Frequency of causes of dropout among patients with hypertension-World Heart Journal; volume-4, number-4.ISSN:1556-4002

Article *in* World Heart Journal · January 2014

1 author:

Mohammad Moniruzzaman
Dhaka Medical College

World Heart Journal
Volume 4, Number 4

ISSN: 1556-4002

Frequency of Causes of Dropout among Patients with Hypertension

Ratindra Nath Mondal[*1], Ashraful Haque[2], Abul Kalam Azad[3], Shah Sarwer Jahan[2], Mahfuzer Rahman[5], Mohammad Moniruzzaman[2], Moni Rani[4], Amaresh Chandra Saha[5], Noor Islam[5], and Zakir Hossain[5]

[1] Assistant Professor of Medicine, Rangpur Community Medical College, Rangpur, Bangladesh
[2] Assistant Professors of Medicine, Rangpur Medical College, Rangpur, Bangladesh
[3] Rangpur Medical College & Hospital, Rangpur, Bangladesh
[4] Honarary Medical Officer of Medicine, Rangpur Medical College & Hospital, Rangpur, Bangladesh
[5] Professors of Medicine, Rangpur Medical College & Hospital, Rangpur, Bangladesh

Abstract

Background: Uncontrolled hypertension is one of the major determinants of cardiovascular mortality and morbidity. Non-adherence to regular follow up is one of the main causes of inadequate control of blood pressure in hypertensive patients.
Subjects and methods: A prospective study was conducted in the Hypertension and Research Centre, Rangpur; Bangladesh, among 1267 patients who were diagnosed with hypertension and receiving antihypertensive treatment after initial evaluation. All adult hypertensive patients of 18 years & above who registered from 1st March 2011 to 31st October 2011 were enrolled and followed up for at least 9 months after registration. Evaluation was by a physician and a dietitian administered questionnaire, a physical examination and using a sphygmomanometer. The diagnosis of pre-hypertension and hypertension were based on modified JNC-VII criteria.
Results: Of 1267 patients who were registered; 862 (68.03%) patients dropped out from follow up. Drop out was significantly more common among male patients (51.2%), rural dwellings (68.6%), only primary education (28.1%) and low economic status (<5000 taka) (37.2%). Those having no housewife, had more dropout rate (32.1%), Uncomplicated hypertensive patients dropped out more than the complicated hypertensive patients (69.41% vs. 61.39%). Major causes of dropout were ignorance of the patients (46.53%); patients' busy schedule (24.87%), change of physician (13.53%) and low economical state (4.39%).
Conclusion: This study showed that dropout and noncompliance to drug therapy has become a major problem among hypertensive patients. Ignorance, patients' busy schedule, lack of health awareness, illiteracy, and low educational status were the major causes of dropout. Improved awareness, motivation, better educational status of the patient, will reduce dropout from follow up.

Keywords: Dropout, hypertension, ignorance, education, awareness.

[*] **Correspondence:** Dr. Ratindra Nath Mondal, Assistant Professor of Medicine, Rangpur Community Medical College; Rangpur, Bangladesh. Email: dr.ratinmondal@gmail.com.

Introduction

Hypertension as a risk factor for stroke and CAD has been recognized in developed countries since 1950. It is now also considered important in the pathogenesis of cardiovascular disease (CVD) in developing countries [1-4]. While prevalence and mortality due to CVD is rapidly declining in most developed countries, it is in sharp contrast, rising in the developing countries. Hypertension is an important independent predictor of cardiovascular disease, cerebrovascular diseases and death [3,4] Sustained elevated blood pressure levels are related to a higher incidence of morbid events, are mainly associated with atherosclerosis, and may manifest itself as ischemic heart disease, cerebral stroke, and renal and peripheral vascular diseases [3,4] Hypertension has been reported to be responsible for 57% of all stroke deaths and 24% of all cardiovascular deaths in East Asians [3]. In India, there is a 4 to 5 fold increase in prevalence of hypertension. Prevalence of prehypertension and hypertension, respectively, was significantly greater in South India (Trivandrum:W (31.5%; 31.9%); M (35.1%; 35.5%): male=M; women=W.) and West India (Mumbai: W (30.0%; 29.1%); M (34.7%; 35.6%) compared to North India (Moradabad: W 24.6%; 24.5%; M 26.7%; 27.0%) and East India (Kolkata: W (20.9%; 22.4%; M 23.5%; 24.0%). [1]. Subjects with prehypertension and hypertension were older, had a higher BMI, central obesity and a sedentary lifestyle. They had a higher salt and alcohol intake, with greater oral contraceptive usage (W). Multivariable logistic regression analysis revealed strong positive associations of hypertension with age, central obesity, BMI, sedentary lifestyle, salt and alcohol intake and oral contraceptive usage (W). An earlier study carried out in 1999 showed prevalence of hypertension in Bangladesh was 11.3%, and the Nationwide 'NCD Risk Factor Survey, BSM 2010' later in Bangladesh showed that prevalence was 17.9% and at present 12 million Bangladeshis are suffering from hypertension [8,9]. Only 17.6% have control of their blood pressures.

Despite national and international guidelines and initiatives for management of hypertension, population based surveys and cohort studies have found that around two third of people with hypertension are either not taking drugs or are not adequately controlled [2, 5-7]. The World Health Organization has stated that low adherence to treatment is a key factor impeding good control and has called for research into adherence promoting interventions [10]. In various studies, clinical observations indicate the rate of poor adherence or non-adherence to treatment range from 30-50% [11]. Observational studies have shown that most patients with a diagnosis of hypertension have poor adherence to treatment, even though it was observed that, in the clinical practice, some patients do not even return for regular medical visits [10, 11]. There appear to be several causes for noncompliance of drug therapy among hypertensives; complicated drug regimens, the costs of drugs, older age, poor social support, cognitive problems, and depression [12]. Qualitative research on drug taking in a wide range of medical conditions reported that patients often actively decided not to take drugs (intentional non-adherence) rather than unintentionally omitting them [13]. Educational interventions aimed at promoting drug compliance in hypertension have been examined in randomised controlled trials, but most simply informed patients about the importance of adherence and were ineffective [14]. Noncompliance of hypertensive patients to drug therapy has been shown to be an important reason for ineffective blood pressure control, because a substantial proportion of patients drop out of treatment [10-15]. Some of these patients who abandon antihypertensive treatment turn up in the hospital emergency room with a serious complication of uncontrolled hypertensive disease [2-4]. Therefore a better understanding of patients' perspectives, through qualitative research, is critical to provide an explanation of the low rates of treatment, adherence, and blood pressure control. It is not clear why educational interventions have so far failed? Epidemiological studies indicate that it is failure of the clinicians to recognise how people understand disease causation and risk is one of the key obstacles to the success of public health programs [4,14-16].

In the present study, we have examined the frequency and public understandings about the causes of drop out in hypertension. We also studied how patients perspectives varied among different cultures and ethnic groups.

Patients and Methods

Study Design

This prospective study was conducted at Hypertension and Research Centre, Rangpur, Bangladesh, among 1267 patients, aged 18 years and above, who were diagnosed as hypertensive and prescribed an antihypertensive treatment after an initial evaluation. All hypertensive patients who visited the Hypertension and Research Center, between 1st March 2011 to 31st October 2011 were enrolled in this study and the follow up period was 9 months after registration. Primary endpoint was fulfillment of the criteria of dropout from follow up. Age, sex, level of education, occupation, smoking status, duration of hypertension at entry to study, co-morbidity, complications of hypertension and causes of dropout during the follow up were studied with a structured preformed questionnaire. The dropout patients were interviewed over the telephone to determine causes of dropout from follow up. After approval from the ethic committee, the study was explained to all the patients and written informed consent was taken in each subject.

Blood pressures (systolic and diastolic phase V Korotkoff) was measured by a physician while seated, using the right arm after a 5 minute rest period and using a standard mercury manometer. In each case, the same person measured the blood pressure of all the subjects. If high blood pressure (>140/90 mm Hg) was observed by any physician, a final reading was recorded in the lying position, after a 5 min rest period, as per World Health Organization guidelines.

Criteria

The criteria of diagnosis, management and follow up schedules were based on The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7). Following were the operational definitions. Systemic hypertension was defined as systolic blood pressure ≥140mmHg and/or diastolic blood pressure ≥ 90mmHg (or taking antihypertensive medications) in adults; 18 years of age or older.

Dropout from Follow Up

A patient was regarded as dropout from follow up when he/she had not returned to follow up after three months of the scheduled follow up visit. In uncontrolled hypertension, we have followed up the patient at 4 weekly intervals and in controlled hypertension at 6 monthly intervals. Noncompliance to treatment was considered, if a patient after drop out and discontinued medication for 30 days or more.

Data Collection

Data were collected from the study population through direct interview based on a questionnaire and secondary data were taken from their registration book and records.

Statistical Analysis

The relevant variables are processed, edited and analyzed by SPSS windows version 15.0. The socio demographic data of the study population were expressed as frequencies and their observed difference was tested by one sample ‘t’ test and ‘chi square’ test. P value <0.05 was considered as statistically significant with the 95% confidence interval. The results were presented in tables.

Results

During the study period, we have studied a total of 1267 patients (Table I shows the characteristics of the study people at baseline). 862 (68.03%) patients dropped out from follow up and 405 (31.97%) coming to regular follow up. Analysis of all the variables have shown that dropped out was mostly associated with male (sex), patients from rural areas, educational level below primary, and monthly income <5000 taka. Among the dropped out patients the maximum was housewives (32.1%), followed by service man (25.3%) and least was unemployed (0.8%) (Table 2). Uncomplicated hypertensive patients were dropped out more than the complicated hypertensive patients (69.41% vs. 61.39%) (P= 0.46744892).

Table 1. Characteristics of the study subjects at baseline

Characteristics	Total patients (n=1267)
Age of the patient	Number (%)
<40 years	283 (22.34%)
40-60 years	741 (58.49%)
>60 years	243 (19.17%)
Sex	
Male	650 (51.30%)
Female	617 (48.70%)
Level of education	
Illiterate	152 (12%)
<10 class	650 (51.30%)
>10 class	465 (36.70%)
Occupation	
Service	319 (25.17%)
Business	177 (13.97%)
Agriculture	165 (13.02%)
Retired	76 (5.99)
Unemployed	11 (0.86%)
Housewife	375 (29.59%)
Others	144 (11.36%)
Monthly income	
<5000	478 (37.72%)
5001-10000	389 (30.70%)
10001-15000	130 (10.26%)
>15000	270 (21.31%)
Residence	
Rural	867 (68.42%)
Urban	400 (31.58%)

Among the newly diagnosed hypertensive patients, dropout occurred in 66.67% (p = 0.00085586). Among hypertension patients with co-morbidity, drop out was observed in 17.6%.

Causes of dropout were detected by interview with the patient over telephone. In 31.4% of the dropout patients we failed to detect the causes of dropout, as their mobile phone was switched off on repeated calls. Major causes of dropout were ignorance of the patients (46.53%) and patient's busy schedule (24.87%) (Table 3). Among the dropout patients, dropout from treatment was found only in two patients. Ignorance was the cause in both the two cases.

Among the dropped out patients, maximum were housewives (32.1%), followed by service man (25.3%) and least were unemployed (0.8%) (Table 2). Uncomplicated hypertensive patients were dropped out more than the complicated hypertensive patients (69.41% vs. 61.39%) (P value 0.46744892). Among the newly diagnosed hypertensive patients, dropout occurred in 66.67% (p value 0.0008).

Table 2. Characteristics of the dropout patient (n=862)

Characteristics	Dropped out	P value
Age of the patient		
<40 years	192 (22.3%)	
40-60 years	508 (58.9%)	
>60 years	162 (18.8%)	
Sex		
Male	441 (51.2%)	P value 0.80968541
Female	421 (48.8%)	
Level of education		
Illiterate	103 (11.9%)	P value 0.00000547
<10 years	446 (51.75%)	
>10 years	312 (36.31%)	
Occupation		
Service	218 (25.3%)	
Business	120 (13.9%)	
Agriculture	110 (12.8%)	
Retired	53 (6.1%)	
Unemployed	7 (0.8%)	
Housewife	277 (32.1%)	
Others=7	77 (8.9%)	
Smoking status		
Current smoker	133 (15.4%)	
Ex-smoker	9 (1%)	P value 000
Not smoker	720 (83.5 %%)	
Monthly income		
<5000	321 (37.2%)	
5001-10000	266 (30.9%)	P value 0.00103765
10001-15000	91 (10.6%)	
>15000	184 (21.3%)	
Residence		
Rural	591 (68.6%)	P value 0.00019927
Urban	271 (31.4%)	

Table 3. Causes of dropout (n=591)

Ignorance	275 (46.53%)	P value= 0000
Poor motivation	13 (2.19%)	
Economical	26 (4.39%)	
Patient's busy schedule	147(24.87%)	
Lack of faith to the physician/change physician	80 (13.53%)	
Long distance from centre	18 (3.04%)	
Migration	27(4.56%)	
Others	5 (0.84%)	

Discussion

The majority of the complications of hypertension occur due to target organ damage which are clinical outcomes resulting from persistent elevation of blood pressure [17-20]. Hypertension is an independent predisposing factor for heart failure, coronary artery disease, stroke, renal disease, and peripheral arterial disease [17-20]. The causal role of high blood pressure in the pathogenesis of cardiovascular disease is confirmed by the results of clinical trials documenting reductions in risk for stroke, heart failure and myocardial infarction in hypertensive patients whose blood pressure is lowered [17-20]. Meta-analyses of clinical trials have indicated reductions in risk for stroke by more than 40% and heart failure by about 50% [10-18]. In our study dropout from follow up was 68.03%, which seems to be high compared with other studies [10-18]. Among the dropped out patients the maximum were housewives (32.1%), followed by service man (25.3%) and least was unemployed (0.8%) (Table 2). Uncomplicated hypertensive patients were dropped out more than the complicated hypertensive patients (69.41% vs. 61.39%) (P value= 0.46). Among the newly diagnosed hypertensive patients, dropout occurred in 66.67% (p value =0.0008).

We have only few studies from south Asia to compare our results [1,8,9,15]. The Five City Study in India reported that awareness of hypertension was significantly lower at Moradabad, north India (n-220,11%), and Nagpur, central India (n=125,14%), compared to Kolkatta, east India (n=199, 22.1%) where it was comparable with Mumbai, west India (n=385,24.9%) and Trivandrum, south India (n=416,25.9%) [1].Only half of the subjects who were aware of their hypertension, were taking drug therapy. The number of pharmacologically treated patients was 84 at Moradabad, 62 at Nagpur, 101 at Kolkatta, 194 at Mumbai and 228 at Trivandrum. The total number of subjects receiving drug therapy was 669 and only one in three of these patients had controlled systolic and diastolic blood pressure below 140/90 mm of Hg [1]. NCD Risk factors Survey 2010 in Bangladesh have shown that only 17.6% of subjects had control of hypertension [9]. Bhandari et al conducted a cross-sectional study to determine the prevalence and predictors of adherence to modern antihypertensive pharmacotherapy among slum dwellers in Kolkata, India [15]. Prevalence of adherence based on patient self-reports of consuming ≥80% of the prescribed medications over a recall period of 1 week was found to be 73% (95% confidence interval = 68%-78%). The following subjects were more likely to be adherent to treatment compared with others: patients hypertensive for ≥5 years (2.98 times), those whose hypertension was detected during checkups for conditions related to hypertension (2.35 times), those living with ≤4 family members (2.01 times), those with family income of ≥3000 rupees (2.56 times), those who were getting free drugs (4.16 times), patients perceiving current blood pressure to be under control (2.23 times), and those satisfied with current treatment (3.77). The subjects adherent to their prescribed medications were 1.71 fold more likely to achieve adequate control of blood pressures compared with those who were not adherent.

Marshall et al conducted a meta-analysis including studies from 16 countries (United States, United Kingdom, Brazil, Sweden, Canada, New Zealand, Denmark, Finland, Ghana, Iran, Israel, Netherlands, South Korea, Spain, Tanzania, and Thailand) [16]. A large subset of subjects widely intentionally reduced or stopped treatment without consulting their doctor. Majority of these subjects commonly perceived that their blood pressure improved when symptoms abated or when they were not stressed, and that treatment was not needed at these times. Most participants disliked treatment and its side effects and feared addiction and these observations were consistent across countries and ethnic groups. Many subjects also reported various external factors that prevented adherence, including being unable to find time to take the drugs or to see the doctor; having insufficient money to pay for treatment; the cost of appointments and healthy food; a lack of health insurance; and forget fullness. Non-compliance to drug therapy often resulted from patients' understanding of the causes and effects of hypertension. Such patients particularly relied on the presence of stress or symptoms to determine if blood pressure was raised. Across ethnic and geographical groups; these beliefs were remarkably similar which calls for culturally specific education for individual ethnic groups. It seems that clinicians and educational interventions must better understand and engage with

patients ideas about causality, experiences of symptoms, and concerns about drug side effects to improve drug compliance. A continuous adherence of the patient to the recommended measures is paramount for obtaining an adequate control of blood pressure [10-18].

In an earlier study conducted in Brazil [21], 56% patients dropped out from follow up. However, the definition of dropout from follow up was 'no-show to follow-up in a period from 12 to 24 months after the initial evaluation. This definition of dropout is much weaker than the definition of dropout we have used in our study. The total duration to declare dropout in our study was minimum 4 months for uncontrolled hypertension and maximum 9 months for controlled hypertension. In an another study [23], 50% of the patient dropped out from follow up at 11 months, 74% patient dropped out at 5 years and only 17% patient were coming to regular follow up. In our study, dropout from follow up was associated with the male sex (51.2%), patients from rural area (68.6%), educational level below primary (28.1%) and monthly income <5000 taka (37.2%) which is similar with findings in other study (21). Current smoking (65.5%) was more commonly associated with dropout from follow up in the other study, but in our study current smoking was found only on 15.5% of subjects [21]. Uncomplicated hypertensive patients were associated with dropout from follow up in 72.2%, complicated hypertensive in 7.2% and patient of hypertension with co-morbidity in 17.6% only. However, dropouts were significantly more in newly diagnosed hypertensive patient (66.67%) which is consistent with the observation in another study [21]. In our study, duration of hypertension of dropout and non-dropout group was almost similar (43.42 months vs. 44.19 months). Although the dropout from follow up, rate was high, dropout from treatment, rate is very low (2 patients). Ignorance of the patient was the main patient reported cause of dropout from the follow up, followed by patient's busy schedule. This implies, that asymptomatic patients of this silent killer disease do not allow them to come for regular follow up. Proper motivation of patients by health education, about the long term complications of hypertension, may improve patient's adherence to regular follow up [18, 23, 24-24, 25, 26].

Adherence may be defined as consuming ≥80% of doses of the prescribed medication regimen correctly [24]. WHO has defined adherence to long-term therapy as "the extent to which a person's behavior—taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider [24]. Adherence to pharmacotherapy for hypertension varies from around 43% to 88% worldwide depending on the population under study, the duration of follow up, the method of assessment of adherence. A higher family income, which forms the common pool to meet the expenses of the family as well as the individual members, increases the probability of meeting the expenses of the long-term treatment of hypertension.

Therapeutic non-adherence occurs when an individual's health-seeking or maintenance behavior lacks agreement or harmony with the recommendations prescribed by a health care provider [25].

Our results are much lower, than prevalence reported by a hospital-based study done in Karachi, Pakistan (77%), with a similar cutoff for adherence [26]. Bhandari et al reported that despite around 73% adherence, adequate control of blood pressure was achieved among only 42.2% of the patients [15]. This finding is consistent with the findings from Thailand, where adequate blood pressure control was achieved in 42.3% of rural people receiving antihypertensive treatment [27]. Another recent study from Thailand reported still lower rates of treatment and control of hypertension [28].

Dr. Paolo Palatini (University of Padova, Italy) presented the New results from the Hypertension and Ambulatory Recording Venetia Study (HARVEST) here at the 2013 International Conference on Prehypertension and Cardiometabolic Syndrome. Barcelona, Spain. The analysis may have implications for hypertension guidelines that typically recommend a delay to treatment in the range of several months for patients diagnosed with grade 1 hypertension. The data detail the characteristics of young adults (mean age 33) diagnosed with grade 1 hypertension whose blood pressure fell to within normal range within the first few months of the study and who then managed to remain normotensive over 15 years of follow-up. HARVEST was originally designed to examine characteristics of subjects diagnosed with grade 1

hypertension (140-159/90-99 mm Hg) who went on to develop established white-coat, masked, or sustained hypertension over a six-year period. In the data he presented today, Palatini zeroed in on the 198 subjects whose BP fell to normal (<140/90) in the initial months of HARVEST, as compared with 822 patients who developed hypertension. In this subset, he noted, both systolic and diastolic BP fell sharply between study outset and three months (from grade 1 hypertension to normotensive) and continued to decline over the next decade and a half. Statistically significant baseline differences included a slightly lower body-mass index (BMI), lower coffee consumption, lower triglycerides, and higher physical-activity levels among patients who remained normotensive.

In brief, ignorance, patients' busy schedule, lack of health awareness, illiteracy, and low educational status were found to be the major causes of dropout and noncompliance to drug therapy during the follow up among hypertensive patients. It is possible that improvement in awareness, proper motivation, and improvement of educational status of the patient will reduce dropout from follow up.

Conflict of interest: There was no conflict of interest.

Contributions by the authors: Dr. Ratindra Nath Mondal planned and supervised the study. Dr. Shah Sarwer Jahan, Dr. Mahfuzer Rahman, Dr. Moni Rani helped to collect the data, Dr. Ashraful Haque, Dr. Abul Kalam Azad analysed the data, Professor Dr. Amaresh Chandra Saha and Professor Dr. Zakir Hossain helped in writing of the manuscript and presentation of the data.

Acknowledgment

The authors of this study are grateful to Professor M. A. Jalil Chowdhury, all the staff of Hypertension and Research Centre, Rangpur for their kind co-operation and to Dr. DW Wilson and Dr. RB Singh for editorial corrections.

References

[1] Singh RB, Fedacko J, Pella D, Macejova Z, Ghosh S, de Amit K, Begom R et al, Prevalence and risk factors for prehypertension and hypertension in five Indian cities; *Acta Cardiol*. 2011 Feb;66(1):29-37.

[2] Indian Consensus Group. Indian consensus for prevention of hypertension and coronary artery disease. A scientific statement of the Indian Society of Hypertension and International College of Nutrition. *J Nutr Envirn Med* 1996;6:309-318.

[3] Singh RB, Suh IL, Singh VP, Chaithiraphan S, Laothavorn P, Sy RG, Babilonia NA, Rahman AR, Shaikh S, Tomlinson B, Sarraf-Zadigan N. Hypertension and stroke in Asia. Prevalence, control and strategies in developing countries. *J human Hyper* 2000;14:749-763.

[4] World Health Organization (WHO). *The world health report 2002—reducing risks, promoting healthy life.* 2011. www.who.int/whr/2002/en/.

[5] Falaschetti E, Chaudhury M, Mindell J, Poulter N. Continued improvement in hypertension management in England: results from the Health Survey for England 2006. *Hypertension* 2009;53:480-6.

[6] Antikainen RL, Kastarinen MJ, Jousilahti P, Peltonen M, Laatikainen T, Beckett N, et al. Despite evidence-based guidelines, systolic blood pressure remains inadequately controlled in older hypertensive adults. *J Hum Hypertens* 2010;24:439-46.

[7] Hart PD, Bakris GL. Hypertension control rates: time for translation of guidelines into clinical practice. *Am J Med*2004;117:62-4.

[8] MM Zaman and MA Rouf. Adherance to treatment in hypertension. *Journal of Human Hypertension* (1999) 13, 547–549.

[9] NCD risk factor survey 2010 report published and disseminated, published on 7th August 2011http://www.ban.searo.who.int/EN/Section31_295.htm.

[10] World Health Organization. Adherence to long-term therapies: evidence for action. 2010. www.who.int/chp/knowledge/publications/adherence_report/en/index.html.

[11] Schroeder K, Fahey T, Ebrahim S. How can we improve adherence to blood pressure-lowering medication in ambulatory care?: systematic review of randomized controlled trials. *Arch Intern Med* 2004;164:722-32. CrossRefMedlineWeb of Science.

[12] Horne R, Weinman J, Barber N, Elliott R, Morgan M. Concordance, adherence and compliance in medicine taking: a conceptual map and research priorities. National Co-ordinating Centre for NHS Service Delivery and Organisation NCCSDO; 2005. www.medslearning.leeds.ac.uk/pages/documents/useful_docs/76-final-report%5B1%5D.pdf.

[13] Pound P, Britten N, Morgan M, Yardley L, Pope C, Daker-White G, et al. Resisting medicines: a synthesis of qualitative studies of medicine taking. *Soc Sci Med* 2005;61:133-55.Cross Ref Medline Web of Science.

[14] Glynn L, Fahey T. Cardiovascular medication: improving adherence. Clin Evid (Online)2011;ii:0220.

[15] Bhandari S, P. Sarma S and Thankappan KR, Adherence to antihypertensive treatment and its determinants among urban slum. *Asia Pac J Public Health* published online 14 November 2011 DOI: 10.1177/1010539511423568.

[16] Marshall LJ, Wolfe CDA, McKevitt C. Lay perspectives on hypertension and drug adherence: systematic review of qualitative research. *BMJ* 2012;345:e3953, doi: http://dx.doi.org/10.1136/bmj.e3953 (Published 9 July 2012)

[17] Heart Disease and Stroke Statistics 2013 Update. A report from the American Heart Association. *Circulation* 2013;127:e6-e245.

[18] The "Heart Disease and Stroke Statistics--2013 Update" and the Need for a National Cardiovascular Surveillance *System Circulation*. 2013;127:21-23.

[19] Rodgers A, Lawes C, MacMahon S. Reducing the global burden of blood pressure related cardiovascular disease. *J Hypertens* 2000; 18 (Suppl 1):S3-6.

[20] Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J. Global burden of hypertension: analysis of worldwide data. *Lancet* 2005; 365: 217-23.

[21] .Fuchs FD, Lubianca JF, Moraes RS, et al. Blood pressure effects of antihypertensive drugs and lifestyle modification in a Brazilian hypertensive cohort. *J Hypertension* 1997; 15: 783-92.

[22] Riegel G, Moreira LB, Fuchs SC, et al. Long-term effectiveness of non-drug recommendations to treat hypertension in a clinical setting. *Am J Hypertens* 2012; 11:1202-1208.

[23] Tao S, Wu X, Duan X, et al. Hypertension prevalence and status of awareness, treatment and control in China. *Chin Med J* 1995; 108: 483-9.

[24] Sabate E. Adherence to long-term therapies: evidence for action. http://www. who.int/chp/knowledge/ publications/adherence_full_report.pdf. Accessed January 27, 2009.

[25] Heisler M, Hogan MM, Hofer TP, Schmittdiel JA, Pladevall M, Kerr EA. When more is not better: treatment intensification among hypertensive patients with poor medication adherence. *Circulation.* 2008;117:2884-2892.

[26] Hashmi SK, Afridi MB, Abbas K, et al. Factors associated with adherence to anti-hypertensive treatment in Pakistan. *PLoS One*. 2007;2:1-8.

[27] Howteerakul N, Suwannapong N, Sittilerd R, Rawdaree P. Health risk behaviours, awareness, treatment and control of hypertension among rural community people in Thailand. *Asia Pac J Public Health*. 2006;18:3-9.

[28] Aekplakorn W. Prevalence, treatment, and control of metabolic risk factors by BMI Status in Thaiadults: National Health Examination Survey III. *Asia Pac J Public Health.* 2011;23:298-306.

[29] White WB. "Defining the problem of treating the patient with hypertension and arthritis pain". The American Journal of Medicine 122 (5 Suppl): S3–9. doi:10.1016/j.amjmed.2009.03.002. *PMID* 19393824. Retrieved 2009-06-22.

[30] Gaddam KK, Verma A, Thompson M, Amin R, Ventura H. "Hypertension and cardiac failure in its various forms". The Medical Clinics of North America 2009; 93 (3): 665–80. doi:10.1016/j.mcna.2009.02.005. PMID 19427498. Retrieved 2009-06-20.

[31] Reisin E, Jack AV. "Obesity and hypertension: mechanisms, cardio-renal consequences, and therapeutic approaches". The Medical Clinics of North America 2009; 93:733–51. doi:10.1016/j.mcna.2009.02.010. PMID 19427502. Retrieved 2009-06-20.

[32] Agabiti-Rosei E. "From macro- to microcirculation: benefits in hypertension and diabetes". *Journal of Hypertension* 20098; 26 Suppl 3: S15–21. doi:10.1097/01.hjh.0000334602.71005.52. PMID 18815511. Retrieved 2009-06-20.

[33] Murphy BP, Stanton T, Dunn FG. *"Hypertension and myocardial ischemia"*. The Medical Clinics of North America 2009; 93 (3): 681–95. doi:10.1016/j.mcna.2009.02.003. PMID 19427499. Retrieved 2009-06-20.

[34] Tylicki L, Rutkowski B. "[Hypertensive nephropathy: pathogenesis, diagnosis and treatment]" (in Polish). Polski Merkuriusz Lekarski: Organ Polskiego Towarzystwa Lekarskiego 2003; 14 (80): 168–73. PMID 12728683.

[35] Truong LD, Shen SS, Park MH, Krishnan B. "Diagnosing nonneoplastic lesions in nephrectomy specimens". *Archives of Pathology & Laboratory Medicine 2009*; 133 (2): 189–200. doi:10.1043/1543-2165-133.2.189. PMID 19195963. Retrieved 2009-06-20.

[36] Aronow WS. "Hypertension and the older diabetic". *Clinics in Geriatric Medicine* 2008; 24 (3): 489–501, vi–vii. doi:10.1016/j.cger.2008.03.001. PMID 18672184. Retrieved 2009-06-20.