Prevalence, Awareness, Treatment, and Control of Hypertension Among United States Adults 1999–2004

Kwok Leung Ong, Bernard M.Y. Cheung, Yu Bun Man, Chu Pak Lau, Karen S.L. Lam

Abstract—Detection of hypertension and blood pressure control are critically important for reducing the risk of heart attacks and strokes. We analyzed the trends in the prevalence, awareness, treatment, and control of hypertension in the United States in the period 1999–2004. We used the National Health and Nutrition Examination Survey 1999–2004 database. Blood pressure information on 14 653 individuals (4749 in 1999–2000, 5032 in 2001–2002, and 4872 in 2003–2004) aged ≥18 years was used. Hypertension was defined as blood pressure ≥140/90 mm Hg or taking antihypertensive medications. The prevalence of hypertension in 2003–2004 was 7.3±0.9%, 32.6±2.0%, and 66.3±1.8% in the 18 to 39, 40 to 59, and ≥60 age groups, respectively. The overall prevalence was 29.3%. When compared with 1999–2000, there were nonsignificant increases in the overall prevalence, awareness, and treatment rates of hypertension. The blood pressure control rate was 29.2±2.3% in 1999–2000 and 36.8±2.3% in 2003–2004. The age-adjusted increase in control rate was 8.1% (95% CI: 2.4 to 13.8%; $P=0.006$). The control rates increased significantly in both sexes, non-Hispanic blacks, and Mexican Americans. Among the ≥60 age group, the awareness, treatment, and control rates of hypertension had all increased significantly ($P\leq0.01$). The improvement in blood pressure control is encouraging, although the prevalence of hypertension has not declined. **(*Hypertension*. 2007; 49:69-75.)**

Key Words: hypertension ■ United States ■ prevalence ■ awareness ■ control

Hypertension affects ≥65 million adult Americans[1] and is a major risk factor for myocardial infarction, stroke, heart failure, and renal failure. The control of blood pressure (BP) is crucial in the prevention of these adverse outcomes. However, hypertension can be asymptomatic, so many people with hypertension do not see a doctor. The detection and control of BP is, thus, a major public health challenge in the United States. The National Health and Nutrition Examination Survey (NHANES)[2] is a large health and nutritional survey of the civilian noninstitutionalized population of the United States and is very useful for monitoring trends in the health status of the population that arise as a result of public health measures or changes in clinical practice. In NHANES 1999–2000, 28.7% of people had hypertension. A total of 68.9% of people with hypertension were aware of the diagnosis, 58.4% received treatment, and only in 31.0% was the BP controlled.[3] We reported previously a nonsignificant trend of improvement in the BP control rate among people with hypertension in the period 1999–2002.[4] Moreover, the BP goal for hypertensive patients with diabetes has changed from 130/85 mm Hg to 130/80 mm Hg.[5] Data from the NHANES study conducted in 2003–2004 have recently become available. Here, we analyzed the trends in the prevalence, awareness, treatment, and control of hypertension in the United States in the period 1999–2004 to ascertain whether there are further improvements in hypertension control according to the current treatment goals.

Methods

NHANES was conducted by the National Center for Health Statistics of the Centers for Disease Control and Prevention.[2] A stratified, multistage probability sampling design was used in the survey. The detailed measurement procedures and protocols have been described in previous publications and also on its website.[6–8] Since 1999, NHANES has become a continuous survey program. The 1999–2004 results are available online. All of the participants gave informed consent, and the study received approval from the Centers for Disease Control and Prevention Institutional Review Board.

BP was measured 3 or 4 times manually by a trained operator using a mercury sphygmomanometer according to a standard protocol and calculated as the average after excluding the first measurement.[9] The BP measurement techniques were identical over the 3 periods (1999–2000, 2001–2002, and 2003–2004). Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters. Individuals aged ≥18 years were included in the analysis (n=17 061). Participants who were interviewed but not examined were excluded from analysis (n=1190). Those with missing data on BP or BMI were also excluded (n=1218).

Hypertension was defined as an average BP ≥140/90 mm Hg or if the participant was taking antihypertensive medications. The same BP criteria applied to diabetic participants. Participants who had been diagnosed to have hypertension were considered to be aware of their hypertension. Participants were considered to be treated if they were taking antihypertensive drugs. Hypertension was considered

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From the Department of Medicine and the Research Centre of Heart, Brain, Hormone and Healthy Aging, University of Hong Kong, Hong Kong.

Correspondence to Bernard M. Y. Cheung, University Department of Medicine, Queen Mary Hospital, Pokfulam, Hong Kong. E-mail mycheung@hkucc.hku.hk

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TABLE 1. Characteristics of Participants in the 3 NHANES Phases

Characteristics	1999–2000 (n=4749)	2001–2002 (n=5032)	2003–2004 (n=4872)
Age, mean (SE), y	43.88 (0.39)	44.02 (0.48)	44.97 (0.53)
Age group, y			
18–39	46.4 (0.9)	43.0 (1.7)	41.5 (1.5)†
40–59	32.8 (0.9)	38.3 (1.3)	37.0 (1.2)†
≥60	20.8 (1.0)	18.7 (0.8)	21.4 (1.0)
Women, %	51.7 (0.8)	51.5 (0.7)	51.2 (0.8)
Race/ethnicity, %			
Non-Hispanic white	70.7 (2.8)	72.6 (2.3)	73.2 (3.5)
Non-Hispanic black	10.6 (1.6)	10.8 (1.7)	11.2 (1.8)
Mexican American	6.5 (1.4)	7.3 (0.9)	7.8 (2.0)
Other	12.2 (3.0)	9.3 (1.9)	7.8 (1.1)
Less than high school, %	24.6 (1.3)	19.2 (1.0)	18.8 (1.1)‡
Weight, mean (SE), kg	79.4 (0.6)	79.9 (0.5)	80.5 (0.4)
Waist circumference, mean (SE), cm	94.95 (0.64)	95.43 (0.34)	96.74 (0.35)*
BMI, mean (SE), kg/m^2	27.81 (0.22)	27.87 (0.16)	27.99 (0.13)
BP, mean (SE), mm Hg			
Systolic			
Overall	122.30 (0.69)	121.64 (0.50)	122.10 (0.49)
18–39 y	114.57 (0.78)	113.51 (0.36)	113.77 (0.43)
40–59 y	122.44 (0.67)	122.58 (0.64)	123.53 (0.73)
≥60 y	139.29 (0.88)	138.38 (1.00)	135.76 (0.94)†
Diastolic			
Overall	72.23 (0.45)	71.80 (0.44)	70.54 (0.33)†
18–39 y	70.73 (0.65)	69.15 (0.45)	68.20 (0.30)‡
40–59 y	76.13 (0.23)	75.98 (0.49)	75.42 (0.46)
≥60 y	69.43 (0.81)	69.35 (0.53)	66.66 (0.46)†
Diabetes mellitus, %	5.8 (0.5)	6.1 (0.4)	7.0 (0.6)

Data are weighted to the US population and expressed as percentages unless otherwise noted.
*$P<0.05$, †$P<0.01$, ‡$P<0.001$ for the difference between 1999–2000 and 2003–2004.

controlled in those on treatment if the average BP was <140/90 mm Hg in nondiabetic patients. Participants were considered to have diabetes if it had been diagnosed previously by a doctor or if they were receiving insulin or oral diabetic medications. For diabetic participants, hypertension was considered to be controlled if the average BP was <130/80 mm Hg.[5]

Data were analyzed using the complex sample function of SPSS (version 13.0). Sampling errors were estimated using the primary sampling units and strata provided in the data set. Sampling weights were used to adjust for nonresponse bias and the oversampling of blacks, Mexican Americans, and the elderly in NHANES. The prevalence of hypertension, as well as the awareness, treatment, and control rates, were age adjusted by direct standardization to the US 2000 standard population.[10] To analyze differences over time, the 2003–2004 data were compared with the 1999–2000 data. Estimates with a coefficient of variation >0.3 were considered unreliable. A 2-tailed P value <0.05 was considered statistically significant.

Results

In this analysis, data on 14 653 individuals (4749 in 1999–2000, 5032 in 2001–2002, and 4872 in 2003–2004) were included. Table 1 shows the age, race/ethnicity, BMI, BP, and diabetic status of the US population estimated from NHANES 1999–2004. There was no overall significant difference in the mean age between 1999–2000 and 2003–2004. However, in 2003–2004, there were fewer people in the 18 to 39 age group and more people in the 40 to 59 age group. In 2003–2004, fewer US adults had not completed high school. There was a trend of decreasing BP levels, especially in the elderly. Among the ≥60 age group, the mean systolic and diastolic BPs had decreased significantly ($P=0.006$ and 0.003, respectively). It is interesting that weight and BMI did not increase significantly from 1999–2000 to 2003–2004. However, the waist circumference had increased, from 94.95±0.64 cm (37.4±0.3 in) in 1999–2000 to 95.43±0.34 cm (37.6±0.1 in) in 2001–2002 to 96.74±0.35 cm (38.1±0.1 in) in 2003–2004 ($P=0.014$).

Table 2 shows the prevalence of hypertension in the United States. There was no significant change in the prevalence of hypertension, even in different age, sex, race/ethnicity, and BMI groups ($P>0.05$). The prevalence of hypertension was also analyzed by sex, race/ethnicity, and BMI in 18 to 39, 40 to 59, and ≥60 age groups, but the age-specific changes in sex, race/ethnicity, and BMI were not significant. In all 3 of the periods, the prevalence of hypertension increased with increasing age and BMI ($P<0.001$) but did not vary significantly with sex. Non-Hispanic blacks had the highest preva-

TABLE 2. Prevalence of Hypertension in the US Population, 1999–2004

	Hypertension Prevalence, % (SE)					
	1999–2000		2001–2002		2003–2004	
Characteristics	Unadjusted	Age Adjusted	Unadjusted	Age Adjusted	Unadjusted	Age Adjusted
Overall	26.8 (1.3)	28.6 (0.8)	26.0 (1.1)	27.9 (0.7)	29.3 (1.2)	29.6 (0.8)
Age, y						
18–39	7.7 (1.7)	-	7.0 (0.6)	-	7.3 (0.9)	-
40–59	30.2 (2.0)	-	28.1 (1.8)	-	32.6 (2.0)	-
≥60	64.2 (1.7)	-	65.7 (1.7)	-	66.3 (1.8)	-
Sex						
Male	26.6 (1.6)	28.7 (1.1)	24.1 (1.4)	26.5 (1.0)	29.8 (1.5)	30.7 (1.2)
Female	27.1 (1.5)	28.3 (1.1)	27.9 (1.2)	28.9 (1.1)	28.9 (1.4)	28.2 (1.1)
Race/ethnicity						
Non-Hispanic white	27.4 (1.8)	27.2 (1.1)	26.7 (1.1)	26.4 (1.0)	30.3 (1.4)	28.5 (1.1)
Non-Hispanic black	32.4 (1.3)	39.0 (2.2)	35.3 (2.4)	41.5 (2.2)	34.4 (1.8)	39.1 (2.1)
Mexican American	18.0 (1.5)	28.3 (1.6)	13.2 (1.2)	24.1 (1.8)	16.9 (3.1)	27.8 (1.8)
BMI, kg/m^2						
<25.0	15.0 (1.1)	19.2 (1.1)	16.0 (1.2)	20.4 (1.2)	17.5 (1.6)	20.5 (1.2)
25.0–29.9	27.4 (2.2)	27.4 (1.3)	27.3 (1.5)	26.9 (1.2)	30.8 (1.8)	28.4 (1.3)
≥30.0	41.2 (1.9)	40.6 (1.7)	36.7 (1.8)	36.1 (1.6)	40.8 (1.9)	39.0 (1.6)

Data are weighted to the US population.

lence. To measure the independent association of these variables and education with hypertension, a multiple logistic regression using the data from NHANES 2003–2004 was performed with hypertension as the dependent variable. Increasing age, increasing BMI, being non-Hispanic black, and having less education were significantly associated with hypertension, whereas sex was not (Table 3).

Table 4 shows the rates of awareness, treatment, and BP control. In 2003–2004, 75.7±2.1% of people with hypertension were aware of their diagnosis, 65.1±2.4% were treated, and 36.8±2.3% had BP controlled (56.6±2.4% among those treated). The age-adjusted awareness and treatment rates increased but not significantly since 1999–2000. There was also a nonsignificant increase in the control rate among treated hypertensive people. The proportion of treated hypertensive people with diabetes reaching the contemporary target of <130/80 mm Hg increased, although this was not statistically significant after age adjustment. However, the BP control rate among all people with hypertension increased significantly from 29.2±2.3% in 1999–2000 to 36.8±2.3% in 2003–2004 (P=0.02 and after age adjustment, P=0.006). The increase in age-adjusted BP control rate in this 6-year period was 8.1% (95% CI: 2.4 to 13.8%) in absolute terms.

TABLE 3. Multiple Logistic Regression of Hypertension Prevalence in the US Population, 2003–2004

Factors	Odds Ratio (95% CI)
Age (referent: 18–39 y)	
40–59 y	6.04 (3.99 to 9.16)‡
≥60 y	27.35 (18.88 to 39.61)‡
Sex (referent: women)	1.17 (0.94 to 1.45)
Race/ethnicity (referent: non-Hispanic white)	
Non-Hispanic black	1.61 (1.30 to 1.99)‡
Mexican American	0.68 (0.43 to 1.08)
Education (referent: more than high school)	
High school diploma	1.31 (0.94 to 1.82)
Less than high school	1.41 (1.01 to 1.97)*
BMI (referent: lean, <25 kg/m^2)	
Overweight, 25–29 kg/m^2	1.73 (1.18 to 2.54)†
Obese, ≥30 kg/m^2	3.39 (2.49 to 4.61)‡
R^2	0.37

*P<0.05, †P<0.01, ‡P<0.001 for the independent association between hypertension prevalence and each factor after adjusting for the remaining factors.

The Figure shows the age-specific prevalence of hypertension and BP control rates in different racial/ethnic groups. It shows the marked increase in the prevalence of hypertension with age and the significantly higher prevalence of hypertension in non-Hispanic blacks. The control rates were the lowest in middle-aged Mexican American women (27.8%) among all of the hypertensive people and in old non-Hispanic black women (39.8%) among those treated.

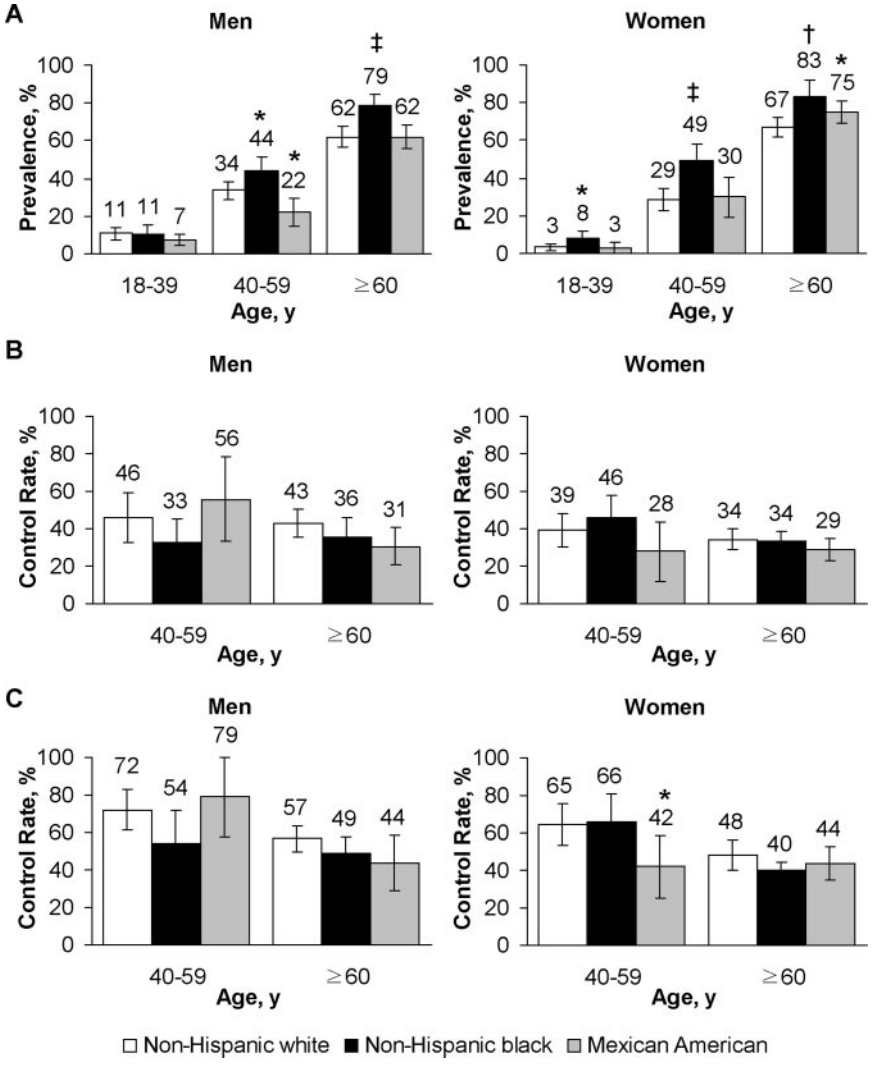
Table 5 shows the effects of sex and race/ethnicity on the awareness, treatment, and control of hypertension. Between 1999 and 2004, there were no significant changes in the awareness and treatment rates of hypertension by sex and race/ethnicity. There was also no significant change in the control rate among treated hypertensive people by sex and race/ethnicity. However, the control rate among all of the hypertensive people increased in both men and women (P=0.03 and 0.05, respectively). It improved significantly in non-Hispanic blacks and Mexican Americans (P=0.02 and

TABLE 4. Awareness, Treatment, and Control among Participants With Hypertension in US Population, 1999–2004

	Percentage, % (SE)					
	1999–2000 (n=1530)		2001–2002 (n=1500)		2003–2004 (n=1614)	
Outcome Measures	Unadjusted	Age Adjusted	Unadjusted	Age Adjusted	Unadjusted	Age Adjusted
Awareness	68.7 (2.0)	63.0 (3.2)	70.7 (1.7)	62.5 (3.0)	75.7 (2.1)*	66.5 (3.2)
Treatment	58.2 (2.9)	47.3 (2.4)	60.1 (1.6)	50.1 (2.6)	65.1 (2.4)	53.7 (2.8)
Control						
Among all with hypertension	29.2 (2.3)	25.0 (1.8)	32.5 (1.6)	30.3 (2.2)	36.8 (2.3)*	33.1 (2.3)†
Among those treated	50.2 (2.2)	51.3 (5.8)	54.0 (1.6)	63.9 (6.0)	56.6 (2.4)	63.9 (5.9)
Among treated hypertensive diabetic subjects	24.1 (3.6)	15.7 (5.9)‡	35.6 (3.9)	32.1 (8.4)	37.5 (4.0)*	33.2 (9.8)

Data are weighted to the US population.
*$P<0.05$, †$P<0.01$ for the difference between 1999–2000 and 2003–2004.
‡Estimates are unreliable because of coefficient of variation >0.3.

0.03, respectively). In Mexican American men, it increased from 8.7±2.2% in 1999–2000 to 31.1±7.0% in 2003–2004 ($P=0.002$), which was mainly because of the age-adjusted proportion on treatment increasing from 28.9±4.9% to 49.8±8.8% ($P=0.04$). Table 6 shows the effects of age and BMI on the awareness, treatment, and control of hypertension in 1999–2004. The awareness, treatment, and control rates of hypertension increased in the ≥60 age group ($P\leq0.01$). In



Hypertension prevalence and control rates in 2003–2004 by age and race/ethnicity in men and women. A, Hypertension prevalence. B, Control rates in all hypertensive patients. C, Control rates in treated hypertensive patients. Data are weighted to the US population. *$P<0.05$, †$P<0.01$, ‡$P<0.001$ for the difference within the same age group (non-Hispanic whites as the referent for race/ethnicity). Error bars indicate 95% CIs. The estimate for prevalence of hypertension in 2003–2004 among Mexican American women aged 18 to 39 years is unreliable because of coefficient of variation >0.3.

TABLE 5. Awareness, Treatment, and Control by Sex and Race/Ethnicity in the US Population, 1999–2004

	Percentage, % (SE)		
Sex and Race/Ethnicity	1999–2000	2001–2002	2003–2004
Awareness			
Sex			
Men	61.6 (4.1)	56.5 (3.6)	66.7 (4.1)
Women	62.0 (5.1)	72.6 (5.6)	67.6 (5.6)
Race/ethnicity			
Non-Hispanic white	64.0 (5.3)	59.9 (4.5)	66.9 (4.7)
Non-Hispanic black	64.3 (5.6)	73.2 (5.7)	66.4 (5.7)
Mexican American	53.9 (5.8)	44.9 (5.8)	63.5 (8.7)
Treatment			
Sex			
Men	44.6 (3.1)	43.0 (2.9)	52.1 (3.4)
Women	50.3 (4.2)	62.1 (5.2)	58.0 (5.2)
Race/ethnicity			
Non-Hispanic white	48.8 (4.2)	47.1 (3.7)	53.7 (4.0)
Non-Hispanic black	51.1 (4.6)	59.7 (5.0)	55.0 (4.9)
Mexican American	33.4 (4.0)	29.9 (4.2)	48.3 (6.7)
Control (all treated)			
Sex			
Men	55.1 (8.1)	62.6 (9.0)	65.8 (7.7)
Women	48.5 (8.3)	65.2 (8.0)	62.5 (9.4)
Race/ethnicity			
Non-Hispanic white	56.8 (9.0)	68.6 (10.5)	68.2 (8.4)
Non-Hispanic black	33.7 (8.0)	49.8 (7.4)	52.4 (9.5)
Mexican American	43.8 (15.0)‡	67.4 (30.2)‡	56.6 (19.6)‡
Control (all hypertensive)			
Sex			
Men	25.5 (2.3)	25.6 (2.3)	33.3 (2.8)*
Women	24.9 (2.9)	39.8 (4.5)	35.2 (4.4)*
Race/ethnicity			
Non-Hispanic white	28.6 (3.2)	30.0 (3.3)	35.4 (3.4)
Non-Hispanic black	18.8 (2.6)	28.7 (3.6)	28.9 (3.5)*
Mexican American	13.6 (2.7)	15.3 (3.5)	26.5 (5.1)*
Sex and race/ethnicity			
Men			
Non-Hispanic white	29.5 (4.1)	26.8 (3.5)	34.8 (3.9)
Non-Hispanic black	16.3 (2.9)	24.9 (4.4)	26.8 (4.7)
Mexican American	8.7 (2.2)	9.2 (2.4)	31.1 (7.0)†
Women			
Non-Hispanic white	27.6 (5.0)	39.9 (7.5)	41.8 (7.9)
Non-Hispanic black	24.0 (5.9)	32.8 (6.1)	30.3 (5.3)
Mexican American	23.4 (7.4)‡	25.0 (8.3)‡	24.6 (10.0)‡

Data are weighted to the US population and are age adjusted by direct standardization to the US 2000 standard population.

*$P<0.05$, †$P<0.01$ for the difference between 1999–2000 and 2003–2004.

‡Estimates are unreliable because of coefficient of variation >0.3.

this elderly age group in 2003–2004, 81.0±2.0% were aware of their diagnosis, 73.4±2.1% received treatment, and BP was controlled in 36.7±1.9% (50.0±2.5% among those treated). In the 18- to 39-year age group, there was an increase in the control rate ($P=0.04$) but not in the awareness and treatment rates. In obese people with a BMI ≥30 kg/m^2, there was an increase in the control rate ($P=0.007$). The unadjusted rates of awareness, treatment, and control of hypertension in different sex, race/ethnicity, age, and BMI groups are shown in Supplementary Tables I and II (available online at http://hyper.ahajournals.org).

Discussion

The NHANES database has been valuable for the study of the trends in the health status of a population because of its large sample size, complex sampling design, good quality control, and comprehensive content.[2] It has been used to study the prevalence, awareness, treatment, and control of hypertension in the United States.[3,4,11–15] The data for 2003–2004 have just been released, and our analysis confirms previous observations and extends previous conclusions. The prevalence of hypertension has not increased significantly since 1999. At the same time, there has been increasing control rate of hypertension, especially in Mexican American men, elderly, and obese people. The lack of increased prevalence of hypertension may be because of the lack of a further increase in BMI in the population, although there was an increase in waist circumference. Better publicity and education and effort from health professionals may be another reason for this. The increase in BP control rates may be the result of clinical guidelines on the management of hypertension[5] rather than improved antihypertensive drugs, because there were no new major antihypertensive drugs introduced in this period. Public health measures and intensified antihypertensive treatment seem to be effective in improving BP control rates. The latest hypertension management guidelines recommended the use of diuretics as first-line antihypertensive medications for uncomplicated hypertension and the use of multiple antihypertensive drugs to control BP.[5,16] A recent report revealed an increase in the use of antihypertensive medications in men from NHANES III (1988–1994) and NHANES 1999–2002.[17] Moreover, there was increasing use of angiotensin-converting enzyme inhibitor among hypertensive patients with diabetes, congestive heart failure, and heart attack.[17] This was consistent with current guidelines.[5,16] The use of diuretics also increased shortly after the release of new evidence on the clinical equivalence of diuretics to calcium channel blockers and angiotensin-converting enzyme inhibitors in December 2002.[18,19] In recent years, it is recognized that most hypertensive patients require multiple antihypertensive drugs to control BP.[20–23] The readiness to use multiple drugs may explain the increase in BP control rates in 1999–2004.

The awareness and control rates of hypertension were better in older people and people with higher BMI, whereas there was relative undertreatment of hypertensive people of younger age and lower BMI. This may be because of greater concerns in health status among older and obese people. The significant increase in waist circumference but not weight and BMI suggests an increasing trend of abdominal obesity. In fact, a detailed study of obesity in NHANES 1999–2004 revealed a significant increase in the prevalence of obesity among men but not women.[24]

Large clinical trials in hypertensive patients showed that BP reduction is crucial in reducing adverse cardiovascular

TABLE 6. Awareness, Treatment, and Control by Age and BMI in the US Population, 1999–2004

	Percentage, % (SE)		
Age and BMI	1999–2000	2001–2002	2003–2004
Awareness			
Age, y			
18–39	50.7 (5.9)	46.8 (4.1)	51.2 (6.4)
40–59	72.7 (3.0)	74.1 (2.5)	75.6 (2.6)
≥60	70.6 (2.0)	73.5 (1.7)	81.0 (2.0)‡
BMI, kg/m^2			
<25	51.3 (7.2)	51.6 (5.3)	55.5 (7.3)
25–29	53.7 (5.2)	51.3 (4.6)	62.9 (5.9)
≥30	70.6 (4.5)	76.1 (5.3)	73.2 (4.6)
Treatment			
Age, y			
18–39	26.0 (5.1)	32.6 (4.3)	35.5 (6.9)
40–59	62.1 (3.2)	60.7 (2.0)	62.7 (3.8)
≥60	63.8 (3.1)	66.3 (2.1)	73.4 (2.1)*
BMI, kg/m^2			
<25	36.1 (5.1)	37.9 (4.3)	45.5 (6.4)
25–29	42.1 (4.0)	41.2 (3.8)	50.8 (5.1)
≥30	53.6 (3.5)	62.6 (4.6)	59.4 (3.9)
Control (all treated)			
Age, y			
18–39	46.5 (10.3)	77.2 (6.7)	71.7 (6.2)*
40–59	63.1 (2.7)	58.0 (2.2)	63.5 (4.2)
≥60	41.3 (2.2)	48.1 (1.6)	50.0 (2.5)†
BMI, kg/m^2			
<25	60.2 (23.2)§	72.7 (17.9)	57.4 (13.1)
25–29	68.1 (18.9)	61.7 (12.4)	63.9 (11.7)
≥30	45.6 (6.2)	63.9 (7.5)	64.9 (8.0)
Control (all hypertensive)			
Age, y			
18–39	12.1 (2.4)	25.2 (4.4)	25.5 (6.2)*
40–59	39.2 (2.9)	35.2 (2.1)	39.8 (4.3)
≥60	26.4 (2.2)	31.9 (1.7)	36.7 (1.9)‡
BMI, kg/m^2			
<25	22.1 (4.1)	23.2 (3.9)	25.8 (4.9)
25–29	26.5 (3.5)	23.4 (3.1)	32.2 (4.1)
≥30	25.1 (2.4)	39.0 (3.8)	36.2 (3.3)†

Data are weighted to the US population. Percentages are age adjusted by direct standardization to the US 2000 standard population, except age-specific values.

*$P<0.05$, †$P<0.01$, ‡$P<0.001$ for the difference between 1999–2000 and 2003–2004.

§Estimates are unreliable because of coefficient of variation >0.3.

outcomes.[25–28] A small reduction in BP could reduce the risk of heart failure, stroke, and myocardial infarction markedly.[5,29] The increased control rates and decreased mean BPs, especially among the elderly, may help to decrease the incidence of strokes and heart attacks, which is highly encouraging. Clinicians need to overcome clinical inertia and step up treatment to reach the BP target. Other than antihypertensive medication, lifestyle interventions should also be encouraged in hypertensive patients.[30]

According to the national goal of Healthy People 2010, the proportion of adults with high BP should be reduced to 16%, and the proportion of adults with high BP whose BP is under control should be reduced to 50%.[31] It seems unlikely, because of the aging population, that the proportion of adults with hypertension can be reduced to 16%. However, the improvement in BP control rates in the last few years is highly encouraging, suggesting that, with concerted effort from health professionals and the government agencies, the target of 50% BP control rate may be reached by 2010. Recent clinical trials showed that a high BP control rate of 66% to 71% could be achieved in some settings and environments.[22,23,32,33] Although we did not find a significant increase in the age-adjusted rate of BP control in patients under treatment, the age-adjusted rate was 63.9% in 2003–2004, close to the control rates of 70% to 80% found in clinical trials.[22,23,32,33] The increase in age-adjusted control rates among treated hypertensive patients with diabetes from 15.7% to 33.2% is promising although not statistically significant, but this is still in need of substantial improvement. In 2003–2004, approximately one third of hypertensive patients were unaware of their hypertension, and our efforts to detect hypertension need to be improved. The treatment rate among hypertensive patients was only 53.7%. Therefore, approximately half of the hypertensive subjects were not being treated. To meet Healthy People 2010, the greatest attention must be paid to this group. In countries with limited resources like Cuba, very good BP control can be achieved through investment in the training of health professionals, availability of locally manufactured drugs, and more aggressive policy at the primary care level.[34] Therefore, there is room for further improvement in the control of hypertension in the United States.

Studies using a BP goal of <140/90 mm Hg in hypertensive people with diabetes might overestimate BP control rates.[1,3,4,13–15,35] Therefore, in this study, different control goals were used for those with and without diabetes to produce a more accurate control rate. However, there are some limitations in our study. The BP goal for hypertensive patients with diabetes was changed from <130/85 mm Hg to <130/80 mm Hg in 2003.[5] Therefore, the BP control rates in people with diabetes might seem poor before 2003. Inaccuracies in estimating BP control rates in the diabetic population might also arise from not classifying diabetic people with prehypertension as hypertensive, although they may require antihypertensive medications to bring their BP to <130/80 mm Hg. The limited sample sizes for each 2-year period made the estimates in some subgroups less reliable and made it difficult to study interactions between factors such as age, sex, and race/ethnicity. Estimates of prevalence are substantially affected by age adjustment. The age distribution of the US general population, used for the adjustment standard, is much younger than the hypertensive population, so the adjustment emphasizes the estimates among the younger population. A better standard population might be the age distribution of those with hypertension, such as for the entire 1999–2004 period.

Perspectives

Our study indicated that there was no significant change in the prevalence of hypertension in the US population in the period 1999–2004. However, there were significant improvements in the control rates, especially in the elderly. These findings suggest that public health measures or changes in clinical practice are in the right direction.

Disclosures

None.

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