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Potential epidemiological impact of the 2017 American College of Cardiology/American Heart Association high blood pressure guideline on the Chinese population: a cross-sectional study in rural areas of Liaoning Province

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ABSTRACT

Objectives The present study estimated the percentage of rural Chinese adults with hypertension and recommended pharmacological antihypertensive treatment according to the 2017 American College of Cardiology/American Heart Association (ACC/AHA) guideline compared with the 2010 Chinese Guideline for the Management of Hypertension.

Design Cross-sectional study.

Setting Three counties in rural areas of northeastern China.

Participants A total of 11 747 eligible individuals aged ≥35 years from rural areas of northeastern China were selected for the present analysis.

Main outcome measures The percentage of rural Chinese adults with hypertension and recommended pharmacological antihypertensive treatment according to the 2017 ACC/AHA guideline and the 2010 Chinese Guideline for the Management of Hypertension, and the proportion of rural Chinese adults taking antihypertensive medication with blood pressure (BP) above the 2017 ACC/AHA guideline and the 2010 Chinese guideline treatment goal.

Results The mean age of the study population was 53.9±10.8 years and 53.7% of the participants were women. According to the 2017 ACC/AHA guideline and the 2010 Chinese guideline, the crude prevalence of hypertension was 72.2% and 49.8%, respectively, and the percentage of recommended antihypertensive medications for rural Chinese adults was 56.4% and 51.4%, respectively. Among these rural Chinese adults taking antihypertensive medications, 96.7% had above goal BP according to the 2017 ACC/AHA guideline compared with 86.1% with above goal BP according to the 2010 Chinese guideline.

Conclusion The present analysis demonstrated that compared with the 2010 Chinese guideline, the 2017 ACC/AHA hypertension guideline will result in a substantial increase in the percentage of rural Chinese adults defined as having hypertension and a small increase in the percentage of adults who are recommended antihypertensive medications. More intensive management is suggested to improve the control rate of hypertension among rural Chinese adults.

Strengths and limitations of this study

- This is the first study to analyse the potential impact of the 2017 American College of Cardiology/American Heart Association (ACC/AHA) guideline on the prevalence of hypertension, the recommended antihypertensive medications and the above goal blood pressure (BP) in rural areas of Liaoning Province, China.
- The atherosclerotic cardiovascular disease risk calculation model used in this study is more consistent with the Chinese population than is the pooled cohort risk formula recommended by the 2017 ACC/AHA guideline.
- This study only analyses a group of individuals from rural areas of Liaoning Province, and more diverse representative samples are needed to analyse the further impact of the 2017 ACC/AHA guideline on hypertension management in China.
- BP in this study was measured three times on the same day and was not measured on different days.

INTRODUCTION

On 13 November 2017, the American College of Cardiology and American Heart Association (ACC/AHA) issued the Guideline for the Prevention, Detection, Evaluation and Management of High Blood Pressure in Adults.[1] This guideline substantially updated the 2003 JNC-7 guideline after 14 years.[2] The 2017 ACC/AHA guideline substantially modified and described the definition

of hypertension and recommended blood pressure (BP) thresholds for the initiation of antihypertensive medications and BP target goals in detail. One of the most notable changes is the definition of hypertension, which was modified from systolic blood pressure (SBP)/diastolic blood pressure (DBP) ≥140/90 mm Hg to SBP/DBP ≥130/80 mm Hg. The new definition will increase the prevalence of hypertension from 31.9% to 45.6%, and the number of patients with hypertension will increase by 31.1 million in the USA.[3] In addition, according to the 2017 ACC/AHA guideline, the proportion of people for whom antihypertensive medication is recommended will slightly increase by 1.9% (from 34.3% to 36.2%).[3] Among US adults taking antihypertensive medication, the proportion of patients with above goal BP will also increase from 39.0% to 53.4%, and the control rate of hypertension will be lower. This new hypertension guideline has concerned cardiologists and public policymakers in this research field of hypertension. How should one face this new guideline, and what is its potential impact on local hypertension management? All of these concerns will remain hot topics for a long period of time.

In the last decade, the prevalence and incidence of hypertension have increased steeply in China, especially in rural areas.[4–6] China is experiencing a high prevalence with a low rate of treatment and control of hypertension.[4 7] Recently, using a representative sample of more than 1.7 million (aged 35–75 years), Jiang *et al* revealed that the prevalence of hypertension was 44.7%, whereas the rates of taking hypertensive medications and achieving BP goals in patients with hypertension were 30.1% and 7.2%,[7] respectively.

The present study was performed in a representative sample of ≥35-year-old adults from rural areas of Liaoning Province to analyse the prevalence of hypertension and the rates of recommended antihypertensive medication treatment and above goal BP according to the 2017 ACC/AHA guideline and the 2010 Chinese guideline, and to discuss the potential impact of the 2017 ACC/AHA hypertension guideline on the current epidemiological characteristics of the prevention and treatment of hypertension in rural areas of China.

METHODS

Study sample

Liaoning Province is located in northeastern China. The study population was derived from the 'Northeast China Rural Cardiovascular Health Study' cohort, which was described in a previous study.[6 8] The baseline survey adopted a multistage stratified cluster random sampling method. From January to August 2013, 11 956 (≥35 years) eligible subjects (response rate of 85.3%) from three counties (a total of 26 rural villages), namely, Dawa, Zhangwu and Liaoyang in Liaoning Province were recruited to carry out epidemiological studies of cardiovascular disease (CVD) in rural areas of northeastern China. Each participant completed a baseline questionnaire, physical examination, laboratory examination and blood sample collection after written informed consent.

For the present study, we excluded individuals who lacked the following information: participants who did not have three BP measurements or who were missing data on antihypertensive medication use (n=108), and on variables (gender, age, smoking, total cholesterol, high density cholesterol, family history of diabetes and CVD) used to calculate the risk of atherosclerotic cardiovascular disease (ASCVD) (n=101). Finally, 11 747 individuals were left for the present analysis.

BP measurement and antihypertensive medication use

A trained and certified observer used an AHA protocol to perform BP measurements, and participants were advised to avoid caffeinated beverages, alcohol consumption, cigarette smoking and exercise for at least 30 min and to rest for at least 5 min before measurement. BP was measured while individuals were in a seated position in a quiet local room. BP measurements were performed using a standard electronic automated BP monitor (HEM-907; OMRON, Tokyo, Japan) with one of three cuff sizes (regular adult, large or thigh) chosen on the basis of arm circumference. BP was measured three times for each individual at 2-minute intervals on the same day. The mean of three BP measurements was calculated as the individual's BP value and was used in all analyses. The investigator obtained data on the use of antihypertensive medication by asking the questions 'Did you take antihypertensive medication in the past 2 weeks?' and 'What is the type and name of the antihypertensive medication?'

Definition of hypertension, recommended antihypertensive medication and above goal BP standards

The definition of hypertension, the recommended initial treatment and above goal BP standards will be strictly in accordance with the 2017 ACC/AHA guideline and the 2010 Chinese guideline (table 1).

Cardiovascular risk factors and ASCVD risk calculation

History of CVD was defined by self-reported prior diagnosis of coronary heart disease, stroke or heart failure. Among individuals without CVD history, because the pooled cohort risk model recommended by the 2017 ACC/AHA guideline cannot be used for Chinese individuals, the present study selected the ASCVD risk calculation model developed by Yang *et al*[9] to assess the risk of ASCVD and participants were categorised into the following groups: <5%, 5%–<10%, 10%–<20%, ≥20%. Low-risk population was defined as ASCVD risk <5%, and moderate risk population was defined as ASCVD risk 5%–<10%. High-risk population was defined as having a history of CVD or ASCVD risk ≥10%. Diabetes was defined as a previous history of self-reported diabetes or fasting blood glucose ≥7.0 mmol/L. Chronic kidney disease (CKD) was defined as an estimated glomerular filtration rate <60 mL/min/1.73 m^2, which was calculated by CKD-EPI equations.[10]

Table 1 Blood pressure levels used to define hypertension, recommend antihypertensive medication and treatment goal according to the 2017 ACC/AHA guideline and the 2010 Chinese guideline

	Guideline—definition of hypertension	
	2017 ACC/AHA	2010 Chinese guideline
SBP, mm Hg	≥130	≥140
DBP, mm Hg	≥80	≥90
	Guideline—recommended antihypertensive medication	
SBP (mm Hg)		
General population	≥140	≥140
Aged ≥65 years	≥130	≥140
Diabetes or CKD	≥130	≥130
High risk population*	≥130	≥140
DBP (mm Hg)		
General population	≥90	≥90
Aged ≥65 years	≥80	≥90
Diabetes or CKD	≥80	≥80
High risk population*	≥80	≥90
	Treatment goal among those taking antihypertensive medication	
SBP (mm Hg)		
General population	<130	<140
Aged ≥65 years	<130†	<150
Diabetes or CKD or CHD	<130†	<130
DBP (mm Hg)		
General population	<80	<90
Diabetes or CKD or CHD	<80†	<80

*High cardiovascular risk is defined as a history of cardiovascular disease (coronary heart disease, stroke and heart failure) or 10-year predicted ASCVD risk ≥10%.
†No specific blood pressure threshold is provided in the guideline for this population.
ACC/AHA, American College of Cardiology/American Heart Association; ASCVD, atherosclerotic cardiovascular disease; CHD, coronary heart disease; CKD, chronic kidney disease; DBP, diastolic blood pressure; SBP, systolic blood pressure.

Statistical analysis

Continuous variables were reported as the means and SDs, and categorical variables were expressed as frequencies and percentages. We categorised the participants into five groups based on BP levels and antihypertensive medication use, including four groups not taking antihypertensive drugs (SBP/DBP ≥140/90, 130–139/80–89, 120–129/<80 and <120/<80 mm Hg), and a group taking antihypertensive drugs. These BP levels represented the BP stages in the 2017 ACC/AHA guideline. Subgroups were compared by χ^2 tests for categorical variables or one-way analysis of variance for continuous variables. We calculated the percentage of adults with hypertension in rural areas of China and the percentage of people for whom antihypertensive medication is recommended based on the 2017 ACC/AHA guideline, the 2010 Chinese guideline and the 2017 ACC/AHA guideline but not the 2010 Chinese guideline. We also calculated the percentage of adults taking antihypertensive medication with BP above goal according to the 2017 ACC/AHA guideline, the 2010 Chinese guideline and the 2017 ACC/AHA guideline but not the 2010 Chinese guideline. These calculations were performed in the general population and in different subgroups (such as age (35–44, 45–54, 55–64, 65–74, ≥75 years), sex (men and women), ethnicity (Han, Mongolian and others) and history of CVD (yes or no)). All analyses were performed with SPSS statistical software V.13.0 and SAS statistical software V.9.2. A p value of less than 0.05 was accepted as indicating statistical significance.

Patient and public involvement

There was no patient or public involvement in the design of this study.

RESULTS

The mean age of the study population was 53.9±10.8 years, and 53.7% of those were women. A total of 15.2%, 18.3%, 16.7% and 35.5% of Chinese adults not taking antihypertensive medications had SBP/DBP levels of <120/80, 120–129/<80, 130–139/80–89 and ≥140/90 mm Hg, respectively (table 2). A total of 14.3% of the study population was taking antihypertensive medication. The baseline characteristics of the study participants according to different BP subgroups are shown in table 2. With increasing BP values, their age, the total cholesterol levels and the prevalence of diabetes also increased (table 2).

Based on the 2010 Chinese guideline, the prevalence of hypertension among rural adults in Liaoning Province was 49.8%. According to the 2017 ACC/AHA guideline, the prevalence of hypertension was as high as 72.2%, an increase of 22.4% (table 3). Table 3 also shows the differences in the prevalence of hypertension among different subgroups according to the 2010 Chinese guideline and the 2017 American ACC/AHA guideline. The results showed that there was a difference between the two guidelines in diagnosing the prevalence of hypertension in the subgroups of men, lower age group, without CVD history and ASCVD risk <10% (p<0.05).

Table 4 shows the differences in the proportion of people for whom antihypertensive medication is recommended among different subgroups according to the 2017 ACC/AHA guideline and the 2010 Chinese guideline. According to the 2017 ACC/AHA guideline, 56.4% of the study population will be recommended antihypertensive medication, an increase of 5.0% relative to the 51.4% recommended by the 2010 Chinese guideline (table 4). Non-pharmacological therapy is advised for

Table 2 Baseline characteristics of rural Chinese adults by blood pressure levels and antihypertensive medication use (n=11 747)

	SBP/DBP categories in mm Hg among Chinese adults not taking antihypertensive medication					
	<120/80 (n=1787)	120–129/<80 (n=2149)	130–139/80–89 (n=1961)	≥140/90 (n=4168)	Taking antihypertensive medication (n=1682)	P value*
Percentage of population (%)	15.2	18.3	16.7	35.5	14.3	
Population characteristics						
Age (years)	48.8±9.7	50.2±9.9	52.1±10.1	56.9±10.6	58.5±9.7	<0.001
Women (%)	66.4	54.0	50.1	48.2	57.6	<0.001
Ethnic (%)						
Han	95.0	94.1	95.3	94.2	95.1	
Mongolian	2.1	2.5	1.9	3.3	2.6	
Others	2.9	3.4	2.8	2.5	2.3	<0.001
Current smoking (%)	34.5	39.2	41.2	42.6	34.7	<0.001
TC (mmol/L)	4.8±1.0	5.1±1.0	5.2±1.0	5.4±1.1	5.5±1.2	<0.001
HDL (mmol/L)	1.4±0.3	1.4±0.4	1.4±0.4	1.5±0.4	1.3±0.3	<0.001
Diabetes (%)	3.2	4.7	7.2	12.0	19.4	<0.001
Glucose (mmol/L)	5.5±1.2	5.7±1.3	5.8±1.4	6.1±1.8	6.4±2.0	<0.001
eGFR (mL/min/1.73 m^2)	95.8±13.8	95.9±15.1	95.3±14.1	92.3±16.7	87.2±16.9	<0.001
SBP (mm Hg)	112.1±5.9	124.6±3.3	134.5±2.9	157.7±17.0	164.6±23.5	<0.001
DBP (mm Hg)	69.2±5.8	76.2±6.3	79.2±6.2	88.2±10.5	91.3±12.5	<0.001
10-year ASCVD predicted risk	0.04±0.05	0.06±0.05	0.08±0.06	0.16±0.10	0.21±0.11	<0.001
High-risk population† (%)	10.2	17.3	32.4	68.2	86.0	<0.001
ASCVD risk (%)						
<5%	77.3	57.6	38.1	11.1	3.1	
5%–<10%	15.9	28.1	32.1	22.3	12.5	
10%–<20%	5.6	11.9	24.6	38.8	35.7	
≥20%	1.1	2.4	5.2	27.8	48.7	<0.001

*Difference between subgroups, p<0.05.
†High cardiovascular risk is defined as a history of cardiovascular disease (coronary heart disease, stroke and heart failure) or 10-year predicted ASCVD risk ≥10%.
ASCVD, atherosclerotic cardiovascular disease; DBP, diastolic blood pressure; eGFR, estimated glomerular filtration rate; HDL, high-density lipoprotein; SBP, systolic blood pressure; TC, total cholesterol.

15.8% of study participants diagnosed with hypertension according to the 2017 ACC/AHA guideline.

According to the 2010 Chinese hypertension guideline, the percentage of above goal BP among patients taking antihypertensive medications reached 86.1% (table 5). According to the 2017 ACC/AHA guideline, it was as high as 96.7%. This proportion significantly increased by 10.6%. The differences in the rate of above goal BP between the two guidelines were also observed in different subgroups (table 5).

DISCUSSION

The present study, using a representative population of rural areas of Liaoning Province, revealed the potential impact of the 2017 ACC/AHA guideline on the epidemic characteristics of hypertension. Based on the 2010 China hypertension guideline and the 2017 ACC/AHA guideline, the prevalence of hypertension in rural areas of Liaoning Province increased from 49.8% to 72.2%, the proportion of people for whom antihypertensive medication was recommended increased from 51.4% to 56.4% and the proportion of above goal BP among patients taking antihypertensive medications increased from 86.1% to 96.7% (figure 1). More intensive management for hypertension is necessary for rural adults in Liaoning Province in China.

In recent decades, the prevalence of hypertension among adults in China has increased dramatically, and it has become an important public health issue. A recent China Patient-centered Evaluative Assessment of Cardiac Events (PEACE) Study including more than 1.7 million people indicated that the prevalence of hypertension was 44.7% (95% CI: 44.6%–44.8%) among adults aged ≥35 years.[7] Recently, the incidence of hypertension has also shown a steep increasing trend, especially in rural areas of northeastern China.[5 6] This study found that according to

Table 3 Prevalence of hypertension among rural Chinese adults based on the 2017 ACC/AHA guideline and the 2010 Chinese guideline (%)

	2017 ACC/AHA guideline	2010 Chinese guideline	Difference (2017 ACC/AHA but not 2010 Chinese guideline)
Overall (n=11 747)	72.2	49.8	22.4
Age (year)			
35–44 (n=2793)	56.1	27.3	28.8
45–54 (n=3644)	69.2	43.9	25.3
55–64 (n=3537)	81.0	61.9	19.1
65–74 (n=1405)	85.8	72.2	13.5
≥75 (n=368)	88.9	77.2	11.7*
Sex			
Men (n=5441)	76.7	52.8	23.9
Women (n=6306)	68.4	47.2	21.2*
Ethnic			
Han (n=11 113)	72.3	49.7	22.6
Mongolian (n=308)	72.7	58.8	14.0
Others (n=326)	69.3	44.2	25.2*
ASCVD risk			
<5% (n=3882)	42.8	13.2	29.6
5%–<10% (n=2658)	74.4	42.9	31.5
10%–<20% (n=3055)	90.0	72.6	17.4
≥20% (n=2152)	97.3	92.0	5.3*
The history of CVD†			
Yes (n=994)	83.7	71.2	12.5
No (n=10 753)	71.2	47.8	23.3*

*Difference between subgroups, p<0.05.
†Defined as a history of cardiovascular disease (coronary heart disease, stroke and heart failure).
ACC/AHA, American College of Cardiology/American Heart Association; ASCVD, atherosclerotic cardiovascular disease; CVD, cardiovascular disease.

the 2010 Chinese hypertension guideline, the prevalence of hypertension among adults (≥35 years) in rural areas of Liaoning Province was 49.8%, with one in two people having hypertension. However, according to the 2017 ACC/AHA guideline, the prevalence of hypertension in this region will increase to a level as high as 72.2%, with a relative increase of 45%, which is similar to US data.[3] Using the 2011–2014 National Health and Nutrition Examination Survey (NHANES) population data, Muntner *et al* showed that the 2017 American ACC/AHA guideline will increase the prevalence of hypertension in the USA from 31.9% (JNC-7 guideline) to 45.6%, with a relative increase of 43.0%.[3] According to the 2017 ACC/AHA guideline, more individuals with BP ≥130–139/80–89 mm Hg will be newly diagnosed with hypertension. China is facing enormous public health challenges with a large population. High levels of attention should be paid to strengthening the management of hypertension among rural adults in China to reduce the burden of hypertension and its complications on treatment, medical expenditures and the national economy. However, there is no doubt that the diagnosis of hypertension provides an opportunity for healthcare providers and patients to discuss the value of non-pharmacological treatment in lowering BP, to implement recommended lifestyle changes and to emphasise that BP is a potential controlled hazard of CVD, end-stage renal disease, subclinical atherosclerosis and all-cause mortality. Therefore, we should also pay more attention to the positive impact of a new definition of hypertension on rural adults in China based on the 2017 ACC/AHA guideline.

The 2017 ACC/AHA guideline has drastically changed the recommended treatment for patients with hypertension on the basis of JNC-7, which recommends lifestyle treatment for the general population at a BP of 130–139/80–89 mm Hg.[1 2] Additional initial medical treatment is recommended for high-risk patients (CVD, CKD, diabetes and so on), including high ASCVD risk (≥10%). NHANES data analysis results show that, according to the 2017 ACC/AHA guideline, the recommended antihypertensive medication for US adults will increase from 34.3% to 36.2%, with a small increase of 1.9%.[3] Our study

Table 4 Percentage of recommended antihypertensive medications among rural Chinese adults based on the 2017 ACC/AHA guideline and the 2010 Chinese guideline (%)

	Recommended antihypertensive medications		
	2017 ACC/AHA guideline	2010 Chinese guideline	Difference (2017 ACC/AHA but not 2010 Chinese guideline)
Overall (n=11 747)	56.4	51.4	5.0
Age (years)			
35–44 (n=2793)	28.8	28.4	0.4
45–54 (n=3644)	47.6	45.4	2.2
55–64 (n=3537)	72.4	63.7	8.7
65–74 (n=1405)	85.6	74.3	11.3
≥75 (n=368)	88.9	80.7	8.2*
Sex			
Men (n=5441)	61.7	54.4	7.3
Women (n=6306)	52	48.9	3.0*
Ethnic			
Han (n=11 113)	56.4	51.3	5.1
Mongolian (n=308)	63.0	61.4	1.6
Others (n=326)	51.3	46	5.2
ASCVD risk			
<5% (n=3882)	14.3	13.6	0.6
5%–<10% (n=2658)	46.4	44.6	1.8
10%–<20% (n=3055)	90.0	75.4	14.6
≥20% (n=2152)	97.3	94.1	3.3*
The history of CVD†			
Yes (n=994)	83.7	72.7	11.0
No (n=10 753)	53.9	49.5	4.5*

*Difference between subgroups p<0.05.
†Defined as a history of cardiovascular disease (coronary heart disease, stroke and heart failure).
ACC/AHA, American College of Cardiology/American Heart Association; ASCVD, atherosclerotic cardiovascular disease; CVD, cardiovascular disease.

suggests that 56.4% of the population will be recommended antihypertensive medication, higher than the 51.4% recommended by the 2010 Chinese hypertension guideline, with a 5.0% increase. In fact, an additional 5.0% of people taking antihypertensive drugs will constitute a large group and need far more social and medical resources in China. Although there is some evidence from clinical trials suggesting that more benefit will be achieved by lowering BP below 120/80 mm Hg, there is no direct evidence from Chinese samples.[8] However, regardless of the guideline recommendations we consider, we must pay more attention to the rate of taking antihypertensive medication and obtaining regular treatment as quickly as possible, which are urgent issues in China. There are some effective and affordable methods for enhanced BP monitoring, treatment and control programmes in the Chinese rural regions, such as free physical examinations for residents more than 60 years old once a year in the primary care centre, home BP monitoring two times a day for patients with hypertension, the promotion of popular science on the prevention and treatment of hypertension on TV and the WeChat official account, follow-up via telephone by village doctors and online consultations on the internet healthcare platform. We believe that a public health strategy involving educational and environmental interventions should be targeted at village doctors and others responsible for primary care in rural areas as well as the rural population.

An improvement in the rate of hypertension control is a serious challenge that we must face. The China PEACE Study showed that the control rate of hypertension (≥35 years) was 7.2%.[7] Our study indicated that according to the 2010 Chinese guideline, the above goal BP among rural patients with hypertension in Liaoning Province is 86.1% (control rate 13.9%); however, based on the 2017 American ACC/AHA guideline, it will be as high as 96.7% (control rate is only 3.3%). NHANES data show the above goal BP will increase from 39.0% (JNC-7 guideline) to 53.4% (2017 ACC/AHA guideline), with a relative increase of 30.0%.[3] Our data show that a relative increase

Table 5 Proportion of rural Chinese adults taking antihypertensive medication with blood pressure above the 2017 ACC/AHA guideline and the 2010 Chinese guideline treatment goal (%)

	Blood pressure above goal according to:		Difference (2017 ACC/AHA but not 2010 Chinese guideline)
	2017 ACC/AHA guideline	2010 Chinese guideline	
Overall (n=1682)	96.7	86.1	10.6
Age (years)			
35–44 (n=142)	95.8	79.6	16.2
45–54 (n=427)	94.6	87.4	7.3
55–64 (n=716)	97.8	92.0	5.7
65–74 (n=337)	97.6	76.3	21.4
≥75 (n=60)	96.7	78.3	18.3*
Sex			
Men (n=713)	97.6	88.4	9.3
Women (n=969)	96.1	84.5	11.6
Ethnic			
Han (n=1600)	96.6	85.9	10.7
Mongolian (n=43)	100.0	95.3	4.7
Others (n=39)	100.0	87.2	12.8
ASCVD risk			
<5% (n=52)	67.3	25.0	42.3
5%–<10% (n=210)	91.4	74.8	16.7
10%–<20% (n=601)	96.8	83.9	13.0
≥20% (n=819)	99.9	94.6	5.3*
The history of CVD†			
Yes (n=1365)	98.4	87.1	11.4
No (n=317)	96.3	85.9	10.4

*Difference between subgroups p<0.05.
†Defined as a history of cardiovascular disease (coronary heart disease, stroke and heart failure).
ACC/AHA, American College of Cardiology/American Heart Association; ASCVD, atherosclerotic cardiovascular disease; CVD, cardiovascular disease.

of 12.3% in the above goal BP with reference to the 2017 ACC/AHA guideline, which is lower than the change in US data. The difference is partly explained by the fact that the rate of above goal BP is too high and that the control rate of hypertension is extremely poor in rural areas of China.

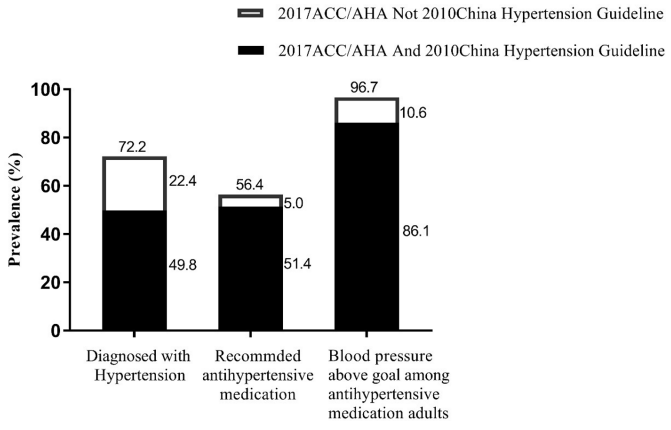

Figure 1 Prevalence of diagnosed with hypertension, recommendation for pharmacological antihypertensive treatment and blood pressure above goal among rural Chinese adults according to the 2017 American College of Cardiology/American Heart Association guideline and the 2010 Chinese guideline.

The strength of the present study is that it is the first study to analyse the potential impact of the 2017 ACC/AHA guideline on the prevalence of hypertension, the recommended antihypertensive medications and the above goal BP in rural areas of Liaoning Province, which will provide important supporting data for the future prevention and treatment of hypertension. However, there are still some limitations in this study. First, instead of using the pooled cohort risk formula recommended by the 2017 ACC/AHA guideline, the ASCVD formula used in this study, developed by Yang *et al*,[9] is more consistent with the characteristics of the Chinese population. Second, this study only analysed a group of individuals from rural areas of Liaoning Province, and more diverse representative samples are needed to analyse the further impact of the 2017 ACC/AHA guideline on hypertension management in China. Finally, BP in this study was measured three times on the same day during a single visit because the number of the participants was large, but the investigators were limited. The 2017 ACC/AHA guideline emphasised the importance of accurate BP measurement in its definition of hypertension and recommended that

the diagnosis of hypertension be based on the average of multiple BP measurements obtained during two or more visits. However, BP was not measured on different days, which may induce a misclassification bias.

CONCLUSION

In conclusion, our study found that the 2017 ACC/AHA hypertension guideline has a potential impact on the prevalence of hypertension, the recommended antihypertensive medications and the control rate of the rural Chinese population with hypertension. The 2017 ACC/AHA guideline will significantly increase the prevalence of hypertension (22.4%), while the recommended antihypertensive medication in this population will increase slightly (5.0%) among rural adults in Liaoning Province. We should pay more attention to the positive impact from the 2017 ACC/AHA guideline on rural Chinese adults and further do some cost-effectiveness analysis regarding the guideline. Regardless, we should positively focus on the control and management of hypertension and further reduce the burden of chronic disease in China.

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