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## CHARACTERISTICS OF PATIENTS WITH UNCONTROLLED HYPERTENSION IN THE UNITED STATES

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### ABSTRACT

**Background** Treatment of hypertension is one of the most common clinical responsibilities of U.S. physicians, yet only one fourth of patients with hypertension have their blood pressure adequately controlled.

**Methods** We analyzed data from the third National Health and Nutrition Examination Survey to assess the role of access to and use of health care in the control of hypertension. Hypertension was defined as a blood pressure of at least 140/90 mm Hg or the use of anti-hypertensive medication.

**Results** The study sample consisted of 16,095 adults who were at least 25 years old and for whom blood-pressure values were known. We estimated that 27 percent of the population had hypertension, but only 23 percent of those with hypertension were taking medications that controlled their condition. Among subjects with untreated or uncontrolled hypertension, the pattern was an elevation in the systolic blood pressure with a diastolic pressure of less than 90 mm Hg. The great majority had health insurance. Independent predictors of a lack of awareness of hypertension were an age of at least 65 years, male sex, non-Hispanic black race, and not having visited a physician within the preceding 12 months. The same variables, except for non-Hispanic black race, were independently associated with poor control of hypertension among those who were aware of their condition. An age of at least 65 years accounted for the greatest proportion of the attributable risk of the lack of awareness of hypertension and the lack of control of hypertension among those who were aware of their condition.

**Conclusions** Most cases of uncontrolled hypertension in the United States consist of isolated, mild systolic hypertension in older adults, most of whom have access to health care and relatively frequent contact with physicians. (N Engl J Med 2001;345:479-86.)

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**H**YPERTENSION is the leading reason for office visits to physicians in the United States,<sup>1</sup> and the widespread treatment of hypertension is a major contributor to the decline in the incidence of stroke and heart disease over the past 30 years.<sup>2</sup> However, the percentage of persons in whom hypertension is controlled (defined as a systolic blood pressure of less than 140 mm Hg and a diastolic blood pressure of less than 90 mm Hg) is widely viewed as unsatisfactory and may in fact have decreased since 1990.<sup>3</sup> Frequently cited data from phase II (1992 to 1994) of the third National Health and Nutrition Examination Survey (NHANES III) indicate that 32 percent of all persons with hypertension are unaware of their condition and are not receiving treatment, 15 percent are aware of it but are not receiving treatment, and 26 percent have treated but uncontrolled hypertension, leaving only 27 percent in whom hypertension is controlled.

Limitations in the extent of the control of hypertension in the population are commonly attributed to lack of access to health care, noncompliance with treatment, and a disproportionate burden of hypertension among racial and ethnic minorities. However, there is growing evidence that uncontrolled hypertension also occurs in populations with good access to health care.<sup>4</sup> The role of physicians' patterns of practice is gaining attention as a contributor to the poor control of hypertension. A national survey of primary care physicians suggests that approximately one third do not recommend treatment in patients whose diastolic blood pressure ranges from 90 to 100 mm Hg and that an even higher percentage would not treat or intensify treatment in patients whose systolic blood pressure ranged from 140 to 160 mm Hg.<sup>5</sup> Studies that documented physicians' behavior confirmed that physi-

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cians are unlikely to diagnose persistently elevated systolic pressure with a diastolic pressure of less than 90 mm Hg as hypertension or to treat this condition aggressively.<sup>6,7</sup>

Because of the potential effects of more aggressive treatment of hypertension on the costs of health care and on outcomes among patients, efforts to improve the extent of the control of hypertension in the population must be based on a thorough understanding of the characteristics of patients and the health care system that contribute to poor control. Although the NHANES III data have been analyzed from an epidemiologic perspective,<sup>8</sup> little attention has been given to the clinical implications of the blood-pressure levels observed in persons with poorly controlled hypertension or to the role of access to and use of health care services in efforts to control hypertension. Therefore, we analyzed NHANES III data to compare the actual blood-pressure levels in persons who were unaware that they had hypertension, those who were aware of their condition but who were not being treated, those who had treated but uncontrolled hypertension, and those in whom hypertension was controlled by treatment. In addition, we assessed the effect of sociodemographic characteristics and variations in access to and the use of health care on the control of hypertension and determined the population-attributable risk associated with the variables that were found to be independently predictive of an increased likelihood of uncontrolled hypertension. We hypothesized that most cases of uncontrolled hypertension in the United States consist of mild elevations in systolic pressure in patients receiving regular medical care.

## METHODS

Details of the survey methods used in NHANES III, including the protocol for blood-pressure measurement, have been published by the National Center for Health Statistics.<sup>9</sup> Written informed consent was obtained from the subjects. Information on the variables selected for the present analysis was collected during an extensive interview in the subject's home, and these variables have been widely studied by other investigators with respect to their value as predictors of the outcomes of chronic disease.<sup>10,11</sup> They include sociodemographic factors (age, sex, race or ethnic background, and level of education), factors related to access to health care (family income, the availability of health insurance, and the presence or absence of a usual source of care), and the extent of the use of health care. The design of NHANES III included oversampling of persons over the age of 65 years, Mexican Americans, and non-Hispanic blacks to provide reliable estimates in these subgroups of the population.

We defined access to health care as the subjects' report of having either public or private health insurance and a usual source of care. The use of health care was examined both as a continuous variable (in terms of the number of visits to a physician reported in the past 12 months) and as a dichotomous variable (having or not having visited a physician at least once in the past year). Current cigarette smoking was included as a potential confounder of the use of health care and control of hypertension. We defined hypertension status according to the criteria used by Burt and colleagues<sup>8</sup> (Table 1).

We used descriptive statistics to compare the distribution of study variables among all categories of hypertension. We used logistic-regression analysis to identify the independent contribution of so-

**TABLE 1.** CRITERIA FOR THE CLASSIFICATION OF HYPERTENSION.\*

CATEGORY†	CRITERIA
No hypertension	SBP <140 mm Hg and DBP <90 mm Hg; subject not currently taking an antihypertensive medication
Hypertension	SBP ≥140 mm Hg or DBP ≥90 mm Hg or subject currently taking an antihypertensive medication
Hypertension present but subject unaware of it	SBP ≥140 mm Hg or DBP ≥90 mm Hg; subject answers "no" to the question, "Have you ever been told you have hypertension, also known as high blood pressure?"
Acknowledged, untreated hypertension	SBP ≥140 mm Hg or DBP ≥90 mm Hg; subject answers "yes" to the question, "Have you ever been told you have hypertension?" but states he or she is not currently taking antihypertensive medication
Treated uncontrolled hypertension	Subject answers "yes" to questions regarding awareness and treatment of hypertension but has a SBP ≥140 mm Hg or a DBP ≥90 mm Hg
Treated controlled hypertension	Subject answers "yes" to questions regarding awareness and treatment of hypertension and has a SBP <140 mm Hg and a DBP <90 mm Hg

\*SBP denotes systolic blood pressure, and DBP diastolic blood pressure.

†In keeping with the long-standing classification criteria, subjects who reported having been told they had hypertension but who were not currently taking antihypertensive medication and whose blood pressure was less than 140/90 mm Hg were assigned to the group without hypertension.

ciodemographic factors and factors related to access to and use of health care to the risk of having hypertension but being unaware of the condition and to the risk of having acknowledged but uncontrolled hypertension (defined as a blood pressure of at least 140/90 mm Hg). To assess the relative risk of having hypertension but being unaware of the condition that was associated with access to and use of health care, we used subjects without hypertension as the comparison group, since the diagnosis of hypertension is, in itself, likely to alter a person's patterns of health care use. The conventional definitions of categories of hypertension applied to data from NHANES III do not permit multivariate modeling of the contribution of drug treatment to the control of hypertension in the population, since subjects who reported having been told they had hypertension, who were not taking antihypertensive agents, and yet whose blood pressure was less than 140/90 mm Hg were assigned to the group without hypertension. We conducted additional multivariate modeling to verify that the estimates of relative risks obtained for our main study variables were not altered by the inclusion of other potential confounders of hypertension control, including the body-mass index and the level of alcohol consumption.

We used the estimates of relative risks for significant variables in the logistic-regression analyses to calculate population-attributable risks associated with specific variables.<sup>12</sup> This measure provides an additional perspective on the extent to which the control of hypertension in the population could be improved by addressing a specific risk factor, since very large relative risks may have a small effect on a population when the prevalence of the risk factor is low.

All analyses were performed with the use of SUDAAN, a statistical package that adjusts all estimates, including odds ratios and their standard errors, for the complex survey design.<sup>13</sup> Since the observations contributed by each person in the sample must be weight-

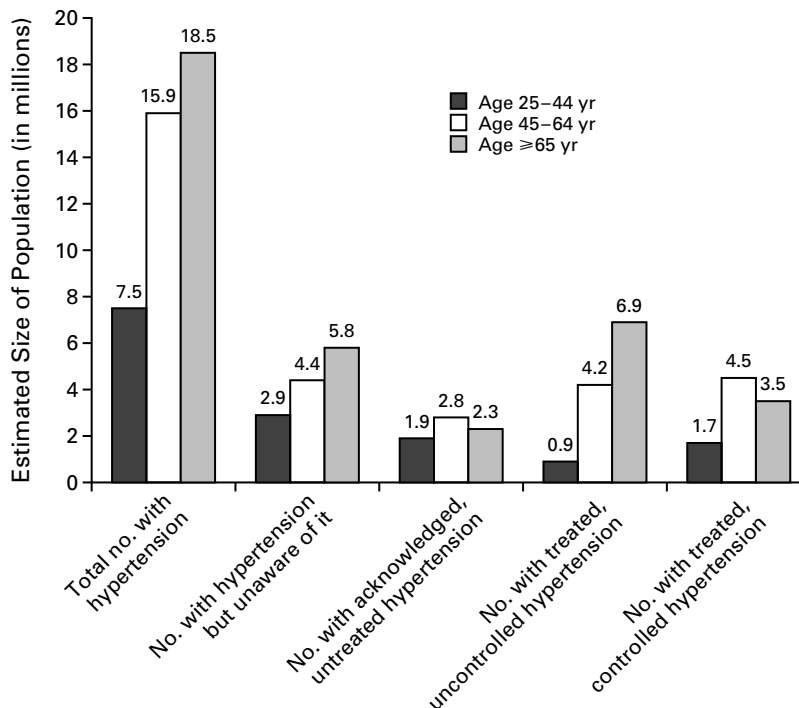
ed for the differential probabilities of selection and nonresponse, the actual sample sizes in each category of hypertension are not included in the tabulated results. Total population sizes, represented by each person in the sample for whom data were available, are included in the results obtained with the use of SUDAAN.

RESULTS

The NHANES III sample included a total of 16,095 adults who were at least 25 years old and for whom blood-pressure values and hypertensive-medication status were known. The projected size of the population in each category of hypertension in the U.S. population as a whole on the basis of the NHANES III sample is presented in Figure 1. Of the estimated 41.9 million people with hypertension, 31 percent (approximately 13.1 million) were unaware of their hypertension, 17 percent (7.0 million) were aware of their condition but were not being treated, 29 percent (12.0 million) were being treated but their hypertension remained uncontrolled, and only 23 percent (9.7 million) were taking medications that controlled their hypertension. Although persons 65 years of age or older represent only 19 percent of the total population, they constituted 45 percent of the persons who were

unaware of their condition, 32 percent of those who were aware of their condition but not being treated, and 57 percent of those who had treated but uncontrolled hypertension. The largest segment of the population was 25 to 44 years old, but only 22 percent of the subjects who were unaware of their hypertension, 27 percent of those who were aware but not being treated, and less than 10 percent of those with treated but uncontrolled hypertension were in this age group. Among persons who were being treated, hypertension was controlled in 65 percent of those who were 25 to 44 years old, 52 percent of those who were 45 to 64 years old, and 34 percent of those 65 or older.

The proportion of non-Hispanic whites, non-Hispanic blacks, and Mexican Americans who were in each category is shown in Figure 2. A higher percentage of non-Hispanic blacks than of non-Hispanic whites had hypertension. A slightly smaller percentage of non-Hispanic blacks than of non-Hispanic whites were unaware of their condition, and the percentage of non-Hispanic blacks with controlled hypertension was essentially the same as that among non-Hispanic whites. Although the overall prevalence of hyperten-



**Figure 1.** Number of Persons Classified in the Various Categories of Hypertension in Each Age Group among the Members of the U.S. Population Who Were at Least 25 Years Old.

Data are from the third National Health and Nutrition Examination Survey. At the time of the survey (1988 to 1994), an estimated 154.2 million people in the United States were at least 25 years of age; of this number, an estimated 41.9 million (27 percent) had hypertension. Because of rounding, not all bars sum to the totals shown.

sion is lower among Mexican Americans than in the other two groups, Mexican Americans were markedly more likely than non-Hispanic whites or non-Hispanic blacks to be unaware that they had hypertension and less likely to have controlled hypertension if they were receiving treatment.

The mean blood pressure in each category of uncontrolled hypertension is shown according to age in Table 2. More than 75 percent of all the subjects who were unaware that they had hypertension and of those with uncontrolled, treated hypertension, as well as about 60 percent of those with acknowledged, untreated hypertension, had a diastolic blood pressure of less than 90 mm Hg. The elevation in systolic blood pressure in the three groups was mild, as assessed on the basis of historical standards. A pattern of elevation in the systolic blood pressure with a diastolic blood pressure of less than 90 mm Hg was dominant in both the group that was 45 to 64 years of age and the group that was 65 years of age or older. Only in the youngest group did the average diastolic blood pressure equal or exceed 90 mm Hg. Yet even in this stratum, over 50 percent of those who were unaware that they had hypertension had a diastolic blood pressure

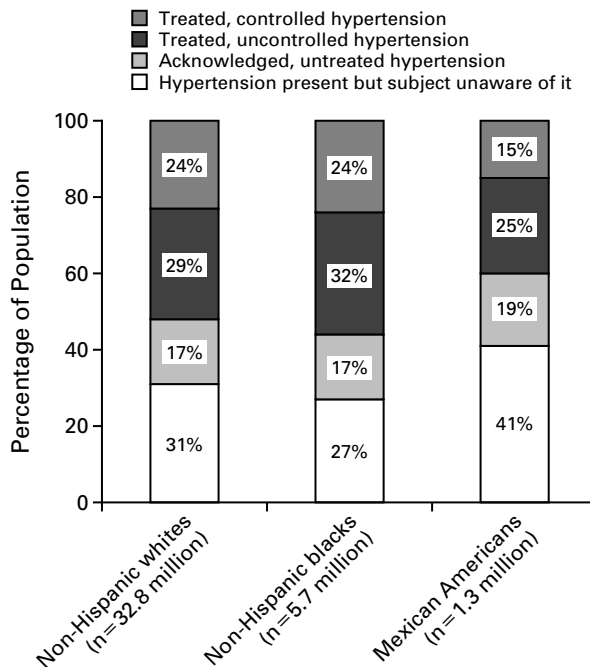
of less than 90 mm Hg with a systolic blood pressure of 140 mm Hg or more.

Data on demographic characteristics and the extent of access to and use of health care according to category of hypertension are presented in Table 3. Although there were some differences in access and use among the groups, 92 percent of all subjects with uncontrolled hypertension had health insurance, 86 percent reported having a usual source of care, and the mean number of visits to physicians in this group was 4.28 per year. About 75 percent of the subjects who were unaware that they had hypertension had had their blood pressure measured by a health professional in the preceding year. Subjects who were unaware of their hypertension were less frequent users of health care than other subjects with hypertension, but their frequency of use was quite similar to that of the subjects without hypertension. Subjects who were unaware of their hypertension and those with acknowledged, untreated hypertension still averaged at least three visits to physicians per year, and over 40 percent of the subjects in each group were taking a prescription drug but not an antihypertensive drug. There was little difference in the use of health care between subjects with treated controlled hypertension and subjects with treated uncontrolled hypertension; subjects in both groups had made a mean of more than six visits to a physician in the past 12 months.

Results of the logistic-regression analyses are reported in Table 4. Male sex, non-Hispanic black race, and not having seen a physician in the past year increased the risk of being classified as having hypertension but being unaware of the condition — by 57 percent, 45 percent, and 41 percent, respectively. An age of at least 65 years was by far the strongest risk factor for the lack of awareness of hypertension. Having health insurance did not affect the risk, even in models that did not include the variable concerning the frequency of visits to physicians. Treating the number of visits to physicians as a continuous variable did not significantly change the odds ratios associated with other variables concerning the extent of access to health care. Similarly, when body-mass index and alcohol consumption were included in the model, these variables did not alter the magnitude of the odds ratios associated with variables concerning access to and use of health care.

In the model that assessed the risk of having acknowledged but uncontrolled hypertension, male sex, not having seen a physician in the preceding 12 months, and an age of at least 65 years were significant risk factors. Again, having health insurance was not independently related to the likelihood of having acknowledged, uncontrolled hypertension, even in models that did not include the frequency of visits to physicians. These results were not altered by the inclusion of body-mass index and alcohol consumption in the model.

In Table 5, the population attributable risks are pre-



**Figure 2.** Extent of Awareness, Treatment, and Control of Hypertension among Non-Hispanic Whites, Non-Hispanic Blacks, and Mexican Americans with Hypertension in the Third National Health and Nutrition Examination Survey.

Sample sizes for other racial and ethnic groups were too small to analyze separately. Percentages may not sum to 100 because of rounding.

**TABLE 2.** BLOOD-PRESSURE LEVELS IN SUBJECTS WITH UNCONTROLLED HYPERTENSION, ACCORDING TO AGE.\*

AGE GROUP	HYPERTENSION PRESENT BUT SUBJECT UNAWARE OF IT		ACKNOWLEDGED, UNTREATED HYPERTENSION		TREATED, UNCONTROLLED HYPERTENSION	
	MEAN BLOOD PRESSURE	SBP ≥140	MEAN BLOOD PRESSURE	SBP ≥140	MEAN BLOOD PRESSURE	SBP ≥140
		mm Hg AND DBP <90		mm Hg AND DBP <90		mm Hg AND DBP <90
	mm Hg	%	mm Hg	%	mm Hg	%
25–44 yr	138/91	51.9±7.4	141/94	25.1±7.9	147/95	29.1±7.9
45–64 yr	148/86	69.4±3.3	152/89	53.5±4.8	150/87	66.1±2.8
≥65 yr	153/77	91.1±1.1	160/81	81.5±2.7	159/78	87.6±1.3
All subjects	148/83	78.8±2.0	151/88	59.1±2.7	155/82	76.9±1.5

\*Plus–minus values are means ±SE. SBP denotes systolic blood pressure, and DBP diastolic blood pressure.

**TABLE 3.** DEMOGRAPHIC FACTORS AND FACTORS REFLECTING THE EXTENT OF ACCESS TO AND USE OF HEALTH CARE, ACCORDING TO CATEGORY OF HYPERTENSION.\*

FACTOR	NO HYPERTENSION	UNCONTROLLED HYPERTENSION			TOTAL	TREATED, CONTROLLED HYPERTENSION
		UNAWARE OF CONDITION	ACKNOWLEDGED, UNTREATED HYPERTENSION	TREATED, UNCONTROLLED HYPERTENSION		
<b>Demographic</b>						
Age (yr)	38.14±0.31	58.31±0.64	55.34±0.68	64.85±0.59	60.08±0.44	58.64±0.65
Male sex (%)	47.49±0.52	58.70±1.35	54.36±2.92	40.76±1.73	51.15±1.22	37.69±1.72
<b>Access to health care (%)</b>						
High-school graduation	76.31±1.00	66.06±1.66	67.17±2.11	58.37±2.14	63.46±1.50	65.61±2.46
Family income						
<\$20,000/yr	27.08±1.02	37.72±2.56	38.34±2.34	42.23±2.02	39.51±1.86	39.18±2.46
\$20,000–\$50,000/yr	47.44±0.83	44.15±2.23	48.46±2.55	40.40±1.70	43.67±1.56	39.82±2.00
>\$50,000/yr	25.47±1.36	18.13±1.70	13.20±1.49	17.37±1.84	16.82±1.24	21.00±2.61
Has health insurance	85.69±0.95	90.16±1.32	89.50±2.04	95.72±0.66	92.09±0.81	93.50±1.12
Has a usual source of care	74.94±0.93	79.22±1.88	80.38±2.63	97.05±0.58	86.05±1.06	95.20±0.71
<b>Use of health care</b>						
Visited physician ≥1 times in past 12 mo (%)	75.90±0.63	71.70±1.80	72.52±2.69	96.00±0.62	80.84±1.08	96.73±0.93
No. of visits to physician in past 12 mo	3.47±0.08	3.04±0.18	3.52±0.30	6.13±0.23	4.28±0.13	6.26±0.25
Time since last blood-pressure measurement (%)						
<6 mo	59.43±0.92	60.11±1.46	62.33±4.00	88.79±0.91	72.39±1.05	89.57±1.46
6–11 mo	18.21±0.66	14.89±1.26	12.40±2.17	7.98±0.78	11.71±0.79	8.25±1.17
1–4 yr	18.58±0.64	19.32±1.59	23.60±3.71	3.19±0.65	13.05±0.96	2.13±0.66
≥5 yr	3.91±0.26	5.69±0.70	1.68±0.55	0.04±0.03	2.86±0.33	—
<b>Lifestyle</b>						
Current smoking (%)	29.07±0.83	22.80±1.70	26.08±1.72	16.32±1.70	21.12±1.11	18.80±1.55

\*Plus–minus values are means ±SE.

**TABLE 4.** RESULTS OF MULTIVARIATE ANALYSIS OF PREDICTORS OF THE LACK OF AWARENESS AND LACK OF CONTROL OF HYPERTENSION IN THE U.S. POPULATION.\*

VARIABLE	LACK OF AWARENESS OF CONDITION†		ACKNOWLEDGED, UNCONTROLLED HYPERTENSION‡	
	ODDS RATIO (95% CI)	P VALUE	ODDS RATIO (95% CI)	P VALUE
Age ≥65 yr (vs. <65 yr)	7.69 (5.88–9.09)	<0.001	2.08 (1.64–2.53)	<0.001
Male sex (vs. female sex)	1.57 (1.36–1.82)	<0.001	1.30 (1.02–1.65)	0.03
Race or ethnic group (vs. non-Hispanic white)				
Non-Hispanic black	1.45 (1.18–1.79)	0.001	1.24 (0.97–1.59)	0.08
Mexican American	0.86 (0.66–1.13)	0.28	1.17 (0.92–1.48)	0.20
High-school graduation (vs. no high-school graduation)	0.87 (0.69–1.09)	0.21	1.00 (0.75–1.33)	0.98
Family income (vs. ≥\$50,000/yr)				
<\$20,000/yr	1.25 (0.90–1.74)	0.18	1.03 (0.69–1.55)	0.87
\$20,000–\$49,999/yr	1.06 (0.82–1.38)	0.63	1.26 (0.93–1.73)	0.14
Has health insurance (vs. has no health insurance)	0.91 (0.61–1.34)	0.62	1.30 (0.79–2.13)	0.29
Has a usual source of care (vs. has no usual source of care)	1.12 (0.87–1.43)	0.38	1.07 (0.63–1.84)	0.79
No visits to physician in past 12 mo (vs. ≥1 visits in past 12 mo)	1.41 (1.14–1.75)	0.002	1.89 (1.09–3.29)	0.03
Current smoking (vs. nonsmoking)	0.78 (0.62–0.98)	0.04	1.20 (0.92–1.57)	0.17

\*Data are from phases I and II (1988 to 1994) of the third National Health and Nutrition Examination Survey. CI denotes confidence interval.

†The model included a total of 10,576 persons: 8928 persons without hypertension and 1648 who had hypertension but who were unaware of their condition.

‡The model included 3516 persons: 1117 with acknowledged, untreated hypertension and 2399 with treated hypertension.

sented for the risk factors that were found to be significant in the multivariate analysis. An age of at least 65 years was associated with the largest attributable risk for both outcomes. Male sex was also associated with a substantial attributable risk. Not having visited a physician in the preceding 12 months accounted for less than 10 percent of the attributable risk, and non-Hispanic black race accounted for less than 5 percent.

## DISCUSSION

Our analysis yielded four important observations regarding the factors underlying poor control of hypertension in the United States: undiagnosed hypertension and treated but uncontrolled hypertension occur largely under the watchful eye of the health care system; the problems of the lack of awareness of hypertension and lack of adequate control with treatment are heavily concentrated among older members of our society; the lack of control of hypertension is not confined to the poor, the uninsured, or minorities; and the pattern of an elevation in the systolic blood pressure with a diastolic blood pressure of less than 90 mm Hg predominates not only in the elderly, but also among

the middle-aged. These findings dispel the stereotype that the typical patient with uncontrolled hypertension is a young man (often non-Hispanic black) who does not visit the physician or who will not take antihypertensive drugs regularly.

The multivariate analysis of predictors of the lack of awareness of hypertension indicated that biologic factors known to affect blood-pressure levels, such as increasing age, male sex, and non-Hispanic black race, completely overshadow the contribution of infrequent use of health care. By comparing subjects who were unaware of their hypertension with subjects who did not have hypertension, we were able to assess the role of access to and use of health care in this cross-sectional study without the risk of confounding posed by the diagnosis of hypertension itself.

The largest relative risk and attributable risk of uncontrolled hypertension were associated with an age of at least 65 years. The elderly have the most frequent contact with the health system and are the most likely to have medical insurance. They are not likely to be less compliant than younger adults about taking prescribed medications. Thus, the main challenge in this

**TABLE 5.** PROPORTION OF CASES OF UNCONTROLLED HYPERTENSION IN EACH POPULATION SUBGROUP ATTRIBUTABLE TO IDENTIFIED RISK FACTORS.\*

RISK FACTOR	LACK OF AWARENESS OF CONDITION			ACKNOWLEDGED, UNCONTROLLED HYPERTENSION		
	RELATIVE RISK	PREVALENCE	ATTRIBUTABLE RISK	RELATIVE RISK	PREVALENCE	ATTRIBUTABLE RISK
Age ≥65 yr (vs. <65 yr)	7.69	0.13±0.72	0.46	2.08	0.44±1.53	0.32
Male sex (vs. female sex)	1.58	0.48±0.46	0.22	1.30	0.43±1.04	0.12
Non-Hispanic black race (vs. non-Hispanic white)	1.45	0.11±0.63	0.05	—	—	—
No visits to physician in past 12 mo (vs. ≥1 visits)	1.40	0.25±0.62	0.09	1.89	0.10±0.99	0.08

\*Attributable risk is calculated as  $P(RR - 1) \div [P(RR - 1) + 1]$ , where P is the prevalence of the risk factor in the population and RR is the relative risk associated with the presence of the factor. Dashes indicate that non-Hispanic black race is not a significant risk factor in the model.

group is to identify effective therapeutic regimens to achieve targeted blood-pressure levels. There is persistent controversy about the appropriateness of the current treatment goal of a systolic blood pressure of less than 140 mm Hg in this group.<sup>14</sup> Since in the U.S. population, the highest prevalence of uncontrolled hypertension is in middle-aged and older persons who have mild elevations in systolic blood pressure but not in diastolic blood pressure, more clinical trials may be needed, especially in view of a recent clinical advisory from the National High Blood Pressure Education Program calling for the use of systolic blood pressure as the chief diagnostic and management criterion.<sup>15</sup>

Although a lack of health insurance may partially explain the lower frequency of visits to physicians among subjects who were unaware that they had hypertension and those who had acknowledged, untreated hypertension, it is clearly not the main determinant. The rates of awareness and control of hypertension are significantly higher in the United States than in developed countries with national health insurance systems, suggesting that access to health care is a less important factor than standards of practice.<sup>16,17</sup>

Our study has some limitations. The NHANES III used self-reported data on measures concerning access to and use of health care, and the blood-pressure values used in the analysis were obtained by survey personnel, not by the subjects' health care providers. The survey did not include an examination of the subjects' medical records. Therefore, although we know that the subjects saw physicians and had mild elevations in systolic blood pressure, we cannot directly associate the behavior of these physicians with the blood pressures measured during the survey. The fact that a blood-pressure measurement obtained on a single occasion was used to determine the subjects' awareness of having hypertension and the control of the condition is another possible limitation of the study. However, this

large, national sample provides the best available estimates of blood-pressure levels in the population and is the source of data used to evaluate national public health goals. Although some persons would be reclassified as having either hypertension or normotension on remeasurement, the overall proportions in each category should remain the same.

Nearly 10 years has elapsed since the last NHANES survey was completed. Despite the growing realization of the importance of systolic blood pressure in the control of hypertension, more recent data documenting the actual practices of physicians do not suggest that there have been any major shifts in behavior.<sup>7,18</sup> A new national health examination survey is under way, but the results for a sample size similar to that of NHANES III will not be available for several years. Given the importance of controlling hypertension and the number of people affected by efforts to improve control, NHANES III is still the best available source of data on determinants of the degree of awareness and control of hypertension in the general population.

The prevalence of the lack of awareness and control of hypertension that we found differs slightly from other published estimates because we used 25 years as the lower age limit and we did not have an upper age limit. Other frequently cited sources report data for subjects 18 to 74 years of age, so as to permit comparison with data from previous NHANES.<sup>8</sup> We chose this age range because the new standards of the Health Plan Employer Data and Information Set (HEDIS), published by the National Committee for Quality Assurance, define controlled hypertension as a systolic blood pressure of less than 140 mm Hg and a diastolic blood pressure of less than 90 mm Hg; this criterion is recommended for grading the effectiveness of health care organizations,<sup>19</sup> with no upper age limit suggested. In addition, persons who are 18 to 25 years of age have a low prevalence of hypertension, and their

access to health care may be dependent on that of their parents.

We elected to use a standard definition of controlled hypertension that was based on the criteria used in previous reports. During the time frame covered by the survey, separate, lower standards for persons with diabetes mellitus, renal insufficiency, or congestive heart failure were not in place and thus cannot legitimately be applied to an evaluation of the effect of factors related to the health system on the control of hypertension. We suspect that if lower blood-pressure values were used to define controlled hypertension, even more of those with uncontrolled hypertension would be found to be under medical care.

In summary, we found that the majority of subjects with uncontrolled hypertension — whether or not they were aware of their condition and whether or not they were taking antihypertensive drugs — were persons who had access to medical care and who had a mild elevation in systolic blood pressure with a diastolic blood pressure of less than 90 mm Hg. Randomized clinical trials have provided evidence of the benefit of antihypertensive drugs in elderly patients with a systolic blood pressure of more than 160 mm Hg and a diastolic blood pressure of less than 90 mm Hg,<sup>20,21</sup> but there is no such evidence regarding persons with only a mild elevation in systolic blood pressure.

The guidelines of the sixth report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure<sup>3</sup> recommend drug treatment for persons with a systolic blood pressure of less than 140 mm Hg who have concomitant diabetes, congestive heart failure, or chronic renal insufficiency. Even if such persons are excluded from the calculation, the number of Americans with a systolic blood pressure between 140 and 160 mm Hg and a diastolic blood pressure of less than 90 mm Hg who are classified as being unaware of their condition, as having acknowledged but untreated hypertension, or as having treated but uncontrolled hypertension exceeds 10 million. When calling for improved control of hypertension, the medical community should be aware of the magnitude of the efforts required to achieve this goal and of the characteristics of those labeled as having uncontrolled hypertension.

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## CORRECTION

### Characteristics of Patients with Uncontrolled Hypertension in the United States

Characteristics of Patients with Uncontrolled Hypertension in the United States . On page 485, the standard errors for prevalence in Table 5 were incorrect. The corrected table appears below.

**Table 5.** Proportion of Cases of Uncontrolled Hypertension in Each Population Subgroup Attributable to Identified Risk Factors.

**TABLE 5.** PROPORTION OF CASES OF UNCONTROLLED HYPERTENSION IN EACH POPULATION SUBGROUP ATTRIBUTABLE TO IDENTIFIED RISK FACTORS.\*

RISK FACTOR	LACK OF AWARENESS OF CONDITION			ACKNOWLEDGED, UNCONTROLLED HYPERTENSION		
	RELATIVE RISK	PREVALENCE	ATTRIBUTABLE RISK	RELATIVE RISK	PREVALENCE	ATTRIBUTABLE RISK
Age $\geq 65$ yr (vs. $< 65$ yr)	7.69	0.13 $\pm$ 0.0072	0.46	2.08	0.44 $\pm$ 0.0153	0.32
Male sex (vs. female sex)	1.58	0.48 $\pm$ 0.0046	0.22	1.30	0.43 $\pm$ 0.0104	0.12
Non-Hispanic black race (vs. non-Hispanic white)	1.45	0.11 $\pm$ 0.0063	0.05	—	—	—
No visits to physician in past 12 mo (vs. $\geq 1$ visits)	1.40	0.25 $\pm$ 0.0062	0.09	1.89	0.10 $\pm$ 0.0099	0.08

\*Attributable risk is calculated as  $P(RR-1) \div [P(RR-1) + 1]$ , where P is the prevalence of the risk factor in the population and RR is the relative risk associated with the presence of the factor. Dashes indicate that non-Hispanic black race is not a significant risk factor in the model.