

The Prevalence of Prehypertension and Hypertension Among Rural Adults in Liaoning Province of China

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Summary

Background: The objective of this study was to estimate the prevalence of prehypertension and hypertension in the rural adults of Liaoning province of China.

Methods: The study was conducted in 2004–2006, using a multistage cluster sampling method to select a representative sample. A total of 45925 adults, 35 years or older, were examined. Two blood pressure measurements were obtained by trained observers by use of a standardized electric sphygmomanometer after a 5-min sitting rest. Information on the history of hypertension was obtained by use of a standard questionnaire.

Results: Overall, the prevalence of prehypertension was 44.1%; for men 48.7 and women 39.6%. The prevalence of hypertension was 37.8%; for men 37.0 and women 38.6%. Among hypertensive patients, only 29.5% patients were aware of their high blood pressure, 23.6% patients were taking antihypertensive medication, and 1.1% patients achieved blood pressure control.

Conclusions: Prehypertension and hypertension are highly prevalent in rural areas of China. The percentage of those with hypertension who are aware, treated,

and controlled are unacceptably low. These results underscore the urgent need to develop strategies to improve prevention, detection, and treatment of hypertension in rural areas of China.

Key words: rural adults, prehypertension, hypertension, prevalence

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Introduction

The Seventh Report of the Joint National Committee (JNC-7) On Prevention, Detection, Evaluation, and Treatment of High Blood Pressure proposed a new classification for individuals between normal blood pressure (BP) and established hypertension, in that people with systolic blood pressure (SBP) between 120 and 139 mmHg or diastolic blood pressure (DBP) 80 and 89 mmHg were categorized as having 'prehypertension'.¹ The report emphasized that even slightly elevated BP increase cardiovascular risk. Beginning at a SBP/DBP of 115/75 mmHg, the risk of cardiovascular disease was doubled with each increment of 20/10 mmHg.^{1–3} Lifestyle modification or even medical treatment was recommended for individuals with prehypertension.¹ Clearly, these new guidelines have broadened the target population for high BP (HBP) control. However, little was known about the epidemiology of prehypertension and hypertension in the rural adults of China by then. In this article, we report the prevalence of prehypertension and hypertension according to the new JNC guidelines; we also study awareness, treatment, and control of hypertension in rural adults of China.

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Methods

Study Subjects

The procedures followed were in accordance with the ethical standards of the committee of the China Medical University which was responsible for human experimentation. This investigation was based on a large-scale epidemiological study in China with a cross-sectional survey that adopted a multi-stage, stratified clustering sampling scheme in the rural areas of Fuxin county, Liaoning province, China. Subjects numbering 45,925 who were over 35 years of age were examined between 2004 and 2006. Information on demographic characteristics including age, gender, education, ethnicity, occupation, and household income was collected. The information on history of hypertension and use of antihypertensive medications was also obtained by use of a standard questionnaire. Life habits such as smoking and drinking were also surveyed. For most age-related comparisons, participants were separated into four groups according to their ages (35–44, 45–54, 55–64, and ≥ 65 yrs). The weight and height of the subjects were recorded, Body Mass Index (BMI) was calculated as weight (kg)/height (m)². According to the WHO criteria, BMI is categorized into three groups as normal (BMI < 25), overweight (25 \leq BMI < 30) and obese (BMI \geq 30). Drinking habit status was assessed by alcohol consumption which was defined as the weekly consumption of beer, wine and hard liquor, converted into mL of alcohol. Current drinking was defined as alcohol consumption (≥ 8 mL/week).⁴ Smoking was defined as people who smoked at least one cigarette per day and continued for at least one year. Smoking was assessed as part of the questionnaire. The individuals were asked whether they currently smoked or not (Do you smoke currently?).

Blood Pressure Measurement

After the subject had rested for at least 5 min, BP was measured using an electric sphygmomanometer (OMRON, HEM-741C) by doctors. The subject's arm was placed at the heart level. Two measurements were

taken. If the difference between the two measurements was greater than 10 mmHg, a third measurement was taken. SBP was defined as the average of the closest two SBP readings. DBP was defined as the average of the closest two DBP readings.⁵ We defined prehypertension as the SBP between 120 and 139 mmHg, or DBP between 80 and 89 mmHg, according to JNC-7.¹ Hypertension was defined as an average SBP ≥ 140 mmHg, an average DBP ≥ 90 mmHg, and/or self-reported current treatment for hypertension with antihypertensive medication.⁶ Awareness of hypertension was defined as self-report of any prior diagnosis of hypertension by a health care professional among the population defined as having hypertension. Treatment of hypertension was defined as use of a prescription medication for management of HBP at the time of the interview. Control of hypertension was defined as pharmacological treatment of hypertension associated with an average SBP < 140 mmHg and an average DBP < 90 mmHg.⁶

Statistical Analysis

Continuous variables were presented as mean values and standard deviation. Categorical variables were presented as frequencies. Associations between categorical variables were tested by the use of contingency tables and the χ^2 test. Comparisons between continuous variables between groups were performed by analysis of t-test. Statistical analysis was performed using SPSS version 11.5 software and values of $p < 0.05$ were considered to indicate statistical significance.

Results

The basic characteristics of the survey participants are provided in Table 1. Approximately 22.4% of rural adults were overweight or obese; 25.1 and 17.6% in women and men respectively. More men than women were smoking (66.9 vs. 16.3%); 56.0% men and 5.9% women reported drinking.

Factors associated with different BPs are presented in Table 2. More subjects affected by hypertension or

TABLE 1 Baseline characteristics of subjects in the 2004–2006 survey

| Characteristic | Men (n = 22,747) | Women (n = 23,178) | All (n = 45,925) | P^a |
|-------------------------------|-------------------|--------------------|-------------------|---------|
| Mean age, y | 51.23 \pm 11.79 | 51.20 \pm 11.84 | 51.22 \pm 11.82 | 0.162 |
| Mean BMI (kg/m ²) | 23.03 \pm 2.85 | 23.43 \pm 3.35 | 23.23 \pm 3.12 | <0.0001 |
| BMI (kg/m ²), % | — | — | — | — |
| <25 | 82.4 | 72.9 | 77.6 | <0.0001 |
| 25–30 | 16.3 | 24.4 | 20.4 | |
| ≥ 30 | 1.3 | 0.7 | 2.0 | |
| Current smoking status, % | 66.9 | 16.3 | 41.4 | <0.0001 |
| Current drinking status, % | 56.0 | 5.9 | 30.7 | <0.0001 |

Abbreviation: BMI = body mass index

^a Men vs. Women.

TABLE 2 Factors associated with different blood pressures (n=45,925)

| Characteristic | Normotension ^a (n = 8,296) | Prehypertension (n = 20,274) | Hypertension (n = 17,355) |
|-------------------------------|--|---------------------------------|------------------------------|
| Mean age, y | 47.12 ± 10.29 | 51.20 ± 11.84 ^b | 51.22 ± 11.82 ^b |
| Mean BMI (kg/m ²) | 22.55 ± 2.85 | 23.09 ± 2.82 ^b | 23.73 ± 3.48 ^b |
| Current smoking status, % | 13.8 | 47.7 ^b | 38.5 ^b |
| Current drinking status, % | 15.2 | 46.0 ^b | 38.9 ^b |

^a Normotension is the reference group.

^b The difference is statistically significant (p < 0.05).

TABLE 3 Prevalence of prehypertension and hypertension among rural adults of Liaoning province

| Variable | Men | | Women | | All | |
|--------------------------|------------------------|---------------------|------------------------|---------------------|------------------------|---------------------|
| | Prehypertension (%) | Hypertension (%) | Prehypertension (%) | Hypertension (%) | Prehypertension (%) | Hypertension (%) |
| Total | 48.7 | 37.0 | 39.6 | 38.6 | 44.1 | 37.8 |
| Age, y | | | | | | |
| 35–44 | 59.3 | 22.2 | 46.2 | 21.4 | 52.7 | 21.8 |
| 45–54 | 50.3 | 35.5 | 42.1 | 37.1 | 46.2 | 36.3 |
| 55–64 | 41.2 | 47.5 | 33.4 | 52.9 | 37.3 | 50.2 |
| ≥ 65 | 30.4 | 60.9 | 27.2 | 64.3 | 28.8 | 62.6 |
| BMI (kg/m ²) | | | | | | |
| <25 ^a | 50.2 | 34.2 | 41.2 | 34.1 | 45.9 | 34.1 |
| 25–30 | 42.4 ^b | 49.1 ^b | 36.7 ^b | 48.9 ^b | 39.0 ^b | 49.0 ^b |
| ≥30 | 33.3 ^b | 59.7 ^b | 24.0 ^b | 67.7 ^b | 27.1 ^b | 65.1 ^b |

^a BMI less than 25 is the reference group.

^b The prevalence rate of prehypertension or hypertension is significantly different from that of the referent group (p < 0.05).

prehypertension reported smoking or drinking than normotension people. The mean BMI for hypertension or prehypertension people was greater than normotension people.

Table 3 presents a high prevalence of prehypertension and hypertension. Approximately 81.9% of rural adults of Liaoning province (85.7% in men and 78.2% in women) had prehypertension or hypertension and 37.8% had hypertension. The prevalence of prehypertension was higher among men than women (48.7% vs. 39.6%), but the prevalence of hypertension was higher among women than men (38.6% vs. 37.0%). Furthermore, considerable age- differences were observed. With age increasing, the prevalence rate of prehypertension decreased, whereas the prevalence rate of hypertension increased whether in men or women. Obesity was an important predictor of prehypertension and hypertension. Approximately 88.0% of overweight individuals and 92.2% of obese participants had prehypertension or hypertension, the difference in the prevalence of hypertension among BMI group was very remarkable (34.1, 49.0, and 65.1%).

Table 4 provides the percentage of participants with hypertension who were aware of their hypertensive status, who were being treated with antihypertensive medications, who had their hypertension controlled, and who were both treated and controlled. Overall, 29.5% of those with hypertension were aware of their diagnosis, only

23.6% were taking prescribed medication to lower their BP, and only 1.1% achieved BP control. When confined to those hypertensives that were being treated, only 4.8% were being controlled. More women (32.8%) were aware of their hypertension than men (25.9%). Treatment and control were also more common among women than among men. Awareness was most common in the 55–64, and ≥65 years age group whether among men or women. 19.5% of men reported that they were taking antihypertensive medication for their HBP, and the percentage was much lower for 35–44 years age group than the ≥65 years age group (11.4 vs. 25.3%). Only 27.4% of women reported that they were being treated for their hypertension. Only 0.9% of men and 1.4% of women with hypertension achieved BP control.

Discussion

Our study indicates that elevated BP is a prevalent problem in the rural areas of China, where approximately 81.9% of rural adults (85.7% men and 78.2% women) had prehypertension or hypertension and 37.8% people had hypertension. Low awareness and inadequate management of hypertension deserve great attention. Approximately more than two thirds of hypertensive patients were not aware of their hypertension status. Only less

TABLE 4 Percentage of persons with hypertension who are aware, treated, and controlled, and percentage of treated persons with hypertension who are controlled, in rural adults of Liaoning province

| Age, y | Men | | | | Women | | | | All | | | |
|--------|---------------|---------|------------|-------------------------------|-------------------|-------------------|------------------|-------------------------------|---------------|---------|------------|-------------------------------|
| | Hypertensives | | | Controlled | Hypertensives | | | Controlled | Hypertensives | | | Controlled |
| | Aware | Treated | Controlled | Treated Hyper- tensives | Aware | Treated | Controlled | Treated Hyper- tensives | Aware | Treated | Controlled | Treated Hyper- tensives |
| Total | 25.9 | 19.5 | 0.9 | 4.4 | 32.8 ^a | 27.4 ^a | 1.4 ^a | 5.1 | 29.5 | 23.6 | 1.1 | 4.8 |
| 35–44 | 15.8 | 11.4 | 0.5 | 4.4 | 23.2 ^a | 17.5 ^a | 1.3 ^a | 7.4 | 19.5 | 12.6 | 0.9 | 6.2 |
| 45–54 | 23.4 | 17.4 | 1.1 | 6.3 | 30.3 ^a | 24.5 ^a | 1.4 | 5.6 | 27.0 | 25.3 | 1.2 | 5.9 |
| 55–64 | 30.0 | 23.2 | 0.9 | 3.9 | 43.5 ^a | 35.0 ^a | 1.7 ^a | 4.8 | 35.6 | 33.5 | 1.3 | 4.5 |
| ≥ 65 | 33.4 | 25.3 | 0.8 | 3.3 | 34.8 | 30.2 ^a | 1.2 | 3.8 | 34.1 | 28.7 | 1.0 | 3.6 |

^a Women vs. Men, $p < 0.05$.

than one-fourth of the hypertensive patients had taken prescriptions to control their BP, and only 1.1% had their hypertension controlled.

Consistent with other studies, our analysis shows that obesity was an important predictor of elevated BP: 92.2% of obese individuals had prehypertension or hypertension and 65.1% had hypertension, whereas these figures were 80.0 and 34.1% among nonoverweight individuals, respectively. These findings suggest that the potential health benefits from prevention of obesity are of considerable importance to public health.⁷

Prehypertension was a new category of BP classification. Our study found an overall prehypertension prevalence rate of 44.1% in rural adult people of China. This was higher than the prevailing rate (34%) observed in Taiwanese adults⁵ and (31%) observed in American adults.^{7,8} Consistent with previous reports,^{5,7} we found that in Chinese adults the prevailing rate of prehypertension was greater in men than in women. However, the gender difference in the prevailing rate of prehypertension in Chinese adults was not as significant as that seen in American adults.⁷ We also revealed that the prevalence rate of prehypertension decreased with increasing age, which was different from Taiwanese and American adults.^{5,7} Individuals aged ≥65 years were less likely to have prehypertension than the 35–44 years age group (28.8 vs. 52.7%), the reason being the majority of individuals in the old-age group (62.6%) had progressed to clinical hypertension.

A previous study demonstrated that individuals with a BP level slightly higher than normal had a higher incidence of cardiovascular disease than those with normal BP.⁹ Therefore, preventing prehypertension and hypertension and controlling BP at the target level among hypertensive patients are important public health goals. The JNC-7 report recommends lifestyle modifications for all patients with prehypertension, including losing weight, increasing physical activity, adopting the Dietary Approaches to Stop Hypertension (DASH) eating plan,^{10–12} and moderating alcohol consumption. Our

study underscores the urgent need to inform the general public and health professionals about the new guidelines. People with prehypertension should be told the seriousness of hypertension and the importance of promoting appropriate lifestyle modifications; so as to prevent hypertension and cardiovascular disease later on.

Our results also showed that the prevalence of hypertension in rural adults of China was high (37.8%); even exceeding the prevailing rate in some urban areas.¹³ This increase was probably the result of lifestyle changes in recent years since BP has been strongly associated with BMI, salt intake, and other diet-related factors.¹⁴ Wu *et al.*¹⁵ reported that in the past two decades the prevalence of overweight and hypercholesterolemia increased significantly, the prevalence of alcohol consumption in men increased by 10%, and the prevalence of smoking was still over 60% in men. Following economic development changes in lifestyle and diet such as more drinking, smoking, eating more fat, high salt intake and so on along with an increase in life expectancy, may explain the high prevalence of hypertension in rural of China.

The rates of awareness, treatment and control in our study were lower than that in urban (29.5 vs. 41.1%, 23.6 vs. 35.1%, 1.1 vs. 9.7%).¹³ Such differences were very likely to be related to factors such as the difficult access to medical care and poor health education in rural areas. Furthermore, lower income in rural areas is a barrier to the treatment of hypertension. The data showed that awareness and treatment were higher among women than men, which was also noted in other studies.^{16–18} On the other hand, the rates were lower in younger people, especially in the age group of 35–44 years, compared with older people. It is considered that women, as well as the old, likely pay more attention to their health. The young, busying themselves with their ambitions, pay less attention to their health. Therefore, continuous health education is important for improving the awareness of men and young people.

In conclusion, this study shows that the rural adults of China are facing a challenge in the prevention and

management of prehypertension and hypertension. Our findings underscore the urgent need to develop strategies to improve prevention, detection, and treatment of hypertension in the rural adults of China. It is time for us to take more care about blood pressure in the rural adults of China.

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