Published in final edited form as:
Hypertension. 2008 May ; 51(5): 1275–1281. doi:10.1161/HYPERTENSIONAHA.107.107086.

Screening, Treatment and Control of Hypertension in U.S. Private Physician Offices, 2003–2004

Jun Ma, MD, PhD* and **Randall S. Stafford, MD, PhD†**

* *Palo Alto Medical Foundation Research Institute, Palo Alto, CA*

† *Stanford Prevention Research Center, Stanford University School of Medicine, Stanford, CA*

Abstract

Essential hypertension is the most common diagnosis in U.S. 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 U.S. office visits in 2003 and 2004. Blood pressure was measured in 56% (95% confidence limits: 52%, 59%) of all visits by patients ≥18 years of age and in 93% (89%, 96%) of hypertensive patient visits. Among the latter, 62% (55%, 69%) were treated. Diuretics were the most commonly prescribed antihypertensives (46%; 41%, 50%) and combination therapy was reported in 58% (54%, 63%) of treated visits. Only 39% (34%, 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; 5.5, 16.7) and for non-well care visits (5.6; 3.6, 8.3). Greater odds of not being treated for hypertension were noted by geographic region (South vs. Northeast: 2.6; 1.2, 5.6) and visit type (first time vs. return visits; 1.6; 1.1, 2.4). The odds of not having BP controlled were greater for patients with co-morbidities (1.6; 1.1, 2.4). Data from recent clinical trials and epidemiological studies suggest the Healthy People 2010 objective to increase the proportion of hypertensive adults with controlled blood pressure to 50% can be attained. Nevertheless, 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.

Keywords

Hypertension screening; hypertension diagnosis; hypertension treatment; hypertension control; guideline adherence; NAMCS

INTRODUCTION

More than 65 million American adults, comprising approximately 30% of the general U.S. adult population, have hypertension or elevated blood pressure (BP).[1] Elevated BP is one of the most important, modifiable risk factors for cardiocerebral and renal diseases. The estimated direct and indirect cost of high BP for 2007 is $66.4 billion.[2] Failure to treat and control elevated BP adds to the already substantial economic burden of hypertension in the US due to

Corresponding Author: Jun Ma, MD, PhD, Palo Alto Medical Foundation Research Institute, 795 El Camino Real (Ames Bldg.), Stanford, CA 94301, Tel: 650-853-4809; Fax: 650-329-9114, Email: E-mail: maj@pamfri.org.

Author Conflict of Interest: None for either author

Institutional Conflict of Interest: None.

the high frequency of emergency room visits and hospitalizations associated with unnecessary and preventable cardiovascular events and renal dysfunction.

Data from the National Health and Nutrition Examination Survey (NHANES), a longstanding survey of the U.S. non-institutionalized civilian population, have drawn attention to continuing gaps in the prevalence, awareness, treatment and control of hypertension in relation to U.S. 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 approximately one out of four hypertensive patients were unaware of their hypertension.[1] These findings bolster the importance of the recommendation by the U.S. Preventive Services Task Force (USPSTF) that clinicians routinely screen adults aged 18 and older for high BP.[5]

The same article[1] 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 non-diabetic patients and <130/80 mm Hg for diabetic patients. The 37% control rate reflected an 8% age-adjusted increase from 1999–2000, making it seem feasible to reach the Healthy People 2010 objective[6] that 50% of Americans on treatment for 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 following 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 7), the latest in its series, recommended that individuals diagnosed with hypertension be adequately treated through a combination of lifestyle modification and pharmacotherapy.[7] 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 has been the subject of numerous studies, most are based on NHANES data, which are representative of the entire U.S. non-institutionalized civilian population regardless of their use of health care.[1, 3, 4] Thus, the data do not accurately assess the quality of care regarding clinician adherence to practice guidelines for hypertension screening, treatment and control in routine primary care settings. Yet, essential hypertension is the most common diagnosis in such settings for middle-aged persons and seniors.[8] Only until 2003 did nationally representative data first become available to allow evaluation of hypertension screening and control, in addition to hypertension treatment, in U.S. primary care settings. These data are captured in the National Ambulatory Medical Care Survey (NAMCS).

The NAMCS collects data on outpatient health care services provided by U.S. 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 evaluate rates of hypertension screening, treatment and control in U.S. 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 National Ambulatory Medical Care Survey (NAMCS) datasets. 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/ahcd1.htm. NAMCS has been validated against other data sources[9, 10] and have also been utilized in past research of antihypertensive prescribing.[11, 12]

In brief, NAMCS collects information on patient visits to non-federally funded, community, office-based physician practices throughout the United States. The NAMCS utilizes 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 Census Bureau representatives for a systematic random sample of patient visits during a randomly assigned 1-week reporting period for each selected practice. The NCHS weights each visit to allow extrapolation to national estimates for all aspects of the surveys. The visit weight accounts for selection probability, non-response adjustment, and other adjustments to reflect the universe of private office-based visits in the United States.[13]

Using the same methods, NCHS administered the same patient encounter form in 2003 and 2004 allowing these two years to be aggregated for analysis.[13] The NAMCS collected 25,288 patient encounter forms from 1407 practices in 2003 and 25,286 patient encounter forms from 1121 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 two-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 (*e.g.*, demographics and insurance status), physician practice information (*e.g.*, specialty and geographic region), and visit information (*e.g.*, up to 3 reasons for the visit, 3 diagnoses, and 8 medications). Listed medications included prescription and non-prescription medications that the physician prescribed or provided at or prior to the visit and that the physician expected the patient to continue taking. Item nonresponse rates for most data items were 5% or less 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* [ICD-9-CM].[14] *Hypertensive patient visits* were those who had a diagnosis of hypertension (ICD-9 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 co-morbidities were identified primarily by ICD-9 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,[15] JNC 6[16] and JNC 7[7] were used to identify and classify the antihypertensive medications. 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 more than one active ingredient was mentioned either in one single combination preparation or in multiple pills.

We examined the following antihypertensive drug classes: diuretics, β-blockers, calcium channel blockers (CCB), angiotensin converting enzyme inhibitors (ACEI), angiotensin receptor blocker (ARB), α-blockers, central acting agents, peripheral-acting anti-adrenergic agents, and direct vasodilators. Diuretics were further categorized as thiazide diuretics and all other diuretics (*i.e.*, loop and potassium-sparing diuretics), and β-blockers included alpha-beta blockers. Peripheral-acting anti-adrenergic 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[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/ethnicity, medical insurance, new vs. return visit status, general medical exam (GME) visit, US census region, metropolitan area status, physician specialty, and reported use of electronic medical records (EMRs). Health insurance was classified as private/commercial insurance, public insurance (*i.e*., Medicare and Medicaid), and other insurance (*e.g*., 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 (EMR) were distinguished from those that were not. In 2003–2004, 21% (17%–26%) of visits were recorded in practices with an EMR 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 U.S., we took into account the sampling weights and sample design variables contained in the NAMCS datasets.[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% confidence limits (CL), with respect to the outcome measures -- hypertension screening, diagnosis, treatment, and control. Chi-square 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 (two-sided $p<0.15$) were entered into a multiple logistic regression model (PROC RLOGIST) for that outcome. Adjusted odds ratios (OR) and associated Wald χ^2 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 other explanatory variables in the model. Statistical significance was set at two-sided $p<0.05$.

RESULTS

Rates of hypertension screening and diagnosis

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

Rates of hypertension treatment

Antihypertensive drugs were reported in 62% (55%, 69%) of all hypertensive patient visits, with no difference between visits with uncomplicated hypertension (61%) and those with hypertension-related comorbidities (64%). Nutrition and/or exercise counseling were provided or ordered in 35% (29%, 40%) of hypertensive patient visits. Differences in counseling rates were minimal in relation to use of antihypertensive drugs and type of visits (i.e., first-time vs. return).

Diuretics were the most commonly prescribed antihypertensive drug class (46%; 41%, 50%), followed by ACEIs (37%; 32%, 41%), β-blockers (36%; 32%, 41%), CCBs (27%; 23%, 30%), and ARBs (24%; 20%, 28%) (Table 1). Thiazide-type diuretics accounted for 78% (73%, 84%) of all diuretic prescriptions. We observed a non-significant tendency towards 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 antihypertensive drug visits, 58% (54%, 63%) received combination therapy of two or more drug classes. Similar percentages were found for patient visits with uncomplicated hypertension, as well as those with hypertension and comorbidities. Of all patient visits treated with combination drug therapy, 63% (58%, 68%) were prescribed a 2-drug combination. The most frequently combined drug classes were that 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 or more 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%; 34%, 43%) were treated to the BP goal of <140/90 mm Hg, or <130/80 for individuals with diabetes or chronic kidney disease. Of antihypertensive drug visits that were not at goal, 37% (32%, 42%) had a BP <150/95 mm Hg. Of those antihypertensive drug visits without diabetes and chronic kidney disease, 42% (37%, 48%) were at the BP goal of <140/90 mm Hg, whereas of those with either comorbidity, only 20% (8%, 33%) had a BP <130/80 mm Hg. Mean BP was 141/81 mm Hg (SD: 21/13) for antihypertensive drug visits without diabetes and chronic kidney disease, and 143/79 mm Hg (SD: 19/11) for those with either comorbidity. Similar estimates were found for hypertensive patient visits with no reported antihypertensive medications.

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, 16.7). The odds of no BP screening also were greater during visits by patients who were ≥75 years of age vs. 18–44 years (OR: 1.4; 95% CL: 1.0, 1.8), not covered by private or government medical insurance (vs. the privately insured; 1.6; 1.1, 2.3), not having hypertension-related comorbidities (3.2; 2.3, 4.6), or seen for a non-GME visit (5.6; 3.6 8.3) (Table 2). In addition, men were marginally more likely to be not screened than women (1.2; 1.0, 1.4).

Greater odds of not being treated for hypertension were noted by geographic region (South vs. Northeast; 2.6; 1.2, 5.6) and visit type (first time vs. return visits; 1.6; 1.1, 2.4). The odds of not having BP under control were greater for patients with hypertension-related co-morbidities (1.6; 1.1, 2.4) but lower for patients ≥75 years (vs. 18–44 years; 0.5; 0.3, 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; 0.7, 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. Whereas previous studies based on NHANES data provided such information for the entire U.S. non-institutionalized civilian population, this study analyzed NAMCS data in the period 2003–2004 and the results specifically assess the care provided in office-based practices across the United States with regard to hypertension screening, treatment and control. The NAMCS is a unique data source for evaluating the quality of care in U.S. 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 U.S. adults with hypertension to 16%[6] can be reach by 2010. Compounding the higher than targeted prevalence of hypertension, approximately one in four hypertensive people in the U.S. 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 and older for high BP.[5] 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 PCP 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; for example, these include urology, neurology, endocrinology, obstetrics and gynecology. Also, there is likely value in consistency, even in specialty settings where BP measurement is unlikely to make a difference (e.g., dermatology). This may help raise patients' expectations about BP measurement during office visits and awareness of its importance. It also could counteract the tendency of some specialists to forget that they need to consider the whole patient. BP measurement also can be an important screening tool in settings where obtaining actionable BP results are less likely. For example, surgeons should be concerned about BP both prior to surgery and immediately post-surgery.

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%).[1] This contrasts with our expectation of a higher percentage of treated hypertensive patients in the NAMCS sample as opposed to the NHANES sample, because the latter 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 (e.g., younger patients), and lead to unnecessary antihypertensive drug prescription.[17] BP measurement is prone to human and equipment error. More sources of measurement error exist in clinical practice that would result in BP overestimation than underestimation, e.g., insufficient prior rest period, use of a single BP measurement, end-digit preference, patient anxiety, improper cuff size, etc. In NAMCS, only one BP reading was recorded, and the method of measurement was not specified but likely varied across physician practices. In NHANES, BP was measured three (sometime four) 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 medication. This is consistent with the JNC 7 guidelines recommending diuretics as first-line pharmacotherapy for most patients with uncomplicated hypertension.[7] 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[12, 18–20] published by the current authors and other researchers who reported a marked increase in prescriptions for thiazide diuretics as monotherapy or polytherapy following the publication of trial evidence on the clinical equivalence of diuretics with CCBs and ACEIs in December 2002.[21] The apparently low rates of diet and exercise counseling are not surprising in that voluminous studies have documented many missed opportunities for lifestyle counseling during office visits, even for patients who would clearly benefit for such service.[22, 23]

Rates of treatment to control were surprisingly low among all 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 due to the differences in methodology by which BP was measured and reported in NAMCS vs. NHANES as noted above. Overestimation 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 pre-treatment 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 pre-treatment 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 untreated hypertension that has had no contact with the health care system. Furthermore, treatment of hypertensive patients may fail to achieve “optimal” BP goals due to clinical inertia (or the failure to intensify therapy when clinically indicated)[24] and poor medication adherence and persistence,[25] 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 or appropriate to measure the success of treatment.[26–28] 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.[28] Further, defining BP control using point cut-offs ignores the underlying distribution of what is a continuous variable and minimizes the actual improvement of risk when BP is lowered substantially, yet fails to get below a selected cut-off (e.g., 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 over one third of the hypertensive patient visits that were not treated to goal had a near-goal BP measurement, i.e., <150/95 mm Hg. The clinical importance of small deviations from "optimal" treatment targets such as these is unclear without a comprehensive assessment of the overall risk/benefit ratio of the treatment needed to achieve the idealized goals, as well as patient preferences.

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 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 also may be possible due to incomplete reporting of diagnoses, medications prescribed and services rendered to the patient. This may be particularly problematic when a patient's diagnoses exceed the three 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 eight spaces for reporting. Furthermore, physician awareness and adherence to practice guidelines is a complex issue that requires careful consideration of a range of factors that can influence physicians' decision to screen for, treat and control high BP, for some of which we do not have data in this study.

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. Data from recent clinical trials[29–31] and epidemiological studies[1] suggest the Healthy People 2010 objective to increase the proportion of hypertensive adults with controlled BP to 50%[6] can be attained. The United States is leading the way in hypertension treatment and control compared with other westernized countries[32] and continues to develop new strategies in pursuit of greater success.[33–34]

PERSPECTIVES

National Ambulatory Care Surveys are an important and necessary tool to evaluate the status quo and changes in the quality of care that Americans receive in routine clinical practice settings. Inarguably, the utility of such surveys depends critically on the quality of data. Accurate blood pressure measurements are crucial to hypertension diagnosis, treatment and control. Yet, blood pressure is notoriously difficult to obtain accurately. Not only is blood pressure subject to biological variation but it also is vulnerable to many sources of human and technical error. Blood pressure measurement in routine clinical practice often deviates from standard protocols. System-wide approaches to increasing the accuracy of clinically measured blood pressure are needed to improve the quality of care for individual patients, as well as to allow for more accurate surveillance on a population level. Further research efforts are also needed to refine definitions of treatment success and to develop performance measures that will more fully capture the complex reality of care for patients with hypertension than can be accomplished with the "optimal" treatment goals approach alone.

Acknowledgements

We thank Ky-Van Lee for assistant in data management and analysis.

Sources of Funding: This research was funded by research awards from the National Institute on Aging (P30 AG017253-06) and the U.S. Agency for Healthcare Research and Quality (R01-HS11313).

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Table 1

Prescription of antihypertensive medications by drug class among total antihypertensive drug visits, NAMCS 2003–2004.*

Antihypertensive drug class	All hypertensive patient visits	Hypertensive patient visits without compelling comorbidities †	Hypertensive patient visits with compelling comorbidities
Any diuretics	46% (41% 50%)	47% (42% 52%)	41% (33% 49%)
Thiazide-type diuretics ‡	78% (73% 84%)	81% (75% 87%)	69% (59% 79%)
β-blockers	36% (32% 41%)	35% (29% 41%)	39% (31% 47%)
ACEIs	37% (32% 41%)	34% (29% 38%)	46% (37% 55%)
ARBs	24% (20% 28%)	24% (19% 28%)	26% (19% 33%)
CCBs	27% (23% 30%)	26% (22% 31%)	27% (21% 33%)
Combination drug therapy	58% (54% 63%)	58% (53% 63%)	61% (51% 70%)
Combinations of 2 drug classes §	63% (58% 68%)	68% (62% 74%)	50% (41% 59%)

*Antihypertensive drug visits are patient visits diagnosed with hypertension and treated with any antihypertensive drug therapy. Numbers in parentheses are 95% CLs. Percentages may sum to >100% across drug classes due to combination drug therapy.

†Compelling co-morbidities include hypertensive organ damage, ischemic heart disease, diabetes mellitus, heart failure, cerebrovascular disease, and chronic renal disease.

‡Percentages (95% CLs) of antihypertensive drug visits in which a diuretic was reported.

§Percentages (95% CLs) of antihypertensive drug visits in which combination drug therapy was reported.

Table 2

Independent associations of patient visit characteristics with the risks of not being screened, treated or controlled forhypertension, respectively, during office-based visits by patients ≥18 years of age, NAMCS 2003–2004.

Patient visit characteristic	BP screening N (%)*	Adjusted odds ratio† (95% CI)	BP treatment N (%)‡	Adjusted odds ratio (95% CI)	BP control N (%)§	Adjusted odds ratio (95% CI)
Age (yr)						
18–44	3018 (59%)	1.00 (reference)	95 (60%)	1.00 (reference)	55 (32%)	1.00 (reference)
45–59	2582 (56%)	1.15 (0.97 1.37)	352 (64%)	0.90 (0.56 1.47)	230 (39%)	0.70 (0.43 1.14)
60–75	2338 (53%)	1.18 (0.94 1.47)	403 (62%)	1.00 (0.64 1.56)	219 (33%)	0.92 (0.53 1.56)
75+	1764 (51%)	1.37 (1.03 1.82)	309 (61%)	1.08 (0.65 1.81)	180 (45%)	0.52 (0.28 0.98)
Sex						
Female	5779 (56%)	1.00 (reference)	626 (64%)	1.00 (reference)	370 (36%)	1.00 (reference)
Male	3929 (55%)	1.18 (1.00 1.37)	533 (59%)	1.33 (0.97 1.82)	314 (40%)	0.83 (0.63 1.10)
Race/Ethnicity						
Non-Hispanic white	7605 (54%)	1.00 (reference)	831 (62%)	1.00 (reference)	502 (38%)	1.00 (reference)
Non-Hispanic black	1018 (64%)	0.81 (0.58 1.14)	200 (65%)	0.75 (0.45 1.23)	105 (35%)	1.04 (0.74 1.52)
Hispanic	779 (58%)	0.95 (0.66 1.39)	77 (53%)	1.54 (0.79 2.94)	48 (33%)	1.08 (0.65 1.75)
Asian/Pacific Islander	228 (55%)	1.32 (0.79 2.17)	41 (66%)	1.19 (0.65 2.17)	22 (45%)	0.60 (0.27 1.33)‖
Medical Insurance						
Private	5115 (61%)	1.00 (reference)	#			
Government	3635 (54%)	1.08 (0.88 1.32)				
Other	838 (49%)	1.61 (1.14 2.27)				
Geographic Region						
Northeast	1735 (48%)	1.00 (reference)	203 (76%)	1.00 (reference)		
Midwest	2627 (57%)	0.79 (0.47 1.33)	269 (64%)	1.61 (0.81 3.23)		
South	3320 (57%)	0.78 (0.47 1.28)	410 (53%)	2.63 (1.23 5.55)		
West	2020 (58%)	0.68 (0.40 1.16)	277 (72%)	1.11 (0.46 2.70)		
Urban						

Patient visit characteristic	BP screening N (%)[*]	Adjusted odds ratio[†] (95% CI)	BP treatment N (%)[‡]	Adjusted odds ratio (95% CI)	BP control N (%)[§]	Adjusted odds ratio (95% CI)
Yes	8188 (55%)	1.00 (reference)	1020 (65%)	1.00 (reference)		
No	1514 (62%)	0.83 (0.50 1.41)	139 (47%)	1.89 (0.96 3.70)		
Visit Type						
First-time visits			192 (54%)	1.60 (1.05 2.43)	103 (33%)	1.33 (0.90 1.96)
Return visits			967 (65%)	1.00 (reference)	581 (39%)	1.00 (reference)
Physician Specialty						
Cardiologist	1234 (86%)	1.00 (reference)				
Internist	1368 (84%)	1.09 (0.47 2.50)				
General/Family Practitioner	2976 (85%)	0.93 (0.50 1.75)				
Other	4124 (35%)	10.0 (5.55 16.7)				
Comorbidities[**]						
Yes	1731 (80%)	1.00 (reference)			164 (31%)	1.61 (1.07 2.41)
No	7971 (53%)	3.23 (2.33 4.55)			520 (40%)	1.00 (reference)
General Med Exam						
Yes	901 (86%)	1.00 (reference)				
No	8801 (53%)	5.56 (3.57 8.33)				
Hypertension Medication						
Yes	N/A	N/A	N/A	N/A	471 (39%)	1.00 (reference)
No	N/A	N/A	N/A	N/A	213 (37%)	1.13 (0.74 1.72)

[*] 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 other characteristics included in the multiple logistic regression model for the referenced outcome, i.e., not being screened, treated, or controlled for hypertension, respectively.

[‡] Numbers and percentages of treated hypertensive patient visits in which at least one antihypertensive medication was reported.

[§] Numbers and percentages of hypertensive patient visits in which BP was at goal, i.e., <140/90 mm Hg and <130/80 mm Hg for patients with diabetes or chronic kidney disease.

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[||]According to the NAMCS analytical guidelines, estimates based on fewer than 30 sample cases or with greater than a 30% relative standard error (i.e., the standard error 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 chi-square analyses.

[**]Comorbidities include: hypertensive organ damage, ischemic heart disease, diabetes mellitus, heart failure, cerebrovascular disease, and chronic renal disease.