Evaluating Hypertension Control in a Managed Care Setting

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Background: We conducted a retrospective cohort study on a random sample of adult patients with hypertension in a large health maintenance organization to assess the feasibility of documenting blood pressure (BP) control and to compare different measures for defining BP control.

Methods: Three criteria for BP control were assessed: systolic BP less than 140 mm Hg; diastolic BP less than 90 mm Hg; and combined BP control, with systolic BP less than 140 mm Hg and diastolic BP less than 90 mm Hg. Four methods of assessing hypertension control by the above criteria were examined: proportion of patients with BP under control at 75% and 50% or more of their office visits; the mean of all pressures during the study period; and the BP from the last visit during the study period.

Results: The proportion of patients meeting each criterion for control was similar whether we used the mean BP for all visits, the last recorded BP, or control at 50% or more of visits. Control rates were substantially lower when the more stringent assessment, 75% of visits, was used. The proportion of patients with combined BP control at 75% or more of their visits was half that of the other methods.

Conclusions: In this health maintenance organization population, results with the use of the simplest approach, the last BP measurement recorded, were similar to results with the mean BP. Our findings indicate that evaluation of BP control in a large health maintenance organization will find substantial room for improvement, and clinicians should be encouraged to be more aggressive in their management of hypertension, especially with regard to the systolic BP, which until recent years has been underemphasized.

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THE NATIONAL Committee for Quality Assurance plans to include hypertension (HTN) control as a testing measure on its report card, which is widely used throughout managed care to assess and compare quality of care.[1-4] However, provider organizations generally do not know how well blood pressure (BP) is controlled in their populations, and there is no established method for obtaining this information.

Hypertension is an important health problem for more than 50 million Americans.[5] The value of BP control in reducing morbidity and mortality has been clearly demonstrated. If HTN could be better controlled, the risks of developing coronary artery disease, stroke, congestive heart failure, renal insufficiency, and peripheral vascular disease can be reduced, thereby reducing morbidity and mortality and containing health care costs.[6]

An aggressive BP control campaign initiated more than 2 decades ago by the National Heart, Lung, and Blood Institute has made important strides in improving HTN control.[7,8] Data from the second National Health and Nutrition Examination Survey, obtained during the period from 1976 through 1980, reported BP control in only 10% of hypertensive subjects. In the period from 1988 through 1991, the third National Health and Nutrition Examination Survey (phase 1) found that BP control among hypertensive patients nearly tripled, to 29%.[9] However, this impressive trend toward improving control does not appear to be continuing. Unpublished data from the third National Health and Nutrition Examination Survey (phase 2) for the period from 1991 through 1994 show BP control to be at 27.4%.[6]

We conducted a study to evaluate methods for routinely monitoring BP control among enrollees in a large health maintenance organization (HMO) who had an outpatient diagnosis of HTN. The main purpose of the study was to assess the fea-

PATIENTS AND METHODS

We examined BP control among a sample of adults with a diagnosis of HTN who were enrolled in the Northern California Kaiser Permanente Medical Care Program (KPMCP).

IDENTIFICATION OF THE HTN COHORT

Our HTN cohort was identified from random samples of 2 groups of health plan members who were 25 years of age or older and had at least 2 years of continuous membership. We identified a random sample of 1200 health plan members who had a diagnosis of HTN mentioned at least once in KPMCP's computerized Outpatient Services Clinical Record (OSCR) database for visits occurring in a 1-year observation period (June 1, 1995, through May 30, 1996). A second sample of 500 was drawn from members who did not have an OSCR HTN diagnosis during this interval, to estimate the prevalence of HTN in patients not so identified by the OSCR. Medical chart review was performed for both samples to confirm the diagnosis of HTN and to abstract BP measurements. Of the 1200 patients with an OSCR diagnosis of HTN, 1116 were confirmed by medical chart review. Charts were not available for 7 of the 84 patients whose OSCR diagnosis was not confirmed. Of the 500 members who did not have an OSCR diagnosis of HTN, 53 patients (10.6%) were found to have an HTN diagnosis by a physician at chart review. The HTN cohort consisted of 1169 patients: 1116 whose OSCR HTN was confirmed by medical chart review, and these 53 patients. Prevalence of diagnosed HTN in members of the health plan was estimated by means of results from both samples.

ESTIMATION OF LEVEL OF BP CONTROL AMONG PATIENTS WITH DIAGNOSED HTN

BP Measurements

The BP measurements from all outpatient clinic visits (except emergency department visits) during the 1-year study period from October 1, 1995, to September 30, 1996, were used to examine control among members in the HTN cohort. Other patient characteristics abstracted were date of birth, race or ethnicity, and presence of a physician diagnosis of HTN. Guidelines for selecting a BP measurement when more than 1 measurement was available for a visit gave priorities to BPs taken by a physician, BPs taken in the sitting position, and the last BP measurement taken at the visit. In the case of exercise tolerance testing, the pretest BP was recorded. There were 1101 patients for the HTN control analyses after exclusion of 68 patients who had no BP measurements at outpatient visits during the study period. Three criteria for BP control were assessed: (1) systolic BP (SBP) less than 140 mm Hg, (2) diastolic BP (DBP) less than 90 mm Hg, and (3) combined BP control, with SBP less than 140 mm Hg and DBP less than 90 mm Hg.[10]

Methods of Assessing BP Control

Four methods of assessing HTN control by the above criteria were examined in this study: (1) proportion of patients with BP under control at 75% or more of their office visits; (2) proportion of patients with BP under control at 50% or more of their office visits; (3) the mean of all pressures of their office visits during the study period; and (4) the BP from the last visit during the study period.

STATISTICAL ANALYSES

Hypertension control was determined by each of the 3 criteria and the 4 methods of assessment, overall and in analyses stratified by patient age, sex, and race or ethnicity. Logistic regression was used to determine whether characteristics of patients were related to HTN control.

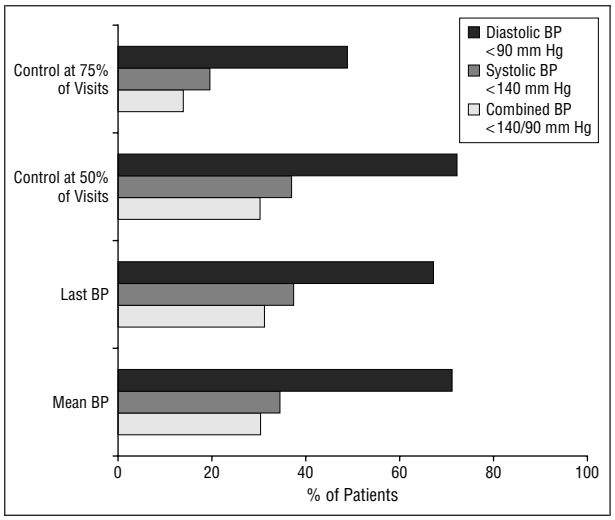
sibility of documenting BP control in a large HMO and to compare different measures for defining BP control.

RESULTS

The prevalence of diagnosed HTN among adult (≥25 years old) KPMCP members, who were in the health plan during 1995 and 1996, was estimated to be 20.0%. This estimate is composed of the 10.6% of KPMCP adults with a diagnosis of HTN in the OSCR database plus an estimated 9.4% of adults who had a diagnosis of HTN in their medical chart, but did not have an HTN diagnosis in OSCR during the 1-year period. This latter component is less stable than the former: it is derived from our unexpected finding of diagnosed HTN in the medical charts of 53 (10.6%) of the 500 adults who were sampled from the 88.4% of adults without an automated diagnosis of HTN.

There were more women (622 [56.5%]) than men (479 [43.5%]) in the patient group. The mean age was 60.7 years, with more than 90% being 45 years of age or older (25-44 years, 117 [10.6%]; 45-64 years, 541 [49.1%]; and ≥65 years, 443 [40.3%]). Of the cohort, 712 (64.7%) were white, 150 (13.6%) were African American, 107 (9.7%) were Asian, and 51 (4.6%) were Latino, and in 81 (7.4%) the ethnicity was other or unknown. The health plan does not routinely collect information on the race or ethnicity of all members. However, the finding that 13.6% of patients with HTN were African Americans suggests that HTN is more prevalent in African American members, because previous estimates from random patient surveys have suggested that no more than 10% of adult members are African American.

The median number of BP measurements used in evaluating BP control was 3. The overall percentage of hypertensive patients (n = 1101) whose combined BP included an SBP less than 140 mm Hg and DBP less than 90 mm Hg was 30.4%. The proportion of patients meeting each criterion for control was similar whether we used the mean BP for all visits, the last recorded BP, or control at 50% or more of visits (**Figure**). The proportions with DBP less than 90 mm Hg ranged from 67% to 71%;



Distribution of blood pressure (BP) control based on 4 methods of assessment and 3 criteria for control.

proportions with SBP less than 140 mm Hg ranged from 35% to 38%. Proportions with combined BP control were essentially the same, 30% to 31%. Control rates were substantially lower when the more stringent assessment, 75% of visits, was used. The proportion of patients with combined BP control at 75% or more of their visits, 14%, was half that of the other methods. Within patients, we observed 82% agreement for combined BP control when mean BP assessment was compared with last BP recorded (**Table 1**).

Age was an important determinant of BP control. The SBP was controlled less frequently in older patients (≥65 years) than younger patients. In contrast, DBP control was less frequent in younger individuals. Among those aged 65 years and older, 83% had mean DBP under control compared with 63% for those younger than 65 years ($P = .001$); SBP control was found in 26% and 40% of the 2 groups, respectively ($P = .001$).

Control based on mean BP showed no differences by race or ethnicity in multivariate logistic regression models that included age, race, and sex. Men tended to have poorer DBP control ($P = .02$) and better SBP ($P = .001$) and combined BP control ($P = .04$) than women.

The distribution of HTN control by mean BP and last BP and patient characteristics are shown in **Table 2**. We compared mean BP control between the hypertensive patients identified in the OSCR and the subgroup of hypertensive patients who did not have an OSCR diagnosis of HTN. This comparison showed greater combined BP control for the non-OSCR sample, 46.3%, compared with 34.1% ($P = .04$). If the results from each of these samples were combined with the use of weights to reflect our estimates of the proportions of patients with diagnosed HTN who were and were not in the OSCR, then the overall estimate of combined BP control would increase from 30.4% to 37.6%.

COMMENT

In this sample of hypertensive patients in a large HMO, we examined 4 methods for evaluating BP control with

Table 1. Comparison of Hypertension Control by Mean Blood Pressure (BP) and Last BP

Last BP Reading at Goal*	Mean of All BP Values at Goal*		
	Yes	No	Total
Yes	662†	95	**757**
No	104	240†	**344**
Total	**766**	**335**	**1101**

**Goal was defined as both systolic BP less than 140 mm Hg and diastolic BP less than 90 mm Hg.*

†Agreement between methods was present in 81.9% (902/1101).

the use of 3 control criteria. Similar results were obtained by 3 of these 4 methods: the proportion of hypertensive patients with BP under control at 50% of their office visits, the mean of BP measures during the study period, and the BP from the last outpatient visit. Not surprisingly, the most stringent method of evaluating BP control, the proportion of hypertensive patients with BP under control at 75% of their office visits, indicated the lowest level of control. Our finding that the last BP and mean BP produce comparable estimates of BP control suggests that the last BP measurement may be an adequate indicator of BP control status, and it is certainly the simplest outcome measure to obtain.

Although the last BP alone does not provide a full, or even adequate, characterization of the results of treatment in individual patients, it appears to be sufficient to characterize the success of treatment in large groups of patients. Using the mean and last methods for evaluating control, we found that approximately 70% of hypertensive patients in the KPMCP had good DBP control (<90 mm Hg). However, less than 40% of patients had HTN controlled to an SBP less than 140 mm Hg. Approximately 30% had both DBP and SBP under control. Age was differentially associated with DBP and SBP control in this population. Older patients were more likely to have elevated SBP, whereas younger patients were more likely to have elevated DBP. Systolic BP control may be more difficult to achieve in the elderly without producing postural or other symptoms of impaired perfusion. Alternatively, physicians may simply be less inclined to push therapy aggressively to achieve this goal. Physicians may also be concerned about excessive lowering of DBP while trying to achieve SBP control. Indeed, patients who had substantial reduction of SBP (>20 mm Hg) in the Systolic Hypertension in the Elderly Program had important benefits, even if they did not achieve the 140–mm Hg target. Since, to our knowledge, there are as yet no data quantifying the benefit of treating patients with isolated systolic HTN in the range of 140 to 159 mm Hg, or demonstrating the superiority of lowering SBP to less than 140 mm Hg if the pretreatment SBP was greater than 160 mm Hg, physicians may accept BPs in the range of 140 to 159 mm Hg in elderly patients who have already shown a substantial response to antihypertensive therapy. If an SBP threshold of less than 160 mm Hg rather than less than 140 mm Hg had been used in patients older than 65 years, in our sample, the control rate for SBP would have improved to 55.1%.

Table 2. Distribution of Hypertension Control by Mean BP and Last BP, Age, Race or Ethnicity, and Sample Source*

	SBP <140 mm Hg		DBP <90 mm Hg		Combined BP <140/90 mm Hg	
	%	95% CI	%	95% CI	%	95% CI
Age, y						
<65 (n = 658)						
Mean BP	40.0	36.2-43.7	63.4	59.7-67.1	33.9	30.3-37.5
Last BP	41.9	38.2-45.7	60.3	56.6-64.1	32.8	29.2-36.4
≥65 (n = 443)						
Mean BP	26.4	22.3-30.5	82.8	79.3-86.4	25.3	21.2-29.3
Last BP	30.9	26.6-35.2	77.4	73.5-81.3	28.9	24.7-33.1
Race or ethnicity						
African American (n = 150)						
Mean BP	35.3	27.7-43.0	66.7	59.1-74.2	33.3	25.8-40.9
Last BP	37.3	29.6-45.1	64.7	57.0-72.3	32.0	24.5-39.5
Asian (n = 107)						
Mean BP	37.4	28.2-46.6	70.1	61.4-78.8	30.8	22.1-39.6
Last BP	40.2	30.9-49.5	69.2	60.4-77.9	33.6	24.7-42.6
Latino (n = 51)						
Mean BP	45.1	31.4-58.8	70.6	58.1-83.1	41.2	27.7-54.7
Last BP	51.0	37.3-64.7	62.7	49.5-76.0	43.1	29.5-56.7
White (n = 712)						
Mean BP	33.6	30.1-37.0	73.6	70.3-76.8	29.4	26.0-32.7
Last BP	36.8	33.3-40.3	69.1	65.7-72.5	30.5	27.1-33.9
Other or unknown (n = 81)						
Mean BP	30.9	20.8-40.9	60.5	49.8-71.1	27.2	17.5-36.8
Last BP	32.1	21.9-42.3	55.6	44.7-66.4	25.9	16.4-35.5
Sample source						
OSCR HTN diagnosis (n = 1060)						
Mean BP	34.1	31.2-36.9	71.3	68.6-74.0	29.8	27.1-32.6
Last BP	37.0	34.1-39.9	67.3	64.4-70.1	30.8	28.1-33.6
No OSCR HTN diagnosis (n = 41)						
Mean BP	46.3	31.1-61.6	68.3	54.0-82.5	46.3	31.1-61.6
Last BP	51.2	35.9-66.5	65.9	51.3-80.4	41.5	26.4-56.5

*BP indicates blood pressure; SBP, systolic BP; DBP, diastolic BP; CI, confidence interval; OSCR, Outpatient Services Clinical Record; and HTN, hypertension.

Nonetheless, current guidelines recommend that the goal of treatment in elderly patients should be identical to that in younger patients,[6] even though special care should be taken in treating these patients. Our findings suggest that better physician education concerning these recommendations will be needed to meet this goal.

Control of BP was significantly better among the patients without an OSCR diagnosis than those whose HTN diagnosis was identified by OSCR (46.3% vs 29.8% below 140/90 mm Hg; $P<.05$). The fact that a diagnosis of HTN appeared in the OSCR during the 1-year period may indicate that the physician actively dealt with the problem at at least 1 visit. Thus, patients with a diagnosis in their medical chart but not in the OSCR may have milder or more readily controlled HTN. If we had weighted the results from patients without an OSCR diagnosis to reflect our estimate that they represent nearly half of our adult hypertensive patients, our estimates of BP control at KPMCP would be higher.

There were several limitations to our study. Blood pressure readings before the diagnosis of HTN were not evaluated, since in many patients these were unavailable. Thus, the magnitude of BP reduction, an important factor in evaluating the success of therapy, could not be determined. A patient whose BP was lowered from 210/110 mm Hg to 150/90 mm Hg was classified identically to a patient whose BP was reduced only from 150/95 mm Hg to 142/92 mm Hg, even though the morbidity and mortality risk of the former patient would have been lowered to a considerably greater extent.[11] If health plans are to be held accountable to strict measures of control in the absence of knowing pretreatment pressures, additional measures that credit the progress made in lowering the BP of hypertensive patients may also be needed.

It also appears that physicians do not always make BP control decisions solely on the basis of the BPs recorded in the office. We found evidence in the chart that physicians sometimes rely on home BP measurements. Some of the BPs measured in the office surely reflect "white-coat" HTN, and home BPs may have been lower. Therefore, these findings may overestimate the degree of inadequate control. Patients who have their BP taken outside the office system (self-monitored at home, local pharmacies, neighborhood firehouses, etc) should be encouraged to mail or bring the measures to their physician for documentation.

Effective evaluation of HTN control in large populations is dependent on appropriate technology. Data collection in this study relied primarily on medical chart abstraction to obtain BP levels in patients identified from computerized records as having HTN. The ideal data source would be an HTN database that includes pretreat-

ment BP, risk factors, evidence of target organ damage, follow-up BP measurements, and laboratory tests. This has become more important, since the Joint National Committee VI now calls for lower BP goals in patients with diabetes and renal disease.[6] Health systems without a computerized data source would have to manually identify HTN cases and review a random sample of medical charts. This would be the most expensive and least efficient method of evaluating HTN control.

To our knowledge, data similar to ours are not available from other large HMOs or health care systems, so it is difficult to assess how these results would compare with those in other systems. The results of this study have several implications with regard to the evaluation of HTN management within populations and health care systems. Several criteria for assessing control could be used, but in this HMO population, results with the simplest approach, the last BP measurement recorded, were similar to results with the mean BP. Our findings indicate that evaluation of BP control in a large HMO will find substantial room for improvement. Similar observations were made in a recent study of BP control at 5 Veterans Affairs sites.[12] The findings of the recently published Hypertension Optimal Treatment study[13] indicate that more aggressive BP lowering, even within the normal range, can result in a reduced rate of outcomes. Practitioners need to be encouraged to be more aggressive in their management of HTN, especially with regard to the SBP, which until recent years has been underemphasized.

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