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Updated hypertension prevalence, awareness, and control rates based on the 2017ACC/AHA high blood pressure guideline

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Abstract

In 2017, the American College of Cardiology/American Heart Association (ACC/AHA) updated the *Guideline of Prevention, Detection, Evaluation and Management and Management of High Blood Pressure (HBP) in Adults*. The purpose of the current study was to evaluate the potential impact of the 2017ACC/AHA HBP guideline on hypertension prevalence, awareness, and control rates. The data were collected from Physical Examination Center of the Second Hospital of Hebei Medical University from January 2012 to December 2017 (N = 66 977), including demographic information and risk factors of hypertension. The hypertension prevalence, awareness, and control rates of people were evaluated according to the new guideline. Additionally, the factors related to hypertension prevalence were also assessed. According to previous HBP guideline, hypertension prevalence, awareness, and control rate were 30.54%, 44.33%, and 13.04%, respectively. However, when the 2017 ACC/AHA HBP guideline was introduced, the population with hypertension increased from 20 453 to 34 460, the hypertension prevalence rate increased from 30.54% to 51.45%, the awareness rate decreased from 44.33% to 26.31%, and the control rate declined from 13.04% to 2.72%. The most newly diagnosed hypertension patients were from the low-risk population with young age and without the above histories. The 2017ACC/AHA HBP guideline indicated that high hypertension prevalence rate still existed with a substantial increase, while the awareness and control rates were relatively lowered.

1 | INTRODUCTION

Hypertension is one of the most common chronic diseases and the major risk factor of cardiovascular diseases (CVD).[1] The complications of hypertension such as coronary heart disease (CHD), heart failure, stroke, and end-stage renal disease (ESRD), are likely to raise the risk of disability and death.[2] Moreover, these complications usually need long-term treatments, medication usage, and insurance cost, which will substantially increase the consumption of medical resources, as well as the economic burdens of families and the society.[3,4]

One-third of Chinese adults were diagnosed as hypertension, but most of their awareness and control rate were low.[3] Thus, the negligence of hypertension strongly increased the mortality risk of cardiovascular events. The 2017 American College of Cardiology/American Heart Association (ACC/AHA) Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults provided recommendations for the hypertension definition, systolic blood pressure (SBP) ≥130 mm Hg, and/or diastolic blood pressure (DBP) ≥80 mm Hg, instead of previous SBP ≥ 140 mm Hg and/or DBP ≥ 90 mm Hg. These amendments

resulted in an increase of hypertension prevalence in the United States from 31.9% to 45.6%.[5]

There were very few studies evaluating the influence of the 2017 ACC/AHA guideline on high blood pressure in an epidemiological aspect.[6-9] On top of this, people had different opinions toward the new cutoff of 130/80 mm Hg. The purpose of the current analysis was to estimate the potential impact of the 2017ACC/AHA HBP guideline on hypertension prevalence, awareness, and control rates.

2 | MATERIALS AND METHODS

2.1 | Study design and participants

The current study was a single-center retrospective study. All data were collected from Physical Examination Center of the Second Hospital of Hebei Medical University from January 2012 to December 2017. The total number was 72 986 and 6009 individuals were excluded because some were under the age of 18 or the data collected violated privacy protection. The final number of 66 977 people (32 694 female and 34 283 male) enrolled in this study were adults with a mean age of 46.39 ± 13.35 years (range: 18-98 years). Demographic information, including age, gender, height, weight, systolic blood pressure, diastolic blood pressure, and heart rate as well as the risk factors of hypertension such as history of hyperlipidemia, diabetes, cardiovascular disease, cerebrovascular disease, respiratory system disease, smoking, alcohol consumption, and family history of hypertension were collected. However, some data regarding BMI (92, 0.14%), family history of hypertension (513, 0.77%), and CHOL (6730, 10.05%) were missing during information collecting process. This study was approved by the Ethics Committee of the Second Hospital of Hebei Medical University.

2.2 | Measurement of blood pressure

The blood pressure was measured by OMRON medical automatic electronic sphygmomanometer (Omron HBP-9012; OMRON Healthcare Product Development Dalian Co., Ltd.,) by one physical examiner. The healthy people were required to rest for at least 5 minutes before measurement. Sitting blood pressure on the right arm was consecutively measured 3 times with 1-minute interval and the mean value of the three readings was used for analyses. All data were input into the Hospital Information Management System.

2.3 | Definitions

According to previous guideline, hypertension was defined as SBP ≥ 140 mm Hg and/or DBP ≥ 90 mm Hg or lowered blood pressure with the administration of antihypertensive medication. The definition of isolated systolic hypertension was SBP ≥ 140 mm Hg and DBP < 90 mm Hg. By contrast, hypertension was defined as SBP ≥ 130 mm Hg and/or DBP ≥ 80 mm Hg or lowered blood pressure with antihypertensive medication according to the 2017ACC/AHA High Blood Pressure Guideline. The levels of hypertension were further classified into stage 1 (SBP 130-139 mm Hg and/or DBP 80-89 mm Hg) and stage 2 (SBP ≥ 140 mm Hg and/or DBP ≥ 90 mm Hg).

The prevalence rate of hypertension was defined as the proportion of hypertensive participants among the general population recruited in the study. The newly diagnosed hypertension was defined as SBP 130-139 mm Hg and/or DBP 80-89 mm Hg, which was first time diagnosed by the 2017 ACC/AHA definition compared with the previous BP guideline. The prevalence rate of newly diagnosed hypertension was the percentage of people newly diagnosed as hypertension (130-140/80-90 mm Hg) according to the 2017 ACC/AHA definition in total adults. Awareness of hypertension was defined as self-reported condition of hypertension that had been diagnosed before the BP measurement during physical examination. The awareness rate was the proportion of self-reports of the hypertension diagnosis among practical hypertensive participants. Treatment of blood pressure was defined as self-reported condition of antihypertensive medicine usage 2 weeks before the BP measurement. The treatment rate was the proportion of self-reports of antihypertensive medicine usage among practical hypertensive participants. Control of blood pressure was defined as SBP < 140 mm Hg and DBP < 90 mm Hg among hypertensive participants according to the previous guideline, and SBP < 130 mm Hg as well as DBP < 80 mm Hg according to the 2017ACC/AHA BP guideline. Control rate was the proportion of achievement of a satisfactory SBP/DBP among hypertensive participants. Overweight was defined as body mass index (BMI) ≥24 kg/m^2 but <28 kg/m^2, obesity was defined as BMI ≥ 28 kg/m^2 as previously described.[10,11]

The history of hypertension was defined as self-reported history of hypertension (SBP ≥ 140 mm Hg or DBP ≥ 90 mm Hg) which were diagnosed by professional doctors 2 weeks or even longer before physical examination. The history of hyperlipidemia was defined as self-reported history of hyperlipidemia including high total cholesterol (TC ≥ 6.22 mmol/L), low high density lipoprotein cholesterol (HDL-C < 1.04 mmol/L), and high triglycerides (TG ≥ 2.26 mmol/L), which were diagnosed by professional doctors 2 weeks or longer before physical examination. The history of diabetes was defined as self-reported history of diabetes (repeated fasting blood glucose ≥7.0 mmol/L, repeated random blood glucose or blood glucose 2 hours after meal ≥11.0 mmol/L), which were diagnosed by professional doctors 2 weeks or longer before physical examination. The history of cardiovascular disease was defined as self-reported history of cardiovascular disease including myocardial infarction (MI), angina pectoris; coronary recanalization, and heart failure which were diagnosed by professional doctors 2 weeks or longer before physical examination. The history of cerebrovascular disease was defined as self-reported history of cerebrovascular disease including ischemic stroke, cerebral hemorrhage, and transient ischemic attack, which were diagnosed by professional doctors 2 weeks or longer before physical examination. The history of respiratory disease was defined as self-reported history of chronic bronchitis, chronic obstructive pulmonary disease (COPD), bronchial asthma, or pulmonary

tuberculosis which was diagnosed by professional doctors 2 weeks or longer before physical examination.

As for family history of hypertension, it applied when the first-degree or second-degree relatives of the participants, such as parents, siblings, children, grandparents, uncles, or aunt, had the history of hypertension.

2.4 | Statistical analysis

SPSS VERSION 13.0 (SPSS) was used for statistical analysis. Data were described as the mean ± standard deviation (SD) for measurement data; the counting data were described with percentages. Each set of data was tested regarding normality and homogeneity of variance.

TABLE 1 The general characteristics (N = 66 977)

	SBP (Mean±SD)			DBP (Mean±SD)		
Parameters	Total (n = 66 977)	Male (n = 32 694)	Female (n = 34 283)	Total (n = 66 977)	Male (n = 32 694)	Female (n = 34 283)
Total	126.80 ± 18.91	131.66 ± 17.46	171.71 ± 19.03	77.44 ± 12.68	81.83 ± 12.25	72.83 ± 11.44
Age groups						
≤44	119.61 ± 14.80	126.68 ± 13.91	112.92 ± 12.28	73.90 ± 11.65	78.77 ± 11.56	69.29 ± 9.69
45-59	128.35 ± 18.29	132.20 ± 17.53	124.10 ± 18.17	80.09 ± 13.14	84.66 ± 12.47	75.04 ± 11.95
60-74	139.51 ± 19.83	139.83 ± 19.37	139.15 ± 20.34	80.75 ± 11.80	83.22 ± 11.50	77.92 ± 11.51
≥75	150.13 ± 20.75	149.28 ± 20.09	151.50 ± 21.72	77.54 ± 12.17	78.94 ± 11.66	75.27 ± 12.63
BMI group[a]						
<18.5	113.06 ± 14.11	120.90 ± 16.32	111.20 ± 12.85	69.63 ± 9.87	74.33 ± 10.66	68.51 ± 9.34
[18.5-24)	120.91±17.21	127.06±16.67	117.35±16.49	73.30± 11.39	77.91±11.30	70.64±10.56
[24-28)	130.71 ± 18.27	132.40 ± 17.17	127.84 ± 19.68	79.92 ± 12.20	82.44 ± 11.85	75.66 ± 11.59
≥28	136.99 ± 18.27	137.15 ± 17.16	136.60 ± 20.75	84.73 ± 12.59	86.49 ± 12.43	80.40 ± 11.92
Hyperlipidemia						
No	126.73 ± 18.87	131.61 ± 17.42	121.62 ± 18.98	77.41 ± 12.67	81.80 ± 12.22	72.81 ± 11.43
Yes	137.71 ± 20.78	138.75 ± 20.27	136.40 ± 21.38	82.15 ± 14.23	86.22 ± 14.13	76.99 ± 12.64
Diabetes						
No	126.26 ± 18.69	131.28 ± 17.30	121.14 ± 18.67	77.27 ± 12.68	81.75 ± 12.26	72.69 ± 11.40
Yes	139.24 ± 19.53	138.45 ± 18.68	140.78 ± 21.03	81.35 ± 12.16	83.22 ± 11.92	77.71 ± 11.78
Cardiovascular disease						
No	126.47 ± 18.73	131.43 ± 17.34	121.33 ± 18.74	77.36 ± 12.69	81.81 ± 12.26	72.74 ± 11.41
Yes	142.30 ± 20.47	140.84 ± 19.28	144.68 ± 22.10	81.06 ± 12.01	82.68 ± 11.71	78.42 ± 12.02
Cerebrovascular disease						
No	126.72 ± 18.86	131.57 ± 17.41	121.64 ± 18.99	77.41 ± 12.68	81.82 ± 12.24	72.81 ± 11.43
Yes	141.83 ± 20.50	143.27 ± 19.70	138.95 ± 21.79	81.86 ± 12.59	83.98 ± 12.21	77.63 ± 12.31
Respiratory disease						
No	126.80 ± 18.91	131.66 ± 17.45	121.70 ± 19.04	77.44 ± 12.68	81.84 ± 12.24	72.83 ± 11.44
Yes	127.78 ± 18.36	132.08 ± 19.01	124.77 ± 17.36	75.95 ± 12.06	79.33 ± 12.99	73.59 ± 10.82
Hypertension						
No	123.61 ± 16.74	128.71 ± 15.59	118.63 ± 16.32	75.75 ± 11.80	80.09 ± 11.38	71.52 ± 10.59
Yes	147.21 ± 19.20	146.55 ± 18.69	148.33 ± 19.99	88.22 ± 12.86	90.64 ± 12.63	84.16 ± 12.19
Hypertension family history[a]						
No	126.25 ± 18.71	131.07 ± 17.27	121.17 ± 18.82	76.87 ± 12.40	81.14 ± 11.95	72.38 ± 11.22
Yes	128.80 ± 19.09	133.99 ± 17.59	123.55 ± 19.12	80.06 ± 13.53	85.22 ± 12.97	74.86 ± 12.00
Total CHOL groups						
<3.11	122.77 ± 18.02	129.71 ± 17.51	115.15 ± 15.30	73.74 ± 12.15	77.95 ± 12.03	69.11 ± 10.50
[3.11-5.20]	125.46 ± 18.64	130.91 ± 17.48	119.76 ± 18.10	76.67 ± 12.59	81.20 ± 12.11	71.94 ± 11.28
>5.20	132.06 ± 19.32	134.09 ± 17.76	129.65 ± 20.77	80.53 ± 12.77	84.19 ± 12.38	76.16 ± 11.81

Abbreviations: BMI, body mass index; BP, blood pressure; CHOL, cholesterol; SD, standard deviation

[a]Indicates partial data missing.

TABLE 2 The prevalence, awareness, treatment and control rates of hypertension

Population	BP guideline	Prevalence rate	Awareness rate	Treatment rate	Control rate
Total	≥140/90[a]	30.54%	44.33%	32.52%	13.04%
	≥130/80[b]	51.45%	26.31%	19.30%	2.72%
Female	≥140/90[a]	21.18%	48.95%	36.97%	15.35%
	≥130/80[b]	36.93%	28.07%	21.20%	3.42%
Male	≥140/90[a]	39.46%	41.96%	30.25%	11.86%
	≥130/80[b]	65.30%	25.36%	18.28%	2.35%

[a]Indicates the hypertension according to the previous high blood pressure guideline (BP ≥ 140/90 mm Hg).
[b]Indicates the hypertension according to 2017 ACC/AHA high blood pressure guideline (BP ≥ 130/80 mm Hg).

If data were normally distributed, independent sample *t* tests were used for comparisons between two data sets and one-way ANOVA was applied among three or above data sets. Otherwise, a non-parametric test was used for data analysis. The prevalence rate of hypertension among different factors was analyzed using chi-square tests. A multivariate logistic regression analysis was used to analyze the factors related to hypertension prevalence rate. Statistically significant level was set at $P < 0.05$ for all hypothesis tests.

3 | RESULTS

3.1 | General characteristics

Totally, this study included 66 977 participants, with a mean age of 46.39 ± 13.35 years (range: 18-98 years). Of these, 32 694 (48.81%) were female with mean age of 45.51 ± 13.31 years and 34 283 (51.19%) were male with mean age of 47.22 ± 13.34 years. The detailed information was described in Table 1.

3.2 | Altered hypertension prevalence, awareness, and control rates of hypertension according to the 2017 ACC/AHA HBP guideline

Hypertension prevalence rate increased from 30.54% according to previous guideline to 51.45% according to the 2017 ACC/AHA guideline. Compared with previous BP guideline, the new definition of hypertension based on the new guideline resulted in an increase of prevalence rate by 20.91% (25.84% for male and 15.75% for female). On the other hand, the hypertension awareness rate decreased by 18.02% (16.60% for male and 20.88% for female), and the hypertension control rate was 3.79 times lower (4.05 times for male and 3.49 times for female; Table 2).

The incidence of newly diagnosed hypertension increased with higher BMI and CHOL,whereas decreased with age, and was high in people without a disease history (Table 3).

3.3 | Hypertension prevalence rate based on demographic and clinical indicators

As recommended in new and previous blood pressure guidelines, the percentage of events attributable to hypertension was higher in male than in female, higher in elder than in younger, and higher in adults with disease history of hyperlipidemia, diabetes, cardiovascular disease, cerebrovascular disease, respiratory system disease, and family history of hypertension than in adults without the above disease histories. However, the prevalence rate of newly diagnosed hypertension in male was comparatively higher than in female, higher in younger than in elder, and higher in adults without the above disease histories than in adults with these disease histories (Table 3).

3.4 | Factors related to the hypertension prevalence

The independent variables included age, gender, BMI, family history of hypertension, and disease history of hyperlipidemia, diabetes, cardiovascular disease, cerebrovascular disease, respiratory system disease, etc The multivariate logistic regression analysis was performed after adjustment for demographic, clinical characteristics, and other confounding factors. The multivariate logistic regression analysis demonstrated that male, elder, higher BMI, the history of hyperlipidemia, diabetes, cardiovascular disease, cerebrovascular disease, and family history of hypertension were identified as risk factors, recommended in previous and new BP guidelines. The most newly diagnosed hypertension was young adults without the history of hyperlipidemia, diabetes, cardiovascular disease, and family history of hypertension. Odds ratio (OR) in the table was used to measure the contribution of the independent variables compared with reference corresponding to the variable (Table 4).

4 | DISCUSSION

The most drastic change in the 2017 ACC/AHA hypertension guideline is the change of hypertension definition from 140/90 mm Hg to 130/80 mm Hg for SBP/DBP.[12] According to the 2017 ACC/AHA HBP guideline, there is a substantial increase in hypertension prevalence rate, but with reductions in the hypertension awareness and control rates.

According to the previous blood pressure guideline, the hypertension prevalence rate was 30.54% which were identical with the China Chronic Disease and Risk Factors Surveillance study (CCDRFS).[13] The CCDRFS reported that there was a geographical variations (17.9%-37.7%) in hypertension prevalence rate in

TABLE 3 The comparison of hypertension prevalence rate based on demographic and clinical indicators

	≥140/90[a]		≥130/80[b]		(130-139/80-89)[c]	
Factors	**No. (%)**	***P***	**No.(%)**	***P***	**No. (%)**	***P***
Gender:No. (%), y						
Female	6924 (21.18)	<0.001	12 073 (36.93)	<0.001	5149 (15.75)	<0.001
Male	13 529 (39.46)		22 387 (65.30)		8858 (25.84)	
Age groups: No. (%), y						
≤44	3729 (12.86)	<0.001	10 017 (34.54)	<0.001	6288 (21.68)	<0.001
45-59	9515 (36.27)		15 245 (58.11)		5730 (21.84)	
60-74	5842 (58.57)		7623 (76.42)		1781 (17.85)	
≥75	1367 (77.23)		1575 (88.98)		208 (11.75)	
BMI group: No. (%), (kg/m^2)						
<18.5	171 (5.92)	<0.001	569 (19.70)	<0.001	398 (13.78)	<0.001
[18.5-24)	5026 (17.72)		10 340 (36.45)		5314 (18.73)	
[24-28)	9462 (38.07)		15 207 (61.19)		5745 (23.12)	
≥28	5756 (53.42)		8297 (77.01)		2541 (23.58)	
Medical history: No. (%)						
Diabetes	1735 (62.21)	<0.001	2205 (79.06)	<0.001	470 (16.85)	<0.001
Cardiovascular disease	1017 (73.01)	<0.001	1187 (85.21)	<0.001	170 (12.20)	<0.001
Cerebrovascular disease	261 (67.10)	<0.001	323 (83.03)	<0.001	62 (15.94)	<0.001
Respiratory disease	57 (37.25)	0.071	81 (52.94)	0.712	24 (15.69)	0.111
Hyperlipidemia disease	292 (62.26)	<0.001	364 (77.61)	<0.001	72 (15.35)	0.003
Hypertension family history	3971 (39.05)	<0.001	5967 (58.68)	<0.001	1996 (19.63)	<0.001
Total CHOL groups: No. (%), (mmol/L)						
<3.11	306 (26.90)	<0.001	473 (41.60)	<0.001	167 (14.70)	<0.001
[3.11-5.2]	11 814 (28.60)		20 007 (48.40)		8193 (19.80)	
>5.20	7324 (41.30)		11 355 (64.00)		4031 (22.70)	

Note: Medical history: The history of hyperlipidemia was defined as self-reported history of hyperlipidemia including high total cholesterol (TC ≥ 6.22 mmol/L), low high density lipoprotein cholesterol (HDL-C < 1.04 mmol/L) and high triglycerides (TG ≥ 2.26 mmol/L), which were diagnosed by professional doctors 2 wk or more before physical examination. The history of diabetes was defined as self-reported history of diabetes (repeated fasting blood glucose ≥7.0 mmol/L, repeated random blood glucose or blood glucose 2 hours after meal ≥ 11.0 mmol/L), which were diagnosed by professional doctors 2 wk or more before physical examination. The history of cardiovascular disease was defined as self-reported history of cardiovascular disease including myocardial infarction (MI), angina pectoris; coronary recanalization and heart failure which were diagnosed by professional doctors 2 wk or more before physical examination. The history of cerebrovascular disease was defined as self-reported history of cerebrovascular disease including Ischemic stroke; cerebral hemorrhage;transient ischemic attack, which were diagnosed by professional doctors 2 wk or more before physical examination

Abbreviations: BMI, body mass index; BP, blood pressure; CHOL cholesterol.

[a]Indicates the hypertension according to the previous high blood pressure guideline (BP ≥ 140/90 mm Hg).

[b]Indicates the hypertension according to 2017 ACC/AHA high blood pressure guideline (BP ≥ 130/80 mm Hg).

[c]Indicates the newly diagnosed hypertension according to 2017 ACC/AHA high blood pressure guideline (BP 130-139/80-89 mm Hg).

China, with the highest prevalence rate in the north (30.5%-37.7%). Moreover, The China Patient-Centered Evaluative Assessment of Cardiac Events (PEACE) Million Persons Project found the hypertension prevalence rate was 37.2% in adults aged 35-75 years from all 31 provinces in China.[14] The hypertension prevalence rate in the current study was lower than PEACE, most likely due to different regional characteristics and age ranging. Many studies demonstrated hypertension prevalence rate rose dramatically with aging,[1] which was similar to the current study. However, hypertension prevalence rate is significantly higher in Chinese than American,[15] which might be associated with different epidemiological characteristics, genetic background, the situation of disease prevention and treatment, and economic level in different countries. In addition, the current study also exhibited increased hypertension prevalence rate in male than in female. Furthermore, hypertension prevalence rate rose dramatically with aging and increased BMI and it was higher in adults

TABLE 4 Multivariate logistic regression analysis for factors related to the hypertension prevalence

	The previous guideline [a]			The new guideline [b]			Newly diagnosed hypertension [c]		
Factors	**OR**	**95%CI**	***P***	**OR**	**95%CI**	***P***	**OR**	**95%CI**	***P***
Male VS Female	1.97	1.89-2.05	0.000	2.55	2.46-2.65	0.000	1.71	1.64-1.79	0.000
Age groups, (years)									
≤44	Reference			Reference			Reference		
45-59	3.20	3.05-3.36	0.000	2.36	2.26-2.46	0.000	1.01	0.97-1.06	0.694
60-74	8.39	7.90-8.92	0.000	5.48	5.16-5.82	0.000	0.80	0.75-0.85	0.000
≥75	21.61	19.00-24.57	0.000	14.10	11.99-16.59	0.000	0.51	0.44-0.60	0.000
BMI groups, (kg/m^2)									
<18.5	Reference			Reference			Reference		
[18.5-24)	1.97	1.64-2.36	0.000	1.66	1.47-1.87	0.000	1.48	1.29-1.70	0.000
[24-28)	4.15	3.47-4.97	0.000	3.23	2.86-3.65	0.000	1.72	1.50-1.97	0.000
≥28	8.69	7.24-10.44	0.000	7.01	6.16-7.97	0.000	1.65	1.43-1.91	0.000
Total CHOL groups, (mmol/L)									
<3.11	Reference			Reference			Reference		
[3.11-5.20]	1.19	1.00-1.40	0.045	1.36	1.18-1.58	0.000	1.35	1.14-1.59	0.001
>5.20	1.58	1.33-1.86	0.000	2.00	1.69-2.27	0.000	1.58	1.33-1.87	0.000
Medical history									
Diabetes history	1.68	1.54-1.84	0.000	1.60	1.44-1.77	0.000	0.80	0.72-0.89	0.000
Cardiovascular history	2.12	1.86-2.43	0.000	1.88	1.60-2.21	0.000	0.62	0.52-0.73	0.000
Cerebrovascular history	1.31	1.03-1.66	0.000	1.43	1.07-1.92	0.016	-	-	-
Hypertension family history	2.01	1.91-2.12	0.000	1.66	1.58-1.75	0.000	0.87	0.82-0.92	0.000
Hyperlipidemia history	1.76	1.42-2.18	0.000	1.43	1.13-1.82	0.003	0.69	0.52-0.90	0.006

Abbreviations: CI, confidence interval; OR, Odds ratioa.
[a]Indicates the hypertension according to the previous high blood pressure guideline (BP ≥ 140/90 mm Hg).
[b]Indicates the hypertension according to 2017 ACC/AHA high blood pressure guideline (BP ≥ 130/80 mm Hg).
[c]Indicates the newly diagnosed hypertension according to 2017 ACC/AHA high blood pressure guideline (BP 130-139/80-89 mm Hg).

with the history of hyperlipidemia, diabetes, cardiovascular disease, cerebrovascular disease, and family history of hypertension than in adults without above histories. These findings were similar to studies from other cohorts based on other countries and other races.[16-18]

The National Health and Nutrition Examination Survey (NHANES) reported that the awareness of hypertension in the United States was 84.6% during 2007-2014,[15] whereas the awareness rate of hypertension from 2012 to 2015 in China among adults was only 46.9%, which indicated that more than half of adults in China were not self-conscious about their hypertension, and that there was a huge discrepancy regarding the awareness of hypertension between countries.[19] In the current study, the awareness rate of hypertension was 44.33%, which was slightly lower than national hypertension awareness rate of China, and significantly lower than the US hypertension awareness rate.[20] However, if the 2017 ACC/AHA HBP guideline is used to diagnose hypertension, the present awareness rate of hypertension will even decrease to 26.31%. Such low hypertension awareness rate is most likely due to the newly diagnosed hypertension population (BP 130-139/80-89 mm Hg). Because newly diagnosed hypertension people (BP 130-139/80-89 mm Hg) do not have hypertension under current Chinese medical practice and will not be aware that they have hypertension with the new cut point of 130/80 mm Hg. On the other hand, the present study also showed that most people newly diagnosed as hypertension were exempted from disease history of hyperlipidemia, diabetes, cardiovascular disease, and family history of hypertension. They appeared to have relatively low prevalence of other risk factors, and were likely to be at lower risk of CVD than those with SBP >140 mm Hg. If the 2017 ACC/AHA HBP guideline is adopted, many measures to improve the hypertension awareness rate should be taken to improve cardiovascular outcomes.

The current study indicated the control rate of hypertension was 13.04%, which was approximately equal to the national control rate (13.8%), and significantly lower than the US control rate (51.8%).[15] The uncontrolled hypertension substantially increased the risk for cardiovascular mortality.[3] Hu et al found the uncontrolled

hypertension was the major reason for increased mortality in China in recent 20 years, resulted from coronary heart disease and stroke.[21] According to the 2017 ACC/AHA HBP guideline, the control rate of hypertension decreased to 2.72%, approximately 3.79 times lower than the previous guideline. The newly diagnosed hypertension population mainly came from low-risk population without hypertension awareness and interventions, thus might contribute to the low control rate.

2017ACC/AHA HBP guideline will result in a substantial increase in prevalence rate and a significantly decrease in awareness and control rate. It has not recently been adopted in China yet for the following reasons: Firstly, even though the new guideline based on considerable evidence and abundant data and many studies had identified the importance of a lower blood pressure threshold,[22-24] the new definition of hypertension was mainly based on epidemiological and natural history studies instead of randomized controlled clinical trials. Secondly, the impact of the new guideline in China needs to be evaluated in the long term to assess its value and appropriateness. Therefore, more studies on the prevention of the development of hypertension, the relation between target organ damage of hypertension and CVD risk, and the lifetime benefit of low blood pressure should be conducted. Chinese health care system and community still exist some defect and deficiency under the influence of different social, cultural, economic factors, and disease control level in China,[25-27] which therefore make it difficult to manage hypertension in the primary health care system and community with new lower thresholds.

Nevertheless, there were several limitations in the study that needs to be addressed. The present study was a single-center retrospective study which may result in region-specific variance. Moreover, partial data missing in present study were likely to have influence on our results.

In conclusion, 2017ACC/AHA HBP guideline will generate certain effect on hypertension prevalence, awareness, and control rates in Chinese populations, compared to the data based on previous guideline. This study will in a way help evaluate the potential impact of the 2017ACC/AHA HBP guideline on the prevention, detection, evaluation, and management of HBP in China.

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CONFLICT OF INTEREST

The authors report no conflict of interest.

AUTHORS' CONTRIBUTIONS

YQZ and WC participated in the design of this study, YQZ, LMJ, BJL, GQG, HJH, ZYZ, LB, and WC carried out the study. YQZ and LMJ and performed the statistical analysis. YQZ drafted the manuscript. WC performed manuscript review. All authors read and approved the final manuscript.

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