Prevalence of Hypertension and Associated Factors among Older Rural Adults: Results from Liaoning Province, China

Wenyue Pang^a Zixu Li^a Zhaoqing Sun^a Liqiang Zheng^a Xingang Zhang^a
Changlu Xu^a Shuangshuang Liu^a Jue Li^b Dayi Hu^b Yingxian Sun^a

^aDivision of Cardiology, Shengjing Hospital of China Medical University, Shenyang, and ^bHeart, Lung and Blood Vessel Center, Tongji University, Shanghai, PR China

Key Words

Hypertension, prevalence · Older rural Chinese

Abstract

Objective: The objective of the study was to estimate the prevalence of hypertension and associated factors among older rural adults in Liaoning Province, China. **Subjects and Methods:** The study was conducted in 2004–2006, using a multistage, stratified clustering sampling scheme to select a representative sample. A total of 10,065 adults aged 60 years or older were examined. A survey of blood pressure and associated factors was carried out. All data analyses were conducted using SPSS 11.5 statistical software package. **Results:** Overall, the prevalence rates of hypertension are 57, 64.4 and 64.9% for the age groups 60–69, 70–79 and ≥80 years, respectively. The prevalence of hypertension was positively correlated with age, female gender, Mongolian ethnicity, overweight and obesity, smoking and drinking, whereas income level was a protective factor for hypertension. The rates of awareness, treatment and control among older rural adults were very low (overall 35.2, 28.7 and 1.0%, respectively). **Conclusion:** Hypertension was highly prevalent among older rural adults in Liaoning Province, and it was associated with many factors. The percentages of hypertensives who were aware, treated, and controlled were very low. These data underscore the urgent need to strengthen the public

health education and blood pressure monitoring system to better manage hypertension among older adults in rural China.

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Introduction

Hypertension is a leading risk factor and one of the major causes of death from cardiovascular disease. It can lead to coronary heart disease, stroke, congestive heart failure, renal insufficiency, and peripheral vascular disease [1]. Highly prevalent in Western countries, hypertension is increasing rapidly in developing countries. A recent cross-sectional study in China estimated that 129 million people aged 35–74 years have hypertension [2]. Although the exact causes and mechanisms of hypertension are not known, it is generally believed that both genetic and environmental factors [3], such as cigarette smoking [4], are implicated in determining the levels of blood pressure and the prevalence of hypertension.

Aging has become a worldwide social challenge. China has the world's largest older population. Its older population more than tripled in the past 50 years and the increase will continue to accelerate in the next 50 years [5]. Hypertension is common among older adults. Its prevalence and blood pressure levels increase with age.

One study, using Framingham Heart Study data, showed that the residual lifetime risk for developing hypertension was 90% in participants aged 55 and 65 [6]. However, little is known about the epidemiological data of hypertension in older adults in China. Therefore, the present study was undertaken to reveal the prevalence and associated factors for hypertension in older rural adults in Liaoning Province, China.

Subjects and Methods

Study Subjects

The procedures were in accordance with ethical standards of the committee on human experimentation of China Medical University Shenyang, China. Informed consent was obtained from each patient. A large-scale cross-sectional survey was conducted from 2004 to 2006 in the rural areas of Fuxin county, Liaoning Province. There are 35 towns and about 640,000 rural people in Fuxin county. The study adopted a multistage, stratified cluster sampling scheme, and included samples from the northern, southern, western, eastern and central regions. According to the number of people, 3 towns were selected from the southern region, 2 from the eastern region and only 1 from other regions. Finally, rural villages near each town were selected from different geographic areas. In total, 8 towns from these regions and 84 rural villages were selected. All residents selected were aged ≥ 60 years. 10,065 subjects were examined using a standard questionnaire to collect demographic, socioeconomic, cigarette smoking and alcohol consumption data. Weight and height were measured and the body mass index (BMI) was calculated [weight (kg)/height² (m²)].

For most age-related comparisons, participants were divided into three age groups (60–69 years, 70–79 years and ≥ 80 years). The educational level (<high school, high school and >high school) was chosen as the indicator of socioeconomic status [7]. Weight was measured with a lever balance, to the nearest 100 g; subjects were without shoes and in light undergarments. BMI was categorized according to the World Health Organization criteria as normal (BMI <25), overweight ($25 \leq \text{BMI} < 30$), and obese (BMI ≥ 30). Alcohol consumption was assessed by converting the weekly consumption of any beer, wine or hard liquor into weekly kilograms of alcohol consumed; current drinking was then defined as alcohol consumption of ≥ 0.008 kg/week [8]. Smoking was defined as consumption of at least 1 cigarette every day continuously for at least 1 year. Income per year was categorized into four groups: income 1 (<1,000 CNY), income 2 ($\geq 1,000$ CNY but <1,500 CNY), income 3 ($\geq 1,500$ but <2,000 CNY), and income 4 ($\geq 2,000$ CNY) (1 CNY = 0.14 USD).

Blood Pressure Measurements

A trained and certified observer used an American Heart Association protocol to perform three blood pressure measurements with the participant in a sitting position after 5 min of rest. Participants were advised to avoid alcohol consumption, cigarette smoking, coffee/tea, and exercise for at least 30 min before these measurements. The research staff used a standardized electronic sphygmomanometer (HEM-741C; Omron, Tokyo, Japan) and

Table 1. Baseline characteristics of subjects

	Male (n = 5,092)	Female (n = 4,973)	p
Age, years	68.81 $\pm$ 6.79	69.24 $\pm$ 7.12	0.002
Income, CNY per year			0.614
<1,000	1,258 (24.7)	1,263 (25.4)	
$\geq 1,000$ but <1,500	1,843 (36.2)	1,830 (36.8)	
$\geq 1,500$ but <2,000	967 (19.0)	915 (18.4)	
$\geq 2,000$	1,024 (20.1)	965 (19.4)	
Ethnic group			<0.001
Han	4,114 (80.8)	3,844 (77.3)	
Mongolian	937 (18.4)	1,059 (21.3)	
Others	41 (0.8)	70 (1.4)	
Education			<0.001
<High school	3,503 (68.8)	4,327 (87.0)	
High school	1,253 (24.6)	557 (11.2)	
>High school	336 (6.6)	89 (1.8)	
BMI			<0.001
<25	4,440 (87.2)	3,904 (78.5)	
25–30	586 (11.5)	945 (19.0)	
≥ 30	66 (1.3)	124 (2.5)	
Current smoker	2,872 (56.4)	1,198 (24.1)	<0.001
Current drinker	2,108 (41.4)	328 (6.6)	<0.001

1 CNY = 0.14 USD. Figures are means $\pm$ standard deviation or numbers with percentages in parentheses.

chose 1 of 4 cuff sizes (pediatric, regular adult, large, or thigh) based on arm circumference. Joint National Committee on High Blood Pressure 7 criteria were used [9] to define hypertension as systolic (blood pressure ≥ 140 mm Hg) or average diastolic (blood pressure ≥ 90 mm Hg), and/or a self-report of the current treatment for hypertension with antihypertensive medication was completed [10]. Hypertension awareness, treatment and control were defined as follows: awareness was a self-report of a prior health professional's diagnosis; treatment was the current use of a prescriptive medication for hypertension management; control was a current average systolic blood pressure <140 mm Hg and an average diastolic blood pressure <90 mm Hg [10].

Statistical Analysis

All data analyses were conducted using SPSS 11.5 statistical software package. Continuous variables were presented as mean values $\pm$ standard deviations. Categorical variables were presented as frequencies. Associations between categorical variables were tested by the use of contingency tables and the χ^2 test. Statistical hypotheses were tested using the 2-tailed t test. To evaluate the association between hypertension and associated factors, multivariate logistic regression analysis was applied to estimate the odds ratio of hypertension through the levels of various explanatory factors. The adjusted odds ratio was presented together with a 95% confidence interval. For all comparisons, p values <0.05 were considered statistically significant.

Table 2. Prevalence rate (%) of hypertension among older rural adults in Liaoning Province, China

	Male	p	Female	p	Total	p
Age group		<0.0001		<0.0001		<0.0001
60–69	54.7		59.5		57.0	
70–79	62.9		65.8		64.4	
≥80	60.2		69.1		64.9	
Education		0.346		0.002		0.056
<High school	57.5		63.5		60.8	
High school	58.1		56.9		57.7	
>High school	61.5		53.8		59.9	
Ethnic group		0.002		0.001		<0.0001
Han	56.7		61.2		58.9	
Mongolian	62.9		66.7		64.0	
Others	61.9		75.0		70.0	
BMI		<0.0001		<0.0001		<0.0001
<25	55.7		59.3		57.4	
25–30	72.8		73.3		73.1	
≥30	69.2		83.6		78.6	
Income, CNY per year		0.001		0.008		<0.0001
<1,000	61.3		65.4		63.3	
≥1,000 but <1,500	57.9		62.0		59.9	
≥1,500 but <2,000	56.4		62.0		59.1	
≥2,000	52.7		58.2		55.3	
Current smoker		0.061		0.022		0.247
Yes	59.0		65.4		60.9	
No	56.4		61.7		59.7	
Current drinker		0.012		0.0001		0.101
Yes	60.0		72.3		61.6	
No	56.4		61.9		59.8	
Total	57.9		62.6		60.2	<0.0001

1 CNY = 0.14 USD.

Results

The baseline characteristics of the survey participants are provided in table 1. Han, the most prevalent nationality in China, and Mongolian, one of the minority nationalities, are the two major ethnic groups represented in the study. The educational level of most subjects was lower than high school educational level. Approximately 1,731 (17.2%) of older rural adults were overweight or obese, 1,069 (21.5%) and 652 (12.9%) among women and men, respectively. More men than women were smokers (56.4 vs. 24.1%); 2,108 (41.4%) men and 328 (6.6%) women reported drinking.

The prevalence rates of hypertension (table 2) were 57% (male 54.7%, female 59.5%), 64.4% (male 62.9%, female 65.8%) and 64.9% (male 60.2%, female 69.1%) for the age groups 60–69, 70–79 and ≥80 years, respectively. Women had a higher prevalence rate of hypertension

than men ($p < 0.0001$). Mongolians had a higher prevalence rate of hypertension than Han in both men ($p = 0.002$) and women ($p = 0.001$). Approximately 1,119 (73.1%) of overweight individuals and 149 (78.6%) of obese participants had hypertension. Hypertension was more common among overweight and obese patients than among those with normal weight in both men and women (both $p < 0.0001$). The prevalence of hypertension decreased when income increased in both men ($p = 0.001$) and women ($p = 0.008$). Smokers and drinkers had a higher prevalence rate of hypertension than nonsmokers and nondrinkers.

The results of the multivariate logistic regression analysis revealed that the prevalence of hypertension was positively correlated with age, female gender, Mongolian ethnicity, BMI group, smoking and drinking, whereas income level was a protective factor for hypertension (table 3).

The percentages of participants with hypertension who were aware of their hypertensive status, were being treated with antihypertensive medications and had their hypertension controlled are given in table 4. Overall, 2,133 (35.2%) older hypertensive people were aware of their diagnosis, only 1,740 (28.7%) of older hypertensive people were taking prescribed medication to lower their blood pressure, and only 61 (1.0%) of older hypertensive people had their hypertension controlled.

Discussion

Our study indicates that elevated blood pressure is a prevalent problem among older rural adults in Liaoning Province, China, therefore indicating that low awareness, inadequate management and unsatisfactory control of hypertension deserve great attention because hypertension is an important risk factor for cardiovascular disease [1]. The prevalence of hypertension for older rural adults in Liaoning Province of this study was lower than the outcomes of some studies [11–15], but higher than the prevalence in others [16–18]. The high prevalence in our study was probably the result of lifestyle changes in recent years, since blood pressure has been strongly associated with BMI and other diet-related factors [19]. In addition, our study revealed that older rural women have a higher prevalence rate of hypertension than older men in the same area, which is similar to some surveys [11–15] and different from others [16, 17, 20]. The prevalence rates of hypertension for older rural adults increase with age, as other investigations [9, 12, 13, 15, 17, 20] have suggested, although it was not observed for men in this study. An increase in life expectancy, together with changes in lifestyle and diet such as more smoking and drinking, high salt and fat intake and less exercise, may explain the high prevalence of hypertension in older rural Chinese people.

Similar to the findings of other studies, the present study indicated that age [11, 14, 15, 21, 22], female gender [11, 21, 22], Mongolian ethnicity, overweight and obesity [11, 13–16, 21–23], as well as smoking and drinking [11, 17, 21, 22] were clearly associated with hypertension, whereas income level was a protective factor for hypertension [20].

It has been considered that there may be a difference in the prevalence of hypertension among various ethnic groups. The current study included two ethnic groups, Han and Mongolian. The prevalence of hypertension in older Mongolian and Han people was very high (Mon-

Table 3. Multiple logistic regressions of hypertension prevalence in older rural adults in Liaoning Province, China

	Odds ratio (95% confidence interval)
Age group	
60–69	1.000 (reference)
70–79	1.408 (1.284–1.543)*
≥80	1.563 (1.338–1.827)*
Gender	
Men	1.000 (reference)
Women	1.240 (1.113–1.362)*
Education	
<High school	1.000 (reference)
High school	0.990 (0.886–1.106)
>High school	1.104 (0.896–1.359)
Ethnic group	
Han	1.000 (reference)
Mongolian	1.254 (1.129–1.393)*
BMI	
<25	1.000 (reference)
25–30	2.127 (1.878–2.410)*
≥30	2.807 (1.961–4.020)*
Income, CNY per year	
<1,000	1.000 (reference)
≥1,000 but <1,500	0.876 (0.787–0.976)*
≥1,500 but <2,000	0.808 (0.712–0.917)*
≥2,000	0.723 (0.638–0.818)*
Current smoker	
No	1.000 (reference)
Yes	1.129 (1.026–1.242)*
Current drinker	
No	1.000 (reference)
Yes	1.185 (1.058–1.327)*

* $p < 0.05$ for the independent association between hypertension prevalence and each factor after adjusting for the remaining factors. 1 CNY = 0.14 USD.

Table 4. Awareness, treatment, and control rates (%) of hypertension among older rural adults in Liaoning Province, China

Age	Aware- ness	Treat- ment	Control	
			hypertension	treated
Total	35.2	28.7	1.0	3.7
60–69	37.6	30.7	1.3	4.4
70–79	34.4	27.6	0.7	2.6
≥80	24.1	21.4	0.7	3.3

golians: 64%; Han: 58.9%). Similar to our previous study [24], Mongolians have a higher prevalence rate of hypertension than Han. Besides environmental factors such as different eating habits, genetic factors may play an important role in the development of hypertension. Further studies will be conducted to ascertain the reason.

Overweight and obesity have become a global public health issue and are highly prevalent worldwide. They are important risk factors for hypertension. Blood pressure has a positive correlation with BMI. The risk of developing hypertension within 5 years will increase by 9% if baseline BMI increases by 1. A previous study [25] reported that the prevalence of hypertension was 2- to 6-fold higher in obese than in normal-weight individuals. As shown in this study, about 17.2% of older rural adults were overweight or obese. As in other studies [15, 16], overweight and obese participants have a higher prevalence rate for hypertension than those with normal BMI. These findings suggest that the potential health benefits from obesity prevention are of considerable public health importance.

A previous study has revealed that alcohol consumption in larger amounts (more than 2 portions a day) and cigarette smoking increase blood pressure and overall mortality [26]. It is generally considered that alcohol consumption has a linear relationship with blood pressure level, especially systolic blood pressure. The prevalence rate of hypertension increases noticeably when more than 0.05 kg of alcohol is consumed daily. In our study, it was confirmed that smoking and drinking positively correlated with the prevalence rate of hypertension. These data emphasize the importance of smoking cessation and restriction of alcohol consumption for the prevention of hypertension. Public education should be improved and the strategies used by health professionals should be en-

hanced to better inform people of the harm caused by smoking and drinking.

The rates of awareness, treatment and control in the present study were lower than the results of other studies [18, 21, 26]. This is probably because of multiple factors, such as inadequate health education, and limited access to medical services due to the lower income in rural areas. Another problem that emerged was that the control rate was rather low. This can be explained in part by the lack of awareness or treatment of the condition [20]. However, even for those who reported receiving medication for hypertension, only 3.7% had hypertension controlled to the recommended target. Therefore, more efforts, such as public health education and a blood pressure monitoring system, should be mandated for the older group to improve their unsatisfactory awareness, treatment and control of hypertension.

Conclusions

Hypertension is highly prevalent among older rural adults in Liaoning Province, China, yet the awareness, treatment and control rates are extremely low. These data emphasize the urgent need to promote hypertension education and augment blood pressure monitoring projects to better manage hypertension among older rural adults in China.

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