Cost of care for hypertension in a selected health center of urban Puducherry: An exploratory cost-of-illness study

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ABSTRACT
Background: Among noncommunicable diseases, hypertension is one of the most important risk factors, the control of which imposes a huge financial burden on the healthcare system and the society.
Objectives: The objective of this study was to measure the monthly cost incurred in care of hypertension in urban Puducherry and to estimate the total annual cost required to provide care for the adults with hypertension in a typical primary health center (PHC) of India.
Materials and Methods: The study was conducted in the service area of urban health center (UHC) in Puducherry, functioning under the Department of Preventive and Social Medicine, JIPMER. A sample of 238 adults ≥ 18 years identified through a baseline survey conducted in 2014 was interviewed using a pretested semi-structured questionnaire. The questionnaire collected information on sociodemographic data, place of seeking hypertension care, and its duration and various direct and indirect costs incurred. Recall period was fixed as 1 month for OP care and 1 year for hospitalization. A prevalence-based approach was used for calculating the cost of illness. Average monthly and annual direct and indirect costs were calculated and were compared across the type of facility of care and with the presence or absence of comorbidities. The cost of care from UHC and other government hospitals were calculated from standard rates. The average annual cost from UHC was used to calculate the annual amount required to provide care of hypertension in a typical PHC of India.
Results: Among the 238 participants, 73.5% (n = 175) were female, and the mean (standard deviation) age was 58 (11.7) years. Majority (72%, n = 172) took care for their hypertension from UHC, JIPMER. Half of them (n = 119) had associated comorbidities. Average monthly direct cost of care for hypertension was 223.2 (198.0–329.4) Indian national rupees. There was statistically significant difference in the cost of care among participants utilizing public and private facilities, and also among participants with comorbidities and without comorbidities. The estimation of annual cost of hypertension care for a typical PHC comes around 1.07 crores.
Conclusion: The control of hypertension in a community leads to a significant load on health system; however, it is essential for preventing further catastrophic costs as a result of complications and mortality. This cost could be saved if we could prevent the population from becoming hypertensives by preventive measures, and it will further lead to reduction in mortality and morbidity and the associated costs.

Keywords: Cost of care, direct cost, hypertension, India, indirect cost

Introduction
Noncommunicable diseases (NCDs) impose a large burden on human health worldwide. An estimated 36 million deaths, or 63% of the 57 million deaths that occurred
globally in 2008, were due to NCDs, comprising mainly cardiovascular diseases (48% of NCDs), cancers (21%), chronic respiratory diseases (12%), and diabetes (3.5%).[1]

The so called “diseases of affluence,” is currently affecting deprived sections of the society. In 2008, roughly four out of five NCD deaths occurred in low-income and middle-income countries, up sharply from just under 40% in 1990.[2,3]

Although research on the global economic effects of NCDs is still in a nascent stage, economists are increasingly expressing concern that NCDs will result in long-term economic impacts on labor supply, capital accumulation, and gross domestic product (GDP) worldwide with the consequences most severe in developing countries.[4] India was projected to lose 1.5% of GDP as a result of NCDs from 2005 to 2015 which has major implications. The high burden of cost of NCD care on households (as out of pocket expenditure [OOPE]) as well as healthcare systems is leading to major macroeconomic impacts especially in the low-middle income countries.[1,4-6]

At the microeconomic level of households, studies suggest relatively sizable impacts. In a study from Jamaica, 59% of those affected with chronic disease experienced financial difficulties and in many cases avoided medical treatment as a result.[7] Another study from Burkina Faso found that the probability of catastrophic financial consequences more than doubled in households affected by chronic illness.[8] In Russia, chronic disease resulted in 5.6% lower median per-person income.[9] Data from India show that the OOPE by the households on NCD care is on a rising trend, up from 31.6% in 1995–1996 to 47.3% in 2004.[10]

Hypertension or high blood pressure is one of the most prevalent vascular diseases, and it is considered as a main risk factor for cardiovascular, cerebrovascular, and peripheral vascular diseases that include coronary disease, stroke, peripheral artery disease, renal disease, and heart failure. Hypertension may increase an individual’s risk for one of these cardiovascular diseases by about two to three times.[10] The cost of treating hypertension takes up a huge and rising share of healthcare resources.

Knowing cost of treating hypertension will have two benefits. First, it generates baseline data on how much the household is spending for availing hypertension care. Second, cost analysis studies will provide the required information for planning and budget allocation for the National Programme for Prevention and control of Cancer, Diabetes, CVD, and Stroke, which was launched by the Ministry of Health and Family Welfare, Government of India in 2008, as a pilot in 10 districts and currently in 100 districts since 2011.

**Objectives**

The present study was undertaken, aiming to measure the monthly cost (direct and indirect) incurred in care of adults with hypertension in urban Puducherry and to estimate the total annual cost required to provide care for the adults with hypertension in a typical primary health center (PHC) of India (30,000 population).

**Materials and Methods**

The study was conducted as a descriptive study (cost-of-illness study) using the prevalence-based approach for calculating the cost of illness. It was conducted in an urban setting in the Union Territory of Puducherry, where the JIPMER Urban Health Centre (JUHC) functioning under the Department of Preventive and Social Medicine, JIPMER, Puducherry, is situated. The JUHC provides care to approximately 9000 population in four areas, namely Kurusikuppam (926 households), Chinmayapuram (385 households), Vazhakulam (663 households), and Vaithikuppam (100 households).

All adults of ≥18 years in the study area who were diagnosed with hypertensive by a community-based house-to-house survey in 2014 were included in the study. In total, 238 adult hypertensives (known cases of hypertension) were included as participants.

The study was conducted for 1 year. The questionnaire was developed using the cost-of-illness approach. Data collection was done using this structured questionnaire among already identified hypertensive participants.

The participants were those hypertensive adults as identified in a baseline survey conducted by the Department of Preventive and Social Medicine, JIPMER, Puducherry, in 2014. It was carried out using adapted WHO STEPS instrument to find the prevalence of hypertension and associated risk factors. STEPS instrument is a standard tool proposed by WHO for the surveillance of NCD risk factors and seeks information on core sociodemographic information, core behavioral measures, and physical measurements.[11]

A prevalence-based approach for calculating cost-of-illness care was followed in the present study. The cost-of-illness approach distinguishes between direct and indirect costs.
of different health conditions. Direct costs referred to visible costs associated with diagnosis, treatment, and care. Direct costs included personal medical care costs or personal nonmedical costs such as the cost of transport to a health provider. For the present study, direct costs included medical costs such as registration fee, consultation fee, other hospital charges, investigation charges and cost of medicines and other devices, and nonmedical costs such as travel cost and food cost. Indirect costs refer to the invisible costs associated with lost productivity and income owing to disability or death. We considered only wages lost by the patient and attendant due to illness and the cost of diet/lifestyle changes due to illness. Recall period was fixed as 1 month for OP care costs and 1 year for hospitalizations. Diseases, such as diabetes, cardiac, and renal diseases, were considered as comorbidities.

The participants were interviewed on a mutually convenient time and place. The participant was explained about the study, and written informed consent was obtained from all study participants. The questionnaire collected information on demographic (age, sex, and race), clinical (stage of hypertension, blood pressure readings, laboratory tests’ results, and treatment options), and economic (drugs, diagnostic procedures, laboratory tests, physician’s, pharmacist’s and nurse’s, transportation cost, and monthly salary) variables. Appropriate probes were used wherever necessary. Privacy and confidentiality of the respondents were maintained as far as possible.

The cost of the medicines received from UHC and JIPMER was calculated based on the rates quoted in pharmacy of JIPMER and those received from other State Government hospitals were calculated using rates quoted in Tamil Nadu Medical Services Corporation website. The cost of consultation by the physician at the Government health centers and JIPMER was calculated using the rates given as per Central Government Health Scheme.

Data were entered using Epidata Manager Software and analysis was conducted using SPSS software (IBM-International Business Machines, New York, United States.) version 21. The study was cleared by the Institute Ethics Committee. The average expenditure in Indian rupees (INR) was expressed in median and interquartile range (IQR). This was done for both OOPE (amount the patient had to spend during availing care) and total cost of care (OOPE + cost incurred by the health system). The cost of healthcare for a person with hypertension without comorbid condition was compared with person with associated comorbid condition using the Mann–Whitney U test. The cost of healthcare for people receiving treatment from PHCs, government hospitals, and private hospitals was compared using the Kruskal–Wallis H test. All statistical analyses were carried out at 5% level of significance and $P < 0.05$ was considered as statistically significant. The average cost of healthcare was multiplied by the prevalence of hypertension in the area under a PHC to calculate the total cost of treating all patients under that PHC.

**Results**

**Sociodemographic profile**

A total of 238 participants participated in this study. Among the participants, 73.5% ($n = 175$) were female. Mean (standard deviation) of the participants was found to be 58 (11.7) years. Majority of the participants (82.8%, $n = 197$) belonged to the nuclear family. Furthermore, 43.7% ($n = 104$) of the participants had no formal education and 79.4% ($n = 189$) were not having any occupation currently.

Among the participants, majority (72%, $n = 172$) took care for their hypertension from UHC, JIPMER. Half of them ($n = 119$) had associated comorbidities. There were 11 cases of hospitalizations related to hypertension. These sociodemographic and clinical characteristics are given in Table 1.

**Objective 1**

The average monthly direct cost of care, median (IQR) was found to be INR. 223.2 (198.0–329.4) and the median monthly indirect cost was found to be 0. The average (median and IQR) annual OOPE was estimated to be INR. 0 (0–1350) and monthly OOPE was INR. 0 (112.5).

The average monthly direct, indirect, and OOP costs according to the type of facilities are described and compared in Table 2. Furthermore, cost of care of hypertension without comorbidities was compared against that with comorbidities is also compared.

It can be seen that there was a statistically significant difference in the cost of care (direct, indirect, and OOP costs) between the types of facilities with the cost in private facilities being more than double that of government facilities ($P$ value of difference in average direct cost and OOPE $< 0.001$, df-2, and indirect cost $< 0.021$, df-2). Similarly, direct and indirect costs of care of hypertension with comorbidities were also found to be higher than that of the cost of care of hypertension.
with comorbidities which was statistically significant ($P$ value of difference in average direct cost – $<0.001$, df-1, and indirect cost – 0.047, df-1).

**Objective 2**
The prevalence of hypertension among =18 years (58.9% as per Census 2011)$^{12}$ in the study area of 9000 population was estimated to be 22.7%, i.e., 22.7% of 5301 population = 1203 patients, with the average monthly cost of care per person as INR.223. Hence the annual cost of care in our service area will be 1203X223X12= 32,19,228 INR. If we project this value to a typical PHC of 30,000 population in India, we come to a value of 1.07 crore INR (32,19,228X 30,000/9000) per year.

**Discussion**
Our study results show that the average monthly direct cost of care for hypertension, median (IQR) was INR.223.2 (198.0–329.4), and there was statistically significant difference in the cost of care between public and private facilities, and among participants with comorbidities and without comorbidities.

Although some studies were available from the literature attempting to estimate the cost of care of hypertension, due to wider variations in the contexts and settings and owing to periodic variation in economic aspects including inflation, the aggregate costs could not be compared to most of them.$^{13-19}$

In the present study, majority (73.5%) of the study participants were females. Literature suggests that the average direct costs for women are greater than men, as the women stay at home mostly and thus makes it convenient for them to seek care and thereby, incur costs. This would have reflected as a higher average cost in our study.

Furthermore, the mean age of the participants was 58 years which is past the retirement age of 55 years. Majority of the participants were not currently employed too. These would have led to the meager average indirect cost, as wages lost for the patient and attendant were the most important components of indirect costs that we could quantify.

In the present study, the estimation of the annual cost of hypertension care for a typical PHC comes around INR 1.07 crores, which appears as a significant amount. There is evidence from literature which suggests that increasing

| Characteristics | Frequency | Direct cost, INR | Indirect cost, INR | OOPE, INR |
|-----------------|-----------|-----------------|-------------------|-----------|
| Type of facility |           | Median (IQR)    | Median (IQR)      | Median (IQR) |
| UHC             | 172 (72.3)| 214 (198-177)   | 0                 | 0         |
| Other government| 19 (8)    | 211 (188-530)   | 0 (0-500)         | 0         |
| Private clinics/hospitals | 47 (19.7) | 550 (270-780)   | 0 (0-750)         | 550 (270-780) |
| Co morbidities  |           |                 |                   |           |
| HTN without comorbidities | 119 (50) | 200 (189-222)   | 0                 | 0         |
| HTN with comorbidities | 119 (50) | 293 (224-416)   | 0 (0-200)         | 0         |

*P value calculated using Kruskal–Wallis $H$-test, df=2, *P value calculated using Mann–Whitney U-test, df=1, IQR - Inter quartile range, INR - Indian rupees, OOPE - Out of pocket expenditure, UHC - Urban Health Center, HTN - Hypertension
the cost of hypertension, coupled with the high OOPE even deter patients from seeking appropriate care.\cite{20}

In this study, it was found that hypertension, if led to complications or comorbid conditions, costed significantly higher and hence is the major cause of increasing financial burden on families and the healthcare system. This is the context where the role of primary prevention becomes essential. Hypertension is considered as one of the most important factors which lead to cardiovascular complications which have huge economic costs associated with it. In a PHC, the detection and management of hypertension as early as possible can avert the higher costs of complications thus significantly saving the resources of the health system. Literature too suggests that controlling hypertension is a cost-effective strategy in reducing cardiovascular events and deaths.\cite{21} As India being a resource constraint society, the high cost of care points to the need of efficient utilization of resources along with population-based preventive approaches including multisectorial collaborations in hypertension control.\cite{22}

Cost-of-illness studies are useful in understanding how much the society (including the health system) spends on a particular disease, implying how much money can be saved if the burden of that particular disease is brought down. In the present context, the society spends around INR 1.07 crores for controlling hypertension, which if reduced by controlling the risk factors through tobacco control, lifestyle modifications, etc., could be saved entirely. Since the cost-of-illness studies cannot necessarily give an accurate picture on whether the incurred costs are actually translated to the desired outcomes, as well as identifying the areas of inefficiency and wastage,\cite{23} we would need much detailed economic evaluations such as cost-effectiveness analyses of care of hypertension in the further steps.

The present study has some limitations. As any other economic study involving direct data collection from respondents, there is a possibility of reporting bias with typical under or overreporting of costs according to the nature of the participants. Furthermore, there is a chance that those who had severe comorbidities or hospitalizations recalled the costs incurred better than those with only hypertension. Even so, efforts were taken to minimize the errors by emphasizing on standardized way of interviews and using appropriate probes to ensure the accuracy of data. Furthermore, there is a criticism of calculating indirect costs using “human capital approach” as it gives greater weightage to certain groups such as men and youth (earning members).\cite{24} As it was the only feasible method of approximation of indirect costs at this stage, we adopted this method along with the limitations. Another limitation would be that the outpatient treatment costs were collected for a month and projected to annual costs, which could have failed to accommodate seasonal variations or irregular events if any and thus resulted in errors. But since, this is a very first attempt of such study in a community setting and following up participants for a longer period was not possible currently.

**Conclusion**

Hypertension treatment imposes a financial burden on health system and families, but if appropriately given, will save higher costs by preventing complications such as cardiovascular events. Our findings suggest that the average monthly direct cost of treating hypertension in the service area of an UHC in Puducherry came to INR 223 and when projecting it to a typical PHC in India, it came up to INR 1.07 crores annually. Thus, if measures for adequate prevention strategies, such as lifestyle modifications, including physical activities, diet regulation, and controlling alcohol and tobacco use, were taken, this much amount could be saved directly, and may be furthermore by avoiding costs of complications.

**Financial support and sponsorship**
The PH-LEADER program, author Sitanshu Kar, and the research reported in this publication were supported by the Fogarty International Center of the National Institutes of Health under Award Number D43TW009135. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

**Conflicts of interest**
There are no conflicts of interest.

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