20.0% (95% CI): 9.9 – 30.2). The percentage of prevalence of hypertension, the awareness, the treatment and control is shown in Figure 4.

## DISCUSSION

The analyses indicate very high prevalence rates of hypertension in India which complements the findings of NFHS-4 where a high prevalence of hypertension was also noted. While it has been noted in the literature that the prevalence of hypertension has not reduced during the last 50 years, this paper presented the status for last 10 years i.e. from the year 2010 to 2020. The results for the last ten years also point out that hypertension is still prevalent to a higher degree in the Indian adults, with no reduction in the rate of prevalence as such. The same is true for awareness of hypertension, its treatment and control as well.

## CONCLUSION

The prevalence of hypertension is high among the Indian adults. The overall prevalence of Hypertension in India is 25.6%. The awareness of hypertension in India is 34.0%. The treatment of hypertension in India is 27.6% and control of hypertension in India is 20.0%.

Indian Public Health system needs to take up steps for improvement of the situation of hypertension by following the cues provided by the common risk factors. Government and policymakers must exercise political will to prevent and control hypertension. In addition, the Health workers, each sector associated, each family and every individual have a crucial role to play. Effective and SMART policy starting from primary health care level will enable better control of hypertension in India. A comprehensive hypertension education program can also lead a long way to improving the awareness of hypertension. While not addressing hypertension or delayed addressing of hypertension in a timely fashion will have significant burden of the disease and would also impact the economic and social structure which needs to be avoided under all circumstances.

Since 2011, the global efforts to tackle the challenge of hypertension and other non-communicable diseases have gained momentum. In 2016, WHO and the United States CDCP launched the Global Hearts Initiative. World Health Organization mentions six strategic components of any initiative by the country to address the issue of hypertension. The components include a primary care programme, the cost associated for implementation, basic diagnostics process and medicine required, methods for risk factors reduction, wellness programmes based on workplace and progress monitoring. In the same line or context, Indian government can use the above six components as guidelines and address the issue of hypertension by national programmes or by state specific State Implementation Plan (SIPs) via appropriate budget allocation and wide area coverage.

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***Conflict of Interest***

The author(s) declared no conflict of interest.

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