Prevalence, awareness, treatment & control of hypertension in rural Liaoning province, China

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Background & objectives: Hypertension is a major risk factor for cardiovascular and renal diseases. In PR China, the prevalence of hypertension has substantially increased during the past four decades. Information on prevalence as well as awareness regarding treatment and prevention of hypertension is scarce particularly in rural settings. The objective of this study was therefore to estimate the prevalence and distribution of hypertension and to determine the status of hypertension awareness, treatment, and control in the general rural adult population in northeast China.

Methods: During 2005–2007, in Liaoning province of northeast China a probability proportional to size sampling method was used to select a nationally representative sample. A total of 45,925 adults (aged >35 yr) were examined. Three blood pressure measurements were obtained by trained observers using a standardized sphygmomanometer after a 5-minute sitting rest. Information on history of hypertension and use of antihypertensive medications was obtained. Hypertension was defined as a mean systolic blood pressure >140 mm Hg, diastolic blood pressure >90 mm Hg, and/or use of antihypertensive medications.

Results: Overall, 37.8 per cent of the rural adult population from northeast China aged 35 to 85 yr had hypertension. Among hypertensives, only 29.5 per cent were aware of their high blood pressure, 20.2 per cent were taking antihypertension medication and 0.9 per cent achieved blood pressure control (<140/90 mm Hg). Of all subjects, 43.9 per cent did not think that high blood pressure would endanger their lives. The reasons why not taking antihypertensive medication in hypertensives aware of having hypertension was 40.2 per cent for their lack of knowledge about the fatalness of hypertension and 32.3 per cent for financial straits.

Interpretation & conclusion: Our results indicated that hypertension is highly prevalent in rural areas of northeast China. The percentages of those with hypertension who were aware, treated and controlled were unacceptably low. These results underscore the urgent need to take comprehensive controlling measures and improve the awareness of hypertension at the same time to control hypertension in rural population of Liaoning province.

Key words Cross-sectional studies - hypertension - northeast China - rural population
High blood pressure (HBP) is an important modifiable risk factor for cardiovascular and renal disease in Western\textsuperscript{1-3} and Asian\textsuperscript{4,5} populations. It is an extremely common finding in the community and a risk factor for myocardial infarction, stroke, congestive heart failure, end-stage renal disease, and peripheral vascular disease\textsuperscript{6}. A recent cross-sectional study of China\textsuperscript{7} estimated that 129 million people aged 35-74 yr have hypertension. This showed that the prevalence and absolute numbers of individuals with hypertension have increased dramatically during the past several decades\textsuperscript{7,9}. For example, the estimated number of hypertension cases among Chinese adults has increased from 30 million in 1960 to 59 million in 1980 and to 94 million in 1990\textsuperscript{8}. Although the exact causes and mechanisms of hypertension are not known, it is generally believed that both genetic and environmental factors, such as higher sodium intake, cigarette smoking, and mental stress were involved in determining the levels of blood pressure and the prevalence of hypertension\textsuperscript{10-12}.

Liaoning province located in the northeast of China, has many differences in geographic characteristics and lifestyles comparing with other areas of China, especially in rural areas. For example, in winter seasons, rural people of northeast China usually do not go out for work and activity because of the very cold weather of outdoor, so they spend more time at home in some amusements including drinking, smoking, watching TV, gambling and so on. At the same time, in rural China, medical treatment conditions and people’s education level are much poorer than that in urban. Therefore, information on prevalence, awareness, treatment, and control of hypertension in these poor resource settings is very scarce. We thus carried out this study with the objective to estimate the prevalence and distribution of hypertension and to determine the status of hypertension awareness, treatment, and control in the rural adult people from northeast of China.

Material & Methods

Sample design: The subjects were selected from CHEAPS Study (Control Hypertension and Other Risk Factors to Prevent Stroke with Low Cost in Countryside of Northeast China). This investigation was based on a large-scale epidemiological study in Liaoning Province of northeast China during 2005 to 2007. In this study, PPS (probability proportional to size sampling) was employed and the design was self-weighting. The country was stratified in to five geographic zones, North, South, East, West and Central. Two towns were randomly selected from South, East and West zones and one town each from North and Central. All subjects aged 35 to 85 yr in a total of 89 villages in the selected towns were included in the study sample. Finally, a total of 53,216 persons were randomly selected from those selected villages and 45,925 persons (22,747 men and 23,178 women) completed the survey and examination. The overall response rate was 86.3 per cent. The age of the subjects was 35 to 85 yr, with an average of 51.22 ± 11.82 yr.

The procedures followed were in accordance with ethical standards of the responsible committee on human experimentation of China Medical University, and ethics committees and other relevant regulatory bodies in Liaoning province approved the study. A written informed consent was obtained from each participant before data collection.

BP measurement: Three BP measurements were obtained from each participant by trained and certified observers according to a common protocol adapted from procedures recommended by the American Heart Association\textsuperscript{13}. BP was measured three times with the participant in the sitting position after 5 min of rest, and the time interval between 3 measurements of BP was 1 min. In addition, participants were advised to avoid alcohol, cigarette smoking, coffee/tea, and exercise for at least 30 min before their BP measurement. A standardized electronic sphygmo-manometer (OMRON, HEM-741C) was used, and one of 4 cuff sizes (paediatric, regular adult, large, or thigh) was chosen on the basis of the circumference of the participant’s arm.

All study investigators and staff members successfully completed a training programme that oriented them both to the aims of the study and to the specific tools and methodologies employed. At the training sessions, interviewers were given detailed instructions on administration of the study questionnaire. All BP observers participated in a special training session on the use of a standardized protocol for measurement of BP. Satisfactory performance during a written test on knowledge of preparing study participants for measuring BP, selecting correct cuff size, and using standard techniques for BP measurement; during a standardized videotape examination; and during concordant measurements of BP with an instructor were required for certification as a BP observer.

Information on demographics (age, gender and residential area), socio-economic status (education level
achieved, marital status and annual household income),
cigarette smoking, alcohol consumption, family history
of hypertension, medical treatment conditions about
hypertension and other information was collected with
a standardized questionnaire which has been used in
other studies of China4,7,8.

**Diagnostic Criteria:** The hypertension status of the
subjects was assessed based on the US Seventh Joint
National Committee (JNC 7) report on the prevention,
detection, evaluation, and treatment of high BP14.
Hypertension was defined as an average systolic BP
(SBP) ≥ 140 mm Hg, an average diastolic BP (DBP) ≥ 90
mm Hg, and/or self-reported current treatment for
hypertension with antihypertensive medication.
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
high BP at the time of the interview among persons
who were aware their hypertensive status. Control of
hypertension was defined as pharmacological treatment
of hypertension associated with an average SBP < 140
mm Hg and an average DBP < 90 mm Hg.

**Statistical analysis:** The population was stratified by
age into five groups: 35 to 44, 45 to 54, 55 to 64, 65 to
74, ≥75 yr. Continuous variables were given as mean ±
SD and categorical variables as percentage in each
subgroup. All data analyses were conducted using SAS
8.12 (Statistics/Data Analysis) software (version 8.12;
SAS Institute, Inc., Cary, NC, USA). *P* < 0.05 was
considered to be statistically significant.

**Results**

**Prevalence:** Overall, 37.8 per cent (17,355/45,925) of
the Chinese adult population age 35 to 85 yr had
hypertension. Among the 17,355 hypertensives, 13,261
(6764 in men and 6497 in women) were defined as
hypertensives using BP measurement; 4094 (1643 in
men and 2451 in women) were reporting consumption
of antihypertensive medication, and 4.8 per cent (196/
4094) had their BP at a normal level. The overall
prevalence of hypertension was significantly higher
among women (38.6%) than among men (37.0%)
(*P* < 0.001). The prevalence of hypertension and the
blood pressure levels increased with age in both men
and women. Males aged 35-44 yr had a slightly higher
prevalence of hypertension than females (22.2 vs
21.4%), but the difference was not statistically

**Table I.** Prevalence of hypertension by age and sex in rural Chinese
population

<table>
<thead>
<tr>
<th>Age (yr)</th>
<th>Number of subjects</th>
<th>Prevalence of hypertension (%)</th>
<th>Excess in females (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>35 - 44</td>
<td>8086</td>
<td>8292</td>
<td>22.2</td>
</tr>
<tr>
<td>45 - 54</td>
<td>6688</td>
<td>6857</td>
<td>35.5</td>
</tr>
<tr>
<td>55 - 64</td>
<td>4593</td>
<td>4664</td>
<td>47.5</td>
</tr>
<tr>
<td>65 - 74</td>
<td>2313</td>
<td>2199</td>
<td>61.1</td>
</tr>
<tr>
<td>≥75</td>
<td>1067</td>
<td>1166</td>
<td>60.5</td>
</tr>
<tr>
<td>Total</td>
<td>22747</td>
<td>23178</td>
<td>37.0</td>
</tr>
</tbody>
</table>

significant. At subsequent ages, however, females
consistently had a higher prevalence, the consolidated
figure for those aged >45 yr being 45.1 per cent of
14,661, as compared with 48.2 per cent of 14,886
(*P* < 0.001) (Table I).

**Distribution of BP:** Gender- and age-specific estimates
of the distribution of BP according to the categories
established in European Society of Hypertension-
European Society of Cardiology15 are presented in Table
II. Overall, 38.1 per cent of men and 43.9 per cent of
women had optimal or normal BP (SBP <130 mm Hg
and DBP < 85 mm Hg), whereas 25.2 per cent of men
and 18.0 per cent of women had high normal BP. The
prevalence of stage I, II, and III hypertension was 20.6,
9.3, and 6.8 per cent in men and 19.1, 10.4, and 8.6 per
cent in women, respectively.

**Awareness, treatment, and control of hypertension:**
Fig. I showed the percentages of participants with
hypertension who were aware of their hypertensive
status, who were being treated with antihypertensive
medications, and who had their hypertension controlled.
Overall, 29.5 per cent (5,116/17,355) of those with
hypertension were aware of their diagnosis, only 20.2
per cent (3,507/17,355) were taking prescribed
medication to lower their BP, and only 0.9 per cent (159/
17,355) achieved BP control. Of those aware of having
hypertension, 68.6 per cent (3,507/5,116) were treated.
Only 4.5 per cent (159/3,507) of those treated were
normotensive with treatment.

More women (32.8%) were aware of their hypertensive
status than were men (25.9%) (*P* < 0.001). Treatment and control were also more common among
women (23.4 and 1.2%) than among men (16.8 and
0.6%). For age <75 yr, the percentages of persons who
were aware of their hypertensive status increased with
age among both men and women.
Of the hypertensives aware of having hypertension, only 26.5 per cent of persons reported that they were measuring their BP at least every one month, and only 18.3 per cent (17.2% male, 1.1% female) took antihypertensive medication for their hypertension regularly. Of the hypertensives treated, only 7.7 per cent in men and 7.9 per cent in women had controlled their BP at normal level for at least 9 months in a whole year. The reasons why not taking antihypertensive medication in hypertensives aware of having hypertension was 40.2 per cent for their lack of knowledge about the fatalness of hypertension and 32.3 per cent for financial straits. Of all the participants, 43.9 per cent did not think that high blood pressure would endanger their lives, and only 33.2 per cent recognized the fatalness of hypertension (Table III).

**Discussion**

This study reports reliable and updated information on the current prevalence of hypertension and the extent to which it is being treated and controlled in the rural adult population in northeast China. This study was conducted in a large representative sample of the Chinese adult rural population using standard protocols and instruments. Strict training processes for data collectors and vigorous quality assurance programmes were employed to ensure the quality of the data collection. Additional strengths of the study include a high response rate, 3 BP measurements, and detailed information on history of hypertension and on pharmaceutical.

**Table II. Distribution of subjects by systolic and diastolic blood pressures, sex and age**

<table>
<thead>
<tr>
<th>Sex</th>
<th>Age (yr)</th>
<th>SBP (mmHg)</th>
<th>DBP (mmHg)</th>
<th>Normotensive or hypertension controlled</th>
<th>Hypertension</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Optimal</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt; 120</td>
<td>120-129</td>
<td>130-139</td>
<td>140-159</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt; 80</td>
<td>80-84</td>
<td>85-89</td>
<td>90-99</td>
</tr>
<tr>
<td>Male</td>
<td>35 - 44</td>
<td>8086</td>
<td>18.5</td>
<td>32.1</td>
<td>27.3</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>45 - 54</td>
<td>6688</td>
<td>14.2</td>
<td>23.6</td>
<td>27.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>55 - 64</td>
<td>4593</td>
<td>11.3</td>
<td>18.2</td>
<td>23.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>65 - 74</td>
<td>2313</td>
<td>8.5</td>
<td>12.7</td>
<td>18.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>75+</td>
<td>1067</td>
<td>9.1</td>
<td>11.0</td>
<td>19.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>22747</td>
<td>14.3</td>
<td>23.8</td>
<td>25.2</td>
</tr>
<tr>
<td>Female</td>
<td>35 - 44</td>
<td>8292</td>
<td>32.5</td>
<td>28.7</td>
<td>17.7</td>
</tr>
<tr>
<td></td>
<td>45 - 54</td>
<td>6857</td>
<td>20.8</td>
<td>23.1</td>
<td>19.5</td>
</tr>
<tr>
<td></td>
<td>55 - 64</td>
<td>4664</td>
<td>13.9</td>
<td>16.7</td>
<td>17.5</td>
</tr>
<tr>
<td></td>
<td>65 - 74</td>
<td>2199</td>
<td>9.5</td>
<td>12.5</td>
<td>16.4</td>
</tr>
<tr>
<td></td>
<td>75+</td>
<td>1166</td>
<td>7.0</td>
<td>9.8</td>
<td>16.0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>23178</td>
<td>21.8</td>
<td>22.1</td>
<td>18.0</td>
</tr>
</tbody>
</table>

*Based on categories established in European Society of Hypertension-European Society of Cardiology

**Table III. Conditions about blood pressure in hypertensives aware of having hypertension in rural northeast China, 2005-2007**

<table>
<thead>
<tr>
<th>Condition of hypertension</th>
<th>Male (%)</th>
<th>Female (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodicity of BP measurement</td>
<td>N=2181</td>
<td>N=2935</td>
</tr>
<tr>
<td>Weekly</td>
<td>5.9</td>
<td>5.2</td>
</tr>
<tr>
<td>Monthly</td>
<td>19.7</td>
<td>22.0</td>
</tr>
<tr>
<td>3-monthly</td>
<td>19.7</td>
<td>20.0</td>
</tr>
<tr>
<td>6-monthly</td>
<td>10.1</td>
<td>10.3</td>
</tr>
<tr>
<td>&gt;6-monthly</td>
<td>15.9</td>
<td>15.9</td>
</tr>
<tr>
<td>Never measuring BP</td>
<td>28.9</td>
<td>26.6</td>
</tr>
<tr>
<td>Conditions of taking antihypertensive medication/year†</td>
<td>N=2181</td>
<td>N=2935</td>
</tr>
<tr>
<td>Regularity (&gt;9 months/yr)</td>
<td>17.2</td>
<td>19.1</td>
</tr>
<tr>
<td>Interruption (3-9 months/yr)</td>
<td>25.5</td>
<td>30.6</td>
</tr>
<tr>
<td>Occasionally (&lt;3 months/yr)</td>
<td>22.1</td>
<td>21.9</td>
</tr>
<tr>
<td>Never taking medicine</td>
<td>35.3</td>
<td>28.6</td>
</tr>
<tr>
<td>Effect of antihypertensive medication‡</td>
<td>N=1412</td>
<td>N=2095</td>
</tr>
<tr>
<td>Good (&gt;9 months/yr)</td>
<td>7.7</td>
<td>7.9</td>
</tr>
<tr>
<td>Acceptable (&gt;6 months/yr)</td>
<td>32.0</td>
<td>33.2</td>
</tr>
<tr>
<td>Dys-effect (&lt;6 months/yr)</td>
<td>44.3</td>
<td>47.1</td>
</tr>
<tr>
<td>Never measuring BP</td>
<td>16.0</td>
<td>11.9</td>
</tr>
<tr>
<td>Cause of not taking antihypertensive medication</td>
<td>N=769</td>
<td>N=840</td>
</tr>
<tr>
<td>Lack of knowledge about dangerous of hypertension</td>
<td>44.1</td>
<td>36.9</td>
</tr>
<tr>
<td>Financial straits</td>
<td>30.6</td>
<td>33.8</td>
</tr>
<tr>
<td>Lack guidance</td>
<td>5.2</td>
<td>6.0</td>
</tr>
<tr>
<td>Troublesome</td>
<td>11.5</td>
<td>15.0</td>
</tr>
<tr>
<td>Other</td>
<td>8.6</td>
<td>8.3</td>
</tr>
</tbody>
</table>

†represent the time of taking antihypertensive medication/yr, ‡represent the time of controlling the BP (systolic BP <140 mm Hg and diastolic BP <90 mm Hg)/yr
Comparing with the results of InterASIA, the prevalence of hypertension among rural adults from northeast China was much higher in men (37.0%) and in women (38.6%), and the percentages of awareness, treatment, and control of hypertension were much lower in both men and women. These findings in the present study indicate that hypertension has become a major public health problem in rural northeast China and underscores the urgent need to develop strategies for prevention and treatment of hypertension in rural areas.

The results of this study also demonstrated that hypertension was more prevalent among women than among men and that the prevalence increased with age. We also found for age group 35 to 44 yr, men had a slightly higher rate of hypertension than that in women, however, the reverse was true for >45 yr of age. Studies conducted in other countries among elderly subjects have similarly shown a higher prevalence of hypertension among women compared with men and an increase with age. Hormonal factors, postmenopausal weight gain, and a different risk profile might account for the higher age-specific prevalence rates of hypertension among women compared with men. However, contrast to our study, earlier studies in China have reported that the levels of blood pressure and prevalence of hypertension was higher in males than in females.

In conclusion, hypertension was found to be highly prevalent in rural adults in northeast China, and the rates of awareness, treatment and control of hypertension were unaccepted by low. At the same time, of all subjects, 43.9 per cent did not think that high blood pressure would endanger their lives. These results underscore the urgent need for developing a high blood pressure education programme to co-ordinate the effort of detection, prevention, and treatment of hypertension in the national rural areas of northeast China.

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References


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