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Interrelation between poverty and hypertension: a cross-sectional study in the Happy Valley Tea Garden, Darjeeling, India

Bidyut Pramanik*

Department of Geography, Haldia Government College, Debhog, Haldia-721657, West Bengal, India

Abstract: *Background:* The general belief among the common people is that hypertension is a disorder prevalent among people of higher economical status. But the cross sectional and observational study of the distribution of common risk factors of Hypertension (HTN) as well as the prevalence of Hypertension and its interventional status among the workers of Happy Valley Tea Garden Darjeeling, India shows that poor socio-economic condition is a major source of hypertension. The workers, who have their leading role behind the famous brand of Darjeeling tea of Happy Valley Tea Garden, suffer from different health problems due to their poor socio-economic conditions. *Objective:* This paper primarily focuses on the characteristics of the chronic problem of hypertension among those workers and policy required to be framed to find out the crux of the problem and to eradicate that. Also, to corroborate the viewpoint as focused, a comparison has been done among the tea garden workers and the other secured job holders in the study area regarding the spread of HTN. *Methods:* Blood pressure, BMI and other detail examinations of 130 tea garden workers and 100 people having other jobs were performed along with interviews. *Result:* The spread of HTN is much higher in tea garden workers who are poorer in income and having less education, lack of healthy water resource and good quality houses. *Conclusion:* Although the tea garden workers are not involved in taking junk foods or very light and sedentary physical works, they are still very much prone to HTN due to their poverty.
Keywords: Hypertension, Happy Valley tea garden workers, other job holders, poverty, addiction.

Introduction

Hypertension (HTN) is a chronic condition of concern due to its role in the causation of Coronary Heart Disease (CHD), stroke and other vascular complications. In 90% of all the cases of HTN, the reasons remain unknown. Medical science can only predict the inherent reasons and possible remedies for the rest 10% cases. HTN is predicted as an 'iceberg' disease which shows 'the rule of halves', that is half the population with HTN know their status of disease, half of them do not know how to treat their conditions and half of them do not know how to treat and treat adequately [1]. Interestingly, all such non-communicable diseases like CHD, diabetes, HTN, obesity etc grow over similar behavioural pattern and control of any one of them results in discriminate change in the overall mortality rate due to such diseases.

The control of hypertension seems to be uncomplicated and cost effective. In the late 1960s and 1970s in the United States only simple educational measures about the risk factors of hypertension provided by the government reduced the undiagnosed and untreated cases to less than 25% which was a significant step toward the drop in CVS deaths in that country from 1980 onwards [2]. But presently due to lack of knowledge about this disease in India, HTN is spreading very fast and as per the medical scientists India is going to be the capital of diabetes and HTN of the world in the coming 2020 [3].

After searching from MEDLINE, INDMED and EMBACE database from 1998 to till date, it has been found that at present around 20% of the total death in India is due to the cardio vascular diseases (CVD) and the rate is projected to be as high as 33% by 2020. In the ICMR study in 1994 involving 5537 individuals (3050 urban residents and 2487 rural residents) demonstrated 25% and 29% prevalence of hypertension (Criteria: B.P ≥140/90 mm of Hg) among males and females respectively in urban Delhi and 13% and 10% in rural Haryana [4].

A few studies on prevalence on HTN within eastern Indian population are available. In 2002, Hazarika et al [5] reported 61% prevalence (criteria: = JNC 6) among men and women aged thirty and above in Assam. Further, through three serial epidemiological studies (Criteria: B. P ≥140/90 mm of Hg) by research [6] carried out during 1994, 2001 and 2003 demonstrated rising prevalence of hypertension (30%, 36%, and 51% respectively among males and 34%, 38% and 51% among females). Very few studies were carried out comparing different socio economic groups.

In the initial study from urban Chennai, Mohan et al [7] reported 8.4% prevalence of HTN among men and women aged 20 years and above and belonging to the low socio economic group (based on household income, occupation and dietary pattern). Similarly, the middle socio economic group had a higher prevalence (15%) during 1996-97. A study conducted in the urban areas of Chennai during 2000-2003 (age group≥40) reported a higher prevalence of hypertension (54%) among low income group (income < Rs 30000/annum) and 40% prevalence among high-income group (income > Rs 60000/annum). Misra [8] reported 12% prevalence of HTN in the slums of Delhi. As per WHO, the importance of the study of the negative role of HTN in human life can not be neglected [9]. With this background in mind, the study in this paper has been undertaken to find out the situations regarding hypertension along with its contributory risk factors as it is well known that the assessment and knowledge of particular health related issue serves as the primary step to initiate worthy interventions. This work contains cross-sectional study of HTN among the tea garden workers in Happy Valley of Darjeeling, India.

The concerned people are generally economically very poor and they are from backward class communities and more over their life span is also very short. The financial crunch compels them to be addicted to different drugs, alcohols etc. Behind the exquisite scenic grandeur and invigorating climate in the area of Darjeeling Himalayan region the 'Queen of the Hill Stations' and the rich taste of Darjeeling tea famous all over the world, there remains darkness of poverty, drug addiction and short life span of the tea garden workers. Although in literature there remains a lot of related data for financially rich societies in India, scarcity of data for lower economic background deprives us of drawing any relation between HTN, morbidity and mortality and poverty. It is well known that the changing lifestyle or sedentary work has increased intake of saturated fat and fast food, increased consumption of alcohol and smoking, added greater stress to daily life and together with ever increasing numbers of geriatric population contributed significantly towards these changes. But the situation is somewhat different in the present study area discussed here, which describes the effect of some apparently non-coherent issues that can trigger HTN in a society, even if the curses of changing lifestyle are seemingly absent. To prove the correlation between poverty and HTN, the investigation of HTN has also been done among the other job holders of the Happy Valley Area and compared with tea garden workers.

Study Area: The study area of this work is related to the Happy Valley Tea Garden, Darjeeling, India which is situated from $27^0 13'$ N to $26^0 27'$ N Latitude and from $88^0 53'$ E to $87^0 59'$E Longitude (Official website of Darjeeling). Presently, there are almost 86 gardens operating in Darjeeling with almost 52000 workers, Happy Valley is one of the most famous of them (www.explore darjeeling.com). This tea estate is the closest tea estate to Darjeeling town, and tourists often visit the garden [10]. The number of tea workers engaged there is roughly 330 [11].

Objectives: The study was undertaken with the following objectives.

1. To find out socio-economic conditions of the workers of Happy Valley Tea Garden.
2. To assess the prevalence of common modifiable and non-modifiable risk factors of HTN among the workers of Happy Valley Tea Garden, Darjeeling, India
3. To find out the prevalence of HTN among the workers of Happy Valley Tea Garden, Darjeeling, India.
4. A comparative study of HTN between tea garden workers and other secured job holders.

Material and Methods

The study is completely Descriptive, Cross-Sectional and Field based.

Study Period: The **s**tudy was performed from the year 2010 to 2011.

Study Population: Workers of the happy valley tea garden, Darjeeling willing to participate in the study and present on the particular date and time of data collection were involved in this study.

Size of Study Population: The data were collected from 157 workers out of 330 (almost 48% of the total worker population). The data were also collected from 100 people of different age groups in the surrounding area of the tea garden having other jobs which are more secured than that of tea garden labourers.

Tools and techniques: Pre-designed, pre-tested, semi-structured master table was created for the study. The pre-testing of the said table was performed based on the workers of Happy Valley Tea Garden and necessary modifications were done. The following instruments were used for the purpose of investigation and data record.

1. Spring Balance
2. Measuring Tape
3. Sphygmomanometer (Mercury)
4. Stethoscope

Risk Factors for HTN and measurements: The different risk factors for HTN were classified into two groups (WHO, 1983), non-modifiable and modifiable risk factors. The risk factors involved in this work have been described below and corresponding measurements done are also explained.

(1) Non-modifiable risk factors:
   (a) Age: By detailed field survey.
   (b) Sex: By detailed field survey.
   (c) Genetic factors: Whether father or mother or both have had hypertension, by detailed field survey.

(2) Modifiable risk factors:

(a) *Obesity:* The obesity was studied in terms the following variables:

- *Weight:* Weight was measured by spring balance which was standardised each time we used it for data collection. While measuring weight the balance had been at Zero (0). The respondents were asked to be in light clothing and without shoes. The respondents stood on the balance looking straight ahead. The respondents were instructed not to touch any part of the spring balance. The weights were recorded to the nearest 500gms.
- *Height:* Height was measured by the measuring tape, which was standardised for each time when used for data collection. The persons were without their foot wares and made to stand before a continuous smooth wall whiles his/her heel touched the floor and the feet remained slightly abducted. It was noticed whether his/her buttock and shoulders touched the wall.
- *Waist Circumference:* For measuring waist circumference first we felt the anterior superior iliac spine and the circumference were measured over the two points horizontally to the nearest 0.5 cm. For Hip circumference the maximum available circumference over hip was measured to the nearest 0.5 cm.
- *Blood Pressure:* Blood pressure was measured with the help of mercury sphygmomanometer. At first the person was made relaxed. He was asked to sit and the cuff was tied. The BP apparatus was placed at the level of heart. First the systolic blood pressure was measured by palpatory method. Then the diaphragm of the stethoscope was placed over the cubital fossa on the brachial artery. The Korotkoff sounds were heard and at the start of phase I systolic pressure was taken and at the end of phase IV diastolic pressure was taken. Two measurements were made and the average was recorded (JNC-7 guideline).
- *Body Mass Index (BMI):* It is measured by weight in kilograms divided by the square of height in meters. It was classified according to the standards of WHO guidance for obesity.
- *Waist Hip Ratio:* It is measured by waist circumference divided by the hip circumference.

(b) Addictions:

- *Smoking:* Current consumption of cigarette or bidi was taken as smoker.
- *Alcohol and drug consumptions:* current consumption of alcohol and drug addictions was taken in this group.
- *Others:* Includes the habit of consuming pan, gutkha, khaini etc.

(c) Physical activity:

- *At work place:* Sedentary- Clerical work, Moderate- Where the job include some physical stress,
- *At Home:* Doing the daily household work. i.e. the necessary work done at home.
- *Additional Exercise:* It includes free hand exercises, walk and other energy consuming activities.

(d) Measures taken: Whether treatment for hypertension were taken at all or not.

(e) Socio-economic status: The definition of 'poverty' is highly important in socio-economic status. The World Bank's definition of poverty line [12], for an underdeveloped country like India, is US Dollar 1.25/day/person.

(f) Food Habit: The food habit data of individuals related to hypertension was collected in the following way:

- *Consumption of extra salt:* If they take table salt during their meal it was considered as extra.
- Extra Free Fat: If they take ghee, butter with their meal it was considered as extra.
- *Fast Food:* If they take snacks like momo, chowmin, chops, rolls, burgers and pizzas etc.
- *Green Vegetables:* If they take green leafy vegetables.

The intake of extra free fat and fast food was qualified as the following:

- *Regular:* ≥ 3 times/month.
- *Occasional:* ≤ 3times/month.

However for green leafy vegetables the classification was:

- *Regular:* ≥ 3times/week
- *Occasional:* ≤ 3times/week

(g) Residence (Urban/Rural): Urban population is defined as those residing in Municipalities or Corporation areas. Rural population can be defined as those residing in Panchayet areas.

Results and Discussion

Table-1: Different risk factors of HTN and corresponding percentage of tea garden workers.

Risk Factors of HTN	Percentage of tea garden workers
BMI	
≤18.5	8.97
18.5-25	56.41
25-29.9	27.57
30-39.99	6.41
>40	0.64
Waist Hip ratio	Male(%)
≤0.9	37.93
0.9-1.1	62.07
Waist Hip ratio	Female(%)
≤0.85	7.50
>0.85	92.50
Food Habits	
Fat, junk foods	22.93
Green vegetables	87.89
Fast foods	26.75
Addictions	Male (%)
Smoking	47.01
Alcohol	23.94
Both	17.95
Other	33.33
Nil	31.62
Addictions	Female (%)
Addictions	17.50
Non-addiction	82.50
Physical Activity	
Nothing	33.76
Low to high	66.24

The BMI index [13] distribution shows that 65% percent of the male workers of Happy Valley tea garden are mainly underweight or having normal weight (BMI ≤ 25) with waist-

hip ratio is fairly well implicating very fit to normal fit body. Even this conclusion is also true for the female workers. It is seen from the table that the food habit of the tea garden workers depends on fresh green vegetables, especially local hilly ones like squash, cauliflower, radish, tomato, beans and green leafy vegetables.

Maximum people (almost 77%) very rarely or occasionally take fast foods and occasionally take (almost 73%) free fats. Male workers are addicted to smoking, alcoholism, gutkha chewing, and drugs (number of addiction less is only ~33%), whereas their female counterparts are predominantly addiction less (~82%). The physical exercise of the study population is mainly walking and other low to heavy exercises (66%). While 34% of the population do not perform any extra physical exercises other than walking. Table1A shows the different socio-economic conditions of the tea garden workers.

Table-1A: Different socio-economic factors and percentage of tea garden workers	
Living standard	
Pucca House (furnished)	16.70
Kutcha (unfurnished)	8.10
Semi-furnished	75.20
Drinking water sources	
Jhora (spring)	79.87
Tap	20.13
Education	
Illiterate	22.2
Primary	61.0
Secondary	9.3
Higher secondary	7.5

The comparison between tea garden workers and other job holders are given in table 2A and B. Distribution of hypertension of total population with age group (table 2A) among the tea garden workers shows that with age the hypertension disorder increases (predominantly HTN I and II). The figure 1 gives a linear relationship between age and percentage of HTN suffered population among the tea garden workers. The relationship is given by, %HTN population=1.36(age)-20.2, with correlation coefficient $r^2 = 0.875$.

Figure-1: Relationship between age and percentage of hypertension among the Happy Valley tea garden workers (Black circles: study area data points, Black continuous line: linear regression model. At the top right section the regression formula is shown).

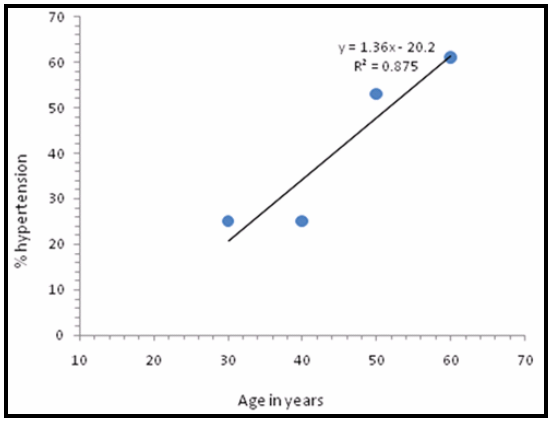


Table-2A: Distribution of the study population of different ages according to presence of hypertension among tea garden workers					
Age Group (years)	**HTN number**	**HTN (%)**	**Non-HTN number**	**Non-HTN %**	**Total**
≤ 30	2	25	6	75	8
31 – 40	7	25	21	75	28
41 – 50	25	53	22	47	47
≥ 51	45	60.81	29	39.19	74
Total	79	50.32	78	49.68	157

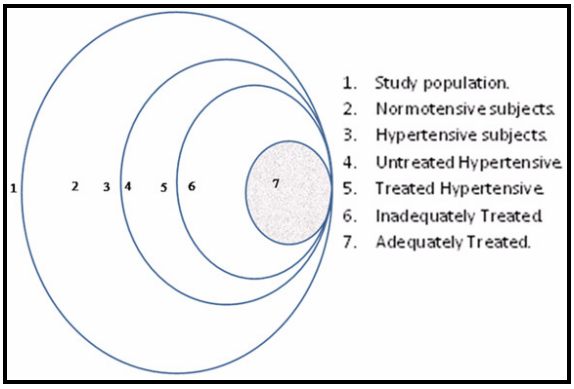
Table-2B: Distribution of the study population of different ages according to presence of hypertension among other job holders in surrounding area.					
Age Group (years)	**HTN number**	**HTN (%)**	**Non-HTN number**	**Non-HT (%)**	**Total**
≤ 30	1	33	2	67	3
31 – 40	4	25	11	75	15
41 – 50	16	49	17	51	33
≥ 51	22	45	27	55	49
Total	43	43.00	57	57.00	100

Table-3: Distribution of untreated study population according to their blood pressure among the workers of Happy Valley tea garden and other job holders				
Blood pressure (mm HG)	**Number (tea garden workers)**	**Percentage (%) (tea garden workers)**	**Number (other job holders)**	**Percentage (%) (other job holders)**
Normal (SBP<120/ DBP<80)	23	20.54	42	42.00
Pre-HTN (SBP 120-139/ DBP 80-89)	36	32.14	32	32.00
HTN Grade I (SBP 140-159/DBP 90-99)	48	42.86	19	19.00
HTN Grade II (SBP ≥160/ DBP≥100)	5	4.46	7	7.00
Total	112	100.00	100	100.00

The table 3 gives the distribution of tea garden workers and other job holders according to their HTN conditions. The normal non-HTN and HTN suffered workers are in the ratio of 51% to 49%. The corresponding distribution among the other job holders in the surrounding area in table 2B shows that the ratio between normal and HTN is 57% to 43%. Among the other secured job holders, 42% people are not prone to HTN i.e normal, whereas 56% are suffering from HTN. Only 26% are from HTN-I and II groups, while rest 32% is pre-HTN. For the tea garden workers the situation is different. Almost 47% of the tea garden workers are among high to very high hypertensive (defined according to JNC 7), whereas ~32% is pre hypertensive, if they are not treated in the very moment they will also move to high hypertensive group. The normal workers are only ~20%.

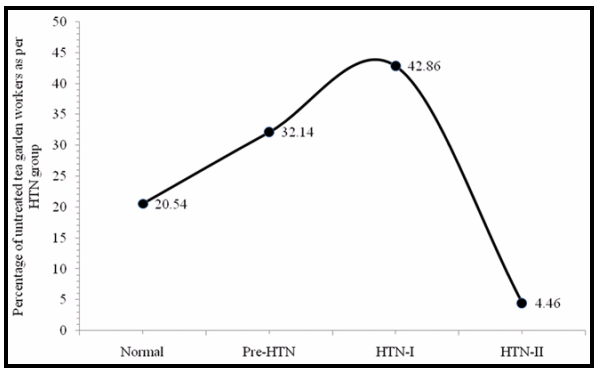
The figure 2 gives the idea of hypertension in the worker community as a "rule of halves". The different numbers showing different meanings have been explained in the box.

Figure-2: Status of Blood pressure in the study population showing 'Rule of Halves'. The different numbers showing different meanings have been explained in the box.



The figure 3 shows the distribution of tea garden workers according to their conditions of HTN.

Figure-3: Percentage distribution of tea garden workers as function hypertension criteria (Black circle: study area data, Black continuous line is shown to illustrate the data points.)



The table 4A and B gives the distribution of tea garden workers and other job holders according to their average income and expenditure, respectively.

Table-4A: Distribution of average income and expenditure among the Happy Valley tea garden workers

Average monthly income (Rs)	Percentage of tea garden workers	Average monthly expenditure (Rs)	Percentage of tea garden workers
≤1250	57.50	≤1000	45.50
1251-3000	15.75	1001-2500	36.75
3001-4000	14.60	2501-3500	10.74
≥4001	12.15	≥3501	7.01

Table-4B: Distribution of average income and expenditure among the other job holders in surrounding

Average monthly income (Rs)	Percentage of other job holders	Average monthly expenditure (Rs)	Percentage of other job holders
≤1250	10.20	≤1000	7.50
1251-3000	10.25	1001-2500	21.25
3001-4000	22.35	2501-3500	28.15
≥4001	57.20	≥3501	43.10

The table 4A and B clearly shows that economically the other job holders are more secured and financially richer than the tea garden workers. Those tables indicate group of tea garden workers with average income less than Rs. 1250 is highest (~58%), whereas percentage of people with average expenditure more than Rs. 3500 is almost 46%. The table gives a very rude picture that majority of the tea garden workers are from the class BPL. But the cost of living is very high in Darjeeling, situated at high altitude and a famous tourist spot, which is reflected from their expenditure levels. The table 4B shows that almost 80% of other job holders are of the group APL and they are more or less out of the danger of poverty line.

The socio-economic conditions of the tea garden workers are thus very poor and also worsening day by day. The local movement for separate state has also made the situation worse by general strikes or tea garden strikes since 1984. The problem became grave from 2007 and still persisting. Though, presently, the problem has been minimised by the intervention of State Government of West Bengal and Central Government of India.

The labours and management of Happy Valley, both get festive bonus (~8% of annual income), provident funds and gratuities along with their salaries. The management gets ration (usually in low price), while labours do not get so. Darjeeling is famous for heavy rainfall and cold weather, but the labours are not given raincoat, umbrella and blanket, whereas the lucky management persons are given those things free of cost for utilization. More over the workers generally gets higher daily wages as per the table 4A during peak season (March-October), whereas they get lower daily wages in off-season (November-February).

The following points can be inferred from the above findings.

The table 1A and B shows that the house condition of the workers are not all suitable for living in a hill region which is famous for land-slide, with kutcha (not furnished) and semi-pucca (semi-furnished) houses comprise

almost 83% of the houses of the workers. All the other job holders in the area generally have pucca i.e furnished housings. The water, especially the drinking water scarcity is a big problem in Darjeeling. The unhygienic spring (Jhora) water is generally taken by almost 80% of the workers; while other job holders have the luxury of drinking tap water established in their houses. The tap water is more hygienic and costly. Some of them also have water purifiers. The table 1B gives the idea that illiteracy rate is very high among the tea garden workers (~22%), the literate workers are there but they are educated mostly up to class XII (~8%), whereas the primary class educated persons are ~61% of the total population of workers. The corresponding picture in case of other job holders are reverse, the people are mostly graduate.

The average body fitness of the tea garden workers is fairly well; their food habit is also not a risk factor for HTN. The majority of the workers perform physical exercises, at least a significant amount of walking. In spite of that, the number of pre-HTN and HTN sufferers is very alarmingly growing. This gives a strong signal that merely controlling food habit and performing physical exercises can not eradicate HTN. The major reason behind the HTN in the study area is inferred to be the prevailing lower socio-economic conditions. The majority of the workers always remain in a state of mental tension without having a steady income. The tea garden peak season gives them a sigh of relief as the daily wages becomes higher and overtime work possibilities.

But during off-season they do not have a steady income, the possibility of alternative income source is also too remote in this hilly area. More over, the political turmoils, the "Bandhs" (strikes in hill/tea garden) also put the labourer in a dire state, as they are generally not paid during tea garden closure. Sometimes Bandhs continue for a long time, making the matter worse. Sometimes the tea gardens are intentionally closed by the management. The low income tea garden work without having any alternative source of income is a major issue for the outbreak of HTN. The cold and rainy season of Darjeeling is another risk factor for HTN. Blood pressure increases due to cold weather. The workers do not have the capability of purchasing good quality winter wears for them and their families. They do not have the capability for purchasing and running electric heaters. The heavy rainfall creates land slide, resulting a lot of casualties in Darjeeling. This is another source of mental stress to the tea garden workers, who predominantly lives in kutcha (unfurnished) and semi-Pucca houses. The earning of the workers in this region mainly ends up in a high expenditure in terms of umbrella, shoe, winter wear, blankets and water purchasing.

The "jhora" (spring) water is unhygienic and creates many diseases. The workers have to purchase extra water during winter or summer time. The worse economic condition is highly responsible for HTN, in this area. The increasing number of uneducated people or lowly educated people in this area is another reason of increasing HTN [14]. The poor workers also do not have the luxury to treat their families in hospitals or private nursing homes other than treating with some herbal medicines. These workers due to their mental stress, from the young age become addicted with different bad addictives like cigarettes, bidis, gutkha, alcohols and even drugs, which in turn causes more HTN and CHD, paving the way for stroke and mortality.

The inference drawn is strongly supported by the similar investigation performed on the people with other job holders in the surrounding area. They are mainly in government (central and state) and private jobs. The jobs are comparatively secured and they also are paid during hill strikes or natural calamities. They are capable of purchasing tap water, water filters. They can purchase good quality umbrellas to work during rainy season. They can also purchase good quality dresses and blankets to fight against winter season. Their families are also well-protected by their salaries. The other job holders are therefore generally more or less protected from the clutches of HTN, as the data shows.

The study finally shows that HTN percentage increases rapidly with age in case of the tea garden workers in a linear fashion, which is understandable in terms of gradual ageing effect of the body. The above-mentioned reasons thus clearly indicates that in the tea

garden workers society the poor economic condition is one of the roots of HTN, which is contrary to our general belief that HTN prevails in financially rich society.

Policy interventions: India, one of the major developing countries, is trying desperately to move to the group of elite developed countries in the present scenario. But different problems are posing threat to India's advancement towards this goal. The alarming growth of non-communicable diseases like HTN is one of them, although non-communicable diseases are the nuisances in the already developed countries. The study shown in this work highlights a very important reason for HTN that is poverty. The poverty, which we know is a major curse to a society, can cause different problems that can impede social advancement. India, as commented by the medical scientists, will be the capital of HTN and diabetes in the world in 2020 should focus to control the HTN and that is only possible if poverty can be decreased as much as it stops to influence major public health problems.

Therefore, different firm policies should be taken by the Government of India very soon. Some of the concrete steps taken by the Central Government are National Social Assistance Programmes (NSAP), Indira Gandhi National Family Benefit Scheme (IGNFBS), Swarna Jayanti Sahari Rojgar Yojana (SJSRY), Indian Housing for Slum Development Project (IHSDP) mainly to help financially the poor people, especially the tea garden workers of Darjeeling via the Darjeeling Municipality. The chief aims are to provide one time financial assistance to the people who are from BPL, to provide pensions to the workers when they are aged, to provide possible new self-employment programmes to the workers so that they can earn even during the off-season of tea gardens, to offer furnished 'Pucca' houses free of cost or for a very meagre amount of cost to the workers. These poverty eradication programmes are highly commendable but should be organised very carefully, so that the actual poor people can be helped.

The Government should also focus on the proper utilization of Plantation Labour Act for the betterment of the tea garden workers. Government and NGO's should also come forward to extend Information, Education and Communication (IEC) on healthy diet, addictions and exercises. The regular screening and treatment of HTN-infected people are very necessary to control the damages.

Conclusion

The work explores the fact that the different socio-economic factors like income, expenditure, health conditions, living standard etc and poverty are the main precursors of HTN. This fact is clear from the cross-sectional study of HTN in the Happy Valley Tea garden workers and the comparison of HTN among tea garden workers with the other job holders in that area. The poverty stricken tea garden workers have a mental setup clouded with tension for a better and steady income to nurture their family.

This provides a pathway for stress and unhappiness resulting high blood pressure, CHD and HTN. Therefore, if this persists, India will become very soon a haven of HTN and other diseases. This is a high time that, Indian Government and NGOs should come forward to eradicate the menace of poverty, though some steps have already been taken by them which is providing some positive ray of hope in our society. In these footsteps the policy will be "Let's make our family a happy family" all over India and eradicate the socio-economic disparity of health.

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*All correspondences to: Dr. Bidyut Pramanik, Assistant Professor, Department of Geography, Haldia Government College, Debhog, Haldia-721657, West Bengal, India. E-mail: binik_darjeeling@rediffmail.com