Hypertension Management: The Care Gap Between Clinical Guidelines and Clinical Practice

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Objective: To evaluate how well hypertension is managed in HMO patients and to assess opportunities for improvement.

Study Design: Retrospective cohort study.

Patients and Methods: The study population included HMO members (age 45-84 years) who had at least 1 ambulatory encounter with an ICD-9-CM diagnosis code of essential hypertension during the first 6 months of 1999. Medical records were reviewed to obtain information on blood pressure measurements, sex, age, coexisting medical conditions, smoking status, and changes made to the antihypertensive drug regimen.

Results: We identified 681 members with 3347 encounters related to hypertension management during 1999. Overall, 74 (11%) patients were at target blood pressure for all visits and 260 (38%) were at target blood pressure for at least 50% of the visits; 222 (33%) patients were not at target blood pressure for any visit. A history of coronary artery disease or cerebrovascular disease was associated with better blood pressure control (defined as being at goal levels during at least 50% of visits), while being older (age ≥75) or having diabetes mellitus was associated with poorer control. Medication regimen intensifications occurred in 10% of visits with systolic blood pressure levels of 140-149 mm Hg, compared with 45% of visits with levels of ≥180 mm Hg. Medication regimen intensifications occurred in 21% of visits with diastolic blood pressure levels of 90-99 mm Hg and 43% of visits with levels of ≥100 mm Hg.

Conclusion: Efforts are required to reduce "therapeutic inertia," particularly in patients with modestly elevated systolic blood pressure levels.

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Hypertension is among the most common outpatient diagnoses in the United States.[1] The accumulated evidence establishing the benefits of treating hypertension far exceeds that which exists for the treatment of most medical conditions managed in the ambulatory setting. Although primary care physicians may be aware of the existence of treatment guidelines for hypertension,[2] these physicians' blood pressure thresholds for the diagnosis and treatment of hypertension reportedly are often substantially higher than recommended.[3] Data from the most recent National Health and Nutrition Examination Survey (NHANES 1999-2000) indicate that hypertension prevalence is increasing in the United States, and hypertension control rates are unacceptably low.[4] In 1999-2000, 28.7% of NHANES participants had hypertension, a 3.7% increase compared with 1988-1991.[4]

Control of high blood pressure has been included as a Health Plan Employer Data and Information Set (HEDIS®) measure by the National Committee for Quality Assurance as part of its program to compare the performances of managed health care plans.[5] Alexander and colleagues previously demonstrated that it is feasible to assess blood pressure control as a quality measure through review of medical records in an HMO population.[6] In the present study, we evaluated the quality of hypertension management in patients followed in a managed care setting in order to assess the opportunities that exist for improvement.

METHODS

Study Population and Design

A retrospective study was conducted among patients enrolled in a mixed-model, not-for-profit HMO operating in New England. The study population included a random sample of 770 HMO members who were 45-84 years old as of January 1, 1999; had continuous plan enrollment in 1999; and had at least 1 ambulatory encounter with a diagnosis of essential hypertension (*International Classification of Diseases, Ninth Revision, Clinical Modification* [ICD-9-CM] code 401.xx) during the first 6 months of 1999 documented in the HMO administrative databases. The age characteristics for study subjects related to the HEDIS® 2000 measure "Controlling High Blood Pressure." Medical records of these members were reviewed by trained nurse abstractors for all ambulatory

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visits to any healthcare provider that were related to the management of hypertension from January 1, 1998, through December 31, 1999. Information was obtained on blood pressure measurements, demographic characteristics (sex and age), coexisting medical conditions (diabetes mellitus, coronary artery disease, cerebrovascular disease, peripheral arterial disease, and hypercholesterolemia), smoking status, and changes made to the antihypertensive drug regimen because of the patient's blood pressure level.

For the purpose of this study, diabetes mellitus was defined by use of a hypoglycemic agent, a documented plasma glucose level of >200 mg/dL, or a glycosylated hemoglobin level of >6%. Coronary artery disease was considered to be present based on a diagnosis documented in the medical record or a history of myocardial infarction, angina, coronary artery bypass graft surgery, percutaneous transluminal coronary angioplasty, or prescription of nitrate therapy. Cerebrovascular disease was determined based on a diagnosis in the medical record, or documentation of a history of stroke or transient ischemic attack. Peripheral arterial disease was considered present based on a diagnosis in the medical record. Hyperlipidemia was defined by use of a lipid-lowering agent or a total cholesterol level of ≥240 mg/dL.

The study population was further restricted to include members who had at least 1 ambulatory encounter associated with the prescription of an antihypertensive medication or a blood pressure measurement above a specified target level documented in the medical chart in both 1998 and 1999. Target blood pressure control levels were defined as a systolic blood pressure of <140 mm Hg and a diastolic blood pressure of <90 mm Hg for nondiabetic patients, and a systolic blood pressure of <130 mm Hg and a diastolic blood pressure of <85 mm Hg for diabetic patients, consistent with guidelines in effect at the time of the study.[7]

When multiple blood pressure readings were documented for the same visit, the blood pressure reading with the lowest systolic blood pressure level during the visit was used in our analyses, regardless of the level of the diastolic blood pressure. For each visit, an intensification of the antihypertensive regimen was considered to have occurred if the dose of an antihypertensive medication had been increased, or a new agent was prescribed.

Statistical Analysis

The numbers and proportions of patients with blood pressure control for at least 50% of visits during calendar year 1999 were determined—both overall and by patient demographic characteristics (sex and age), coexisting medical conditions (diabetes mellitus, coronary artery disease, cerebrovascular disease, peripheral arterial disease, and hypercholesterolemia), smoking status, history of blood pressure control (percentage of visits in the previous year with blood pressure at target level), and history of antihypertensive medication intensification (percentage of visits in the previous year with a medication intensification). Based on the distribution of the data, the percentages of visits in the previous year with blood pressure at target level were categorized as 0%, 1%-25%, 26%-50%, 51%-75%, and >75%; the percentages of visits in the previous year with medication intensification were categorized as 0%, 1%-20%, and >20%. Statistical significance of differences was tested by using the Pearson chi-square statistic and the Mantel-Haenszel test for linear association. Logistic regression was used to estimate the strength of the association between selected patient characteristics and blood pressure at target level for at least 50% of the visits. Stepwise logistic regression was used to identify the multivariate predictors of blood pressure at target level, with the criterion for entry into the models being a probability value of <.05.

Using data from all visits for which the patient's blood pressure was not at target level during calendar year 1999, random effects logistic regression[8] was used to evaluate the associations between patient characteristics and intensification of the antihypertensive regimen. Models were constructed that included variables for patient sex, age (<55 years, 55-64 years, 65-74 years, and ≥75 years of age), coexisting medical conditions (diabetes mellitus, coronary artery disease, cerebrovascular disease, peripheral arterial disease, and hypercholesterolemia), smoking status (current, past or nonsmoker), history of blood pressure control (control at previous visit and the percentage of visits in the previous year with blood pressure at target level), history of antihypertensive medication intensification (intensification at previous visit and the percentage of visits in the previous year with a medication intensification), the number of days since the last ambulatory visit related to management of high blood pressure, systolic blood pressure level (<130, 130-139, 140-149, 150-159, and ≥160 mm Hg), and diastolic blood pressure level (<80, 80-84, 85-89, 90-99, and ≥100 mm Hg).

RESULTS

Medical records were located for 758 (98%) of the 770 patients selected for study. Of these, 10 patients had no documentation of hypertension or use of antihypertensive agents in the medical chart during 1998 and 1999, and an additional 67 patients did not have an ambulatory visit potentially related to hypertension in both calendar years. Thus, 681 members, with 3347 encounters

related to the management of hypertension during the calendar year 1999, met the criteria for inclusion in the study. The mean number of visits per member was 4.9 (range 1 to 24) during 1999, and 4.6 (range 1 to 24) during 1998. Among eligible patients, 637 (94%) had more than 1 visit and 519 (76%) had more than 2 visits in 1999, and 606 (89%) had more than 1 visit and 485 (71%) had more than 2 visits in 1998. The mean age of the study population was 66 years and 55% (n = 373) were female.

Overall, 74 (11%) patients were at target blood pressure for all visits and 260 (38%) were at target blood pressure for at least 50% of visits during 1999; 222 (33%) patients were not at target blood pressure for any visit during 1999. The relationship between patient characteristics and having been at target blood pressure for at least 50% of visits during 1999 is shown in **Table 1.** As detailed in **Table 2,** older patients were less likely to be at target blood pressure (adjusted odds ratio [OR] = 0.49, 95% confidence interval [CI] = 0.29, 0.84 among those age 75 years or older compared with those less than 55 years of age), as were patients with a diagnosis of diabetes mellitus (adjusted OR = 0.32, 95% CI = 0.18, 0.56). Patients with a diagnosis of coronary artery disease and those with a diagnosis of cerebrovascular disease were more likely to be at target blood pressure for at least 50% of visits, as were patients with a prior history of blood pressure control. Patient sex, a diagnosis of hypercholesterolemia, peripheral arterial disease, smoking status, and prior medication change history were not significantly associated with blood pressure control.

Table 1. Associations Between Patient Characteristics and Blood Pressure at Target Level at ≥50% of Visits in 1999

Characteristic*	No. of Patients (%) at Target Blood Pressure Level at ≥50% of Visits	Unadjusted Odds Ratio (95% Confidence Interval)
Sex		
Male (n = 308)	124 (40)	1.17 (0.86, 1.60)
Female (n = 373)	136 (36)	1.0 (reference)
Age, y†		
<55 (n = 142)	65 (46)	1.0 (reference)
55-64 (n = 161)	66 (41)	0.82 (0.52, 1.30)
65-74 (n = 203)	76 (37)	0.71 (0.46, 1.10)
≥75 (n = 175)	53 (30)	0.52 (0.32, 0.82)
Diabetes mellitus‡		
Yes (n = 128)	18 (14)	0.21 (.012, 0.36)
No (n = 553)	242 (44)	1.0 (reference)
Hypercholesterolemia		
Yes (n = 360)	147 (41)	1.27 (0.93, 1.73)
No (n = 321)	113 (35)	1.0 (reference)
Coronary artery disease		
Yes (n = 161)	71 (44)	1.38 (0.97, 1.98)
No (n = 520)	189 (36)	1.0 (reference)
Cerebrovascular disease		
Yes (n = 44)	22 (50)	1.68 (0.91, 3.09)
No (n = 637)	238 (37)	1.0 (reference)
Peripheral arterial disease		
Yes (n = 30)	12 (40)	1.08 (0.51, 2.29)
No (n = 651)	248 (38)	1.0 (reference)
Smoking status		
Current (n = 66)	28 (42)	1.22 (0.73, 2.04)
Nonsmoker/past smoker (n = 615)	232 (38)	1.0 (reference)
Percentage of visits with blood pressure control in previous year[*,‡]		
0 (n = 250)	48 (19)	1.0 (reference)
1-25 (n = 87)	19 (22)	1.18 (0.65, 2.14)
26-50 (n = 160)	76 (48)	3.81 (2.45, 5.92)
51-75 (n = 52)	33 (63)	7.31 (3.83, 13.95)
>75 (n = 108)	74 (69)	9.16 (5.48, 15.31)
Percentage of visits with a medication intensification in previous year[*,†]		
0 (n = 475)	196 (41)	1.0 (reference)
1-20 (n = 65)	20 (31)	0.63 (0.36, 1.11)
>20 (n = 117)	34 (29)	0.58 (0.38, 0.90)

*Baseline characteristics at initial visit during 1999; 24 patients had no visits in the 365 days prior to the initial visit in 1999.
†$P < .05$ for differences between the groups.
‡$P < .001$ for differences between the groups.

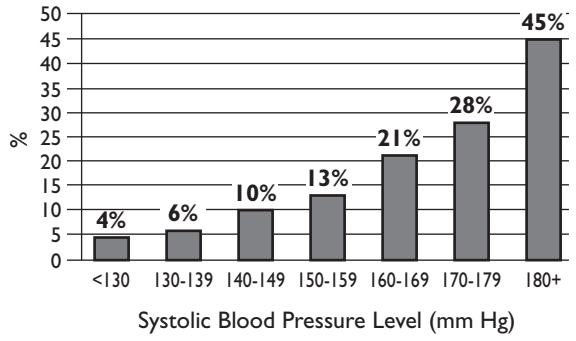
For 388 of the 3347 encounters (12%) during 1999, the patient had the antihypertensive therapeutic regimen intensified (dose increase or switch to a new agent).

Table 2. Associations Between Patient Characteristics and Blood Pressure at Target Level at ≥50% of Visits

Characteristic	Adjusted Odds Ratio (95% Confidence Interval)*
Age, y	
<55 (n = 142)	1.0 (reference)
55-64 (n = 161)	0.95 (0.56, 1.60)
65-74 (n = 203)	0.92 (0.55, 1.51)
>75 (n = 175)	0.49 (0.29, 0.84)
Diabetes mellitus	
Yes (n = 128)	0.32 (.018, 0.56)
No (n = 553)	1.0 (reference)
Coronary artery disease	
Yes (n = 161)	1.62 (1.05, 2.50)
No (n = 520)	1.0 (reference)
Cerebrovascular disease	
Yes (n = 44)	2.17 (1.03, 4.56)
No (n = 637)	1.0 (reference)
Percentage of visits with blood pressure control in previous year*	
0 (n = 250)	1.0 (reference)
1-25 (n = 87)	1.08 (0.58, 2.00)
26-50 (n = 160)	3.43 (2.16, 5.43)
51-75 (n = 52)	6.14 (3.15, 11.96)
>75 (n = 108)	7.53 (4.41, 12.85)

*Adjusted relative risk estimates and 95% confidence intervals are from multivariate logistic regression model. Estimates are from full model; the remaining factors, including sex, peripheral arterial disease, hypercholesterolemia, smoking status, history of antihypertensive medication intensification (intensification at previous visit and the percentage of visits in the previous year with a medication intensification), do not enter the model after adjustment for these covariates.

Figure 1. Percentage of Visits With Medication Intensification According to Systolic Blood Pressure Level

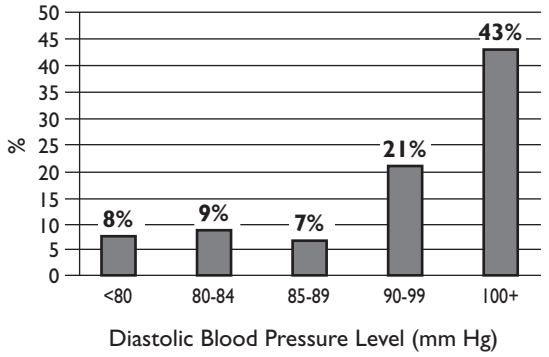


Medication intensification was more likely to occur in the context of visits where the patient's blood pressure was not under control. For 47 of the 1181 visits (4%) where the patient's blood pressure was at target level, the patient had a medication intensification. For 341 of the 2166 visits (16%) where the patient's blood pressure was not at target level, the patient had a medication increase. Healthcare providers were more responsive to substantially elevated systolic and diastolic blood pressure levels than they were to modestly elevated levels. Intensifications in the medication regimen occurred at 10% of visits with systolic blood pressure levels of 140 to <150 mm Hg compared with 45% of visits with levels of 180 mm Hg or more (**Figure 1**). Intensifications in the medication regimen occurred at 21% of visits with diastolic blood pressure levels of 90 to 99 mm Hg and 43% of visits with levels of 100 mm Hg or more (**Figure 2**).

Random effects logistic regression was used to examine the associations between patient characteristics and antihypertensive therapy intensification, with data from 2166 visits where the patient's blood pressure was not at target level (**Table 3**). The level of systolic blood pressure and the level of diastolic blood pressure were both highly predictive of antihypertensive therapy intensification. The unadjusted ORs associated with medication intensification were 11.51 (95% CI = 6.08, 21.81) among patients who had a systolic blood pressure of ≥180 compared with those who had a systolic blood pressure of <140 mm Hg, and 24.82 (95% CI = 7.00, 88.05) among patients who had a diastolic blood pressure of ≥110 mm Hg compared with those who had a diastolic blood pressure of <80 mm Hg. Men were more likely than women to have an intensification of antihypertensive therapy, as were those patients with a prior history of medication change. Patient age and coexisting medical conditions were not significantly associated with a medication increase. There was a statistically significant interaction between gender and high diastolic blood pressure, and between gender and medication intensification at the previous visit.

In full models estimated separately for men and women (**Table 4**), the levels of systolic blood pressure and diastolic blood pressure remained highly predictive of medication intensification. For men, the adjusted ORs associated with a medication intensification were 7.33 (95% CI = 2.92,18.40) among patients who had a systolic blood pressure of ≥180 mm Hg compared with those who had a systolic blood pressure of <140 mm Hg, and 15.10 (95% CI = 2.25, 101.53) among patients who had a diastolic blood pressure of ≥110 mm Hg compared with those who had a diastolic blood pressure of <80 mm Hg. For women, the adjusted ORs associated with a medication intensification were 14.68 (95% CI = 5.03, 42.86)

Figure 2. Percentage of Visits With Medication Intensification According to Diastolic Blood Pressure Level



among patients who had a systolic blood pressure of ≥180 mm Hg compared with those who had a systolic blood pressure of <140 mm Hg, and 7.27 (95% CI = 1.44, 36.67) among patients who had a diastolic blood pressure of ≥110 mm Hg compared with those who had a diastolic blood pressure of <80 mm Hg. In both men and women, patients for whom more than 20% of visits resulted in a medication intensification in the previous year were more likely to have had a medication intensification at the present visit. Blood pressure control at the prior visit was only significantly related to present visit medication intensification in women.

DISCUSSION

The findings of our study serve to reinforce previous reports in the literature indicating that blood pressure control rates are suboptimal.[2,6,9,10] In the present study, deficiencies in the quality of hypertension management were observed despite the fact that patients were assessed frequently, with an average of almost 5 visits per year. According to a recently published report on over 400 indicators of healthcare quality, recommended care was not delivered to about a third of patients with hypertension.[11] While confirming deficiencies in the quality of hypertension management in the United States, that report also brought attention to the very large number of areas that the primary care physician must address in providing care to patients in the ambulatory setting. According to data from the National Ambulatory Medical Care Survey, the length of an average office visit to a primary care physician is about 15 minutes. Although more than 70% of office visits to primary care physicians include blood pressure measurements,[12] hypertension management competes against an increasing array of preventive care priorities and other acute and chronic medical issues.

Table 3. Associations Between Patient Characteristics and Antihypertensive Therapy Intensification for Visits at Which Patient Was Not at Target Blood Pressure

Characteristic	Unadjusted Odds Ratio (95% Confidence Interval)*
Systolic blood pressure, mm Hg	
<140	1.0 (reference)
140-149	1.00 (0.59, 1.68)
150-159	1.51 (0.88, 2.59)
160-169	2.88 (1.65, 5.02)
170-179	4.09 (2.21, 7.58)
≥180	11.51 (6.08, 21.81)
Diastolic blood pressure, mm Hg	
<80	1.0 (reference)
80-84	0.92 (0.63, 1.36)
85-89	0.81 (0.46, 1.42)
90-99	2.37 (1.63, 3.46)
100-109	6.46 (3.70, 11.28)
≥110	24.82 (7.00, 88.05)
Male sex	1.75 (1.30, 2.36)
Age, y	
<55	1.0 (reference)
55-64	0.86 (0.54, 1.37)
65-74	0.70 (0.45, 1.09)
≥75	0.93 (0.60, 1.43)
Coexisting medical conditions	
Diabetes mellitus	1.00 (0.70, 1.43)
Hypercholesterolemia	0.94 (0.69, 1.27)
Coronary artery disease	1.00 (0.71, 1.41)
Cerebrovascular disease	1.19 (0.65, 2.22)
Peripheral arterial disease	0.62 (0.31, 1.24)
Smoking status	
Current smoker	1.01 (0.61, 1.69)
Blood pressure at target level at previous visit	0.56 (0.40, 0.78)
Medication intensification at previous visit	1.85 (1.29, 2.66)
Percentage of visits with a medication intensification in previous year	
0	1.0 (reference)
1-20	1.25 (0.85, 1.82)
>20	2.19 (1.61, 2.98)
Time period since last visit	
≤1 wk	1.0 (reference)
>1 wk to 2 wk	1.27 (0.76, 2.12)
>2 wk to 1 mo	1.23 (0.76, 1.98)
>1 mo to 3 mo	1.09 (0.70, 1.72)
>3 mo to 6 mo	0.81 (0.49, 1.34)
>6 mo	1.10 (0.64, 1.89)

*Unadjusted relative risk estimates and 95% confidence intervals are from random effects logistic regression model.

Table 4. Associations Between Blood Pressure Level and Antihypertensive Therapy Intensification for Visits at Which Patient Was Not at Target Blood Pressure (n = 2166)

Characteristic	Adjusted Odds Ratio (95% Confidence Interval)*	
	Females	Males
Systolic blood pressure, mm Hg		
<140	1.0 (reference)	1.0 (reference)
140-149	2.42 (0.89, 6.54)	1.02 (0.53, 1.98)
150-159	2.48 (0.90, 6.86)	1.60 (0.82, 3.12)
160-169	5.38 (1.97, 14.72)	2.35 (1.13, 4.89)
170-179	4.98 (1.73, 14.35)	3.97 (1.70, 9.28)
≥180	14.68 (5.03, 42.86)	7.33 (2.92, 18.40)
Diastolic blood pressure, mm Hg		
<80	1.0 (reference)	1.0 (reference)
80-84	0.72 (0.43, 1.20)	1.10 (0.62, 1.96)
85-89	0.69 (0.34, 1.40)	0.61 (0.25, 1.52)
90-99	1.32 (0.81, 2.15)	3.02 (1.72, 5.32)
100-109	2.56 (1.14, 5.75)	4.17 (1.90, 9.19)
≥110	7.27 (1.44, 36.67)	15.10 (2.25, 101.53)

*Adjusted relative risk estimates and 95% confidence intervals are from random effects logistic regression models. Estimates are from full models. For females, the model included variables for the percentage of visits with medication intensification in the previous year, blood pressure at target level at the previous visit, and medication intensification at the prior visit. For males, the model included variables for the percentage of visits with medication intensification in the previous year.

Oliveria and colleagues have examined barriers to primary care physicians' willingness to increase the intensity of treatment among patients with uncontrolled hypertension.[2] In that study, the most frequently cited reason for not addressing uncontrolled hypertension related to satisfaction with the current blood pressure level, even if it was above the threshold level for treatment. On average, physicians reported that 150 mm Hg was the lowest systolic blood pressure at which they would recommend pharmacologic therapy to a patient without comorbidities. In the present study, intensifications in the antihypertensive regimen were significantly more likely to occur only when the systolic blood pressure level reached 160 mm Hg or greater. We also found that patients who had prior medication increases were more likely to have an intensification in therapy. Prior efforts to modify the medication regimen may reduce any subsequent reluctance to making additional changes.

One limitation of our study is the use of medical records. Incomplete documentation of drug-prescribing decisions may have led to an underestimation of medication intensifications. In addition, incomplete documentation of diagnoses or laboratory test results may have led to underascertainment of comorbidities. Information on the reasons for the lack of response by providers to elevated blood pressure levels, as well as provider characteristics, also was not available.

Our findings serve to emphasize the opportunities that exist to improve the care of patients with hypertension in the ambulatory setting. The development of successful strategies to improve the quality of hypertension management hinges on an enhanced understanding of the process of how physicians make decisions about initiating and modifying pharmacologic treatment.[13,14] Special efforts are clearly required to reduce therapeutic inertia,[15] particularly in regard to modestly elevated systolic blood pressure levels, as the benefits of blood pressure reduction can be substantial.[16]

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