Hypertension in India: Trends in Prevalence, Awareness, Treatment and Control

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ABSTRACT

Hypertension (HTN) is the attributable cause for 57% of stroke and 24% of coronary heart disease deaths in India. High prevalence of hypertension has been reported from various regions of the country. Recent studies have reported that shown that hypertension is present in 25-30% urban and 10-20% rural subjects in India. This translates into an approximate population burden of 100-110 million persons with high blood pressure (BP). Approximately half to two-thirds of these are stage I hypertension (systolic BP 140-159 and/or diastolic BP 90-99 mm Hg) and the rest have stage II-III disease. There is low awareness, treatment and control status of hypertension in India, more among the rural than in urban populations. Determinants of low hypertension treatment and control are rural locations, low socioeconomic and educational status and female gender. Public health strategies are important for creating awareness of hypertension and physician education is required for its better treatment and control. Use of non-physician community health workers and mHealth technology are promising tools for increasing rates of hypertension treatment and promote control and adherence to healthy lifestyles and medicines.

INTRODUCTION

Cardiovascular diseases (CVD) account for a large proportion of all deaths and disability worldwide. India is the second most populous country in the world and emerging burden of CVD in countries here is alarming. In 1990, CVD accounted for 20% of all deaths in this region. Coronary heart disease (CHD) was responsible for 60% of these and 40% attributed to stroke. This proportion has increased to 30% and currently almost 2 million deaths are annually caused by CVD in India. Escalating cardiovascular risk factors such as smoking, high blood pressure (BP), high low density lipoprotein (LDL) cholesterol, low high density lipoprotein (HDL) cholesterol, metabolic syndrome and diabetes are the major risk factors associated with the increasing CVD in India.

Population-based epidemiological studies have reported that all these risk factors have increased by two to five times in urban and rural regions over the last 50 years. Downward revision of the predicted increase in cardiovascular disease will require modification of risk factors with two characteristics. First, the risk factors must have high attributable risk, high prevalence, or both. Second, reversal of most or all of the risks must be cost-effective. High BP is a major risk factor for several types of cardiovascular disease, and the association of BP with cardiovascular risk is continuous. Large proportions of most populations have non-optimal BP values. Moreover, most or all BP-related risk can be significantly reduced within a few years using relatively inexpensive interventions. The Global Burden of Diseases study has reported that hypertension is the most important cardiovascular risk factor in this region and responsible for the largest burden of disease and mortality. Present estimates suggest that a 2 mm Hg population-wide decrease in systolic BP can lead to prevention of more than 151,000 stroke and 153,000 coronary heart disease deaths in India.

RECENT STUDIES ON HYPERTENSION PREVALENCE IN INDIA

Both urban and rural areas in India have been surveyed to estimate the prevalence of hypertension and a number of reviews have highlighted escalating burden of hypertension in India. In the mid-1950s, Indian urban population based epidemiological studies used older World Health Organization (WHO) criteria for diagnosis (known hypertension or BP ≥160 mm Hg systolic and/or 95 mm Hg diastolic) and reported hypertension prevalence of 1.2 to 4.0%. Since then prevalence of hypertension in Indian cities has been steadily increasing from 3.0-4.5% in early 1960's to 11.0 to 15.5% in mid 1990's. Although rural populations in India generally have lower prevalence of hypertension there has been a significant increase in these populations from less than 1% in early 1960's to 5-7% in late 1990's.

Systolic BP ≥140 mm Hg and/or diastolic BP ≥90 mm Hg is the currently accepted diagnostic threshold for hypertension. Many prevalence studies of hypertension...
defined by current criteria have been performed in late 20\textsuperscript{th} and early 21\textsuperscript{st} century in India as reviewed earlier.\textsuperscript{10,11} Studies have been performed in the urban (Table 1) as well as rural (Table 2) Indian populations.\textsuperscript{12-45} Most of the studies are regional. There are only a few multicentric studies in the country.

There are large regional differences in hypertension prevalence in India (Tables 1 and 2) and large transversal studies are needed. National Family Health Surveys and National Statistical Survey Organization surveys should focus on hypertension screening and referral. Government of India, under the National Program for Control of Cardiovascular Diseases, Stroke, Diabetes and Cancer has initiated a large project of opportunistic screening in India.\textsuperscript{47} More than 50 million adults have been screened and it has been reported that 6.2% participants were suffering from diabetes while hypertension was in 5.5%.\textsuperscript{47} These numbers are clearly an underestimate and much lower than the government sponsored (Indian Council of Medical Research) studies.\textsuperscript{44} Improvement in measurement quality for diagnosis of hypertension and diabetes are required and it is recommended that a better quality program for universal screening for hypertension in India should be implemented. Also, required are population based prospective studies to identify causes and consequences of hypertension in the Indian population.

In India, an estimate regarding the absolute numbers of patients with hypertension that would be eligible for treatment can be made from epidemiological studies. Current studies have shown that hypertension is present in 25\% of urban and 10\% of rural subjects in India.\textsuperscript{11} Because of a difference in the number of BP measurements (typically 1 in epidemiological studies and 3-4 over a time-period in clinical studies), it has been estimated that epidemiological studies over-diagnose hypertension by 20-25\%.\textsuperscript{48} If we discount this proportion, currently 20\% adults in the urban and 10\% in the rural areas of India would be eligible for antihypertensive therapies. Translating these proportions into numbers reveals a

![Figure 1: Convergence in prevalence of hypertension in urban and rural populations in India. Prevalence data from studies that have included subjects aged ≥20 years are included. Prevalence of hypertension in urban areas (black line) has stabilized while in rural areas (grey line) is increasing.](image)

All these studies reveal a high prevalence of hypertension in Indian urban populations. It appears that hypertension is increasing more rapidly in the Indian rural populations and there is an urban rural convergence in hypertension prevalence (Figure 1).\textsuperscript{11} These studies show that almost a third of adult Indian population has high BP. This is similar to other parts of the developing world and only slightly lower than the developed countries.\textsuperscript{46}

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### Table 1: Recent Hypertension Prevalence Studies in Urban Populations

<table>
<thead>
<tr>
<th>First Author</th>
<th>Ref.</th>
<th>Year Reported</th>
<th>Place</th>
<th>Age Group (years)</th>
<th>Sample Size (No)</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gupta R</td>
<td>12</td>
<td>1995</td>
<td>Jaipur</td>
<td>&gt;20</td>
<td>2212</td>
<td>30.9</td>
</tr>
<tr>
<td>Anand MP</td>
<td>13</td>
<td>2000</td>
<td>Mumbai</td>
<td>30-60</td>
<td>1662</td>
<td>34.0</td>
</tr>
<tr>
<td>Gupta R</td>
<td>14</td>
<td>2002</td>
<td>Jaipur</td>
<td>&gt;20</td>
<td>1123</td>
<td>33.4</td>
</tr>
<tr>
<td>Shanthirani CS</td>
<td>15</td>
<td>2003</td>
<td>Chennai</td>
<td>&gt;20</td>
<td>1262</td>
<td>21.1</td>
</tr>
<tr>
<td>Gupta PC</td>
<td>16</td>
<td>2004</td>
<td>Mumbai</td>
<td>&gt;35</td>
<td>88653</td>
<td>47.9</td>
</tr>
<tr>
<td>Prabhakaran D</td>
<td>17</td>
<td>2005</td>
<td>Delhi</td>
<td>20-59</td>
<td>2935</td>
<td>30.0</td>
</tr>
<tr>
<td>Reddy KS</td>
<td>18</td>
<td>2006</td>
<td>National</td>
<td>20-69</td>
<td>19973</td>
<td>27.2</td>
</tr>
<tr>
<td>Mohan V</td>
<td>19</td>
<td>2007</td>
<td>Chennai</td>
<td>&gt;20</td>
<td>2350</td>
<td>20.0</td>
</tr>
<tr>
<td>Kaur P</td>
<td>20</td>
<td>2007</td>
<td>Chennai</td>
<td>18-69</td>
<td>2262</td>
<td>27.2</td>
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<td>Yadav S</td>
<td>21</td>
<td>2008</td>
<td>Lucknow</td>
<td>&gt;30</td>
<td>1746</td>
<td>32.2</td>
</tr>
<tr>
<td>Gupta R</td>
<td>22</td>
<td>2012</td>
<td>National</td>
<td>&gt;35</td>
<td>2616</td>
<td>48.2</td>
</tr>
<tr>
<td>Prince MJ</td>
<td>23</td>
<td>2012</td>
<td>Chennai</td>
<td>&gt;60</td>
<td>1000</td>
<td>60.0</td>
</tr>
<tr>
<td>Gupta R</td>
<td>24</td>
<td>2012</td>
<td>Jaipur</td>
<td>&gt;20</td>
<td>739</td>
<td>32.1</td>
</tr>
<tr>
<td>Joshi SR</td>
<td>25</td>
<td>2012</td>
<td>National</td>
<td>49(mean)</td>
<td>15662</td>
<td>46.0</td>
</tr>
<tr>
<td>Gupta R</td>
<td>26</td>
<td>2013</td>
<td>National</td>
<td>&gt;20</td>
<td>6106</td>
<td>31.5</td>
</tr>
<tr>
<td>Bhagyalaxmi A</td>
<td>27</td>
<td>2013</td>
<td>Gujarat</td>
<td>15-64</td>
<td>1805</td>
<td>29.0</td>
</tr>
<tr>
<td>Bhansali A</td>
<td>28</td>
<td>2014</td>
<td>National</td>
<td>&gt;20</td>
<td>14059</td>
<td>26.3</td>
</tr>
</tbody>
</table>
massive burden of this disease in India. According to the 2011 census there are 700 million adults (of the total 1.21 billion) in India, of whom 450 million are in rural and 250 million in urban areas. The absolute number of hypertensives in India, presently, would therefore be 45 million among rural and 50 million in urban subjects. This would translate into a total of about 95-100 million adults in India with hypertension.

HYPERTENSION AWARENESS, TREATMENT AND CONTROL

Although hypertension is highly prevalent in India, there is low awareness, treatment and control status in Indian urban as well as rural populations. Poor control of high BP has been attributed to a variety of socioeconomic factors including women, low educational status, poverty, rural residence as well as physiological factors, eg. obesity. Awareness status of hypertension has increased in the last 30 years in India but remains very low especially in rural populations. Hypertension awareness has increased from less than 30% in 1980's among urban populations to about 60% presently and from less than 10% in rural areas in 1980's to 35-40% presently. However, treatment and control status remain low at less than 30% in urban and 20% in rural areas.

Anchala et al reviewed hypertension awareness, treatment and control status including all the recent studies in India. Overall estimates (95% confidence intervals) for awareness of hypertension in India was 41.9% (35.1–48.9) for urban and 25.1% (21.0–29.1) for rural populations. The awareness levels for hypertension were consistently above 35% in almost all studies from urban areas. In urban populations the treatment and control status of those with known hypertension was 37.6% (24.0–51.2) and control in 20.2% (11.6–28.7). While in rural populations, the treatment status for those with known hypertension was 25.1% (17.0–33.1), and control status was in 10.7% (6.5–15.0) (Figure 2).

Figure 2: Meta-analysis of hypertension awareness, treatment and control in Indian urban and rural populations.

Treatment status varied by location in urban parts of India with for percentage treated for hypertension varying from a low of 19% to a high of 80%. The treated percentage among hypertensive patients showed greater variation in rural southern parts of India, ranging from 1 to 47% than in urban areas. Overall, close to 38% of urban Indians suffering from HTN are being treated. The BP control among both urban and rural parts of India has been very poor (range 11.6–28.7% in urban and 6.5–15% in rural). Jaipur Heart Watch (JHW) is the only prospective cross-sectional hypertension and other cardiovascular risk
Table 3: 22-year trends in age and sex-adjusted hypertension prevalence and awareness in among urban subjects in Jaipur Heart Watch studies

<table>
<thead>
<tr>
<th>Years of study &amp; reporting</th>
<th>JHW-1 (n=2212)</th>
<th>JHW-2 (n=1123)</th>
<th>JHW-3 (n=458)</th>
<th>JHW-4 (n=1127)</th>
<th>JHW-5 (n=739)</th>
<th>JHW-6 (n=1781)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude prevalence rate</td>
<td></td>
<td></td>
<td>51.3</td>
<td>53.3</td>
<td>34.4</td>
<td>38.9</td>
</tr>
<tr>
<td>(known hypertension + BP &gt;140/&gt;90)</td>
<td>30.9</td>
<td>36.9</td>
<td>35.8</td>
<td>39.4</td>
<td>34.4</td>
<td>36.0</td>
</tr>
<tr>
<td>Age- and sex-adjusted</td>
<td></td>
<td></td>
<td>49.1</td>
<td>38.1</td>
<td>49.2</td>
<td>56.1</td>
</tr>
<tr>
<td>prevalence (%)</td>
<td>29.9</td>
<td>35.3</td>
<td>35.8</td>
<td>39.4</td>
<td>34.4</td>
<td>36.0</td>
</tr>
<tr>
<td>Hypertension awareness (% of total hypertensives)</td>
<td>13.2</td>
<td>43.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In a series of cross-sectional studies in Jaipur (Rajasthan, India) we evaluated trends in hypertension awareness, treatment and control over a 22-year period (Table 3). While the crude prevalence of hypertension has varied from 30-50% in these studies, awareness of hypertension has increased significantly (Table 3). The awareness of hypertension was 13% in early 1990's and has now increased to more than 56%. There is, however, a great need to increase diagnosis of hypertension through screening and its awareness in India so that we can reach the awareness levels of developed countries which are 70-80% in most countries. The reasons for greater awareness of hypertension in JHW studies are not clear, further studies are required. Better health literacy due to public health campaigns could be important factors. In another study we reported that the age-adjusted mean systolic BP has declined over this period. This shows that better awareness is associated with lower systolic BP, possibly due to better lifestyles or better treatments.

Table 4: Hypertension awareness, treatment and control in India Heart Watch Study (n=6198).

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Aware (%)</th>
<th>Treated (%)</th>
<th>Controlled (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-29</td>
<td>23.2</td>
<td>8.7</td>
<td>15.9</td>
</tr>
<tr>
<td>30-39</td>
<td>34.4</td>
<td>20.0</td>
<td>18.4</td>
</tr>
<tr>
<td>40-49</td>
<td>53.3</td>
<td>38.3</td>
<td>25.5</td>
</tr>
<tr>
<td>50-59</td>
<td>60.6</td>
<td>46.4</td>
<td>28.3</td>
</tr>
<tr>
<td>60-69</td>
<td>65.4</td>
<td>55.4</td>
<td>27.5</td>
</tr>
<tr>
<td>70+</td>
<td>64.7</td>
<td>53.8</td>
<td>19.3</td>
</tr>
<tr>
<td>Age-adjusted</td>
<td>55.3</td>
<td>36.5</td>
<td>28.2</td>
</tr>
</tbody>
</table>

India Heart Watch study in urban populations reported prevalence of awareness, treatment, and control of hypertension middle class sites in 11 cities in India and enrolled more than 6000 subjects. Hypertension awareness, treatment and control among the study subjects in different age groups is shown in Table 4. An age-adjusted analysis showed that 53.8% of men and 57.3% of women were aware of hypertension. Among subjects with hypertension, 37.9% of the men and 34.5% of the women were receiving treatment for it. Controlled BP (systolic BP < 140 mm Hg and diastolic BP < 90 mm Hg) was found in 25.6% of the men and 31.6% of the women with hypertension (28.2% overall). Awareness of hypertension increased with age in both men and women, with less than a quarter of men and women under 30 years of age being aware of hypertension as opposed to two-thirds of those > 60 years of age. Treatment status also increased with age, with < 20% of those younger than age 40 years but > 50% of those over age 60 years receiving treatment. Hypertension control status did not change significantly with age. Among the subjects aware of having hypertension, 78.6% of men and 76.1% of women were receiving treatment. Among individuals treated for hypertension, less than half (41.5% of men and 41.6% of women) had controlled BP. This study showed that even among the urban middle class there is a low treatment and control status of hypertension. This study also reported that low educational status was associated with lower hypertension awareness, treatment and control. Poor status of hypertension control, almost similar to Indian rural populations, was observed in this study (Figure 3). There have been limited studies that determined determinants of hypertension awareness, treatment and control. Indian Women Health Study was conducted in low and low-middle socioeconomic status women at multiple urban and rural sites in India. Prevalence of known hypertension was low and only 56.8% urban and 24.6% rural women were aware of the condition. Of the aware hypertensive women only 38.6% were on drug therapy (rural 46.5%, urban 38.6%). Hypertension control defined by systolic BP <140 mm Hg and diastolic BP <90 mm Hg among those on treatment was extremely low and only 10.2% rural and 28.3% urban women had controlled BP values. Overall, of the 1672 hypertensive...
women (rural 746, urban 926) only 18.3% were on treatment (rural 13.1%, urban 22.5%) and control to target achieved in 3.9% (rural 1.3%, urban 5.9%) (p<0.05 for rural-urban difference). Significant lifestyle determinants of hypertension awareness, treatment and control showed that rural location is the most important risk factor for awareness (age-adjusted OR 3.13, CI 2.49-3.93), treatment (1.59, 1.18-2.13) as well as control (5.11, 2.22-11.74). Low educational level and spouse educational status has insignificant association respectively with awareness (age and location adjusted OR and 95% CI 1.39, 0.92-2.09 and 1.14, 0.75-1.74), treatment (0.62, 0.38-1.03 and 1.74 (0.94-3.25) as well as control (0.55, 0.21-1.42 and 0.60, 0.20-1.80). In most developed countries, hypertension awareness, treatment and control is greater among women as compared to men. This study showed that in India in both urban and rural women there is low awareness, treatment and control of hypertension and systematic strategies are required to improve blood pressure control.

**IMPLICATIONS**

There is an urgent need for public health and clinical interventions to prevent onset of hypertension and better hypertension control including long term management using standard public health approaches. These interventions include policy-level, health system-level, population-level and clinic based individual-level interventions (Table 5). Policy and system level interventions should be focused on public education and screening, while population level interventions should focus on reduced intake of salt and alcohol, smoking cessation, promotion of healthy diet and facilitation of physical activity. Individual level interventions should be

<table>
<thead>
<tr>
<th>Table 5: Public health and clinical measures for better hypertension treatment and control in India.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strategy</strong></td>
</tr>
</tbody>
</table>
| **Public education** | • Hypertension is a major cardiovascular risk factor and one of the most important cause of strokes and heart disease  
• Hypertension is most often silent and so regular BP checks are essential in all adults (>35 yrs)  
• Hypertension can be prevented and better controlled by adoption of prudent lifestyle combined with simple, safe and inexpensive drugs |
| **Physician education** | • Greater focus on non-communicable diseases during undergraduate education. Focus on hypertension in public health curriculum.  
• Hypertension as a primary care issue. Knowledge of proper management and long-term care. Physician inertia to be managed.  
• Importance of home monitoring, ambulatory BP measurement, combination therapy and focus on vascular risk management. |
| **Opportunistic screening** | • Screening for hypertension among all adults by physicians or other health care workers at every encounter at all levels of care (universal opportunistic screening).  
• Measurement of BP in adults once a year by trained non-physician health care workers during home visits in rural and urban areas. |
| **Lifestyle changes** | • Focus on reducing high salt in diet, reducing alcohol consumption, weight reduction, and greater physical activity.  
• Smoking/tobacco use cessation for overall risk reduction. |
| **Low dose combination pharmacotherapy** | • Use of low doses of two or more individual drug combination as initial therapy.  
• Use of evidence based combinations. |
| **Control of vascular risk factors** | • Focus on management of all vascular risk factors- smoking, high cholesterol, other lipids, diabetes- in every hypertensive.  
• Polypharmacy approach in high risk persons |
| **Patient empowerment** | • Lifelong commitment to lifestyle changes and anti-hypertensive therapy in patients with hypertension  
• BP self monitoring |
on better physician education who should promote individual lifestyle changes, appropriate pharmacotherapy and control of vascular risk factors along with efforts to improve adherence.

In conclusion, hypertension is an important public health problem in India. Hypertension detection, awareness and its control are poor. Improved detection and management can prevent hundreds of thousands of premature deaths and avoid larger number of strokes and heart attacks every year. Innovative systems-based strategies outlined in Table 5, are required to increase hypertension awareness and for better management of hypertension. A combined approach to lowering risk with lifestyle changes and combined use of anti-hypertensive and lipid lowering therapy can reduce the cardiovascular risk by as much as 75%. We need improved systems of healthcare for widespread screening for hypertension so that it can be detected. Once detected, effective BP control and reduced cardiovascular risk is best achieved by appropriate pharmacotherapy with good adherence. Such a public health approach shall lead to enormous changes in clinical outcomes of hypertension in India.

REFERENCES


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