Screening, Treatment, and Control of Hypertension in US Private Physician Offices, 2003–2004

Jun Ma, Randall S. Stafford

Abstract—Essential hypertension is the most common diagnosis in US primary care settings for middle-aged persons and seniors. Yet, data on hypertension screening, treatment, and control in such settings are limited. We analyzed National Ambulatory Medical Care Survey data to examine the rates of and factors associated with hypertension screening, treatment, and control during US office visits in 2003 and 2004. Blood pressure was measured in 56% (95% confidence limits: 52% to 59%) of all visits by patients ≥18 years of age and in 93% (95% confidence limits: 89% to 96%) of hypertensive patient visits. Among the latter, 62% (95% confidence limits: 55% to 69%) were treated. Diuretics were the most commonly prescribed antihypertensive agents (46%; 95% confidence limits: 41% to 50%), and combination therapy was reported in 58% (95% confidence limits: 54% to 63%) of treated visits. Only 39% (95% confidence limits: 34% to 43%) of treated visits were at recommended blood pressure goals. The odds of not being screened for hypertension were notably greater for visits with a provider other than a primary care physician or cardiologist (10.0; 95% confidence limits: 5.5 to 16.7) and for nonwell care visits (5.6; 95% confidence limits: 3.6 to 8.3). Greater odds of not being treated for hypertension were noted by geographic region (South versus Northeast: 2.6; 95% confidence limits: 1.2 to 5.6) and visit type (first time versus return visits; 1.6; 95% confidence limits: 1.1 to 2.4). The odds of not having blood pressure controlled were greater for patients with comorbidities (1.6; 95% confidence limits: 1.1 to 2.4). In conclusion, more intervention efforts are needed to further reduce the gaps and variations in routine practice in relation to evidence-based practice guidelines for hypertension screening, treatment, and control. (Hypertension. 2008;51:1-2.)

Key Words: hypertension screening ■ hypertension diagnosis ■ hypertension treatment ■ hypertension control ■ guideline adherence ■ NAMCS

More than 65 million American adults, composing ≈30% of the general US adult population, have hypertension or elevated blood pressure (BP). Elevated BP is one of the most important, modifiable risk factors for cardiovascular and renal diseases. The estimated direct and indirect cost of high BP for 2007 is $66.4 billion.5 Failure to treat and control elevated BP adds to the already substantial economic burden of hypertension in the United States because of the high frequency of emergency department visits and hospitalizations associated with unnecessary and preventable cardiovascular events and renal dysfunction.

Data from the National Health and Nutrition Examination Survey (NHANES), a long-standing survey of the US noninstitutionalized civilian population, have drawn attention to continuing gaps in the prevalence, awareness, treatment, and control of hypertension in relation to US public health objectives and clinical practice guidelines.1,3,4 The latest article based on NHANES 1999–2004 reported that the overall prevalence of hypertension was 29% in 2003–2004, with a clear trend of increasing prevalence with age, and ≈1 of 4 hypertensive patients were unaware of their hypertension.1 These findings bolster the importance of the recommendation by the US Preventive Services Task Force that clinicians routinely screen adults aged ≥18 years for high BP.5

The same article1 that analyzed the data from NHANES 1999–2004 also reported that, in 2003–2004, 65% of individuals with known hypertension reported to be taking antihypertensive medications, and 37% had their BP under control, defined as BP <140/90 mm Hg for nondiabetic patients and <130/80 mm Hg for diabetic patients. The 37% control rate reflected an 8% age-adjusted increase from 1999 to 2000, making it seem feasible to reach the Healthy People 2010 objective,6 where 50% of Americans with hypertension would have their BP lowered to <140/90 mm Hg. The authors of the article surmised that the increase in BP control rate may be the result of intensified antihypertensive treatment after new clinical guidelines on the management of hypertension.

The Seventh Report of the Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC), the latest in its series, recommended that individuals diagnosed with hypertension be adequately

Received December 2, 2007; first decision December 18, 2007; revision accepted February 12, 2008.
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DOI: 10.1161/HYPERTENSIONAHA.107.107086
treated through a combination of lifestyle modification and pharmacotherapy. It also recommended diuretics as first-line antihypertensive therapy for uncomplicated hypertension and the use of multiple antihypertensive drugs to control BP in most patients. In JNC 7, the BP goal for hypertensive patients with diabetes or kidney disease was lowered from <130/85 to <130/80 mm Hg, while retaining the same BP goal of 140/90 mm Hg for patients without these diseases.

Although hypertension screening, treatment, and control have been the subjects of numerous studies, most are based on NHANES data, which are representative of the entire US noninstitutionalized civilian population, regardless of their use of health care. Thus, the data do not accurately assess the noninstitutionalized civilian population, regardless of their use of health care. Thus, the data do not accurately assess the noninstitutionalized civilian population, regardless of their use of health care.1,3,4

Diagnosis, Treatment, and Control

In brief, NAMCS collects data on outpatient health care services provided by US office-based physicians and includes data on physician and visit characteristics, as well as diagnoses and pharmacotherapy. In this study, we analyzed data from NAMCS 2003–2004 to evaluate rates of hypertension screening, treatment, and control in US office-based practices, as well as disparities by physician and patient visit characteristics.

Methods

Data Sources

Annual data for 2003 and 2004 were obtained from the NAMCS data sets. The National Center for Health Statistics (NCHS) provides complete descriptions of the NAMCS survey and yearly public use data at http://www.cdc.gov/nchs/about/major/ahcd/ahcl1.htm. NAMCS has been validated against other data sources9,10 and has also been used in past research of antihypertensive prescribing.11,12

In brief, NAMCS collects information on patient visits to nonfederally funded, community, and office-based physician practices throughout the United States. The NAMCS uses a 3-stage probability sampling procedure, with sampling based on geographic location, physician practices within a geographic location (stratified by physician specialty), and visits within individual physician practices. The sampling universe for NAMCS was office-based physician practices in 15 patient-care specialty strata from the master files maintained by the American Medical Association and American Osteopathic Association. Standard encounter forms are completed by participating physicians, office staff, or US Census Bureau representatives for a systematic random sample of patient visits during a randomly assigned 1-week reporting period for each selected practice. The National Center for Health Statistics weights each visit to allow extrapolation to national estimates for all aspects of the surveys. The visit weight accounts for selection probability, nonresponse adjustment, and other adjustments to reflect the universe of private office-based visits in the United States.13

Using the same methods, the National Center for Health Statistics administered the same patient encounter form in 2003 and 2004, allowing these 2 years to be aggregated for analysis. The NAMCS collected 25,288 patient encounter forms from 1,121 practices in 2003 and 25,286 patient encounter forms from 1,121 practices in 2004. The participation rate of contacted physician practices in the NAMCS was 67% in 2003 and 65% in 2004. Quality control was done using a 2-way independent verification procedure for a random 10% of the sample records. Coding errors for various items ranged from 0.0% to 1.1%.

Data items collected on the 2003–2004 patient encounter form included patient information (eg, demographics and insurance status), physician practice information (eg, specialty and geographic region), and visit information (eg, ≤3 reasons for the visit, 3 diagnoses, and 8 medications). Listed medications included prescription and nonprescription medications that the physician prescribed or provided at or before the visit and that the physician expected the patient to continue taking. Item nonresponse rates for most data elements were ≤5% in both years.

Measures

Outcome Measures: Hypertension Screening, Diagnosis, Treatment, and Control

The study sample consisted of office-based visits by men and women >18 years. “Hypertension screening” was defined as a patient visit in which a BP reading was recorded on the encounter form, regardless of whether the patient was diagnosed with hypertension.

Diagnoses of hypertension were identified using the International Classification of Diseases, Ninth Revision, Clinical Modification. Hypertensive patients were those who had a diagnosis of hypertension (International Classification of Diseases, Ninth Revision, codes: 401–405) on their encounter form. Among these visits, those without any of the following compelling indications were defined as having uncomplicated hypertension: hypertensive organ damage, ischemic heart disease, diabetes mellitus, heart failure, cerebrovascular disease, and chronic renal disease. These comorbidities were identified primarily by International Classification of Diseases, Ninth Revision, codes, as well as by the appropriate reason-for-visit codes specific to NAMCS. Patients whose encounter form did not indicate the presence of a condition were assumed as not having that condition.

Treatment for hypertension was defined as a hypertensive patient visit for which prescription of a generic or brand-name antihypertensive medication was documented on the encounter form. We termed these visits as “antihypertensive drug visits.” The JNC 5, JNC 6, and JNC 7 were used to identify and classify the antihypertensive medications used. For brand-name and combination antihypertensive medications, each generic name (active ingredient) component of the medication was counted separately. “Combination drug therapy” was defined as antihypertensive drug visits during which >1 active ingredient was mentioned either in a single combination preparation or in multiple pills.

We examined the following antihypertensive drug classes: diuretics, β-blockers, calcium channel blockers, angiotensin converting enzyme inhibitors (ACEIs), angiotensin receptor blockers (ARBs), α-blockers, central acting agents, peripheral-acting antidiuretic agents, and direct vasodilators. Diuretics were further categorized as thiazide diuretics, and all of the other diuretics (ie, loop and potassium-sparing diuretics) and β-blockers included α-β-blockers. Peripheral-acting antidiuretic agents and direct vasodilators were rarely mentioned, and α-blockers and central-acting agents were mentioned in <5% of antihypertensive drug visits. Therefore, we do not report specific information on these infrequently used drug classes. “Hypertension control” was defined according to the JNC 7 as lowering BP levels to <140/90 mm Hg for hypertensive patients without diabetes and chronic kidney disease comorbidities and to <130/80 mm Hg for patients with either comorbidity.

Explanatory Variables: Patient Visit Characteristics

For the purposes of this study, patient visit characteristics included patient age, gender, race or ethnicity, medical insurance, new versus return visit status, general medical examination visit, US census region, metropolitan area status, physician specialty, and reported use of electronic medical records. Health insurance was classified as

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Table 1. Prescription of Antihypertensive Medications by Drug Class Among Total Antihypertensive Drug Visits, NAMCS 2003–2004

<table>
<thead>
<tr>
<th>Antihypertensive Drug Class</th>
<th>All Hypertensive Patient Visits, % (95% CL)</th>
<th>Hypertensive Patient Visits Without Compelling Comorbidities, % (95% CL)*</th>
<th>Hypertensive Patient Visits With Compelling Comorbidities, % (95% CL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any diuretics</td>
<td>46 (41 to 50)</td>
<td>47 (42 to 52)</td>
<td>41 (33 to 49)</td>
</tr>
<tr>
<td>Thiazide-type diuretics†</td>
<td>78 (73 to 84)</td>
<td>81 (75 to 87)</td>
<td>69 (59 to 79)</td>
</tr>
<tr>
<td>β-Blockers</td>
<td>36 (32 to 41)</td>
<td>35 (29 to 41)</td>
<td>39 (31 to 47)</td>
</tr>
<tr>
<td>ACEIs</td>
<td>37 (32 to 41)</td>
<td>34 (29 to 38)</td>
<td>46 (37 to 55)</td>
</tr>
<tr>
<td>ARBs</td>
<td>24 (20 to 28)</td>
<td>24 (19 to 28)</td>
<td>26 (19 to 33)</td>
</tr>
<tr>
<td>Calcium channel blockers</td>
<td>27 (23 to 30)</td>
<td>26 (22 to 31)</td>
<td>27 (21 to 33)</td>
</tr>
<tr>
<td>Combination drug therapy</td>
<td>58 (54 to 63)</td>
<td>58 (53 to 63)</td>
<td>61 (51 to 70)</td>
</tr>
<tr>
<td>Combinations of 2 drug classes‡</td>
<td>63 (58 to 68)</td>
<td>68 (62 to 74)</td>
<td>50 (41 to 59)</td>
</tr>
</tbody>
</table>

Antihypertensive drug visits are patient visits diagnosed with hypertension and treated with any antihypertensive drug therapy. Percentages may sum to >100% across drug classes because of combination drug therapy.

*Compelling comorbidities include hypertensive organ damage, ischemic heart disease, diabetes mellitus, heart failure, cerebrovascular disease, and chronic renal disease.

†Data show percentages (95% CLs) of antihypertensive drug visits in which a diuretic was reported.

‡Data show percentages (95% CLs) of antihypertensive drug visits in which combination drug therapy was reported.

private or commercial insurance, public insurance (ie, Medicare and Medicaid), or other insurance (eg, workers’ compensation and self-pay). We categorized physician specialties into cardiology, internal medicine, general and family practice, and all others.

In 2003 and 2004, an additional item was added to the NAMCS survey instrument, “Does your practice use electronic medical records (not including billing records)?” Health care providers whose practices used electronic medical records were distinguished from those who were not. In 2003–2004, 21% (95% confidence limits [CLs]: 17% to 26%) of visits were recorded in practices with an electronic medical chart system.

Analyses

The unit of analysis was the patient visit. Statistical analyses were performed using SAS-callable SUDAAN software (RTI, Research Triangle Park, NC). To extrapolate to national estimates that reflect the universe of office-based visits in the United States, we took into account the sampling weights and sample design variables contained in the NAMCS data sets.13 Comparisons of 2003 and 2004 data suggested limited differences on the main outcome measures. Therefore, we combined the data to obtain a larger sample size and, thus, more stable estimates.

The SUDAAN SURVEYMEANS procedure generated national estimates for the number and proportion of patient visits, including 95% CLs, with respect to the following outcome measures: hypertension screening, diagnosis, treatment, and control. χ² tests (PROC CROSSTAB) examined isolated associations between each of these outcome measures and each of the patient visit characteristics. Patient visit characteristics that were at least modestly associated with an outcome measure (2-sided P<0.15) were entered into a multiple logistic regression model (PROC RLOGIST) for that outcome. Adjusted odds ratios and associated Wald χ² statistics from the RLOGIST procedure were used to determine the significance of the independent association of a patient visit characteristic with the outcome measure after controlling for all of the other explanatory variables in the model. Statistical significance was set at 2-sided P<0.05.

Results

Rates of Hypertension Screening and Diagnosis

In 2003 and 2004, 56% (95% CL: 52% to 59%) of all of the patient encounters included a BP measurement, representing 157 million office-based visits. A diagnosis of hypertension was documented in 9.2% (95% CL: 8.1% to 10%) of all of the visits, representing 26 million visits; 75% (95% CL: 71% to 78%) of these visits had uncomplicated hypertension. BP was recorded in 93% (95% CL: 89% to 96%) of hypertensive patient visits.

Rates of Hypertension Treatment

Antihypertensive drugs were reported in 62% (95% CL: 55% to 69%) of all of the hypertensive patient visits, with no differences between visits with uncomplicated hypertension (61%) and those with hypertension-related comorbidities (64%). Nutrition and/or exercise counseling were provided or ordered in 35% (95% CL: 29% to 40%) of hypertensive patient visits. Counseling rates did not differ by use of antihypertensive drugs or by type of visit (ie, first-time versus follow-up).

Diuretics were the most commonly prescribed antihypertensive drug class (46%; 95% CL: 41% to 50%), followed by ACEIs (37%; 95% CL: 32% to 41%), β-blockers (36%; 95% CL: 32% to 41%), calcium channel blockers (27%; 95% CL: 23% to 30%), and ARBs (24%; 95% CL: 20% to 28%; Table 1). Thiazide-type diuretics accounted for 78% (95% CL: 73% to 84%) of all of the diuretic prescriptions. We observed a nonsignificant tendency toward greater prescribing of ACEIs and ARBs among patient visits with hypertension-related comorbidities and greater prescribing of thiazide-type diuretics among those with uncomplicated hypertension.

Among all of the antihypertensive drug visits, 58% (95% CL: 54% to 63%) received combination therapy of ≥2 drugs. Similar percentages were found for patient visits with uncomplicated hypertension, as well as those with hypertension and comorbidities. Of all of the patient visits treated with combination drug therapy, 65% (95% CL: 58% to 68%) were prescribed a 2-drug combination. The most frequently combined drug classes were those of a diuretic and ACEI or ARB. Among patient visits treated with combination therapy, a greater proportion (50%) of those with hypertension and comorbidities than those with uncomplicated hypertension (32%) received ≥3 drugs. The diuretic-β-blocker-ACE/ARB combination was the most common regimen.

Rates of Hypertension Control

Slightly more than one third of total antihypertensive drug visits (39%; 95% CL: 34% to 43%) were treated to the BP
Correlates of Not Being Screened, Treated, and Controlled for Hypertension

Patients who visited a provider other than a general practitioner or internist had 10 times the odds of not being screened for hypertension during the visit as those seen by a cardiologist (95% CL: 5.6 to 16.7). The odds of no BP screening were also greater during visits by patients who were ≥75 years of age versus 18 to 44 years (odds ratio: 1.4; 95% CL: 1.0 to 1.8) who were not covered by private or government medical insurance (versus the privately insured; 1.6; 95% CL: 1.1 to 2.3), not having hypertension-related comorbidities (3.2; 95% CL: 2.3 to 4.6), or seen for a nongeneral medical examination visit (5.6; 95% CL: 3.6 to 8.3; Table 2). In addition, men were marginally more likely to be not screened than women (1.2; 95% CL: 1.0 to 1.4).

Greater odds of not being treated for hypertension were noted by geographic region (South versus Northeast: 2.6; 95% CL: 1.2 to 5.6) and visit type (first time versus return visits; 1.6; 95% CL: 1.1 to 2.4). The odds of not having BP under control were greater for patients with hypertension-related comorbidities (1.6; 95% CL: 1.1 to 2.4) but lower for patients >75 years of age (versus 18 to 44 years, 0.5; 95% CL: 0.3 to 1.0). The odds of not being controlled for hypertension did not reach statistical significance between hypertensive patient visits with reported antihypertensive medications and those without (1.1; 95% CL: 0.7 to 1.7).

Discussion

Monitoring national patterns of hypertension screening, treatment, and control is essential to assessing adherence to evidence-based hypertension prevention and treatment guidelines, such as those published by JNC. Although previous studies based on NHANES data provided such information for the entire US noninstitutionalized civilian population, this study analyzed NAMCS data in the period 2003–2004. The results specifically assess the care provided in office-based practices across the United States with regard to hypertension screening, treatment, and control. NAMCS is a unique data source for evaluating the quality of care in US ambulatory primary care settings, and it has captured BP measurements at the time of a patient visit only since 2003.

According to the latest study of NHANES data, the overall prevalence of hypertension was 29% in 2003–2004, which had not increased significantly since 1999.1 It seems unlikely that, with the aging of the population, the national goal to reduce the proportion of US adults with hypertension to 16% can be reached by 2010. Compounding the higher-than-targeted prevalence of hypertension, ~1 in 4 hypertensive people in the US were unaware of their hypertension. Awareness of one’s BP is the cornerstone of prevention and control of hypertension through lifestyle modification and, if warranted, pharmacotherapy. To raise awareness of hypertension, concerted efforts are needed for clinicians to routinely screen adults aged ≥18 years for high BP.3 However, our analysis of the data from NAMCS 2003–2004 suggests that BP measurements were made in only slightly more than half of all patient visits to physician offices.

Patients who saw a health care provider other than their primary care physician or a cardiologist were at a notably greater risk of not being screened for hypertension. It is worth noting that BP measurement is important in many specialties beyond primary care and cardiology, particularly for nephrology, neurology, endocrinology, and obstetrics. Also, there is likely value in consistency, even in specialty settings where BP measurement is less likely to be clinically important (eg, dermatology). This may help raise patients’ expectations about BP measurement during office visits and awareness of its importance. It could also counteract the tendency of some specialists to forget that they need to consider the whole patient.

Rates of hypertension pharmacotherapy in our study sample in 2003–2004 (62%) were similar to those reported by the NHANES study for the same period (65%).9 This contrasts with our expectation of a higher percentage of treated hypertensive patients in the NAMCS sample as opposed to the NHANES sample. NHANES is representative of the general population, including individuals who may not have access to or use health care services regularly. Yet, it is worth noting that the inaccuracy of clinically measured BP may misclassify patients, particularly patients whose overall cardiovascular risk is low (eg, younger patients), and may lead to unnecessary antihypertensive drug prescription.17 Not only is BP subject to biological variation, but it is also vulnerable to many sources of measurement error and reporting inaccuracies. These include but are not limited to “white coat hypertension,” insufficient previous rest period, use of a single BP measurement, end-digit preference, and improper cuff size. In NAMCS, only 1 BP reading was recorded, and the method of measurement was not specified but likely varied across physician practices. In NHANES, BP was measured 3 (sometime 4) times manually by a trained operator according to a standard protocol and calculated as the average after excluding the first measurement.

In our study sample, diuretics, particularly thiazide diuretics, were the most commonly prescribed antihypertensive medications. This is consistent with the JNC 7 guidelines recommending diuretics as first-line pharmacotherapy for most patients with uncomplicated hypertension.3 Even among patients receiving combination drug therapy, a diuretic was frequently paired with an ACEI, ARB, or β-blocker. These findings are consistent with previous studies published by us and other researchers who reported a marked increase...
Table 2. Independent Associations of Patient Visit Characteristics With the Risks of Not Being Screened, Treated, or Controlled for Hypertension, Respectively, During Office-Based Visits by Patients ≥18 Years of Age, NAMCS 2003–2004

<table>
<thead>
<tr>
<th>Patient Visit Characteristic</th>
<th>BP Screening N (%)*</th>
<th>Adjusted Odds Ratio (95% CI)†</th>
<th>BP Treatment N (%)‡</th>
<th>Adjusted Odds Ratio (95% CI)</th>
<th>BP Control N (%)§</th>
<th>Adjusted Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>18 to 44</td>
<td>3018 (59)</td>
<td>1.00 (reference)</td>
<td>95 (60)</td>
<td>1.00 (reference)</td>
<td>55 (32)</td>
<td>1.00 (reference)</td>
</tr>
<tr>
<td>45 to 59</td>
<td>2582 (56)</td>
<td>1.15 (0.97 to 1.37)</td>
<td>352 (64)</td>
<td>0.90 (0.65 to 1.47)</td>
<td>230 (39)</td>
<td>0.70 (0.43 to 1.14)</td>
</tr>
<tr>
<td>60 to 75</td>
<td>2338 (53)</td>
<td>1.18 (0.94 to 1.47)</td>
<td>403 (62)</td>
<td>1.00 (0.64 to 1.56)</td>
<td>219 (33)</td>
<td>0.92 (0.53 to 1.56)</td>
</tr>
<tr>
<td>≥75</td>
<td>1764 (51)</td>
<td>1.37 (1.03 to 1.82)</td>
<td>309 (61)</td>
<td>1.08 (0.65 to 1.81)</td>
<td>180 (45)</td>
<td>0.52 (0.28 to 0.98)</td>
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<tr>
<td>Sex</td>
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<tr>
<td>Female</td>
<td>5779 (56)</td>
<td>1.00 (reference)</td>
<td>626 (64)</td>
<td>1.00 (reference)</td>
<td>370 (36)</td>
<td>1.00 (reference)</td>
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<td>Male</td>
<td>3929 (55)</td>
<td>1.18 (1.00 to 1.37)</td>
<td>533 (59)</td>
<td>1.33 (0.97 to 1.82)</td>
<td>314 (40)</td>
<td>0.83 (0.63 to 1.10)</td>
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<td>Race or ethnicity</td>
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<tr>
<td>Non-Hispanic white</td>
<td>7605 (54)</td>
<td>1.00 (reference)</td>
<td>831 (62)</td>
<td>1.00 (reference)</td>
<td>502 (38)</td>
<td>1.00 (reference)</td>
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<tr>
<td>Non-Hispanic black</td>
<td>1018 (64)</td>
<td>0.81 (0.58 to 1.14)</td>
<td>200 (65)</td>
<td>0.75 (0.45 to 1.23)</td>
<td>105 (35)</td>
<td>1.04 (0.74 to 1.52)</td>
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<td>Hispanic</td>
<td>779 (58)</td>
<td>0.95 (0.66 to 1.39)</td>
<td>77 (53)</td>
<td>1.54 (0.79 to 2.94)</td>
<td>48 (33)</td>
<td>1.08 (0.65 to 1.75)</td>
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<td>Asian/Pacific Islander</td>
<td>228 (55)</td>
<td>1.32 (0.79 to 2.17)</td>
<td>41 (66)</td>
<td>1.19 (0.65 to 2.17)</td>
<td>22 (45)</td>
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<tr>
<td>Private</td>
<td>5115 (61)</td>
<td>1.00 (reference)</td>
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<td>Government</td>
<td>3635 (54)</td>
<td>1.08 (0.88 to 1.32)</td>
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<td>Other</td>
<td>838 (49)</td>
<td>1.61 (1.14 to 2.27)</td>
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<tr>
<td>Northeast</td>
<td>1735 (48)</td>
<td>1.00 (reference)</td>
<td>203 (76)</td>
<td>1.00 (reference)</td>
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<td>Midwest</td>
<td>2627 (57)</td>
<td>0.79 (0.47 to 1.33)</td>
<td>269 (64)</td>
<td>1.61 (0.81 to 3.23)</td>
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<td>South</td>
<td>3320 (57)</td>
<td>0.78 (0.47 to 1.28)</td>
<td>410 (53)</td>
<td>2.63 (1.23 to 5.55)</td>
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<tr>
<td>West</td>
<td>2020 (58)</td>
<td>0.68 (0.40 to 1.16)</td>
<td>277 (72)</td>
<td>1.11 (0.46 to 2.70)</td>
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<tr>
<td>Urban</td>
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<tr>
<td>Yes</td>
<td>8188 (55)</td>
<td>1.00 (reference)</td>
<td>1020 (65)</td>
<td>1.00 (reference)</td>
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<tr>
<td>No</td>
<td>1514 (62)</td>
<td>0.83 (0.50 to 1.41)</td>
<td>139 (47)</td>
<td>1.89 (0.96 to 3.70)</td>
<td>. . .</td>
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<tr>
<td>Visit type</td>
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<td></td>
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</tr>
<tr>
<td>First-time visits</td>
<td>. . .</td>
<td>192 (54)</td>
<td>1.60 (1.05 to 2.43)</td>
<td>103 (33)</td>
<td>1.33 (0.90 to 1.96)</td>
<td>. . .</td>
</tr>
<tr>
<td>Return visits</td>
<td>. . .</td>
<td>967 (65)</td>
<td>1.00 (reference)</td>
<td>581 (39)</td>
<td>1.00 (reference)</td>
<td>. . .</td>
</tr>
<tr>
<td>Physician specialty</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Cardiologist</td>
<td>1234 (68)</td>
<td>1.00 (reference)</td>
<td>. . .</td>
<td>. . .</td>
<td>. . .</td>
<td>. . .</td>
</tr>
<tr>
<td>Internist</td>
<td>1368 (64)</td>
<td>1.09 (0.47 to 2.50)</td>
<td>. . .</td>
<td>. . .</td>
<td>. . .</td>
<td>. . .</td>
</tr>
<tr>
<td>General/family practitioner</td>
<td>2976 (59)</td>
<td>0.93 (0.50 to 1.75)</td>
<td>. . .</td>
<td>. . .</td>
<td>. . .</td>
<td>. . .</td>
</tr>
<tr>
<td>Other</td>
<td>4124 (35)</td>
<td>10.0 (5.55 to 16.7)</td>
<td>. . .</td>
<td>. . .</td>
<td>. . .</td>
<td>. . .</td>
</tr>
<tr>
<td>Comorbidities**</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1731 (59)</td>
<td>1.00 (reference)</td>
<td>. . .</td>
<td>164 (31)</td>
<td>1.61 (1.07 to 2.41)</td>
<td>. . .</td>
</tr>
<tr>
<td>No</td>
<td>7971 (53)</td>
<td>3.23 (2.33 to 4.50)</td>
<td>. . .</td>
<td>520 (40)</td>
<td>1.00 (reference)</td>
<td>. . .</td>
</tr>
<tr>
<td>General medical examination</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Yes</td>
<td>901 (66)</td>
<td>1.00 (reference)</td>
<td>. . .</td>
<td>. . .</td>
<td>. . .</td>
<td>. . .</td>
</tr>
<tr>
<td>No</td>
<td>8801 (53)</td>
<td>5.56 (3.57 to 8.33)</td>
<td>. . .</td>
<td>. . .</td>
<td>. . .</td>
<td>. . .</td>
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<tr>
<td>Hypertension medication</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Yes</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>471 (39)</td>
<td>1.00 (reference)</td>
<td>. . .</td>
</tr>
<tr>
<td>No</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>213 (37)</td>
<td>1.13 (0.74 to 1.72)</td>
<td>. . .</td>
</tr>
</tbody>
</table>

*Data show the numbers and percentages of all patient visits in which BP was measured and reported.
†The odds ratio for each patient visit characteristic was adjusted for all of the other characteristics included in the multiple logistic regression model for the referenced outcome, ie, not being screened, treated, or controlled for hypertension, respectively.
‡Data show the numbers and percentages of treated hypertensive patient visits in which ≥1 antihypertensive medication was reported.
§Data show the numbers and percentages of hypertensive patient visits in which BP was at goal, ie, <140/90 mmHg and <130/80 mmHg for patients with diabetes or chronic kidney disease.
||According to the NAMCS analytical guidelines, estimates based on <30 sample cases or with more than a 30% relative SE (i.e., the SE divided by the estimate expressed as a percentage of the estimate) may be unreliable.
#Dashes denote patient visit characteristics that were not included in the multiple logistic regression model for the referenced outcome measure for failing the P<0.15 selection criterion in y² analyses.
**Comorbidities include hypertensive organ damage, ischemic heart disease, diabetes mellitus, heart failure, cerebrovascular disease, and chronic renal disease.
in prescriptions for thiazide diuretics as monotherapy or polytherapy after the publication of trial evidence on the clinical equivalence of diuretics with calcium channel blockers and ACEIs in December 2002. The apparently low rates of diet and exercise counseling are not surprising in that numerous studies have documented many missed opportunities for lifestyle counseling during office visits, even for patients who would clearly benefit for such service.}

Rates of treatment to control were surprisingly low among all of the treated hypertensive patient visits (39%) and among treated hypertensive patient visits with diabetes or chronic kidney disease (20%) compared with those reported in 2003–2004 NHANES (57% and 38%, respectively). We speculate that this apparent discrepancy in the observed success of treatment is at least partially because of the differences in methodology by which BP was measured and reported in NAMCS versus NHANES as noted above. Over-estimation of BP in clinical practice understandably translates into underestimation of control rates. In addition, control of BP is more difficult to achieve when starting at a higher pretreatment BP, as is likely the case with the NAMCS population compared with the NHANES population. The latter may also partially explain our finding of no statistical differences in BP control between those on antihypertensive treatment and those not in that treated patients likely include those with the highest pretreatment BP and, therefore, the most difficult-to-control hypertension, whereas untreated patients tend to be less severe and to have borderline BP. This type of bias likely exists in NHANES as well but would be less prominent because NHANES includes the population of patients with untreated hypertension that has had no contact with the health care system. Furthermore, treatment of hypertensive patients may fail to achieve “optimal” BP goals because of clinical inertia (or the failure to intensify therapy when clinically indicated) and poor medication adherence and persistence, both commonly observed in patients with chronic diseases, including those with hypertension.

It is prudent to note that dichotomized optimal treatment goals alone are rarely sufficient to characterize the success of treatment. Despite the definitive evidence of a direct, continuous relationship between BPs and cardiovascular morbidity and mortality, optimal BP goals remain uncertain and could vary by such factors as age and comorbidities, as has been suggested for control of diabetes. Furthermore, defining BP control using point cutoffs ignores the underlying distribution of what is a continuous variable and minimizes the actual improvement of risk when BP is lowered substantially but without achieving a selected cutoff (eg, 140/90 mm Hg). NAMCS is a serial, cross-sectional survey of patient visits and, thus, does not allow for the assessment of intrapersonal changes in BP over time. Nevertheless, we found that, among patient visits with uncontrolled hypertension, one third of those without diabetes and chronic kidney disease had a BP <150/95 mm Hg, and a majority of those with either comorbidity had a BP <140/90 mm Hg. As BP comes closer to target, the clinical importance of deviations becomes less straightforward without a comprehensive assessment of the overall risk:benefit ratio of the treatment needed to achieve the idealized goals, as well as patient preferences. Also, achieving the goals alone may not optimize outcomes for high-risk patients, because achieving BP control better than the goals could be very important.

Several additional data limitations warrant caution in interpreting the findings of this study. NAMCS is designed to produce nationally representative estimates that are linked to patient visits and not to individual patients. Sicker patients, those with difficult-to-control BP, and those prescribed medications requiring more frequent follow-ups may be oversampled, resulting in an overestimation of the volume of patient visits and actual administration of antihypertensive medications on a per-patient basis. Underestimation and omission of clinical data may also be possible because of incomplete reporting of diagnoses, medications prescribed, and services rendered to the patient. This may be particularly problematic when a patient’s diagnoses exceed the 3 spaces allotted for reporting. As a result, hypertension may fail to be reported for some hypertensive patients who had multiple diagnoses, leading to exclusion of such patients from our analysis. In addition, the number of medications may exceed the maximum allowed 8 spaces for reporting. Furthermore, physician awareness and adherence to practice guidelines are complex issues that require careful consideration of a range of factors that can influence a physician’s decision to screen for, treat, and control high BP, for some of which we do not have data in this study.

The United States is leading the way in hypertension treatment and control compared with other Westernized countries. In the United States, however, large variations exist in the rates of hypertension treatment and control based on data sources. For instance, BP control at 140/90 mm Hg was achieved in approximately two thirds of the participants in a recent, large clinical trial of antihypertensive treatment and of ambulatory visits by hypertensive patients in a national survey of physicians whose practice included a significant number of patients with cardiovascular diseases. Rates of control are notably lower in the present study based on a nationally representative survey of office-based, patient care physicians in the United States, as well as in studies of community-based samples. The range of control rates reported in these studies suggests that it would be feasible to increase the proportion of hypertensive Americans with controlled BP to 50%. To achieve this goal, however, more intervention efforts are needed nationwide. New strategies are being pursued to further improve BP screening, treatment, and control in the health care system and in the community at large. In turn, these strategies will help further reduce the burden of cardiovascular disease risk attributable to elevated BP.

Perspectives
National Ambulatory Care Surveys are important for evaluating the status quo and changes in the quality of care that Americans receive in routine practice settings. Inarguably, the utility of such surveys depends critically on the quality of data. BP measurement in routine clinical practice often deviates from standard protocols. Systemwide approaches to increasing the accuracy of clinically measured BP can help improve the quality of care for individual patients and can allow for more accurate surveillance on a population level.
New performance measures of treatment success are needed to more fully capture the complex reality of care for patients with hypertension than can be accomplished with the optimal treatment goals approach alone. Furthermore, increased intervention efforts are needed to further reduce the gaps between clinical practice and evidence-based practice guidelines for hypertension screening, treatment, and control in private office-based physician practices across the United States. Given the strong relationship between BP control and patient outcomes, such efforts would likely yield improvements in public health.

Sources of Funding
This research was funded by research awards from the National Institute on Aging (P30 AG017253-06), the US Agency for Healthcare Research and Quality (R01-HS11313), and the National Heart, Lung, and Blood Institute (K24-HL086703).

Disclosures
None.

References
Screening, Treatment, and Control of Hypertension in US Private Physician Offices, 2003–2004

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Hypertension. published online March 17, 2008;

Hypertension is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0194-911X. Online ISSN: 1524-4563

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