Adherence to anti-hypertensive treatment and its determinants among the urban slum dwellers in Kolkata

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Dissertation submitted in partial fulfillment of the requirements for the award of the degree of Master of Public Health

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October '2009.

Acknowledgements

I take up this opportunity to express my sincere gratitude to Prof. (Dr.) K R Thankappan, Professor and Head of Achutha Menon Centre for Health Science Studies (AMCHSS), my research guide and mentor for his continuous supervision and unstinting support throughout this research study. It was really a moment of good luck to have him as my guide and a real privilege to work under his guidance.

I express my heartfelt thanks to Dr. V Raman Kutty, Professor at AMCHSS, for his valuable suggestions and timely comments. I am very much obliged to him for all his support and guidance which was phenomenal and a noble experience. I also extend my gratitude to Dr. P Sankara Sarma, Additional Professor at AMCHSS for giving me the freedom to barge in on him at any time with doubts and queries regarding any statistical intricacy.

I feel very much grateful to Dr. Mala Ramanathan, Additional Professor and Dr. Manju Nair, Scientist C at AMCHSS, for lending me their patient ears to all my ideas, and for helping me to conceptualize this research topic, explaining all the practical difficulties involved and also giving valuable suggestion whenever I asked.

I would like to extend my sincere thanks to all the faculty members, the administrative and project cell staff of AMCHSS for their help, support, encouragement, timely suggestions and concern shown to me throughout the course of this study. I express my gratitude to all my colleagues at AMCHSS for their valuable suggestions and critics in accomplishing this endeavor and also thankful to Dr. Pinaki Sensarma for his constant support to me.

I sincerely express my thanks to the Director, Registrar and special thanks to Mr. Sundar Jaysingh S, Deputy Registrar, Sree Chitra Tirunal Institute for Medical Sciences & Technology (SCTIMST), for their constant support encouragement and creation of a conducive environment all the way through.

I would like to extend my sincere thanks to Dr. Debdwaipayan Chatterjee, the Chief Municipal Health Officer of Kolkata Municipal Corporation (KMC) for providing me the permission to carry out my study in the selected slums which comes under their purview. I sincerely appreciate the help and support of all the Municipal Health Officers and other health staffs of Borough XIV, KMC for their full cooperation and assistance given to me for conduct of this study. I would like to thank the health staff under Kolkata Urban development Project III for their help in identifying and accessing incomplete and partial address during data collection.

I would like convey my heart full indebtedness to all the respondents of the study, for the inordinate amount of trust they bestowed upon me by divulging their personal information and sparing their precious time without which my research would not have been successful. I am grateful to all my study subjects.

October ‘2009. Dr. Subhasis Bhandari

Declaration

I hereby declare that the work embodied in this dissertation entitled '**Adherence to anti-hypertensive treatment and its determinants among the urban slum dwellers in Kolkata'** is the result of original research and has not been submitted for any degree in any other University or Institution.

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Certificate

I hereby certify that the work embodied in this dissertation entitled '**Adherence to anti-hypertensive treatment and its determinants among the urban slum dwellers in Kolkata'** is the bonafide record of original research work undertaken by Dr. Subhasis Bhandari in partial fulfillment of the requirements for the award of the degree of Master of Public Health, under my guidance and supervision.

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October '2009.

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Glossary of Abbreviations

ACE	Angiotensin Converting Enzyme
ARB	Angiotensin Receptor Blocker
CGHS	Central Government Health Scheme
DALY	Disability Adjusted Life Years
DBP	Diastolic Blood Pressure
ESI	Employees' State Insurance
HDI	Human Development Index
IEC	Institute Ethics committee
KMC	Kolkata Municipal Corporation
NGO	Non Government Organization
SBP	Systolic Blood Pressure
SD	Standard Deviation
SPSS	Statistical Package for Social Sciences
TAC	Technical Advisory Committee
WHO	World Health Organization

Abstract

Background: In India 41.9 million people are suffering from hypertension. Data on adherence to antihypertensive treatment in India are extremely limited particularly in urban slums. Therefore this study was undertaken with an objective to find out the prevalence, pattern and predictors of adherence to antihypertensive pharmacotherapy among slum dwellers in Kolkata.

Methods: A cross sectional survey was conducted among 348 adults aged ≥25 years (mean age 55.13 years, 68% females), availing modern pharmacotherapy for hypertension. Information on socio-demographic variables, economic factor and adherence to antihypertensive medication was collected using a pre-tested structured interview schedule. Blood pressure was measured using standard procedures. Patient self-reports of consumption of ≥80% of the prescribed medications over a period of one week was considered as adherence. Binary logistic regression analysis was done to find out the predictor variables for adherence.

Results: Prevalence of adherence was found to be 73% (95% CI 68-78%) with out any significant sex difference. Patients who were hypertensive for a period ≥5 years were three times [(Odds Ratio (OR) 2.98; 95% CI 1.73-5.14)], those patients whose hypertension was detected during check ups for conditions related to hypertension were two times (OR 2.35: CI 1.25-4.39), those who lived in families with ≤4 members were two times (OR 2.01: CI 1.52-3.50), those with a family income of ≥3000 rupees were three times (OR 2.56: CI 1.47-4.45), those who got their prescribed medicines free were four times (OR 4.16: CI 1.36-12.69), those who perceived their blood pressure to be currently under control were two times (OR 2.23: CI 1.17-4.26) and those who were satisfied with their current treatment were four times (OR 3.77: CI 1.32-10.76) more likely to be adherent compared to their counterparts. Those who were adherent to their prescribed medications were two times more likely to achieve adequate control of hypertension compared to those who were not adherent (OR 1.71: CI 1.04-2.80).

Conclusion: Efforts should be made to increase the adherence to antihypertensive treatment focusing on low income families, those who live in larger families and recently detected hypertensives. Further studies are required to find out the reasons for inadequate control of hypertension among those who were adherent.

1. Introduction

1. 1. BACKGROUND:

Chronic non-communicable diseases are posing a serious threat to public health throughout the world, irrespective of whether developed and developing, and thus deserve to be treated as a global health priority in this new millenium.[1]

1.1.1. The Burden of Cardiovascular diseases

Cardiovascular diseases are the leading cause of mortality (29% of all deaths) globally while low and middle income countries make up 82% of these deaths with almost equal incidence in men and women.[2] World Health Organization (WHO) estimated a total of 17.1 million deaths to be due to Cardiovascular Diseases by the year 2004.[2] The demographic transition in the developing countries is giving rise to an aging of the world's population which is leading towards expected increases in age-specific as well as overall rates of cardiovascular disease.[3] A study from Southeast Asia, based on self-reported cases, found that major chronic diseases including hypertension was prevalent among 22.7% men and 31.6% women.[4] Hypertension is the most important risk factor for cardiovascular diseases.

1.1.2. Hypertension

Hypertension, a haemodynamic disorder, is the sustained elevation of the systemic arterial pressure. Hypertension is defined as a systolic blood pressure (SBP) ≥ 140 mmHg or/and diastolic blood pressure (DBP) ≥90 mmHg among people who are not under anti-hypertensive medication, thus including those who are already consuming medications for hypertension.[5] Among those suffering from Diabetes Mellitus or Kidney diseases a systolic blood pressure (SBP) ≥ 130 mmHg or/and diastolic blood pressure (DBP) ≥80 mmHg is

considered to be Hypertension. This increased pulsatile stress produces a variety of structural changes in the arteries supplying blood to the brain, heart, kidneys and other organs, which lead to a thrombotic paradox.[6] Hypertension is further classified into Stage 1 Hypertension: SBP 140-159 mmHg or DBP 90-99 mmHg and Stage 2 Hypertension: SBP >=160 mmHg or DBP >=100 mmHg. More than 90% cases of all cases of hypertension are primary or essential hypertension, due to unknown causes and the rest are secondary, due to diseases in other organs of the body like the renal, endocrine and pregnancy related disorders.[6, 7] Blood pressure is a measure of the force that the circulating blood exerts on the walls of its circulating blood vessels which is perpendicular to the direction of its flow. Normal Blood Pressure levels are diastolic <80 mmHg and systolic <120 mmHg. Blood pressure levels SBP 120-139 mmHg or DBP 80-89 mmHg is known as Pre- Hypertension. The most common form of hypertension at ages below 50 years is diastolic with or without systolic hypertension but at ages above 50 years systolic hypertension is more common.[8] Systolic hypertension tends to increase with age due to stiffening of the walls of aorta and other large vessels. Hypertension is mostly free of any symptoms or any warning signs. It is a readily detectable and easily treatable condition which if left undiagnosed or untreated, silently leads to lethal complications like stroke, coronary heart disease, heart failure, nephropathy, retinopathy and other target organ damage in the long run.[7] Diabetes mellitus enhances these risks. High blood pressure along with high cholesterol and high body mass index are well-established modifiable cardiovascular risk factors and are indicators of complex dietary patterns like caloric intake, consumption of salt, fats of different composition, fruits and vegetables, and physical activity.[3] These risks are increasingly present in all age groups ranging from 40 to 89 years old and thus imposing a cumulative effect leading to the steady increase of Blood pressure with age. The risk of mortality arising out of ischemic heart disease or stroke doubles for every 20 mm Hg increase in

systolic blood pressure or 10 mm Hg increase in diastolic blood pressure.[9] Thus higher the blood pressure, greater is the risk of cardiovascular diseases, independent of other risk factors which otherwise poses its cumulative effects.

1.1.3. The Global Burden of Hypertension

Hypertension is a major threat to public health globally as it is an important risk factor for mortality and silently increases risk for cerebral, cardiac, and renal events. Globally hypertension takes away about 7.1 million lives every year.[10,11] In the year 2000 it was estimated that about 972 million adults, with 639 million in economically developing countries, were suffering from hypertension making upto 26·4% of the adult population which is predicted to increase by about 60% to a total of 1·56 billion by the year 2025.[12] It has been estimated that about 62% of cerebrovascular disease and 49% of ischaemic heart disease are attributable to systolic blood pressure >115 mmHg.[10]

1.1.4. The Burden of Hypertension in India

Prevalence of hypertension in India is on the rise with 41.5 million people suffering from hypertension in the year '2000 which is projected to be about 46.5 million by '2025.[13] The demographic and socioeconomic transition in India has hastened the health transition with high burdens of chronic diseases, accounting for 53% of all deaths, 44% of disability-adjusted life-years (DALYs) lost and the highest loss in potentially productive years of life, due to deaths from cardiovascular disease in people aged 35–64 years.[14] It has been estimated that 57% mortality in stroke and 24% in coronary heart disease, in India, is directly attributed to Hypertension.[15]

1.1.5. Hypertension among the urban poor

The poorest of the people are at the highest risk of developing and dying prematurely from chronic diseases as their risk exposure is high where as access to health care services is low: “Chronic diseases and poverty are interconnected in a vicious cycle”.[16] The prevalence of hypertension in the urban areas is on the rise. A study from urban West Bengal showed an overall prevalence of hypertension to be 24.9% with higher pre-hypertensive levels mostly among the young students and labourers.[17] It has been estimated that physician-diagnosed self-reported hypertension is prevalent among 32.3% of the urban dwellers of Chandigarh city.[18] Furthermore, Misra et al have estimated 12% prevalence of hypertension in the slums of northern India. [19] The mortality data regarding stroke, myocardial infarction, heart and kidney failure of the slum dwellers which is largely based on clinic, hospital, or national mortality registry confirms the existing burden of hypertension that represents only the "tip of the iceberg".[20]

1.1.6. Treatment and Control of Hypertension

Medications, along with low salt diet and lifestyle changes over the years are the only effective measures for the control of blood pressure and prevention of the complications arising out of it. Thus, it could be simplified as pharmacological and non-pharmacological regimen. Regular physical activity, following a diet rich in fruits and vegetables while avoiding foods that are high in fat, sugar and salt, abstaining from tobacco smoke and alcohol, and maintaining a healthy body weight need sustained efforts through high level of self motivation at the individual level which tend to fade over time due to lack of a societal approach and a state support.[21] Thus, pharmacological regimen- the drugs form the mainstay of therapy even today. There are five major classes of drugs which include the thiazide diuretics, β-blockers, calcium channel blockers, angiotensin-converting enzyme

inhibitors and the angiotensin II receptor blockers that are generally used in the treatment of essential hypertension in ambulatory settings.[22] Irrespective of their classes, all anti-hypertensive drugs equally reduce blood-pressure and risks of cardiovascular mortality even when compared to a placebo, with only mild differences in the degrees of protection against individual cardiovascular morbidities.[23] Initial drug mono-therapy with diuretics or calcium-channel blocker or angiotensin-converting enzyme (ACE) inhibitors equally reduces the risk of fatal coronary heart disease, nonfatal myocardial infarction, or all-cause mortality.[24] To be effective to produce a sustained lowering and maintaining of blood pressure, one needs to strictly follow the physicians advice and adhere to the prescribed drug regimen over long periods of time, which could be even life long. It may be preferable to start with thiazide diuretics due to its lower price as well as its action which does not depend upon its plasma concentration or half life, so that inaccurate timings or short pauses may not pose any clinical threats.[25] But in the long run, most of these hypertensive patients need two or more drugs for their blood-pressure control along with statins and aspirin concomitantly for risk factor reduction.[6] In actual practice, initial antihypertensive treatment with an ACE inhibitor is associated with more adherence than those starting with calcium-channel blocker, β-blockers or a diuretic respectively.[26]

1. 2. THE PROBLEM STATEMENT:

Early diagnosis followed by diet and lifestyle modifications and pharmacological treatment through administration of antihypertensive drugs lowering blood pressure to achieve the optimum levels is the only way of cardiovascular risk reduction.[6] Most of the patients suffering from hypertension across the world do not achieve the target blood pressure levels due to poor adherence to prescribed medications as well as lack of long-term persistence with antihypertensive therapy. Adherence to pharmacotherapy for

hypertension varies between 50-70% worldwide.[27] Non-adherence to prescribed antihypertensive medication is the major cause of inadequate control of high blood pressure.[28] Poor compliance to treatment not only reduces the effectiveness of therapy but it also leads to severe clinical consequences including death and increased cost of care in the long run. Most of these hypertensive patients omit the sequential doses while sometimes more than 50% of them discontinue treatment by one year of starting antihypertensive therapy.[29] High adherence behaviour is associated with lower mortality and hospital admission rates even if it is with a placebo.[30, 31] A comprehensive understanding of the condition and the accompanying risks is absent in spite of the prevailing general knowledge and awareness of hypertension among the patients.[32]

Although the proportion of hypertensives is higher in the developed countries, the absolute number of patients suffering from hypertension is much higher in the economically developing and under developed countries of the world. In these places inability to buy drugs is a major determinant and is significantly associated with poor compliance and poor health outcomes.[33] Even in India, patient non-adherence with prescribed therapy is the leading precipitating factor for poor blood pressure control and the complications arising out of hypertension.[34,35] People who are diagnosed as hypertensive, continue medicines for about a week or so as prescribed by their physicians and discontinue them after a week or a month when they feel well. Mainly the lack of knowledge regarding the need of regular treatment, high cost of medicines and non-availability of a family member who can accompany the patient to the clinics are the main reasons for discontinuing the treatment.[36] Several of them shift to complementary and alternative medicines and land up in the hospital emergencies.[37] This creates a vicious cycle through early onset of the associated morbidity and increasing costs of care and thus further diminishing adherence in them. These effects are probably more pronounced among the

urban poor. About one third of the population of Kolkata Metropolitan Area lives in the registered and unregistered slums in Kolkata and the incidence of heart and circulatory system diseases is predicted to be high among these slum dwellers.[38] A study among the people living in the slums of Kolkata estimated the prevalence of hypertension to be 46% among the adults aged more than 30 years with 28% of them previously diagnosed by physicians.[39] The incidence and prevalence of stroke, the most common complication of long standing uncontrolled hypertension, among these slum dwellers of poor socioeconomic status are not significantly different from their counterparts living in the same city.[40] Thus non-adherence to treatment as the main cause of uncontrolled hypertension leading to fatal complications is a serious threat to public health which needs to be studied with utmost priority.

2. Review of literature

2. 1. ADHERENCE TO THERAPY:

2.1.1. Adherence and Compliance- concepts and ideology

Compliance to therapy has a strong positive influence on health outcomes. Adherence and persistence are the two common measures of compliance.[41] Adherence to long-term therapy has been defined by WHO as "the extent to which a person's behaviour – taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider".[42] The term compliance to medication may be defined as "the extent to which a patient acts in accordance with the prescribed interval and dose of the dosing regimen" reported as a percentage of prescribed doses taken at the prescribed time interval.[43] The terms compliance is used interchangeably with adherence but here the patient is passive in the decision-making which means that the patient has no choice of whether or not to follow treatment recommendations.[44] Adherence refers to the extent of the patient's agreement to the recommendations of the health care provider about the day-to-day treatment with respect to the timing, dosage, and frequency processes. Persistence to medication may be defined as "the duration from the time of initiation to discontinuation of therapy" that refers to the act of continuing the treatment for the prescribed duration.[45] Again the term compliance is not synonymous with concordance, which is more patient-centred with patients taking greater responsibility for their management through collaborative decision making process with the health care provider.[46] Although variations exist all these terminologies have been used interchangeably in most studies.[47]

2.1.2. Therapeutic Non- Adherence

The term non-adherence may be defined as the failure or refusal to agree and adapt to the prescribed medications, follow the diet, execute lifestyle changes or any prescribed course of therapy as per the necessity.[20,48,57.] Therapeutic non-adherence occurs when an individual's health-seeking or maintenance behavior lacks agreement or harmony with the recommendations as prescribed by a healthcare provider. Upto 50% cases of anti hypertensive treatment failure are attributable to non-adherence to medication.[48] Strict adherence to the recommended pharmacologic therapy is of utmost importance in achieving optimal blood pressure levels. Physicians tend to intensify therapy during follow up if they find the blood pressure not adequately controlled. Intensification of therapy by the health provider in order to achieve better control of blood pressure should always be preceded by prior consideration of non-adherence, which otherwise could be detrimental if the patient suddenly starts to take all the blood pressure lowering drugs.[49] Non-adherence to medications is said to occur when <80% doses of the prescribed medications is consumed out of the total number of doses supposed to be consumed as per the health care providers advice or the patient has stopped taking medications after starting treatment at any point of time following diagnosis in the past.[50]

2.1.3. Measuring adherence

Adherence for practical purposes is usually defined as consuming ≥80% doses of the prescribed medication regimen correctly.[51,52] Therapeutic compliance includes patient adherence with medication as well as with diet, exercise, or life style changes.[44] The direct methods of measuring adherence includes directly observed therapy, which is the most accurate among the methods available, and measurement of the level of drug or its metabolite or its biological marker in blood. The indirect methods include patient

questionnaires, patients self reports, pill counts, rates of prescription refills, assessment of patients clinical response, physiological response, electronic medication monitors, and diaries maintained by patient, if available.[43] In community surveys, these indirect methods based on self reports seems to be more feasible.

2.1.4. Prevalence of Adherence and non-adherence

According to WHO, adherence to anti-hypertensive pharmacotherapy varies from 50-70% across the world and among those under medication the number of good compliers could be in between 20-80% in real life situations.[51] Adherence to ≥80% of the prescribed medications is considered as good compliance.[51,52] At this 80% cut off level, a hospital based study from Pakistan estimated the prevalence of adherence to be 77% among these hypertensive patients.[53] Studies from India have identified non adherence to antihypertensive medications as the main cause for poor blood pressure control and its consequences like stroke, heart failure and others.[34,35] It is seen that patients with poor adherence to anti-hypertensive drugs are the ones who discontinue treatment early. In general 20-50% of the new patients discontinue treatment within six months or latest by the fifth year after starting antihypertensive treatment.[29,54]

2.1.5. Factors influencing adherence to anti-hypertensive treatment

Adherence to anti-hypertensive treatment is a complex and diverse phenomena that depends upon a range of demographic, social, economical, and psychological considerations but a comprehensive understanding of the disease, risks, complications and its therapy is necessary for adherence.[32,55] The demographic factors mainly include age, gender, ethnicity, marital status and the socio economic factors include education, occupation, income and cost, inability to take time off work, social and family support.[56] Adherence generally increases with age and persistence is found to be poor in people aged

below forty years.[53,57] Inability to buy drugs is significantly associated with poor compliance in middle and low income countries of the world.[33] The psychosocial factors includes beliefs, motivation, attitude while lack of a sense of dissatisfaction, guilt, regret and shame regarding their non-adherence is one of the major determinants of non-compliance to treatment among the mildly hypertensive patients.[58] Disease-related factors including the disease symptoms, severity of the disease, presence of co-existing illnesses, current therapy, duration of therapy, number of anti-hypertensive drugs, complexity of the treatment, side effects, system of medicine availed, method of initial diagnosis, duration since diagnosis, family history of hypertension, all affect adherence. Knowledge and perceptions regarding the present status of blood pressure, the risks of uncontrolled hypertension, insight into the illness, need for medication, indications for these medications, missing of doses affecting blood pressure, the effectiveness of medication, the benefits of medication, satisfaction with current treatment, forgetfulness and efforts to overcome it, fear of anti-hypertensive drug addiction affects adherence to therapy.[32,59] Personal habits like tobacco smoking or alcohol intake and lifestyle including high salt intake, physical inactivity are strong indicators of poor adherence.[59] Patient knowledge about these as risk factors for hypertension is important in promoting adherence. Adherence is also strongly influenced by the community where patients live, how health providers practice, the type of medical practice, patient-prescriber relationship, accessibility, waiting time at the clinic and unhappy clinic visits.[60,61]

2. 2. JUSTIFICATION/RATIONALE OF THE STUDY:

Going through the published literature it is evident that even today drugs are the main stay of treatment and control of high blood pressure while non adherence to pharmacotherapy is the most important cause of treatment failure in hypertension

management across the world. There are not many studies in India that have exposed the pattern of adherence to anti-hypertensive therapy including the factors affecting and modifying it. It can be assumed that like all other countries in the world and specially those with low Human Development Index, illiteracy and inability to buy drugs could be the most important determinant of non- adherence to anti-hypertensive medication in India. Still there is a dire need to explore and analyze quantitatively the pattern as well as the factors affecting adherence to anti-hypertensive medication in India. It is also evident that the prevalence of hypertension in urban India is high and has indiscriminately affected the urban poor. More over in the urban slums due to economic constraints generally have lower access to all the health facilities compared to their non-slum counterparts living in the same cities. So they form vulnerable groups in large cities. Yet the prevalence of hypertension and its outcomes like stroke have equally affected the urban slum and non slum population. Non adherence to anti hypertensive leads to increased risk of complications leading to increased costs of care in future which these slum dwellers might not be able to bear and thus enter into the vicious cycle of poverty. Thus, their adherence to anti-hypertensive treatment is of paramount importance and need to be explored in order to address their public health needs. This is why I have taken up this opportunity to study the pattern of adherence to anti-hypertensive treatment and the factors affecting this adherence among the urban slum dwellers.

2. 3. OBJECTIVES OF THE STUDY:

1. To study the prevalence and pattern of adherence to anti-hypertensive medication among the hypertensive patients living in urban slums.

2. To study the factors associated with adherence to anti-hypertensive medication among them.

3. Methodology

3.1. Study Type

An exploratory cross sectional survey was undertaken.

3.2. Study Period

A community based survey was conducted during the three month period from 15th June - 14th September '2009 in the slums of Ward no. 132 in the Borough XIV area, Kolkata, for quantitative analysis.

3.3. Study settings

Nearly one third of the population of Kolkata Metropolitan Area lives in the registered and unregistered slums in Kolkata where the prevalence of hypertension is predicted to be as high as 46% among the adults aged more than thirty years.[39] The Kolkata Municipal Corporation Area is divided into fifteen Boroughs. One of these Boroughs was randomly selected by the lottery method and the study was undertaken in the slums of this randomly selected Borough XIV of Kolkata Municipal Corporation area. According to Census 2001, there are 4888 slum dwellers living in the 2 wards i.e. Ward No. 131 (661 slum dwellers) & Ward No. 132 (4227 slum dwellers) out of the total nine wards under Borough XIV of The Kolkata Municipal Corporation. The study population included all the hypertensive patients ≥25 years of age, already diagnosed and treated by physicians, living in these urban slums of Ward no. 132 the larger of the two, under Borough XIV, Kolkata.

3.4. Sample size estimation

A hospital based study from Pakistan estimated the prevalence of adherence to medication to be 77% among hypertensive patients.[53] Using Epi-info 3.4.3 StatCalc, the sample size

was estimated to be 323 at 95% Confidence Interval considering prevalence of 70% and the worst acceptable value as 65% in a large population.

There was a list of 379 known hypertensive patients ≥25 years of age, already diagnosed and treated by physicians, living in these urban slums available with the community health workers serving the slum population of Ward no. 132 which was provided by the Ward Medical officer under Borough XIV of The Kolkata Municipal Corporation, was used to select these people. This list is based on the self reported cases of hypertension that have been diagnosed earlier by physicians and was prepared during the months of January and February '2009 through house to house survey in the slums of this ward. As the sample was taken from this list, all the enlisted 379 hypertensive patients suffering from hypertension were selected for interview and constituted the sample.

3.5. Sample selection procedure

There was no sampling since all the patients living in the selected slums were included in the study.

3.5.1. The inclusion criteria

1) Patients of age 25 years and above,

2) Those who had been diagnosed by any physician with 'essential' hypertension, and

3) Those who have been prescribed antihypertensive medications at any point of time.

Patients with co-existing medical conditions were also included.

3.5.2. The exclusion criteria

1) All people who could not fulfill the inclusion criteria.

2) Those who fulfilled the inclusion criteria but could not converse in Bengali (due to the lack of time and appropriate translators).

3.6. Data collection tools

A pretested semi-structured interview schedule along with a formal informed consent form in Bengali (the local language) was used for data collection.

3.7. Data collection technique

The data were collected through interviews that were conducted in the urban slums of Ward no. 132, Kolkata Municipal Corporation area. During this period, all the patients with hypertension living in these slums, who are included in the mentioned list, were interviewed at their residence. I collected all the data. Each of these respondents was provided the details of the objectives of the study. All interviews were preceded by an informed consent. The consent form was read out to them and the time for the procedure was explained to them. Only when the respondent gave consent, interviews were conducted. Spot blood pressure measurement was a part of the interview and the results were conveyed to the participant. Blood pressure was measured thrice during the interview. The first measurement was taken after rapport building, second after informed consent and the third measurement after filling up of the interview schedule using aneroid sphygmomanometer and a stethoscope. Blood pressure was measured in all subjects after they were in the resting state for ten minutes and in sitting position in the right arm placed at the level of the heart. An appropriate-sized cuff (cuff bladder encircling at least 80% of the arm) was used to ensure accuracy. Patients were asked about details of their prescribed medication regimen. Prescriptions, available at the time of the interview, were used in getting reliable data. Wherever prescriptions were not available, the medicine/drug strips used by the respondents were sought and noted. A standard drug manual was used to find out the generic class of the drug. The information obtained was tabulated. All information was based on self-reporting. It took approximately half an hour to complete an interview.

All interviews were followed by some health education imparted to the respondent as per the situation and referral to nearby health facility where required.

3.8. Data entry, storage and statistical analysis

All data collected was entered into Excel spreadsheets of Microsoft Office 2003 and all data entered were checked twice. After data entry cleaning of data was done for any error or outliers. The cleaned data was then used for statistical analysis using SPSS version 17.0 for Windows. The data analysis for the quantitative process included sample characteristics, bivariate and multivariate analysis. Mean ± one standard deviation were computed for all continuous data. Frequencies (with percentages) were calculated for categorical and binary variables. Adherence was represented in percentage and treated as a continuous variable. For analysis of adherence a cut-off value of 80% was used for labeling patients as adherent or non-adherent.[51,52] Chi-square tests and Fisher's exact tests were used to find out any statistically significant associations. Odds ratios (with 95% confidence intervals, CI) were calculated. Bivariate and binary logistic regression were done using adherent vs. non-adherent status as the outcome variable, while various study variables were used as independent variables. A p-value of less than 0.05 was considered to be statistically significant for all analyses.

3.9. The Variables under study

3.9.1. The Outcome variable

The outcome variable was '**Adherence**' to antihypertensive medications. Adherence as a percentage has been computed as (number of doses of medication taken in the last week / number of doses of medication prescribed for that week) x 100. This adherence value is treated as a continuous variable and associations were tested based on categories of ≥ and < 80% adherence.[51,52]

3.9.1. a. The operational definitions of Adherence and Non-adherence

- **Adherence to medications**: Consuming ≥80% of the prescribed doses of medication out of the total number of doses supposed to be consumed in the past one week.

- **Non-adherence to medications**: Consuming <80% of the prescribed doses of medication out of the total number of doses supposed to be consumed in the past one week or stopped taking medications after starting treatment in the past.

3.9.1. b. Measurement of adherence

The doses consumed or missed, based upon the patients self reports, were used to measure adherence. During interviews, patients were asked non-judgmentally how often they missed their doses. They were asked the total number of tablets they had been prescribed per week and how many pills they took and missed in the last week. The total number of doses (pills) that was supposed to be consumed in the past one week was computed from the available current prescription and when the prescription was not available, the medicine strips shown by the respondents were used. A shorter recall period was employed to elicit more accurate responses by minimizing recall bias.

3.9.2. The Predictor variables

To study the determinants of Adherence and Non-adherence to antihypertensive medications, the predictor variables chosen are as shown in table: 3.8.1.

- **Age:** Individuals over 55 years of age, have been reported to be more adherent and non adherence among them is mostly unintentional and is possibly depended upon the help obtained from the rest of the family members.[56]

- **Sex:** Females are more neglected in families with low-socioeconomic status like the slums which could affect their adherence depending upon the power relationships. Sometimes they act as the bread winners for the family, where they have more freedom to use their money.

- **Martial status:** Presence of a spouse can affect adherence as the help and support obtained from a spouse could increase the adherence compared to single person.

- **Type of family**: Women have more freedom in nuclear families but the focus of the adults in nuclear family is more on children which can affect the adherence. The elderly in joint families generally act as the head and are better looked after by their children.

- **Number of family members:** With increasing number of family members, individual focus is generally lost and thus reducing the adherence. On the other hand social support increases.

- **Highest level of education:** Poor literacy in the slums would lead to a poor understanding of the disease status and its therapy leading to a lower adherence. Studies have shown that even highly educated patients have failed to identify their clinical condition and benefits of adherence to the prescribed therapy.[56]

- **Employment status:** Unemployed adults, including pensioners and homemakers, of low socioeconomic status may show lower adherence to their prescribed drugs unless financially supported by the family. On the other hand, employed people like those skilled, semi skilled or manual laborers living in slums may have to support their families instead of focusing upon oneself.

- **Type of house:** There are three types of houses including *kuchha* houses having a clay wall with a thatched roof, *kuchha-pucca* houses made of brick wall with a thatched roof and *pucca* houses made of brick wall with a concrete ceiling in the slums. It is one of the markers of socio-economic status.

- **Personal income:** If an individual earn less than 1000-1500 rupees it is difficult to sustain the family if the person is the bread winner for the family, in this situation adherence is likely to be affected.

- **Family income:** Family income in the slums forms the common pool to meet the expenses of the family and run the household. The head of the family allocates the money as per the needs of the individuals.

- **Mode of payment for medication:** The costs of medicines may be borne out of pocket either from personal income or pooled family income, which grossly depends on the current financial condition of the family. On the other hand payment not out of pocket which may be in the form of free supply of medicine from the government (Kolkata Municipal Corporation, Central Government Health Scheme, Employees' State Insurance or Kolkata Port Trust) or Non Government Organizations (NGO) run dispensaries or through reimbursement by the employer, relieves the patient from the burden of regular monthly expenditure**.**

- **Duration of hypertension and its treatment:** People with long history of hypertension generally have better adherence because their attitude of denial of their diseased state decreases over time and acceptance of treatment after years of sufferings is improved.

- **Methods of detection of hypertension:** People who are diagnosed during check up for conditions like heart diseases or stroke or other symptoms related to hypertension are generally found to be serious and concerned about their blood pressure that increase their adherence to medications. On the other hand those who are detected of having higher blood pressure during general check up for causes not related to hypertension do not perceive the seriousness of the diseases condition and are less likely to adhere to the prescribed regime.

- **Family history of hypertension:** Patients having a family history of hypertension are generally aware of the course of the diseases which may affect their adherence behavior.

- **Coexisting chronic illness:** Presence of other chronic illness like diabetes mellitus, diseases of the heart, kidney, brain and nervous system, blood cholesterol disorders and some others like Chronic Obstructive Lung Diseases or osteoarthritis can affect the adherence. Severity of these associated illnesses can either increase their adherence behavior or may as well decrease it when the cost of treatment becomes high for the slum dwellers.

- **Presence of symptoms related to hypertension:** Patients experiencing poor health status are motivated to be adherent to their prescribed treatment. Instead of actual severity of the disease, the health status perceived by the patient generally has more influence on adherence.

- **Self administration of pills as per recommendation:** Strict following of medical prescriptions gives rise to good adherence behavior compared to consumptions of pills at one's free will.

- **Relation with the health care provider:** A good relation with the treating physician enhances communication and patients feels free to express their problems. This helps the health care provider to plan the treatment according to the patients' needs, which in turn helps to increase adherence.
- **Local availability of the medications:** Some of the prescribed medicines if not available nearby in the locality prevent the slum dwellers refilling their prescription. This adversely affects adherence.

Table: 3.9.1. List of predictor variables:

I. Socio-demographic profile:
- Age,
- Sex,
- Marital Status,
- Family type,
- Family size.

II. Socio-economic profile:
- Education,
- Occupation,
- Type of house,
- Monthly family income,
- Monthly personal income,
- Average cost of medicines per month,
- Mode of payment for antihypertensive medications.

III. Factors related to Hypertension:
- Duration since diagnosis of hypertension,
- Initial method of detection of hypertension,
- Family history of hypertension,
- Co-existing chronic illnesses,
- Symptoms related to hypertension,
- Present blood pressure,
- Hypertensive status/Hypertension control.

IV. Antihypertensive therapy-related factors:
- Duration of Antihypertensive treatment,
- Number of Pills prescribed per day,
- Number of anti-hypertensive drugs,
- Method of self administration of drugs.

V. Health Care Service -related factors:
- Relation with health care provider,
- Availability of medications locally.

VI. Other therapy related factors
- Self adopted means to avoid missing a pill,
- Regularity of BP check up,
- Last visit to clinic/Physician,
- Anybody accompanying during clinic visit,
- Frequency of procuring medicines per month.

VII. Habits and awareness regarding the Risk Factors:
- Tobacco consumption,
- Alcohol consumption,
- Salt restricted Diet,
- Physical inactivity,
- Fruits and vegetable intake.

VIII. Therapy Related Perceptions:
- Self perception about current blood pressure control,
- Knowledge about serious complications of untreated hypertension,
- Perception about missing a single dose affecting the treatment outcome,
- perception about complexity of current treatment regimen,
- Satisfaction with current treatment,
- perception about benefits of current medication,
- Opinion regarding prolonged treatment regimen.

Source: Author, 2009

3.10. Ethical considerations:

Permission to conduct the study in the mentioned slums was obtained from the Chief Municipal Health Officer and the respective authorities of the Kolkata Municipal Corporation, since these slum areas come under their purview. The study was approved by the Technical Advisory Committee (TAC) and the Institute Ethics committee of the Sree Chitra Tirunal Institute for Medical Sciences & Technology, Trivandrum. Finally after getting these necessary clearances, data collection was started.

Patients who agreed to participate were explained the nature and the objectives of the study, and informed consent was formally obtained from all of the respondents. The informed consent contained the signature of the respondent or the left thumb impression if the person was unable to sign but was willing to participate. Participant confidentiality was respected during and after the study. The information about patient's identity was not included with the main data and only I have access to this data. No reference to the patient's identity was made at any stage during data analysis or in the report. The database is kept safe. All materials which identify the respondent are kept strictly confidential and will never be made public or will be brought to the public domain. The database being used for analysis do not contain any identifiers but only codes and will be destroyed after the completion of the thesis so that there is no possibility of these documents ever to be used as any legal evidence.

4. Results

This chapter describes the outcome of data analysis in accordance with the objectives of the study. The response rate was 93.33% and the number of respondents were 352 of whom 1.1% (N=4) availed other systems of Medicine (all Homeopathy). Since this number was very small, these patients were excluded from the rest of the data analysis. Finally the data obtained from 348 respondents, all availing allopathic treatment for hypertension, were analyzed. Analysis was done in a stepwise manner to find out the base line characteristics of the sample population, pattern of adherence according the socio-demographic, socio-economic and factors related to the affected state of Hypertension and its therapy, and finally the association between the various independent variables and adherence to anti-hypertensive therapy was tested.

4.1. SAMPLE CHARACTERISTICS

4.1.1. Socio-demographic characteristics of the sample population

Out of the 348 respondents with mean [±Standard Deviation (SD)] age of 55.13 (±12.36) years, more than two thirds (68.1%) were females with a mean age of 54.77 (±12.45) years and less than one third (31.9%) males with a mean age of 55.9 (±12.2) years. Among those 69.3% (N=241) having a spouse, 43.15% (N=104) were males and 56.85% (N=137) were females and among the rest 30.7% (N=107) without any spouse, 6.54% (N=7) were males and 93.46% (N=100) were females. The proportion of widows was high upto 39.7% among the females.

Two third (N=233) of the sample population lived in nuclear families with an average (±SD) family size of 4.47 (±2.09) members. 41.1% (143) of the families were having more than four members.

Table 4.1.1. Socio-demographic characteristics of the sample population.

Variables		**Female (*n*=237) (%)**	**Male (*n*=111) (%)**	**Overall (*N*=348) (%)**
Age of subject in years *n* (%)	25-34	8 (3.4)	5 (4.5)	13 (3.7)
	35-44	41 (17.3)	13 (11.7)	54 (15.5)
	45-54	69 (29.1)	33 (29.7)	102 (29.3)
	55-64	54 (22.8)	31 (27.9)	85 (24.4)
	65-74	46 (19.4)	24 (21.6)	70 (20.1)
	≥75	19 (8)	5 (4.5)	24 (6.9)
Marital status *n* (%)	Single	6 (2.5)	5 (4.5)	11 (3.2)
	Married	137 (57.8)	104 (93.7)	241 (69.3)
	Widowed	94 (39.7)	2 (1.8)	96 (27.6)
Type of family *n* (%)	Nuclear	151 (63.7)	82 (73.9)	233 (67)
	Joint	86 (36.3)	29 (26.1)	115 (33)
Average number of family members *n* (%)	≤4 members	134 (56.5)	71 (64)	205 (58.9)
	>4 members	103 (43.5)	40 (36)	143 (41.1)

Source: Primary survey, 2009 Kolkata

4.1.2. Socio-economic characteristics of the sample population.

Nearly half of the sample was found to be illiterate among whom some could sign their names but could not read or write. The proportion of illiterates were high (57%) among the females compared to males with 20.7%. Nearly two thirds of the population was not engaged in formal work. They were either unemployed or retired persons or homemakers. The proportion of formal unemployment was double among the females compared to males. More than half of the sample population was not residing in *pucca* houses.

Table 4.1.2. Socio-economic characteristics of the sample population.

Variables		Female (*n*=237)(%)	Male (*n*=111)(%)	Overall (N=348)(%)
Highest level of Education *n* (%)	Illiterate or Can only sign	135 (57)	23 (20.7)	158(45.4)
	Literate	102 (43)	88 (77.3)	190(54.6)
Formal employment (during past one year) *n* (%)	Unemployed	163 (68.8%)	37 (33.3%)	200 (57.5%)
	Employed	74 (31.2%)	74 (66.7%)	148 (42.5%)
Type of house *n* (%)	Kuchha	17 (7.2)	5 (4.5)	22 (6.3)
	Kuchha-Pucca	129 (54.4)	42 (37.8)	171 (49.1)
	Pucca	91 (38.4)	64 (57.7)	155 (44.5)
Average monthly family income in Rupees *n* (%)	≥3000 Rupees	125 (52.7)	72 (64.9)	197 (56.6)
	<3000 Rupees	112 (47.3)	39 (35.1)	151 (43.4)
Average monthly personal income in Rupees *n* (%)	≥1200 Rupees	30 (12.7)	80 (72.1)	110 (31.6)
	<1200 Rupees	207 (87.3)	31 (27.9)	238 (68.4)

Source: Primary survey, 2009 Kolkata

The mean (±SD) monthly family income of the sample population was Rupees 3331.18 (±1662.35) with a median of Rupees 3000. Half of the females were living in families with a family income of ≥3000 Rupees with a mean (±SD) family income of Rupees 3199.37 (±1654.44). Among the males, 64.9% were living in families with a family income of ≥3000 Rupees with a mean (±SD) family income of Rupees 3612.61 (±1651.51).

The mean (±SD) monthly personal income of the females was Rupees 510.55 (±977) and Rupees 2623.42 (±2012.46) for males with an overall personal income of Rupees 1184.48 (±1704.58) among the sample population.

4.1.3. Characteristic personal habits of the sample population.

The overall prevalence of tobacco consumption during the past one month period was 32.5% among the sample population which was higher among males (45.9%) compared to females (26.2%).

Table 4.1.3. Characteristic personal habits of the sample population.

Variables		Female (*n*=237)(%)	Male (*n*=111)(%)	Overall (N=348) (%)
Tobacco consumption in past one month *n* (%)	No	175 (73.8)	60 (54.1)	235 (67.5)
	Yes	62 (26.2)	51 (45.9)	113 (32.5)
Alcohol consumption in past one month *n* (%)	No	234 (98.7)	93 (83.8)	327 (94)
	Yes	3 (1.3)	18 (16.2)	21 (6)

Source: Primary survey, 2009 Kolkata

Similarly, the overall prevalence of alcohol consumption during the past one month period was only 6% among the sample population which was much higher among males (16.2%) compared to females (1.3%).

4.1.4. Hypertension and anti-hypertensive treatment related characteristics of the sample population.

Nearly half of the study sample had a history of hypertension for more than five years. The mean (±SD) duration of hypertension was 75.96 (±69.08) months among females and 68.65 (±54.52) months among males with an overall mean (±SD) duration of 73.63 (±64.81) months. 28.4% of the population had a family history of hypertension with similar distribution across both sexes. Nearly one fifth of the population had a history of coexisting illnesses with similar distribution across both sexes.

Over half of the study sample had been continuing antihypertensive treatment for more than five years with an overall mean (±SD) duration of 72.96 (±65.18) months. The mean (±SD) duration of antihypertensive therapy was 74.57 (±68.83) months among females and 69.51 (±56.76) months among males. Almost ninety percent of the population had been prescribed a single pill everyday for the treatment of hypertension with similar distribution of advice across both sexes.

Table 4.1.4. Hypertension and anti-hypertensive treatment related characteristics of the sample population.

Variables		**Female (*n*=237)(%)**	**Male (*n*=111)(%)**	**Overall (N=348) (%)**
Duration of hypertension *n* (%)	≥5 years	125 (52.7)	56 (50.5)	181 (52)
	<5 years	112 (47.3)	55 (49.5)	167 (48)
Family history of hypertension *n* (%)	Absent	171 (72.2)	78 (70.3)	249 (71.6)
	Present	66 (27.8)	33 (29.7)	99 (28.4)
Co-existing chronic illnesses *n* (%)	Absent	194 (81.9)	89(80.2)	283 (81.3)
	Present	43 (18.1)	22(19.8)	65 (18.7)
Duration of antihypertensive therapy *n* (%)	≥5 years	123 (51.9)	56 (50.5)	179 (51.4)
	<5 years	114 (48.1)	55 (49.5)	169 (48.6)
Number of anti-hypertensive pills prescribed per day *n* (%)	1 pill per day	205 (86.5)	99 (89.2)	304 (87.4)
	>1 pill per day	32 (13.5)	12 (10.8)	43 (12.6)
Present blood pressure Status *n* (%)	Blood pressure controlled†	105 (44.3)	42(37.8)	147 (42.2)
	Blood pressure not controlled	132 (55.7)	69 (62.2)	201 (57.8)

Source: Primary survey, 2009 Kolkata
† Blood pressure controlled: BP<140/90 mmHg

Three spot blood pressure measurements and the average of the second and third readings revealed that nearly two third of the population had blood pressure in the hypertensive range. The Mean (±SD) Systolic Blood Pressure was 138.09 (±13.66) mmHg among females and 137.68 (±12.67) mmHg among males with an overall Systolic Blood Pressure of 137.96 (±13.33) mmHg. The Mean (±SD) Diastolic Blood Pressure was 84.58 (±6.73) mmHg among females and 85.32 (±6.47) mmHg among males with an overall Diastolic Blood Pressure of 84.82 (±6.65) mmHg. Thus, inadequate blood pressure control was evident.

4.2. DETAILS OF THE PREVALANCE AND PATTERN OF ADHERENCE

The overall mean (±SD) adherence was 89.53 (±16.11) percent among the study population. At the 80% cutoff level, the prevalence of adherence (adherence ≥80%) was 73% (N=254) (95% CI 68-78%) with a mean (±SD) of 98.28 (±4.67) percent while the prevalence of non-adherence (adherence <80%) was found to be 27% (N=94) with a mean (±SD) of 65.88 (±11.62) percent among them.

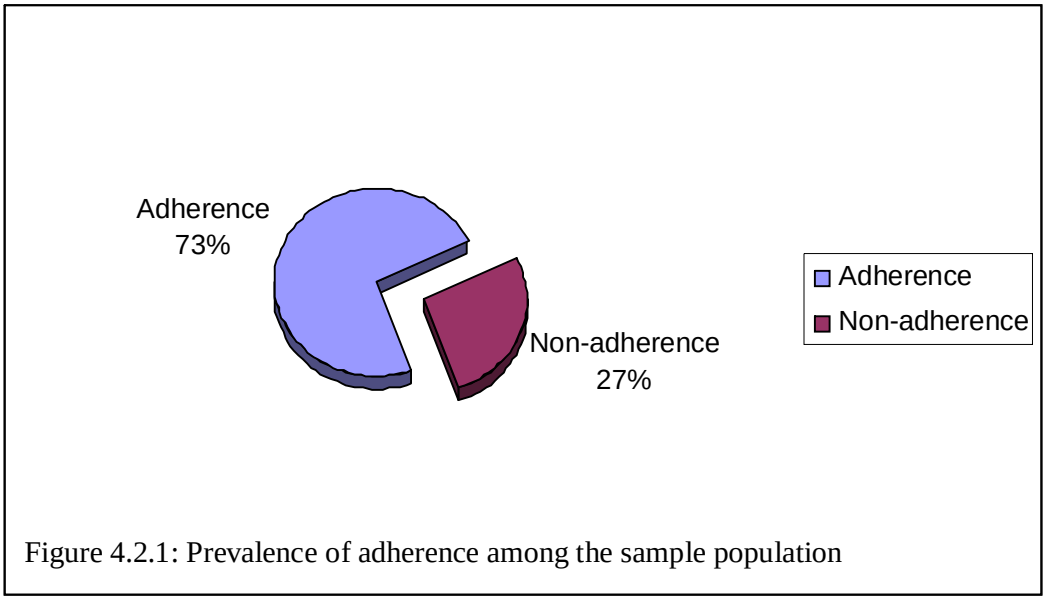

Figure 4.2.1: Prevalence of adherence among the sample population

Source: Primary survey, 2009 Kolkata

4.2.1. Pattern of adherence according to the socio-demographic characteristics of the sample population

Prevalence of adherence was similar across both the age groups <55years or ≥55 years, the median age of the sample population, and is nearly similar to the overall prevalence. Adherence was noted to be higher by 5.3% among males compared to females but this difference was not significant (p>0.05). The mean (±SD) adherence was almost equally distributed across both the sexes with 90.99 (±16.05) percent among males and 88.84 (±16.13) percent among females.

Table 4. 2.1: Pattern of adherence according to the socio-demographic characteristics.

Variables		**Total (*N*=348) (%)**	**Adherence ≥80% (*n*=254)(%)**	**Adherence <80% (*n*=94)(%)**	Chi-Square p-value.
Age of subject in years *n* (%)	25-54 years	169 (48.6)	122 (72.2)	47 (27.8)	0.744
	≥55 years	179 (51.4)	132 (73.7)	47 (26.3)	
Sex *n* (%)	Male	111 (31.9)	85 (76.6)	26 (23.4)	0.302
	Female	237 (68.1)	169 (71.3)	68 (28.7)	
Marital status *n* (%)	Spouse absent	107 (30.7)	79 (73.8)	28 (26.2)	0.813
	Spouse present	241 (69.3)	175 (72.6)	66 (27.4)	
Type of family *n* (%)	Nuclear	233 (67)	177 (76)	56 (24)	0.075
	Joint	115 (33)	77 (67)	38 (33)	
Average number of family members *n* (%)	≤4 persons	205 (58.9)	158 (77.1)	47 (22.9)	0.040*****
	>4 persons	143 (41.1)	96 (67.1)	47 (32.9)	

Source: Primary survey, 2009 Kolkata; *****p<0.05;

Irrespective of having a spouse or not having a spouse, prevalence of adherence was similar across both the groups. Prevalence of adherence was noted to be around 9% higher among those living in nuclear families compared to joint families and similar features was noted among those living in families with upto four members having 10% higher adherence than those with more than four members.

4.2.2. Pattern of adherence according to the socio-economic characteristics of the sample population

The proportion of adherence among the literates was lower by 2.7% compared to the illiterate persons ($p>0.05$). Those who were formally employed achieved a higher adherence of 2.3% compared to those formally unemployed ($p>0.05$). Adherence among the people residing in *pucca* houses was higher than others residing in *kuchha* or *kuchha-pucca* houses by 12.6% ($p<0.01$).

Those who were living in families with an average monthly income of ≥3000 Rupees with mean (±SD) of Rupees 3549.02 (±1674.63) achieved 20% more adherence ($p<0.001$) compared to those living in families with lower average monthly income having a mean (±SD) of Rupees 2742.55 (±1483.85). Similarly, those who had an average monthly personal income of ≥1200 Rupees with mean (±SD) of Rupees 1325.59 (±1832.2) achieved 11.6 % more adherence ($p<0.05$) compared to those earning lower than 1200 Rupees having a mean (±SD) of Rupees 803.19 (±1227.85).

The mean (±SD) cost of anti-hypertensive medicines per month was Rupees 108.48 (±88.38) among those having adherence of ≥80% and Rupees 117.68 (±69.43) for those who were non adherents. Yet it was seen that, those spending rupees 100 or more had 6.3% lower adherence than those spending lower amounts ($p>0.05$). Again it was interesting to find out that payment for medication out of pocket reported 22% lower adherence ($p=0.001$) than those who did not have to pay out of their own pocket or family income.

Table 4.2.2: Pattern of adherence according to the socio-economic characteristics.

Variables		Total (*N*=348) (%)	Adherence ≥80% (*n*=254)(%)	Adherence <80% (*n*=94)(%)	Chi-Square p-value.
Highest level of education *n* (%)	Illiterate or Can only sign	158 (45.4)	113 (71.5)	45 (28.5)	0.109
	Literate	190 (54.6)	141 (74.2)	49 (25.8)	
Formal employment (during past one year) *n* (%)	Unemployed	200 (57.5)	144 (72)	56 (28)	0.629
	Employed	148 (42.5)	110 (74.3)	38 (25.7)	
Type of house *n* (%)	Kuchha or Kuchha-pucca	193 (55.5)	130 (67.4)	63 (32.6)	0.008**
	Pucca	155 (44.5)	124 (80)	31 (20)	
Average monthly family income in Rupees *n* (%)	≥3000 Rupees	197 (56.6)	161 (81.7)	36 (18.3)	<0.001***
	<3000 Rupees	151 (43.4)	93 (61.6)	58 (38.4)	
Average monthly personal income in Rupees *n* (%)	≥1200 Rupees	110 (31.6)	89 (80.9)	21 (19.1)	0.024*
	<1200 Rupees	238 (68.4)	165 (69.3)	73 (30.7)	
Average cost of anti-hypertensive medicines per month *n* (%)	≥100 Rupees	161 (46.3)	112 (69.6)	49 (30.4)	0.182
	<100 Rupees	187 (53.7)	142 (75.9)	45 (24.1)	
Mode of payment for antihypertensive medications *n* (%)	Not out of pocket	49 (14.1)	45 (91.8)	4 (8.2)	0.001†
	Out of pocket (self/family)	299 (85.9)	209 (69.9)	90 (30.1)	

Source: Primary survey, 2009 Kolkata; * p<0.05; ** p<0.01; *** p<0.001; †: p-value <0.001 for Fisher's Exact Test;

4.2.3 Pattern of adherence according to the characteristics of hypertension and anti-hypertensive treatment.

The people who were suffering from hypertension for more than five years were 20% more adherent ($p<0.001$) than those who were suffering for less than five years. The mean (±SD) duration of hypertension was 81.23 (±69.25) months among those who were adherent and 53.09 (±45.17) months among non adherents. Around one third of the patients who discovered their hypertension during medical checkup for symptoms related to hypertension and/or its complications like heart disease, stroke or other symptoms related to hypertension showed higher proportion of adherence by 18.5% compared to those who were initially detected during regular check up or any other cause ($p<0.001$). The proportion of adherence was lower among those having a family history of hypertension by 7.4% compared to those without any family history ($p>0.05$).

The proportion of adherence was nearly equally distributed among those with or without any associated coexisting illnesses. Details of pattern of adherence according to the various associated coexisting illnesses are depicted in Table 4.2.5. The hypertensive patients having symptoms related to hypertension were 8.2% more adherent than those without any symptoms ($p>0.05$). The people who were on anti hypertensive medications for more than five years were 20% more adherent ($p<0.001$) than those who were on anti hypertensive medications for less than five years. The mean (±SD) duration of anti hypertensive therapy was 80.22 (±69.03) months among those who were adherent and 53.24 (±48.54) months among non adherents. Proportion of adherence based on the number of anti-hypertensive pills prescribed per day was found to be about 8% higher among those prescribed single pill per day compared to those been prescribed more than one pill a day ($p>0.05$). The mean (±SD) number of antihypertensive Pills advised per day per

patient was 1.14 (±0.43) among adherents and 1.16 (±0.37) among non adherents showing not much difference between the two groups.

Table 4.2.3. Pattern of adherence according to the characteristics of hypertension and anti-hypertensive treatment.

Variables		Total (*N*=348) (%)	Adherence ≥80% (*n*=254) (%)	Adherence <80% (*n*=94) (%)	Chi-Square p-value.
Duration of hypertension *n* (%)	≥5 years	181 (52)	150 (82.9)	31 (17.1)	<0.001*
	<5 years	167 (48)	104 (62.3)	63 (33.7)	
Initial method of detection of hypertension *n* (%)	During check up for conditions related to hypertension	116 (33.3)	99 (85.3)	17 (14.7)	<0.001*
	During regular check up or for other causes	232 (66.7)	155 (66.8)	77 (33.2)	
Family history of hypertension *n* (%)	Absent	249 (71.6)	187 (75.1)	62 (24.9)	0.159
	Present	99 (28.4)	67 (67.7)	32 (32.3)	
Co-existing chronic illnesses *n* (%)	Absent	283 (81.3)	207 (73.1)	76 (26.9)	0.891
	Present	65 (18.7)	47 (72.3)	18 (27.7)	
Symptoms related to hypertension *n* (%)	Absent	26 (7.5)	17 (65.4)	9 (34.6)	0.364
	Present	322 (92.5)	237 (73.6)	85 (26.4)	
Duration of anti-hypertensive therapy *n* (%)	≥5years	179 (51.4)	148 (82.7)	31 (17.3)	<0.001*
	<5 years	169 (48.6)	106 (62.7)	63 (37.3)	
Number of anti-hypertensive pills prescribed per day *n* (%)	1 pill per day	304 (87.4)	225 (74)	79 (26)	0.219
	>1 pill per day	44 (12.6)	29 (65.9)	15 (34.1)	

Source: Primary survey, 2009 Kolkata; * p<0.001;

Table 4.2.4. Pattern of adherence according to the various associated coexisting chronic illnesses.

Associated diseases	**Total (N=348) (%)**	**Adherence ≥80% (*n*) (%)**	**Adherence <80% (*n*) (%)**	Chi-Square p-value.
Diabetes Mellitus *n* (%)	41 (11.8)	30 (73.2)	11 (26.8)	0.978
Heart diseases *n* (%)	14 (4)	10 (71.4)	4 (28.6)	1.000*
Kidney disease *n* (%)	2 (6)	2 (100)	0 (0)	1.000*
Disease of Brain and Nervous System *n* (%)	3 (.9)	3 (100)	0 (0)	0.566*
Blood Cholesterol *n* (%)	8 (2.3)	5 (62.5)	3 (37.5)	0.450*
Others *n* (%)	11 (3.2)	7 (63.6)	4 (36.4)	0.497*

Source: Primary survey, 2009 Kolkata; *****p-value for Fisher's Exact Test

4.3. THE DETERMINANTS OF ADHERENCE

All the independent variables listed in the methodology section were tested for association with adherence (adherence ≥80%) compared to non adherence (adherence <80%). Correlations with p-values (2-tailed significance) were analyzed for the continuous variable with percentage adherence. Odds ratios with 95% confidence interval were calculated.

4.3.1. Socio-demographic factors associated with adherence

Age groups, sex, absence or presence of a spouse were not seen to be significantly associated with adherence. Age in completed years was found to be slightly negatively correlated (p>0.05) with adherence percentage showing that as age advanced, adherence declined. Residing in nuclear families was nearly significantly associated with adherence. Though the number of family members was negatively correlated (p>0.05) with percentage adherence, the number of family members upto four was significantly associated (p<0.05) with adherence.

Table 4.3.1. Socio-demographic factors associated with adherence.

Variables:		Adherence ≥80% (*n*) (%)	OR (95%CI) of Adherence ≥80%	Chi-Square p-value.
Age Groups	≥55 years	132 (52)	1.08(0.67-1.74)	0.744
	25-54 years [r]	122 (48)		
Sex	Male	85 (33.5)	1.31 (0.78-2.22)	0.302
	Female [r]	169 (66.5)		
Having a Spouse	Spouse Absent	79 (31.1)	1.06 (0.63-1.78)	0.813
	Spouse Present [r]	175 (68.9)		
Type of family	Nuclear	177 (69.7)	1.56 (0.95-2.55)	0.075
	Joint [r]	77 (30.3)		
No of Family members	≤4 members	158 (62.2)	1.65 (1.02-2.65)	0.040*
	>4 members [r]	96 (37.8)		

Source: Primary survey, 2009 Kolkata; OR: Odds Ratio; CI: Confidence Interval
*p<0.05; [r]: Reference category;

4.3.2. Socio-economic factors associated with adherence

Literacy and formal employment during the past one year was not significantly associated (p>0.05) with adherence. Residing in *pucca* house was significantly associated with adherence (p<0.01) with an odds nearing double and there was a positive trend for adherence (p-value for Chi-square trend test = .017 or p<0.05) according to the type of house they reside in from *kuchha* to *kuchha-pucca* to *pucca* house.

An average monthly family income of more than 3000 rupees was significantly (p<0.01) associated with adherence with an odds of slightly less than three times compared to income below 3000 rupees. A significant positive correlation (p<0.001) between average monthly family income and percentage adherence was also seen.

An average monthly personal income of more than 1200 rupees was also significantly ($p<0.05$) associated with adherence with an odds of slightly less than two times compared to income below 1200 rupees. A significant positive correlation (($p<0.05$)) between average monthly personal income and percentage adherence was also seen.

Table 4.3.2. Socio-economic factors associated with adherence.

Variables:		Adherence ≥80% (*n*) (%)	OR (95%CI) of Adherence ≥80%	Chi-Square p-value.
Highest level Education	Literate	141 (55.5)	1.15(0.71-1.84)	0.573
	Illiterate or can sign only [r]	113 (44.5)		
Formal employment (during past one year)	Employed	110 (43.3)	1.13 (0.7-1.82)	0.629
	Unemployed [r]	144 (56.7)		
Type of House	Pucca	124 (48.8)	1.94 (1.18-3.18)	0.008**
	Kuchha or Kuchha-pucca [r]	130 (51.2)		
Average monthly Family income	≥ Rs.3000	161 (63.4)	2.79 (1.71-4.54)	< 0.001***
	< Rs.3000 [r]	93 (36.6)		
Average monthly personal income	≥ Rs.1200	89 (35)	1.87 (1.08-3.25)	0.024*
	< Rs.1200 [r]	165 (65)		
Average monthly cost of medicines	< Rs.100	142 (55.9)	1.38 (.86-2.22)	0.182
	≥ Rs.100 [r]	112 (44.1)		
Mode of payment for antihypertensive medications	Free	45 (17.7)	4.84 (1.69-13.87)	0.001[†]
	Out of pocket (self/family) [r]	209 (82.3)		

Source: Primary survey, 2009 Kolkata; OR: Odds Ratio; CI: Confidence Interval
* p<0.05; ** p<0.01; *** p<0.001; [†]: p-value<0.001 for Fisher's Exact Test; [r]: Reference category;

An average monthly cost of medicines less than hundred rupees was not significantly associated ($p>0.05$) with adherence. Those who got their medications free had nearly five

times the odds of adherence compared to out of pocket payment for medications and this association was significant ($p<0.01$).

More than half of these adherent persons who had to purchase their medicines out of their pocket, were two times (OR 2.08: CI 1.21-3.57) more likely to purchase them once at a time every month than those who could not buy for one whole month ($p<0.01$).

4.3.3. Hypertension and its therapy-related factors associated with adherence

Both duration of hypertension and duration of anti-hypertensive therapy more than five years had significant association with adherence ($p<0.001$) with an odds of nearly three times compared to duration less than five years. A significant positive correlation between adherence percentage and duration of hypertension ($p=0.002$) and duration of anti-hypertensive therapy ($p=0.003$) in months was also seen.

Initial detection during check up for conditions like heart disease, stroke or other symptoms related to hypertension had nearly three times the odds of adherence and was significant ($p<0.001$) compared to those who were initially detected during regular check up or any other cause. On the contrary, absence of family history of hypertension, presence of symptoms related to hypertension and absence of coexisting illnesses not significantly associated ($p>0.05$) with adherence, although a higher prevalence of adherence was seen among these groups. Similar results were seen with prescription of single pill a day. Self administration of antihypertensive medications as recommended by the doctor was also significantly ($p<0.01$) associated with adherence with an odds of greater than two and a half times than other ways of administration. Prescription, at the time of interview, was available with only around 40.8% ($n=142$) of the respondents.

Among those who were adherent to eighty percent of their prescribed pills or even more, prescription was available with only around 37.4% (n=95) of them.

Table 4.3.3: Hypertension and its therapy-related factors associated with adherence.

Variables:		**Adherence ≥80% (*n*) (%)**	OR (95%CI) of Adherence ≥80%	Chi-Square p-value
Duration of Hypertension	≥60 months	150 (59.1)	2.93 (1.78-4.82)	< 0.001***
	<60 months *r*	104 (40.9)		
Initial method of detection of hypertension	During check up for conditions related to hypertension	99 (39)	2.89 (1.62-5.18)	< 0.001***
	During regular check up or for other causes *r*	155 (61)		
Family history of hypertension	Absent	187 (73.6)	1.44 (0.86-2.4)	0.159
	Present *r*	67(26.4)		
Co-existing chronic illnesses	Absent	207 (81.5)	1.04 (0.57-1.91)	0.891
	Present *r*	47 (18.5)		
Symptoms related to hypertension	Present	237 (93.3)	1.48 (0.63-3.44)	0.364
	Absent *r*	17 (6.7)		
Duration of antihypertensive treatment	≥60 months	148 (58.3)	2.84 (1.73-4.66)	< 0.001***
	<60 months *r*	106 (41.7)		
Number of antihypertensive pills prescribed per day	Single pill per day	225 (88.6)	1.47 (0.75-2.89)	0.258
	>1 pill per day *r*	29 (11.4)		
Method of self administration of antihypertensive medications	As recommended by the doctor	237 (93.3)	2.65 (1.26-5.54)	0.008**
	Not as recommended by the doctor *r*	17 (6.7)		

Source: Primary survey, 2009 Kolkata; OR: Odds Ratio; CI: Confidence Interval
*p<0.05; **p<0.01; ***p<0.001; *r*: Reference category;

4.3.4. Non pharmacological therapy-related factors associated with adherence

Doctors' advice on physical activity and salt restriction in diet was significantly associated ($p<0.05$) with adherence with an odds of around two and two and a half times respectively compared to no such advices. On the contrary, practice of these advices, which was calculated among only those who were advised, were not significantly associated ($p>0.05$) with adherence, although more than ninety percent of those who followed these advises were adherent.

Table 4.3.4: Non pharmacological therapy-related factors associated with adherence.

Variables:		**Adherence ≥80% (*n*) (%)**	OR (95%CI) of Adherence ≥80%	Chi-Square p-value.
Doctors advise on physical activity	Yes	216 (85)	1.95 (1.09-3.47)	0.022*
	No[r]	38 (15)		
Practice of physical activity	Yes	204 (94.4)	1.31 (0.44-3.85)	0.573†
	No[r]	12 (5.6)		
Doctors advise on salt restriction	Yes	242 (95.3)	2.4 (1-5.76)	0.044*
	No[r]	12 (4.7)		
Following advice on salt restriction	Yes	225 (93)	1.21 (0.39-2.67)	0.971
	No[r]	17 (7)		

Source: Primary survey, 2009 Kolkata; OR: Odds Ratio; CI: Confidence Interval
*p<0.05; †: p-value for Fisher's Exact Test; [r]: Reference category;

4.3.5. Health care service-related factors associated with adherence

Good relation with health care provider was significantly ($p<0.05$) associated with adherence with an odds nearly twice as those not having good relationship. Similarly, easy

availability of the prescribed antihypertensive medications locally was significantly ($p<0.05$) associated with adherence with an odds nearly five times as compared to those medications which are not easily available locally.

Table 4.3.5: Health care service-related factors associated with adherence.

Variables:		**Adherence ≥80% (*n*) (%)**	OR (95%CI) of Adherence ≥80%	Chi-Square p-value.
Relation with health care provider	Good	208 (81.9)	1.92 (1.11-3.31)	0.018*****
	Not good [r]	46 (18.1)		
Availability of medications locally	Easily available	251 (98.8)	4.7 (1.1-20.07)	0.036[†]
	Not easily available [r]	3 (1.2)		

Source: Primary survey, 2009 Kolkata; OR: Odds Ratio; CI: Confidence Interval

*****$p<0.05$; [†]: p-value <0.05 for Fisher's Exact Test; [r]: Reference category;

4.3.6. Other therapy-related factors associated with adherence

More than eighty percent of those who are adherent keep medications in sight so that they do not forget to self administer them. Half of these people who are adherent, get their pressure measured every month. Nearly three fourths of them had last consulted their physician within the past six months. Less than half of these patients were accompanied by someone during their visit to the clinics. All these features were not significantly associated with adherence ($p>0.05$).

Table 4.3.6: Other therapy-related factors associated with adherence.

Variables:		**Adherence ≥80% (*n*) (%)**	OR (95%CI) of Adherence ≥80%	Chi-Square p-value.
Self adopted means to avoid missing a pill	Keep medicines in sight	210 (82.7)	1.21 (0.66-2.2)	0.534
	Other means [r]	44 (17.3)		
Frequency of blood pressure check up	Once in every 1 month	126 (49.6)	1.22 (0.76-1.96)	0.414
	Once in more than 1 month [r]	128 (50.4)		
Last visit to clinic/Physician	Within 6 months	190 (74.8)	1.46 (.87-2.44)	0.148
	More than 6 months [r]	64 (25.2)		
Anybody accompanying during clinic visit	Yes	118 (46.6)	1.13 (0.70-1.82)	0.615
	No [r]	135 (53.4)		

Source: Primary survey, 2009 Kolkata; OR: Odds Ratio; CI: Confidence Interval
*p<0.05; **p<0.01; [r]: Reference category;

4.3.7. Awareness and perceptions associated with Adherence

Awareness was seemed to be higher among both the groups and awareness of the fact that tobacco and alcohol are risk factors for hypertension was significantly associated with adherence. Yet one third among both adherents and non adherents had history of tobacco consumption during the past one month. On the contrary, only around five percent of both the groups consumed alcohol. Tobacco and alcohol consumption during past one month was not significantly associated (p-value > 0.05) with Adherence. More than two thirds of those who were adherent were also aware that physical inactivity and low fruit and vegetable intake were risk factors for hypertension while around three fourth said that high

salt intake was a risk factor for hypertension while among those who were non adherent, 78.7% were aware that high salt intake was a risk factor for hypertension. All these awareness was not significantly associated with adherence (p-value > 0.05).

Table 4.3.7: High risk awareness associated with adherence.

Variables:		**Adherence ≥80% (*n*) (%)**	OR (95%CI) of Adherence ≥80%	Chi-Squar p-value.
Tobacco consumption as risk factor for hypertension	Yes	148 (58.3)	1.97 (1.22-3.18)	0.005**
	No[r]	106 (41.7)		
Alcohol consumption as risk factor for hypertension	Yes	152 (59.8)	1.84 (1.14-2.97)	0.011*
	No[r]	102 (40.2)		
High salt intake as risk factor for hypertension	Yes	190 (74.8)	0.8 (0.45-1.42)	0.448
	No[r]	64 (25.2)		
Physical inactivity as risk factor for hypertension	Yes	161 (63.4)	1.07 (0.66-1.75)	0.773
	No[r]	93 (36.6)		
Fruits and vegetable intake as risk factor for hypertension	No	151 (59.4)	0.95 (0.59-1.54)	0.841
	Yes[r]	103 (40.6)		

Source: Primary survey, 2009 Kolkata; OR: Odds Ratio; CI: Confidence Interval;
*p<0.05; **p<0.01; [r]: Reference category;

The therapy-related perceptions were not significantly associated with adherence as depicted in table 4.3.8 except for the self perception about current blood pressure that it was under control and satisfaction with the current treatment which increased adherence by three (p=0.001) and five times (p<0.001) respectively.

Table 4.3.8. Therapy-related perceptions associated with adherence.

Variables:		**Adherence ≥80% (*n*) (%)**	OR (95%CI) of Adherence ≥80%	Chi-Square p-value
Self perception about current blood pressure control	Under control	224 (88.2)	2.7 (1.49-4.91)	0.001**
	Not under control[r]	30 (11.8)		
knowledge about serious complications of untreated hypertension	Present	238 (93.7)	1.97 (0.88-4.42)	0.094
	Absent[r]	16 (6.3)		
Perception about missing a single dose affecting the treatment outcome	Makes a difference	165 (65)	1.1 (0.67-1.8)	0.704
	Makes no difference[r]	89 (35)		
Perception about complexity of the current treatment regimen	Simple	234 (92.1)	1.71 (0.8-3.66)	0.161
	Complex[r]	20 (7.9)		
Satisfaction with the current treatment regimen	Satisfied	246 (96.9)	4.93 (1.97-12.33)	< 0.001***
	Not Satisfied[r]	8 (3.1)		
Perceptions about benefits of current medication/s	Beneficial	198 (78)	0.96 (0.54-1.7)	0.877
	No benefits[r]	56 (22)		
Opinion regarding the prolonged treatment regimen	No fear of getting dependent	101 (39.8)	0.82 (0.51-1.32)	0.408
	Some fear of getting dependent[r]	153 (60.2)		

Source: Primary survey, 2009 Kolkata; OR: Odds Ratio; CI: Confidence Interval;
*p<0.05; **p<0.01; ***p<0.001; [r]: Reference category;

4.3.8: Multivariate model of the factors associated with adherence

Table 4.3.9: Results of binary logistic regression: Factors affecting adherence ≥80%

Variables:		Adjusted OR for Adherence	95% C.I. for Adj. OR		Significance (p-value)
			Lower	Upper	
No of Family members	≤4 members	2.01	1.52	3.50	0.014
	>4 members [r]				
Average monthly Family income	≥ Rs.3000	2.56	1.47	4.45	0.001
	< Rs.3000 [r]				
Duration of Hypertension	≥5 years	2.98	1.73	5.14	< 0.001
	<5 years [r]				
Initial method of detection of hypertension	During check up for conditions related to hypertension	2.35	1.25	4.39	0.008
	During regular check up or for other causes [r]				
Self perception about current blood pressure control	Under control	2.23	1.17	4.26	0.015
	Not under control [r]				
Satisfaction with the current treatment regimen	Satisfied	3.77	1.32	10.76	0.013
	Not Satisfied [r]				
Mode of payment for antihypertensive medications	Free	4.16	1.36	12.69	0.012
	Out of pocket (self/family) [r]				

Source: Primary survey, 2009 Kolkata;
OR: Odds Ratio; CI: Confidence Interval; [r]: Reference category;
Dependent variable: adherence ≥80%, other variable(s) considered in this model and not found to be significant includes the type of house, type of family, average monthly personal income, duration of antihypertensive treatment, method of self administration of antihypertensive medications, relation with health care provider, availability of the medicines locally, doctors advise on physical activity, doctors advise on salt restriction, knowledge about tobacco as a risk factor for hypertension, knowledge about alcohol as a risk factor for hypertension. [Model Nagelkerke R^2: 0.281, Chi-square for the model: 74.82, p-value: <0.001]

As already depicted in the table 4.3.9, binary logistic regression analysis of the variables produced a model comprising small family size, higher family income, longer duration of hypertension, first detection during conditions clinically related to hypertension, Self perception about current blood pressure control to be under control, Satisfaction with the current treatment regimen and free availability of medicines as the prospective predictors of adherence found to be significantly associated with adherence.

4.4. THE ASSOCIATION BETWEEN ADHERENCE AND BLOOD PRESSURE CONTROL

Nearly half of those who were adherent to their prescribed medications achieved a control of their blood pressure while blood pressure was not under control among two thirds of those who were not adherent. These adherent patients were two times more likely to achieve adequate control of hypertension compared to those who were not adherent ($p<0.05$) as shown in the table 4.4.1.

Table 4.4.1. The association between adherence and current blood pressure control

Variables:	**Blood pressure controlled**	**Blood pressure not controlled**	OR(95%CI) of Blood pressure <140/90mmHg	Chi-Square p-value.
Adherence ≥80% (*n*) (%)	116 (45.7)	138 (54.3)	1.71 (1.04-2.8)	0.033
Non-adherence [r] (*n*) (%)	31 (33)	63 (67)	1	

Source: Primary survey, 2009 Kolkata; OR: Odds Ratio; CI: Confidence Interval
*p<0.05; **p<0.01; [r]: Reference category;

5. Discussion and conclusion

5.1. DISCUSSION

Adherence to anti-hypertensive therapy was measured as adherence to more than eighty percent of prescribed medications during the past one week. Patient self-reports about the number of pills taken over a period of one week was used to estimate adherence as a percentage. At this cut off, prevalence of adherence was found to be 73% (95% CI 68-78%) prevailing in the urban slums in Kolkata with out any significant sex difference. This result is slightly lower than the prevalence reported by a study done in Pakistan (77%) with the similar cut off.[53] Another study from Egypt reported similar prevalence (74%) but with a higher cut off.[62] This finding proves that people living in the urban slums of a developing country like India are quite adherent to their prescribed medications contrary to what is generally assumed. Such high prevalence could be due to their greater awareness because of their urban location. The predictors of adherence were also studied as a part of this study.

Age of the patient was not significantly associated with adherence contrary to that seen elsewhere where older patients were more adherent to therapy.[53,56] Probably the elderly in the slums are more dependent upon their family to pay for their medications and their non adherence is mostly un-intentional in spite of their greater concern about their health. A study conducted in Iran, with a similar sex ratio (62% females), also could not find any association between gender and adherence as seen in this study.[63] Reviews of several articles were also inconclusive about the association between sex and adherence.[56] The results were the same with the highest level of education achieved.[56] In real life situations

demographic factors act in combination with patients cultural, socio-economic and psychological features to affect the adherence behavior and thus cannot be focused alone.

Patients who lived in families with upto four members reported nearly two times higher adherence (OR 2.01: CI 1.52-3.50) compared to those living in larger families. Probably smaller families had higher interpersonal communication with greater focus on individual health compared to larger families. During bivariate analysis patients living in nuclear families were found to have one and a half times higher adherence compared to those living in joint families but was not significant during regression analysis. Social support has been reported to reduce the negative attitude of the patients towards their treatment and motivates them to be adherent.[56] Thus, these social factors progressively influenced adherence among the slum dwellers.

Those with a family income of three thousand rupees and above were reported to be three times more likely to be adherent (OR 2.56: CI 1.47-4.45) compared to those with lower incomes. Family income in the slums forms the common pool to meet the expenses of the family and the individual members. Thus a higher family income increases the probability of meeting the expenses of the long term treatment of hypertension.[27,56] A personal income greater than twelve hundred rupees and dwelling in *pucca* houses, another marker for the socioeconomic status of the family, was also found to increase adherence by two times. Both these factors were significant during bivariate analysis but were not significant during regression analysis. Thus, inability to meet the expenses incurred during buying of medicines was probably the most important cause of non adherence in the urban slums which is consistent with the results of a study conducted in Nepal concluded that poor socioeconomic status with lack of money in particular was the most important risk factor for non-adherence to treatment.[64]

The number of pills was not significant but whether they were available free of cost was an important predictor for adherence. Those who did not have to pay out of their pocket, either from self income or family funds, for their pills were four times (OR 4.16: CI 1.36-12.69) more adherent to their prescribed medicines than those who had to purchase them. This is consistent with the findings of a recent study from northern India where about sixty percent of the hypertensive patients said that they would be more adherent if their drugs were supplied free of cost to them when only fifteen percent of the patients with uncontrolled blood pressure were found to be adherent.[65]

Patients who were hypertensive for a period of five years or more were three times more likely to be adherent [(Odds Ratio (OR) 2.98; 95% CI 1.73-5.14)] compared to those suffering from less than five years emphasizing the fact that longer duration of the disease helps the patient to accept the diseased state as well as adapt to the adherence behavior over time. This is consistent with various study findings.[56,66] Even the duration of antihypertensive therapy five years or longer was also found to be significantly associated with increased adherence in the bivariate analysis, similar to that found in Iran.[63] Longer time helped these patients grow up a habit of regularly consuming their pills.[56]

Those patients whose hypertension was detected during check ups for conditions related to hypertension were two times more likely (OR 2.35: CI 1.25-4.39) to be adherent compared to those detected during regular check ups or for check ups for other conditions. This was consistent with other study findings.[56] The method of initial detection was important because any patient who was detected during check up for hypertension related symptoms or conditions was more serious and concerned about the disease that motivated them to adhere to the prescribed medications in order to get cured.

Those who perceived their blood pressure to be currently under control were twice more adherent (OR 2.23: CI 1.17-4.26) compared to those who did not think so. This

perception was very much subjective and is a marker for positive attitude. Positive attitude was associated with better adherence. Several studies have shown that Patient's worries about the current treatment and belief that hypertension is uncontrollable reduces their adherence to therapy.[56]

Those who were satisfied with their current treatment were four times more adherent (OR 3.77: CI 1.32-10.76) than those unsatisfied. This is also a marker of positive attitude and faith on the health care provider. These patients are convinced about their treatment by their physician. Yet, temporality of such subjective behaviour is quite difficult to be established in such cross sectional design.

Some of the factors that were found to be significantly associated in the bivariate analysis need to be mentioned. The health care system related factors including easy availability of the prescribed medications locally and a good relation with the health care provider was also significantly associated with increased adherence. As reported so far, a good relation with the treating physician enhances communication and the patients feel free to express their problems.[56] This helps the health care provider to plan the treatment according to the patients' needs, which in turn helps to increase adherence. Easy availability of the prescribed medicines nearby in the locality enhanced these slum dwellers to refill their prescription without any difficulty. This is true as there are numerous pharmacy shops around these urban slums. Patients who consumed medications as per the directions of their doctors were three times more likely to be adherent compared to those who did not follow. Those patients who were advised regular physical activity and reduce daily salt consumption showed significant adherence to medication in spite of not following these non-pharmacological advices. Probably they felt the need to consume their medicines because they were not following these advices. These non-pharmacological advices have emphasized the severity of their illness and the dire need for medication into the minds of

these slum dwellers. Moreover the awareness regarding tobacco and alcohol consumption as risk factors for hypertension was also associated with greater adherence.

Good adherence was also found to be significantly associated with better blood pressure control. Those who were adherent were two times more likely to achieve a blood pressure of <140/90 mmHg measured on the date of interview. In spite of around seventy three percent adherence, adequate control of blood pressure was achieved among only forty two percent of the total patients. Youssef et al had reported a control of hypertension in just half of their study population.[62] Among those who were achieved control, only around seventy nine percent of them were adherent. This is consistent with the findings of an earlier study conducted by Joshi et al in central India.[34] At this point it can be questioned that whether consumption of eighty percent was enough to control the blood pressure of these patients. Or else poor control could be due to poor drug dose titration and lack of follow up for these patients living in these slums.

5.2. STRENGTHS AND WEAKNESSES OF THE STUDY

5.2.1 Weaknesses of the study

It is a cross sectional study and thus carries all the disadvantages of such a design. Temporal relation of several factors could not be established. People suffering from hypertension were not identified by a screening camp by the investigator but instead all the respondents were selected from a list of self reported hypertensives prepared by the municipal authorities of the ward. This could have left out the patients with hypertension non persistent with their prescribed drugs. This is probably the reason for skewed sex ratio in this study sample. Moreover there is a possibility of an over estimation of the

level of adherence in this study if the left out males are less likely to be adherent compared to those who were included in the study.

5.2.2 Strengths of the study

The study was a community based study while most the other studies conducted elsewhere are mostly clinic based. The study has been done based on short term recall period of seven days, there by reducing the recall bias. All patients were checked for either prescriptions or medicine strips to calculate adherence. Response rate was 92%, a modest response rate. The whole study including spot blood pressure measurements were done by a single investigator thereby eliminating inter-observer variability.

5.3. CONCLUSION

In this community based study on adherence to antihypertensive medication, seventy three percent patients living in the urban slums were found to be adherent. Patients who were hypertensive for a period of five years or more were three times more likely to be adherent compared to those patients who were hypertensive for less than five years. Those patients whose hypertension was detected during check ups for conditions related to hypertension were two times more likely to be adherent compared to those detected during regular check ups or during check ups for other conditions. Patients who lived in families with upto four members were twice as adherent compared to those who lived in families with more than four members. Those with a family income of three thousand rupees and above were nearly three times more likely to be adherent compared to those with a family income of less than three thousand rupees. Those who got their prescribed

medicines free were four times more adherent than those who purchased them out of pocket. Those who perceived their blood pressure to be currently under control were twice more adherent compared to those who did not think so. Those who were satisfied with their current treatment were four times more adherent than those unsatisfied. Those who were adherent to their prescribed medications were two times more likely to achieve adequate control of hypertension compared to those who were not adherent.

5.4. POLICY RECOMMENDATIONS

- The Health system should give priority to the low income families and provide free supply of all classes of antihypertensive medicines.
- Recently detected hypertensive patients should be closely monitored for adherence to their prescribed antihypertensive medications.
- Hypertensive patients living in larger families in slums should be monitored closely for adherence.
- Further studies may be conducted to find out the reasons for inadequate control of hypertension among those who were adherent.

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ANNEXURE: 01

INFORMED CONSENT

Achutha Menon Centre for Health Science Studies
Sree Chitra Tirunal Institute for Medical Sciences & Technology,
Thiruvananthapuram, Kerala-695011

Adherence to anti-hypertensive treatment and its determinants among the urban slum dwellers in Kolkata

Confidential:
Only for research purpose

MPH dissertation
June - September '2009

"Namaskar"- my name is Dr. Subhasis Bhandari and presently I am studying the course-Master of Public Health (MPH) at Sree Chitra Tirunal Institute for Medical Sciences & Technology, Thiruvananthapuram. As part of my dissertation, I am conducting this survey and interviewing the people suffering from hypertension, living in the urban slums, to assess their adherence to anti-hypertensive treatment and its determinants among them. I am also carrying out three spot blood pressure measurements of the respondents. The purpose of the study is to gather information that is going to help to make policies to improve adherence to anti-hypertensive management among the urban slum populations.

There will be no direct benefits to you for participating in this interview other than measuring your blood pressure and informing you about the current status of your blood pressure, providing you with some advice or referral to nearby health facility if required. You may chose to answer all or some of the questions that I put to you. Everything you will say will remain private and confidential. If you have any further queries, you are free to contact me at my mobile number given below and I will answer all your queries and if you still have any further queries you can address them to the Member secretary of the Institute Ethics Committee: Dr. Anoopkumar Thekkuveettil (email: anoop@sctimst.ac.in and telephone number: 0471-2520256) at Sree Chitra Tirunal Institute for Medical Sciences & Technology for any further clarification that you need.

The approximate time I will take is about 20-30 minutes. If you agree to participate in the interview please indicate your agreement. Your name will not be used in any report but your ideas and experiences will be of great help to make better strategies in order to improve adherence to therapy in the management of Hypertension, which will be good for the people in future. However you are free to quit the interview at any point of time if you feel so.

❑ Yes, the respondent has agreed to the interview

❑ No, the respondent did not agree to the interview

Signature/Left thumb impression ……

Or

❑ The respondent is not willing to sign or give thumb impression (verbal consent)

Signature of the witness…….

Name and address of the witness:……..

……

If you are not willing to participate, then thank you for your time.

Name of the respondent:……..

Address:……

……..

Identification code:_____ Date: __ /0__/2009

Local contact (mobile) no. of self:

ANNEXURE 02

INTERVIEW SCHEDULE

Achutha Menon Centre for Health Science Studies
Sree Chitra Tirunal Institute for Medical Sciences & Technology, Thiruvananthapuram, Kerala-695011

Confidential:
Only for research purpose

Adherence to anti-hypertensive treatment and its determinants among the urban slum dwellers in Kolkata

Identification code:	Serial No.:	Date: __ /0_/2009

00. Name: _____**X**_____

01. Age (in completed years): _____

02. Sex: 0 ❑ Female 1 ❑ Male

03. Marital Status: 1 ❑ Single 2 ❑ Married 3 ❑ Divorced 4. ❑ Widowed

04. Type of house: 1 ❑ Kuchha 2 ❑ Kuchha-pucca 3 ❑ Pucca

05. Type of family: 1 ❑ Nuclear 2 ❑ Joint 3 ❑ Others: (specify) _____

06. No. of household members: (specify) _____

07. Highest level of Education: _____
1 ❑ Illiterate 2 ❑ can sign only 3 ❑ Primary (upto class 4)
4 ❑ Secondary (upto class 10) 5 ❑ Higher Secondary (upto class 12)
6 ❑ Graduate 7 ❑ Postgraduate

08. Occupation (past one year): _____
1 ❑ Unemployed 2 ❑ Unskilled / Manual Laborers 3 ❑ Skilled / Semiskilled
4 ❑ Self employed 5 ❑ Homemaker 6 ❑ Retired / Pensioners

09. Average Monthly Income (During past one year):

Of the household	Rs.
Of self	Rs.

10.	Did you consume tobacco in the last one month	0 ❑ No 1 ❑ Yes
11.	Did you consume any alcoholic products in the last one month	0 ❑ No 1 ❑ Yes
12.	Did your doctor advise any physical activity	0 ❑ No 1 ❑ Yes
13.	If yes, are you currently following this advice	0 ❑ No 1 ❑ Yes
14.	Were you advised to restrict salt in the diet	0 ❑ No 1 ❑ Yes
15.	If yes, do you follow salt restriction now	0 ❑ No 1 ❑ Yes

16. Which of the following are risk factors for hypertension?

1.	Tobacco consumption	0 ❑ No 1 ❑ Yes
2.	alcohol consumption	0 ❑ No 1 ❑ Yes
3.	high salt intake	0 ❑ No 1 ❑ Yes
4.	physical inactivity	0 ❑ No 1 ❑ Yes
5.	Fruits and vegetable intake	0 ❑ No 1 ❑ Yes

17. Duration of hypertensive status: _____ years_____months

18. Method of detection of hypertensive status:

1 ❑ During regular checkup 2 ❑ During medical consultation for other cause

3 ❑ During medical consultation for hypertension related illness:

a ❑ Heart disease b ❑ Stroke c ❑ Symptoms

4 ❑ Others: (specify) _____

19. Family history of hypertension: 0 ❑ No 1 ❑ Yes

20. Presently do you have any other co-existing chronic illness(es): 0 ❑ No 1 ❑ Yes

Sl. no.	**Disease**	**Duration (years)**	**Continuing Treatment**
1.	Diabetes Mellitus		0 ❑ No 1 ❑ Yes
2.	Heart disease		0 ❑ No 1 ❑ Yes
3.	Kidney disease		0 ❑ No 1 ❑ Yes
4.	Disease of brain and nervous system		0 ❑ No 1 ❑ Yes
5.	Disorder of blood cholesterol		0 ❑ No 1 ❑ Yes
6.	Others (specify):		0 ❑ No 1 ❑ Yes

21.	Do you have any symptoms related to your hypertension like headache, dizziness or weakness	0 ❑ No	1 ❑ Yes
22.	If your answer to the above question (No. 23) is no, then do you think there is a need of medication for your hypertension at present	0 ❑ No	1 ❑ Yes
23.	Do you know that hypertension leads to serious complications like stroke, diseases of the heart, kidney and eye in future if not treated properly	0 ❑ No	1 ❑ Yes
24.	Do you think your blood pressure is under control now:	0 ❑ No	1 ❑ Yes

25. Spot blood pressure:

First Reading SBP:_____mm/Hg, DBP:_____mm/Hg

Second reading SBP:_____mm/Hg, DBP:_____mm/Hg

Third reading SBP:_____mm/Hg, DBP:_____mm/Hg

26. Are you currently on anti-hypertensive treatment: 0 ❑ No 1 ❑ Yes

27. Duration of antihypertensive therapy: _____ years_____months

28. How often do you get your blood pressure checked: 1 ❑ in less than two weeks

2 ❑ in 2-4 weeks 3 ❑ once in six months 4 ❑ more than six months

29. When did you last visit your Physician/clinic: (specify) _____

1 ❑ within last two weeks 2 ❑ within 2 weeks to 1 month 3 ❑ within 1-6 months

4 ❑ within 6 months to 1 year 5 ❑ more than one year 6 ❑ cannot say

30. Does anybody accompany you during your clinic visits in most of the time:

0 ❑ No 1 ❑ Yes

31. System of medicine availed for treatment of hypertension:

1 ❑ Allopathy 2 ❑ Homeopathy 3 ❑ Ayurvedic

4 ❑ others: (specify) _____

32. If your answer to the above question (No. 31) is not Allopathy, then why do you avail non-allopathic systems?

1 ❑ lower cost 2 ❑ light with fewer side-effects

3 ❑ easily available 4 ❑ good for chronic diseases

5 ❑ others: (specify) _____

33. Do you have any prescription now: 0 ❑ No 1 ❑ Yes

34. If your answer to the above question no. 33 is 'Yes' then date of prescription:_____

35. Descriptions of the prescribed antihypertensive drug(s):

Sl. No.	**Medication**	**System of Medicine**	**Drug Class**	**Dosage with timing**	**Duration**	**Any Side Effect**
1.						0 ❑ No 1 ❑ Yes
2.						0 ❑ No 1 ❑ Yes
3.						0 ❑ No 1 ❑ Yes
4.						0 ❑ No 1 ❑ Yes
5.						0 ❑ No 1 ❑ Yes

36. How frequently do you buy your anti-hypertensive medications per month: _____

37. Cost of anti-hypertensive therapy per month: Rs._____

38. Who pays for your medication: 1 ❑ Self 2 ❑ Family 3 ❑ Employer
4 ❑ Others: (specify) _____

39. Total number of doses prescribed per day: _____

Day 1		**Day2**		**Day 3**	
# pills prescribed	# pills taken	# pills prescribed	# pills taken	# pills prescribed	# pills taken
Day 4		**Day 5**		**Day 6**	
# pills prescribed	# pills taken	# pills prescribed	# pills taken	# pills prescribed	# pills taken
Day 7				**Total**	
# pills prescribed	# pills taken			# pills prescribed	# pills taken

40. What do you think about missing a single drug dose:

1 ❑ Does not make any difference 2 ❑ Makes a difference 3 ❑ Cannot say

41. What do you think about the benefits of your current medication:

1 ❑ Not beneficial 2 ❑ Beneficial 3 ❑ Cannot say

42. Are you satisfied with your current treatment: 0 ❑ No 1 ❑ Yes

43. What do you think about your treatment regimen: 1 ❑ Simple 2 ❑ Complex

44. What do you do so that you do not forget to take your medicines:

1 ❑ Keep your medications in sight 2 ❑ Family members help you

3 ❑ Others (specify): _____

45. How do you self administer these prescribed anti-hypertensive medicines/pills:

1 ❑ As recommended by the doctor 2 ❑ When there are symptoms

3 ❑ Cannot say

46. What is your opinion about your prolonged regimen: 1 ❑ Fear of getting dependent

2 ❑ No fear of getting dependent 3 ❑ Cannot say

47. How is your relation with your healthcare provider:

1 ❑ Not good 2 ❑ Average 3 ❑ Good

48. What do you say about the availability of these medications locally:

1 ❑ Not available 2 ❑ Available with difficulty 3 ❑ Easily available

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Thank you for your cooperation!