Original Paper

Prevalence and Predictors of Poor Antihypertensive Medication Adherence in an Urban Health Clinic Setting

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Poor medication adherence may contribute to low hypertension control rates. In 2005, 295 hypertensive patients who reported taking antihypertensive medication were administered a telephone questionnaire including an 8-item scale assessing medication adherence. Overall, 35.6%, 36.0%, and 28.4% of patients were determined to have good, medium, and poor medication adherence, respectively. After multivariable adjustment, adults younger than 50 years and 51 to 60 years were 1.39 (95% confidence interval [CI], 0.56–3.42) and 1.53 (95% CI, 0.64–3.66), respectively, times more likely to be less adherent when compared with their counterparts who were older than 60 years. Black adults and men were 4.30 (95% CI, 1.06–17.5) and 2.45 (95% CI, 1.04–5.78) times more likely to be less adherent, respectively. Additionally, caring for dependents, an initial diagnosis of hypertension within 10 years, being uncomfortable about asking the doctor questions, and wanting to spend more time with the doctor if possible were associated with poor medication adherence. The current study identified a set of risk factors for poor antihypertensive medication adherence in the urban setting. (J Clin Hypertens. 2007;9:179–186) ©2007 Le Jacq

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Hypertension control to systolic blood pressure (BP) less than 140 mm Hg and diastolic BP less than 90 mm Hg approximates 37% among US adults.[1] This percentage remains well below the goal of 50% set by *Healthy People 2010*.[2] Even among treated patients, hypertension control rates remain suboptimal at about 54% to 59%.[1] Approximately 65 million US adults and approximately 1 billion adults worldwide are hypertensive, and the public health impact of uncontrolled BP is substantial.[3,4] A major contributor to poor BP control may be patient nonadherence to prescribed antihypertensive medication therapy.[5] Moreover, poor medication adherence is associated with increased health care costs and disease and hospitalization rates in the United States.[6,7]

Although data are sparse, adherence to antihypertensive medications has been reported to be poor.[8] A meta-analysis of 6 studies of 814 subjects reported that the odds ratio of good BP control among patients adherent to antihypertensive medications, compared with those who were nonadherent, was 3.44 (95% confidence interval, 1.60–7.37).[9] Identifying populations with poor adherence to medication is important if we are to increase hypertension control rates. The goal of the current study was to determine the prevalence and factors associated with poor antihypertensive medication adherence in an urban clinic setting.

METHODS

Study Population

Study participants were identified using the rosters of 4 internists' practices at the Medical Center of Louisiana in New Orleans' adult medicine clinic. These 4 practices, chosen from 8 faculty practices at the clinic, were the projected source population for a subsequent randomized controlled trial of hypertension treatment in urban populations. The population served largely comprises uninsured or underinsured adult patients from the greater New Orleans metropolitan area. In September 2004, medical records were used to identify all patients 18 years and older with established hypertension for a telephone survey. Established hypertension was defined as 2 outpatient diagnoses of hypertension (*International Classification of Diseases, Ninth Revision* (*ICD-9*) code 401.x) during the preceding 12 months recorded in the clinic's administrative database. Of the 1017 eligible patients identified, a total of 696 were not surveyed because they: (1) could not be reached due to inactive or incorrect telephone numbers in the database (n=122); (2) denied a diagnosis of hypertension (n=7); (3) could not be reached despite a working phone number (n=519); or (4) were not called due to the early termination of recruitment because of Hurricane Katrina (n=48). Patients who could not be reached but had telephone numbers in working order (n=519) were called 3 times at varying times of the day and evening in an attempt to reach them. Error in data input led to 1 survey without documented data. Of persons eventually contacted, 24 (7.5%) refused participation in the study. Additionally, 1 participant who reported not being prescribed antihypertensive medication was excluded. Including this participant as having "poor medication adherence" did not materially alter the results (data not shown). After these exclusions, data from 295 participants were available for analysis.

Survey Instrument

Data collection was conducted by telephone between October 2004 and August 2005. After obtaining verbal informed consent, patients were administered the survey by a single trained interviewer using a standardized script and survey instrument. The standardized script used in the current study had a 7th-grade US reading level. Survey software (Key Survey, Braintree, MA) enabled automated data entry by the interviewer onto a Web page at the time of the interview.

The survey instrument included domains assessing sociodemographics, medical history, BP knowledge, experiences with health care, and antihypertensive medication adherence. Sociodemographic information included age, sex, race, monthly income, educational level, and habitation status. The survey instrument included a self-reported history of heart attack, stroke, time since first hypertension diagnosis, family history of hypertension, and history of traditional coronary heart disease risk factors including hypertension, diabetes, elevated cholesterol, and cigarette smoking. Hypertension knowledge was ascertained using a 10-item modified version of a previously validated instrument.[10] This scale includes items requiring the identification of high, low, or normal BPs; specifying activities that may cause BP to go down, go up, or stay the same; and correctly recognizing sequelae of high BP. Health care experiences included questions focused on participants' perception of accessibility to their doctor and their relationship with their physician.

Adherence to antihypertensive medication was measured using the 8-item Morisky Medication Adherence Scale.[11] This scale includes 7 items with yes/no response options and 1 item with a 5-point Likert scale response option. The items in the scale provide information regarding barriers to medication adherence such as forgetting to take medications, not taking medications when one feels worse, and difficulties in sticking to a treatment plan. The scores for the 8 items were summed to create an overall adherence score with a possible range of 0 to 8; higher scores indicated better adherence. Based on this overall score, patients were classified as having poor, medium, or good adherence (Morisky score <6, 6–7.9, and 8, respectively).

Statistical Methods

Data entry occurred at the time of the interview into a back-end application of the Web-based software. Data were stored in an ASCII (American Standard Code for Information Interchange) file and imported into SAS 9.1 statistical software (SAS Institute, Inc, Cary, NC) for analysis.

Characteristics of survey participants were analyzed. As a measure of internal reliability and correlation of scale items, Cronbach's α was computed to specify the ability of the 8-item Morisky Medication Adherence Scale to measure a single unidimensional latent construct. Higher Cronbach's α scores indicate better internal consistency of the scale. Age-standardized percentages of participants with poor, medium, and good antihypertensive medication adherence were calculated overall and stratified by demographic

Table I. Percentage of the Study Population and Age-Standardized Percentages of Participants With Good, Medium, and Poor Antihypertensive Medication Adherence in an Urban Clinic Setting, by Demographics and Comorbidities

		Level of Medication Adherence, %*			
	% of Population (N=295)	Good (n=105)	Medium (n=106)	Poor (n=84)	*P*†
Age group, y					
≤50	32.2	29.5	32.6	37.9	
51–60	30.5	35.6	33.3	31.1	
>60	37.3	40.9	40.9	18.2	.005
Race					
Black	88.8	36.1	33.3	30.6	
Nonblack	11.2	33.1	58.5	8.4	.29
Sex					
Men	20.7	31.6	35.8	32.6	
Women	79.3	36.8	35.9	27.3	.35
Education					
<High school	38.6	34.7	35.5	29.8	
≥High school	61.4	35.7	37.6	26.7	.67
Income per month, $					
<500	22.4	28.4	39.2	32.4	
500–1000	52.5	35.4	37.4	27.2	
>1000	25.1	43.0	31.2	25.9	.10
Dependents					
Yes	42.7	27.4	37.6	35.0	
No	57.3	43.4	34.9	21.7	.001
Diabetes					
Yes	34.9	37.2	33.5	29.3	
No	65.1	34.4	37.8	27.8	.84
Heart attack and stroke					
Yes	14.6	46.1	34.5	19.5	
No	85.4	33.9	36.3	29.8	.10
Family history of hypertension					
Yes	92.2	34.3	37.7	28.0	
No	7.8	50.9	15.1	34.0	.53
Cigarette smoking					
Current	18.6	34.3	28.1	37.6	
Former	34.6	37.2	41.3	21.6	.13
Never	46.8	35.0	35.7	29.3	.41
Blood pressure knowledge					
Low	30.3	37.5	32.2	30.8	
Medium	39.1	35.5	25.4	26.7	
High	37.6	36.0	26.4	27.6	.25

*Percentages of medication adherence levels sum to 100% for each category of participant characteristics. †The reported *P* values were age-adjusted for all comparisons.

and socioeconomic characteristics, disease history, BP knowledge, and health care and hypertension experiences of the study participants. Percentages were age-standardized to the overall survey population. Comparisons of medication adherence level across characteristics (eg, men vs women) were made using least squares after adjustment for age. Multinomial logistic regression, with good adherence as the reference category, was used to identify factors associated with medium and poor medication adherence in a multivariate-adjusted model that included age; race; sex; education; income; dependent-care status; history of diabetes, heart attack, and stroke; family history of hypertension;

Table II. Percentage of the Study Population and Age-Standardized Percentages of Participants With Good, Medium, and Poor Antihypertensive Medication Adherence in an Urban Clinic Setting by Hypertension Duration and Opinion of Health Care

		Level of Medication Adherence, %*			
	% of Population (N=295)	Good (n=105)	Medium (n=106)	Poor (n=84)	*P*†
First diagnosed with hypertension, y					
≤5	52.5	36.9	34.6	28.5	
5–10	18.3	24.2	36.5	39.4	.07
≥10	29.2	46.9	34.0	19.1	.15
Comfortable asking doctor questions					
Always	73.6	38.8	36.7	24.5	
Sometimes/never	26.4	26.1	35.0	38.9	.009
Can see primary doctor when needed					
Yes	71.9	38.5	37.0	24.6	
No	28.1	28.9	33.8	37.3	.02
Easy to reach primary doctor when needed					
Yes	69.5	37.4	36.2	26.5	
No	30.5	32.3	35.2	32.6	.23
Can spend time needed with primary doctor					
Yes	88.5	36.0	37.1	26.9	
No	11.5	34.4	27.0	38.6	.25
Would spend more time with primary doctor if possible					
Yes	63.1	35.4	29.3	35.3	
No	36.9	35.7	47.5	16.8	.05

*Percentages of medication adherence level sum to 100% for each category of participant characteristics. †The reported *P* values were age-adjusted for all comparisons.

smoking status; BP knowledge; time since the participant was first diagnosed with hypertension; comfort asking the doctor questions; ability to see the doctor when needed; ease in reaching primary doctor when needed and spending enough time with the doctor; and desire to spend more time with the doctor.

Study approval was obtained from the Institutional Human Subjects Committees at Tulane University Health Sciences Center and Louisiana State University Health Sciences Center.

RESULTS

The mean age of the study population was 55.8 years. Survey respondents were predominantly black women (Table I). Many patients had graduated from high school, had an income less than $1000 per month, and cared for dependents. A total of 14.6% had a history of myocardial infarction or stroke, and almost all participants had a family history of hypertension. A total of 18.6% of participants were current smokers. Over half of participants were first diagnosed with hypertension within the past 5 years (Table II). While many participants sometimes or never felt comfortable asking their doctors questions, most reported they could see their doctor, reach their doctor, and spend time with their doctor, when needed. Despite this access, many participants reported that they would spend more time with their primary doctor if possible.

The Morisky Medication Adherence Scale demonstrated good internal consistency, with a Cronbach's α of .7. The age-standardized percentage of survey respondents with good, medium, and poor antihypertensive medication adherence was 35.6%, 36.0%, and 28.4%, respectively (Figure). Poor medication adherence was observed more commonly at a younger age, for participants with dependents, among those only sometimes or never comfortable asking their doctor questions, for participants unable to see a primary doctor when needed, and

Table III. Multivariable-Adjusted Multinomial Logistic Regression of Medium and Poor Antihypertensive Medication Adherence Compared With Good Medication Adherence in an Urban Health Clinic Setting

	Level of Medication Adherence			
Variables	Good*	Medium	Poor	*P*
Demographic				
Age, ≤50 y vs >60 y	1.00	1.02 (0.47–2.24)	1.39 (0.56–3.42)	
Age, 51–60 y vs >60 y	1.00	0.88 (0.42–1.85)	1.53 (0.64–3.66)	.81
Black vs nonblack	1.00	0.61 (0.25–1.48)	4.30 (1.06–17.5)	.01
Men vs women	1.00	1.60 (0.74–3.48)	2.45 (1.04–5.78)	.12
Less than vs high school education	1.00	0.91 (0.47–1.73)	0.86 (0.41–1.82)	.92
Income, $/mo				
<500 vs >1000	1.00	2.36 (0.94–5.91)	2.48 (0.91–6.74)	
500–1000 vs >1000	1.00	1.63 (0.79–3.37)	1.24 (0.54–2.83)	.27
Cares for dependents	1.00	2.06 (1.10–3.85)	3.78 (1.86–7.64)	.001
Disease history				
Diabetes	1.00	0.74 (0.39–1.40)	0.72 (0.35–1.49)	.57
Heart attack/stroke	1.00	0.66 (0.29–1.49)	0.32 (0.11–0.92)	.10
Family history of hypertension	1.00	4.70 (1.28–17.2)	1.07 (0.34–3.39)	.05
Smoking				
Current vs never	1.00	0.68 (0.28–1.67)	1.30 (0.53–3.22)	
Former vs never	1.00	1.10 (0.56–2.16)	0.64 (0.28–1.45)	.20
Blood pressure knowledge				
Low vs high	1.00	1.54 (0.75–3.17)	1.17 (0.51–2.67)	
Medium vs high	1.00	0.83 (0.39–1.75)	0.73 (0.31–1.71)	.57
First diagnosed with hypertension				
≤5 vs ≥10 y previously	1.00	0.90 (0.46–1.77)	2.09 (0.90–4.86)	
5–10 vs ≥10 y previously	1.00	1.59 (0.64–3.94)	5.11 (1.78–14.7)	.04
Access to health care				
Sometimes/never vs always comfortable asking doctor questions	1.00	1.64 (0.81–3.33)	2.88 (1.33–6.21)	.03
Can see primary doctor when needed	1.00	0.84 (0.36–1.99)	0.31 (0.12–0.82)	.04
Easy to reach primary doctor when needed	1.00	0.86 (0.37–1.98)	1.25 (0.48–3.31)	.73
Can spend time needed with primary doctor	1.00	1.20 (0.40–3.59)	1.16 (0.38–3.54)	.94
Would spend more time with doctor if possible	1.00	0.55 (0.29–1.03)	2.20 (1.01–4.78)	.002

*Reference category.

among those who would spend more time with their primary doctor (Table I and Table II).

After multivariate adjustment, poor antihypertensive medication adherence was more common among black adults, men, participants caring for dependents, those first diagnosed with hypertension less than 10 years ago, those sometimes or never comfortable asking their doctor questions, and participants who would spend more time with their doctors if possible (Table III). In addition, people with a history of heart attack or stroke and those who could see their primary doctor when needed were more likely to adhere to antihypertensive medication.

DISCUSSION

More than one quarter of participants in the current study were determined or classified as poor compliers with antihypertensive medication. Several sociodemographic and health care characteristics were found to be significantly associated with poor medication adherence after multivariate adjustment. Specifically, black patients, men, patients caring for dependents, and patients initially diagnosed with hypertension in the past 10 years were all more likely to have poor medication adherence in the urban setting. In contrast, patients with a history of a cardiovascular event were less likely to have poor medication adherence, and this may indicate better awareness and understanding of the importance of taking medication. In addition, patients reporting better access to health care, satisfaction with their care, and good patient-doctor relationships were significantly less likely than their counterparts to omit taking medications.

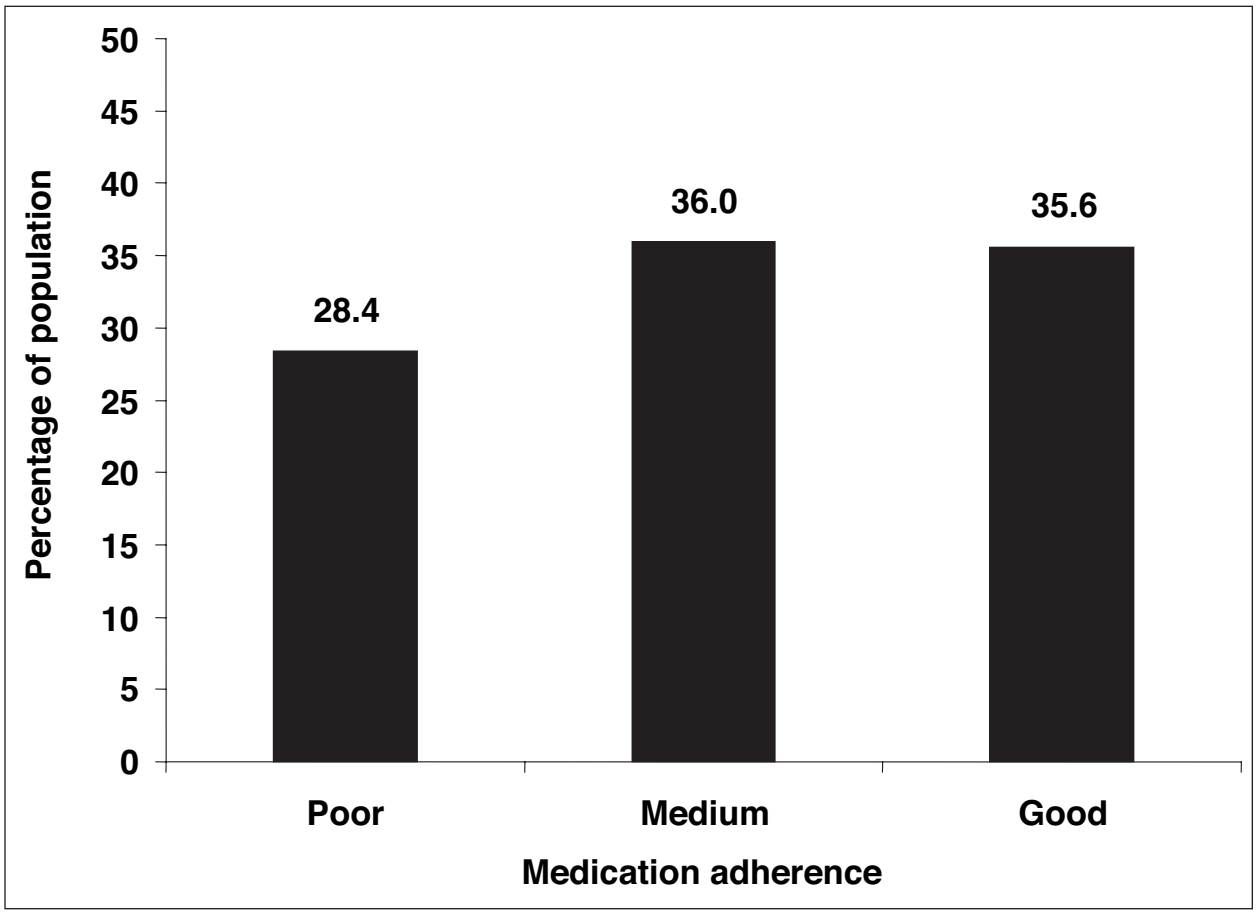

Figure. Age-standardized percentages of antihypertensive medication adherence level for adults in an urban clinic setting. Medication adherence was measured using the 8-item Morisky Medication Adherence 8-point scale, with poor, medium, and good adherence defined by a score of less than 6, 6 to 7.9, and 8, respectively.

Only a few studies have reported rates of medication adherence in the outpatient setting. In a study including a suburban elderly clinic population of hypertensive patients, medication adherence was assessed using the Hill-Bone Compliance to High Blood Pressure Therapy Scale.[12] In this survey, 59% of respondents reported perfect antihypertensive medication adherence. After multivariate adjustment, poor medication adherence was observed in younger adults, nonwhites, women, unmarried patients, and individuals with less than a high school education. In the current study, the age-adjusted prevalence of perfect adherence was much lower (ie, achievement of a Morisky Medication Adherence Scale score of 8 was 36.0%), but similar associations were detected. In a published report of a hypertension control clinical trial in urban hypertensive black men, higher levels of depression were correlated with poor medication compliance.[13] In contrast, a cross-sectional survey of hypertensive patients from a large health maintenance organization and a Veteran's Affairs medical center failed to find a significant association between medication adherence and health beliefs and behaviors, social supports, and satisfaction with care.[14] The current study extends these findings by studying the relationship between health care opinions and experiences with rates of medication adherence.

Consistent with the study performed in patients recruited from a health maintenance organization and the Veteran's Affairs medical center, we found no significant association between hypertension knowledge and medication adherence, although learning about hypertension may be helpful in improving outcome.[14] Nonetheless, patients first diagnosed with hypertension 10 or more years ago and those with a history of a heart attack or stroke were more likely to adhere to medication, indicating an understanding of the importance of medication-taking behaviors and their effects on long-term health. This suggests that personal experience with hypertension and cardiovascular disease, rather than basic knowledge, may lead to improved adherence behaviors.

A consistent relationship between various measures of access to health care and health status factors with medication adherence was present in the current study. In this urban clinic population, patients reporting an inability to see their primary doctor when needed, a desire to spend more time with their doctor, and not always feeling comfortable asking their doctor questions were observed to have higher rates of poor medication adherence. These findings highlight possible health care deficiencies in the urban setting and their impact on health outcomes.

The strongest predictor of poor medication adherence in the current study was caring for dependents. Dependent care has been characterized as actions taken and decisions made for the purpose of helping another person, not onesself.[15] The additional responsibilities of caring for another person may affect the extent to which self-care is maintained. Dependent care was discussed by authors of a study examining access to care for individuals with the human immunodeficiency virus and acquired immune deficiency syndrome as a possible competing demand on the time of caregivers.[16] The relationship between caring for others and poor health outcomes deserves more attention, as caregivers are an easily defined population that could be targeted during routine medical visits for counseling on balancing responsibilities and self-care.

Several studies have examined factors influencing medication adherence as well as interventions designed to improve adherence. Although more than 50 separate strategies to improve adherence with the ultimate goal of improving rates of BP control have been investigated, no single intervention has emerged as superior to others.[17–22] Patient and provider education interventions, behavioral strategies, simplification of dosing regimens, and multifaceted approaches have all been evaluated for their effectiveness to improve adherence in antihypertensive patients. As underscored in the current analysis, medication adherence is influenced by multiple factors. Therefore, a patient-centered, tailored approach has been recommended to increase rates of adherence.[18,19,23] These tailored methods may address patient-specific barriers to adherence, and it appears that in an urban setting with patients in lower socioeconomic circumstances, such a unique set of factors may include access to health care and dependent-care issues.

Multiple tools are available to measure antihypertensive medication adherence. These include self-reporting of medication-taking behaviors through validated surveys, electronic adherence monitoring devices, pharmacy refill rates, and pill counts.[24] In the current study, data were limited to the self-reported use of antihypertensive medications in a group of patients who responded to a telephone survey. Given their ease of use and low cost, validated self-report measures may be the ideal measure to identify barriers to adequate compliance and assess medication-taking behavior in hypertensive patients. The 8-item Morisky Medication Adherence Scale[11] and the 9-item medication compliance subscale of the Hill-Bone Compliance to High Blood Pressure Therapy Scale[12,25] provide relatively simple and inexpensive methods to assess adherence and exhibit high reliability and validity.

The strengths and weaknesses of the current study should be considered in the interpretation of the results. First, although the participation rate was high among those patients reached in the current study, there were a substantial number of individuals selected for inclusion who were not reached. Therefore, the sample included in the analysis may not be representative of an urban clinic population. Also, we surveyed internal medicine patients receiving care at a single urban clinic site serving primarily uninsured/underinsured black women, which certainly limits the generalizability of these results to other patient populations. Second, our measures were self-reported and response bias may be present. To address the risk of bias, a single trained interviewer who strictly followed a standardized script was used to strengthen the validity and reliability of the data. Major strengths of the current study include the use of a relatively large sample size of patients, a validated measure to assess medication adherence, and the inclusion of many factors that have not been fully evaluated in their relationship to medication adherence. As a result, several sociodemographic, access to health care, and health status factors were identified that may help to guide targeted efforts to improve medication adherence in the urban setting.

CONCLUSIONS

Poor antihypertensive medication adherence is common in the urban clinic population. A set of factors that influence medication adherence in the urban setting including sex, race, length of time since initial hypertension diagnosis, access to health care, caring for dependents, and comfort in asking questions of doctors were observed in the current study. Additional studies to further elucidate these factors and determine effective interventions to improve adherence are warranted.

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