Original Research Paper

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Prevalence of Hypertension among the Indian population: Meta-Analysis.

Statistic

KEYWORDS: Prevalence, Hypertension, BP, India, Rural, Urban, Meta-analysis.

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ABSTRACT

Background: The study attempted to identify the prevalence of hypertension in India as well as urban and rural population of India. There are many descriptive studies on prevalence of hypertension in India, mostly assessing the prevalence of the diseases and its associations with various risk factors. We systemically reviewed the all available studies and analyzed their finding by using Meta-analysis method. **Method:** In the present study, we searched electronic databases MEDLINE, Pub Med, Google Scholar from 1990 to July 2015 for prevalence of Hypertension, burden of Hypertension among Indian population. Data was analyzed using the MetaXL package version 3.0 of Excel worksheet. The random effect model was used to calculate the estimate of the prevalence of hypertension rather than fixed effect model. The random effect model takes into account any heterogeneity inherent in the Meta-analysis. **Results:** Overall prevalence of hypertension in India was 26.6% (95%CI: 23.6%-29.7%). A significant differences in hypertension prevalence were noted between rural and urban parts i.e. 29.6% (95%CI: 24.9%-34.5%) in urban and 24.3% (95%CI: 21.1%-27.7%) in rural.

1. Introduction

Hypertension is becoming a public health emergency Worldwide, especially in developing countries, where studies projected an increase by 30% in the number of hypertensive by the year 2025 (1). Hypertension is directly responsible for 57% of all stroke deaths and 24% of all coronary heart disease deaths in India (2). Hypertension is a controllable disease and a small decline of 2mmHg population-wide in BP can prevent 151,000 stroke cases (3). The prevalence of hypertension has increased by 30 times among the urban population over a period of 55 years and about 10 times among the rural population over a period of 36 years. Hypertension increases the risk of heart attack, stroke, kidney failure and much other associated co-morbidity. Treating raised blood pressure and maintaining it below 140/90 mmHg is associated with a reduction in Cardiovascular complications**.**

India accounts for 17% of the world's population, the second largest in the world, and hence it contributes largely to the statistics of any disease in the World (4)**.** Cardiovascular diseases are a major cause of mortality and disease in the Indian subcontinent, causing more than 25% of deaths (5). It has been predicted that these diseases will increase rapidly in India and this country will be the locale of more than half the cases of heart disease in the World within the next 15 years (6). Studies done in India have shown that tobacco use, obesity (high waist: hip ratio), high blood pressure, low consumption of fruits and vegetables and sedentary lifestyles are important determinants of cardiovascular diseases in India (7). Giving the fact that hypertension is on the rise in developing countries like India, this meta-analysis is designed to consolidate the available data to find out the current prevalence of hypertension among the Indian population by residential location wise and overall.

2. METHODS

2.1 Literature search

Meta-analysis of published studies is characterized by organized literature search. It is essential to obtain all relevant studies related to prevalence of hypertension among the Indian population to reduce bias in the study. All published studies related to hypertension in India for the last 25 years (1990to 2015) were collected from electronic databases like Science Direct (http://www.sciencedirect.com/), Pubmed (http://www.ncbi.nlm.nih.gov/) and Google Scholar (http://scholar.google.co.in/) and from non-electronic material such as journals, abstracts, thesis. The following keywords were looked for individually or in association: hypertension, India, urban, rural, prevalence, blood pressure, systolic, diastolic. Furthermore studies were identified by checking cross-references of collected studies.

2.2 Selection criteria and data extraction

The studies that met all of the following criteria were included in the present analysis: (1) they were prevalence studies and the performance period of the study mainly after 1990. (2) The study design was cross-sectional and cohort design. (3) The age group included in the study was 15 years and above. (4) The studies were conducted among the Indian population. (5) The cut-off for classification of hypertension was according to JNC6 & JNC7 criteria. Conference proceedings, reviews, letters to editors, case series and case-control studies were not included.

Exclusion criteria: We excluded the studies whose age- specific prevalence was not reported. We also excluded the generic studies as these were stand-alone studies with small sample size to generalize the findings. A data collection form was designed prior to the implementation of the search strategy. Having reviewed the age categorizations in the studies, we set cut-offs in a way to maximize the compatibility of our age groups with the age groups reported in the eligible studies. Nonetheless, most of citations were reported the prevalence of HTN in more than one age group; therefore, we entered the age-specific prevalence of these studies in our meta-analysis. In addition, the age of subjects, publication year, sample size classified by gender, study location, and type of study entered in our analysis to assess the prevalence of HTN. This form is used by us to extract the relevant information from the selected studies. The data is collected form included studies on year of publication, design, geographic origin and setting, selection criteria, patient samplings and location of research group, participant characteristics.

2.3 Statistical Analysis

Study details such as author, year, location and period of study, type of study, prevalence of studies and method of detection were extracted and encoded in Excel spreadsheets. The pooled estimates of prevalence of Hypertension were obtained by meta-analysis technique under random effects model (DerSimonian and Laird 1986) as follows:

$$\bar{\beta}_{\omega} = \frac{\sum_{i=1}^{k} w_i^* \hat{\beta}_i}{\sum_{i=1}^{k} w_i^*} \quad \text{and} \quad \text{SE}\left(\bar{\beta}_{\omega}\right) = \frac{1}{\sqrt{\sum_{i=1}^{k} w_i^*}} \quad \text{where } w_i^* = \frac{1}{s_i^2+\delta^2}$$

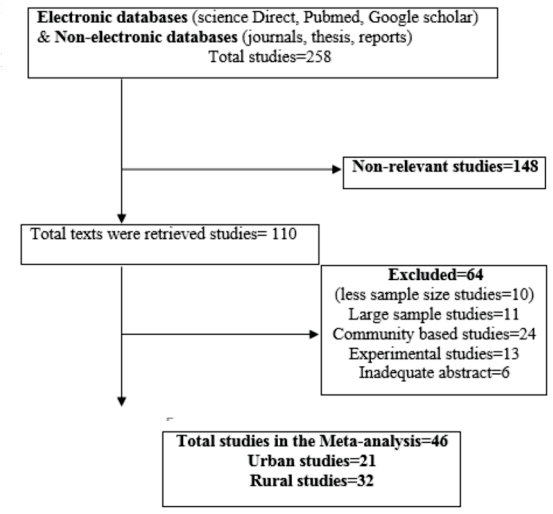
Where $\bar{\beta}_{\omega}$ represents pooled estimate, $\bar{\beta}_i$ represents the estimate of the ith study, w_i^* represents weights, and s_i^2 and δ^2 represents within study variance and between study variance, respectively. Heterogeneity of the prevalence estimates between studies was decided by Q statistics (Cochran 1954) and further quantified by I^2 index (Higgins and Thompson 2002; Higgins et al. 2003) as follows.

$$Q = \sum_{i=1}^{k}\left[w_i\left(\hat{\beta}_i - \bar{\beta}_{\omega}\right)^2\right] \quad \text{And} \quad I^2 = \frac{Q-df}{Q}\%$$

Graphical representation of meta-analysis was done using forest plots. Meta-analysis was done in MetaXL package version 3.0 of Excel worksheet. The pooled estimate for overall prevalence of hypertension in India was calculated using regional population weights. The mean percentage (%) prevalence and 95% confidence intervals (CIs) have been reported in the pooled analysis.

3 Results

This study undertook a systematic review of prevalence of hypertension among the Indian population under the preset criteria for the period from1990 to 2015. Finally we have included 46 studies in meta-analysis, among 6 studies reported both urban and rural and



3.1Meta-analysis of HTN among Indian population

Meta-analysis of hypertension among Indian population was carried out by using data of 1, 14,769 subjects from 46 Studies. The pooled estimate of prevalence of hypertension among the Indian population was observed as 26.6% (95% CI 23.6%; 29.7%). This study has found significantly heterogeneity (Q=6171.01, *df* = 45, p<0.0001) between 46 studies. Heterogeneity was quantified by I^2 index and observed as 99.3%. The forest plot (fig.2) is represents the proportions of subjects affected due to hypertension per study and the pooled estimate of prevalence of hypertension among Indian population.

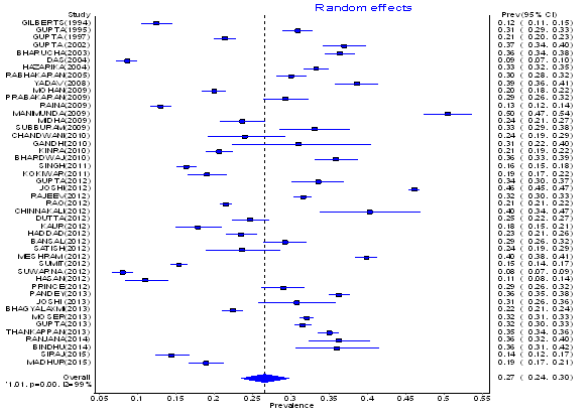


Fig.2 Forest plot for the prevalence of HTN among the Indian population

3.2 Meta-analysis of HTN among the urban & rural subjects of India.

Meta-analysis of hypertension among urban subjects of Indian population was carried out by using data of 52584 Subjects from 21 studies. The pooled estimate of prevalence of hypertension among the urban population was observed as 29.6% (95% CI 24.9%; 34.6%). In our study we found significantly heterogeneity (Q=2748.25 *df* =20, p<0.0001) between 21 studies. Heterogeneity was quantified by I^2 index and observed as 99.3%. The forest plot (fig.3) is represents the proportions of subjects affected due to hypertension per study and the pooled estimate of prevalence of hypertension among the urban subjects of India.

Meta-analysis of hypertension among rural subjects of Indian population was carried out by using data of 61,992 Subjects from 32 Studies. The pooled estimate of prevalence of hypertension among the rural population was observed as 24.4% (95% CI 21.1%; 27.9%). In our analysis we found significantly heterogeneity (Q= 2857.27, *df*=31, p<0.0001) between 31 studies. Heterogeneity was quantified by I^2 index and observed as 98.9%. The forest plot (fig.3) is represents the proportions of subjects affected due to hypertension per study and the pooled estimate of prevalence of hypertension among the rural subjects of India.

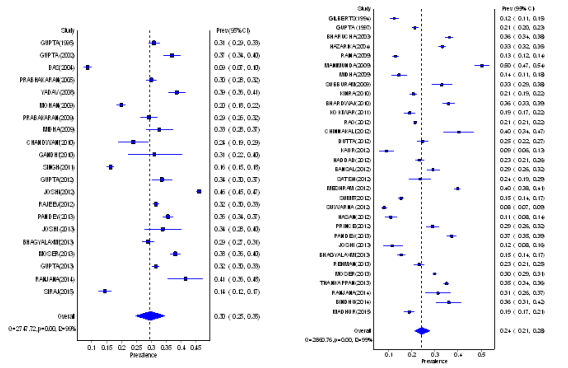


Fig.3 Forest plot for the prevalence of HTN among the Urban and Rural population of India.

4. Discussion

Through in this Meta-analysis we attempt to provide the point estimate of prevalence of hypertension among Indian population along with 95% confidence interval. For this purpose we searched Medline, PubMed, Google Scholar, during the year 1990 to 2015. In the present meta-analysis, the estimated overall prevalence of hypertension was 26.6% (95%CI: 23.6%-29.7%) and the prevalence of hypertension among the urban population was estimated to be 29.6% (95%CI: 24.9%-34.6%) which is lower than the prevalence (46.1%) reported by joshi *et al.* (2012). However, the lowest prevalence (16.4%) was observed by Singh(2011). Midha et al. (32.8%), Moser et al. et al (38.1%) and Bhagyalakshmi et al. (2013) (28.9%) have reported a lower prevalence compared to Pandey et al (35.6%). Also the estimated prevalence of hypertension in the rural subjects was 24.4% (95%CI: 21.1%-27.9%). However in the rural population, Despite the lack of an obvious trend, the prevalence of hypertension in the rural population is rising swiftly to match up to the urban rates. Chinnakali *et al* reported the highest prevalence of hypertension (40.3%) in the rural population of Puducherry. However Kaur et.al.(2012) reported 9.00%, the lowest prevalence, (16.4%) was observed by Hasan et al. (2012). Midha et al. (14.5%), Moser et al. et al (30.03%) and Bhagyalakshmi et al. (2013) (15.4%) have reported a lower prevalence compared to Pandey et al (37.3%).

Moreover, the prevalence of hypertension in rural populations is steadily increasing and is approaching the rates of the urban population. We found that the prevalence of HTN in urban population was around 5.2% greater than that of rural population of India which is due to their lifestyle and geographical factors. Greater prevalence of HTN in urban subjects has been detected in many other studies.

5. Limitations.

This present study has certain limitations, namely, the studies included were heterogeneous in terms of age group, classification of HTN and limited amount of data available on the prevalence of HTN in India. The studies conducted in subjects with different bio social

characteristics having included in the analysis. Nevertheless the pooled estimate does provide an overview of the problem of HTN in Indian population.

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