Survey of Prevalence, Awareness, Treatment, and Control of Hypertension Among Chinese Governmental and Institutional Employees in Beijing

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ABSTRACT

Background: Few studies have been done on the effects that awareness, treatment, and control have on hypertension among governmental and institutional employees.

Hypothesis: The aim of this study was to explore prevalence, awareness, treatment and control of hypertension among governmental and institutional employees.

Methods: A total of 80 governmental organizations and institutions were selected with a 2-stage clustering sampling method in Beijing and all employees in the selected institutions were considered our study subjects. The survey questionnaires included demographic characteristics; medical, personal, and family health history; lifestyle information; and sources of blood pressure knowledge.

Results: The ages of 30 682 subjects ranged from 18 to 65 years and averaged 40.3 ± 11.4 years. The proportion of males was 54.4% (16 702 subjects). A total of 9216 subjects were diagnosed hypertensive and the prevalence rate was 30.0%. Among hypertensive patients, 5399 subjects were aware of being hypertensive and the awareness rate was 58.6%. Although 51.7% of hypertensive subjects were taking antihypertensive medications, only 2371 subjects had their blood pressure under control ($<140/90$ mm Hg) and the control rate was 25.7%. Only 4915 subjects (16.0%) monitored their own blood pressure regularly. Health publications (50.6%) and families/friends (49.1%) were the main sources of hypertension knowledge. Female hypertensive subjects have more effectively controlled blood pressure than their male counterparts. Subjects with a bachelor's degree or higher had a lower awareness rate and treatment rate, but a higher control rate.

Conclusions: The percentage of hypertensive subjects who are aware, treated, and controlled are unacceptably low among Chinese governmental and institutional employees. Regular medical check-ups and measuring of blood pressure are necessary to improve awareness, treatment, and control of hypertension.

Introduction

Cardiovascular disease is rapidly becoming the leading cause of morbidity and mortality worldwide.¹ With the changes in lifestyle and diet structure, cardiovascular disease has become the leading cause of death in China.² Hypertension has been identified as the major risk factor leading to myocardial infarction, stroke, heart failure, and end-stage renal disease.^{3,4} Hypertension has affected 26.4% of the world's adult population (972 million) in 2000, and the rates are expected to increase to 29.2% (1.56 billion) by 2025.⁵

The general trend in most developing countries is an increased level of hypertension. According to the Nutrition and Health Survey, the prevalence rate of hypertension

is approximately 18.8% in Chinese adults and 0.17 billion people suffered from it in 2002.⁶ Hypertension is a serious threat to the Chinese people. In Beijing, the prevalence rate is 25.0% for residents >15 years old and over 50% for middle aged and elderly people (≥ 45 years old).⁷ The control of blood pressure (BP) is crucial for the prevention of these adverse outcomes.

Surveys about prevalence rate, awareness rate, and control rate of hypertension have been conducted in China and abroad,^{8–12} but the majority of those surveys were carried out in the general population and few reports are available for the levels of awareness, treatment, and control of hypertension among governmental and institutional employees, especially in developing countries. Chinese governmental and institutional employees have a relatively

higher education level and more regular work schedule than the general population. But they spend more time sitting in front of their computers and may lack enough exercise. To explore prevalence, awareness, treatment, and control of hypertension in this special population, 32 917 subjects were surveyed in 80 government organizations and institutions in Beijing in 2007.

Methods

Sampling Method and Subject Selection

There were more than 300 000 governmental and institutional employees in Beijing in 2007. Government organizations and institutions were defined as being funded by the government and their employees are working for the government. We planned to select approximately one-tenth of all employees to be our study subjects with a 2-stage cluster sampling method. To do that, 80 government organizations and institutions were selected with a simple random sampling method and all employees in each institution were considered our study subjects. This study was approved by the ethics committee of Fuwai Cardiovascular Hospital. All subjects were included only after they had signed an informed consent form. Subjects were excluded from the survey if they were not willing to complete all required questions.

Data Collection

Questionnaire survey and BP measurement were completed in the sampled institutions by trained physicians. The survey questionnaires included: (1) Demographic characteristics which were comprised of age, gender, height, weight, education, and ethnic group. (2) Medical, personal, and family health history included family history of hypertension, current and past use of medications. Family history of hypertension was defined as the subjects' direct relatives ever being diagnosed as hypertensive, such as parents, grandparents, children, grandchildren, brothers, or sisters. (3) Lifestyle information included smoking, alcohol, diet (sodium use), and exercise. Healthcare access and behaviors included medical check-ups in the past year and self-monitoring of BP. (4) Sources of BP knowledge were recorded as self-chosen answers from 5 choices (radio or TV, health publications, families/friends, doctors, and network). The proportion for each choice was calculated by the number of selected subjects divided by all subjects.

Blood Pressure Measurement

Trained physicians performed BP measurement following standard guidelines. Standard operating methods were used to measure BP according to an American National High Blood Pressure Education Program^{13,14} and Chinese Guidelines For Hypertension Prevention and Treatment.¹⁵ Measurement of BP was taken for all subjects with 3 readings in a mercuric-column sphygmomanometer after

resting for 5 minutes. The 3 measurements were taken 5 minutes apart and all 3 measurements were averaged.

Definitions

Subjects were defined as being hypertensive if they had an average systolic BP (SBP) ≥ 140 mm Hg, and/or average diastolic BP (DBP) ≥ 90 mm Hg, and/or were diagnosed as being hypertensive in the past, and/or reported current treatment with antihypertensive medications.

Awareness of hypertension was defined as self-reporting any prior diagnosis of hypertension by healthcare professionals among the population defined as being hypertensive. Treatment of hypertension was defined as the use of an antihypertensive medication at the time of the interview or during the previous year for hypertension. Control of hypertension was defined as measuring an average SBP of < 140 mm Hg and an average DBP of < 90 mm Hg among the population defined as being hypertensive.

Body mass index (BMI) was defined as weight (kg) divided by squared height (m^2). According to the Chinese Guidelines for Prevention and Control of Adult Overweight and Obesity,¹⁶ obesity was defined as BMI $\geq 28 \text{ kg/m}^2$; overweight was defined as BMI $< 28 \text{ kg/m}^2$ and $\geq 24 \text{ kg/m}^2$.

Statistical Analyses

Baseline characteristics were described with a mean (SD) for continuous variables and numbers (proportions) for categorical variables. Comparisons of categorical variables were conducted with a χ^2 test. The test for linear trend across BMI groups was conducted using the Mantel-Haenszel χ^2 statistic. Multivariate logistic regression models were done to explore the associations between baseline characteristics and prevalence rate, awareness rate, and control rate. These were reported with odds ratio (OR) and corresponding 95% confidence interval (95% CI). A P value < 0.05 was considered statistically significant. All statistical analyses were performed by SAS 9.13 software.¹⁷

Results

Demographic Characteristics

A total of 32 917 governmental and institutional employees were confirmed as eligible subjects. A total of 30 682 subjects signed the informed consent and completed the survey following the protocol. The response rate was 93.2%.

The age of 30 682 subjects ranged from 18 to 65 years and averaged 40.3 ± 11.4 years old. The proportion of males was 54.4% (16 702 subjects). The proportion of Han subjects was 84.8%. A total of 54.4% of subjects had a bachelor's degree or higher; 4696 subjects (15.3%) drank regularly, and 6522 subjects (21.3%) smoked regularly. A total of 19 254 subjects (62.8%) could access a medical check-up at least once per year. Table 1 shows demographic characteristics across gender in detail. Figure 1 shows sources of BP knowledge. Health publications (50.6%) and families/friends (49.1%)

Table 1. Characteristics of the Sample

Variable	Male (n = 16 702)	Female (n = 13 980)	Total (n = 30 682)
Age (yr)	40.7 ± 11.3	39.8 ± 11.6	40.3 ± 11.4
BMI (kg/m ²)	23.3 ± 3.0	22.1 ± 3.2	22.7 ± 3.1
Smoking (%)	5625 (33.7%)	5625 (6.4%)	6522 (21.3%)
Alcohol (%)	4014 (24.0%)	682 (4.9%)	4696 (15.3%)
Medical check-up (%)	10 265 (61.5%)	9006 (64.4%)	19 254 (62.8%)
Ethnic group (Han)	14 081 (84.3%)	11 921 (85.3%)	26 002 (84.8%)
Education			
Postgraduate	1822 (10.9%)	1410 (10.1%)	3232 (10.5%)
University	7179 (43.0%)	6286 (45.0%)	13 465 (43.9%)
Other	7698 (46.1%)	6281 (44.9%)	13 979 (45.6%)

Abbreviations: BMI, body mass index.

Figure 1. Source of blood pressure knowledge.

were the main sources of knowledge. Only 32.2% of subjects got healthcare information from doctors.

Prevalence, Awareness, Treatment, and Control of Hypertension

Based on the measurement values taken at the interview, the mean SBP and DBP were 125.25 ± 15.78 and 76.71 ± 10.86 mm Hg. There were 4782 subjects (15.6%) taking

antihypertensive medications at that time. Of all the subjects, 9216 subjects were diagnosed to be hypertensive and the prevalence rate was 30.0%. Only 4915 subjects (16.0%) monitored their own BP regularly. A total of 10 691 subjects (34.8%) reported that they knew their own BP status.

Among 9216 hypertensive patients, 5399 subjects were aware of being hypertensive and the awareness rate was 58.6%. There were 4767 hypertensive subjects taking antihypertensive medications and the treatment rate was 51.7%. A total of 2371 subjects kept their BP under control (<140/90 mm Hg) and the control rate was 25.7%.

A total of 17 750 subjects (57.9%) knew hypertension diagnosis standards correctly; 17 722 subjects (57.8%) knew that family history was a risk factor for hypertension. In addition, 19 547 subjects (63.7%) knew that being overweight/obesity was a risk factor for hypertension. When discussing the harmful effects of hypertension on target organs, 11 711 subjects (38.2%) knew hypertension could do damage to the heart. Furthermore, 16 346 subjects (53.3%), 15 088 subjects (49.2%), 10 229 subjects (33.3%), and 7605 subjects (24.8%) mentioned brain, kidney, eye, and artery damage, respectively.

Hypertension Status and Demographic Characteristics

Table 2 shows that the prevalence rate of hypertension was significantly higher in male subjects (35.5% vs 23.5%), but the awareness rate (55.4% vs 64.4%), the treatment rate (48.4% vs 57.0%), and the control rate (22.4% vs 31.7%) was lower than in female subjects ($P < 0.0001$). Subjects <45 years old had a lower prevalence rate (24.8% vs 40.8%), awareness rate (49.8% vs 69.5%), treatment rate (42.6% vs 63.0%), and control rate (24.6% vs 27.2%) than elderly subjects ($P < 0.0001$).

Table 2. Relationship between Hypertension Status and Demographic Characteristics

		n	Prevalence, n (%)	Awareness, n (%)	Treatment, n (%)	Control, n (%)
Gender	<i>P</i>		<0.0001	<0.0001	<0.0001	<0.0001
	Male	16 701	5934 (35.5)	3285 (55.4)	2898 (48.4)	1330 (22.4)
	Female	13 978	3282 (23.5)	2114 (64.4)	1869 (57.0)	1041 (31.7)
Age (yrs)	<i>P</i>		<0.0001	<0.0001	<0.0001	<0.0001
	>45	20 586	5098 (24.8)	2537 (49.8)	2174 (42.6)	1252 (24.6)
	45–65	100 095	4118 (40.8)	2862 (69.5)	2593 (63.0)	1119 (27.2)
Education level	<i>P</i>		<0.0001	<0.0001	<0.0001	<0.0001
	University or postgraduate	16 701	4292 (25.7)	2387 (55.6)	2070 (48.2)	1212 (28.2)
	Other	13 980	4924 (35.2)	3012 (61.2)	2697 (54.8)	1159 (23.5)
Ethnic group	<i>P</i>		<0.0001	0.0005	0.0056	<0.0001
	Han	26 002	7986 (30.7)	4734 (59.3)	4176 (53.3)	2128 (26.7)
	Other	4679	1230 (26.3)	665 (54.1)	591 (48.1)	243 (19.7)
Family history	<i>P</i>		<0.0001	<0.0001	<0.0001	<0.0001
	Yes	8843	3788 (42.8)	2922 (77.1)	2598 (68.6)	1293 (34.1)
	No	17 308	4249 (24.6)	2013 (47.3)	1757 (41.4)	3334 (21.5)
BMI (kg/m ²)	<i>P</i> for trend		<0.0001	<0.0001	<0.0001	<0.0001
	>24	20 824	4814 (23.1)	2617 (54.4)	2270 (47.2)	1329 (27.6)
	24–28 (overweight)	8213	3462 (42.2)	2140 (61.8)	1917 (55.4)	822 (23.7)
	>28 (obesity)	1644	940 (57.2)	642 (68.3)	580 (61.7)	220 (23.4)
Total		30 682	9216 (30.0%)	5399 (58.6%)	4767 (51.7%)	2371 (25.7%)

Abbreviations: BMI, body mass index.

Subjects who held bachelor's degrees or higher had a lower prevalence rate (25.7% vs 35.2%), awareness rate (55.6% vs 61.2%), and treatment rate (48.2% vs 54.8%), but had a higher control rate (28.2% vs 23.5%) than others ($P < 0.0001$). All 4 rates were higher in Han subjects ($P < 0.01$) and in subjects with family history of hypertension as well ($P < 0.0001$). Furthermore, an obvious trend was found showing that higher BMI was associated with higher prevalence rates, awareness rates, and treatment rates, but lower control rates (P for trend < 0.0001).

Hypertension Status and Lifestyle

Table 3 shows the association between hypertension prevalence, awareness, treatment, control, and lifestyle. Subjects who were accustomed to high sodium intake were more susceptible to hypertension (38.6% vs 26.6%,

$P < 0.0001$), were well aware of their hypertension status (68.4% vs 52.9%, $P < 0.0001$), and had higher treatment rates (61.0% vs 46.3%, $P < 0.0001$).

Both drinkers and smokers accounted for higher prevalence rates (40.4% vs 28.2%; 38.3% vs 27.8%; $P < 0.0001$) and lower control rates (38.3% vs 27.8%; 22.5% vs 26.9%; $P < 0.0001$). All 4 rates are significantly higher in subjects who exercised regularly or measured their blood pressure regularly (all $P < 0.0001$). Subjects accessing a medical check-up at least once per year were aware, treated, and controlled better (all $P < 0.0001$).

Multivariate Analyses about Prevalence, Awareness, Treatment, and Control of Hypertension

Table 4 reports the multivariate analyses results about the relationship of prevalence, awareness, and control to demographic characteristics and lifestyle as well.

Table 3. Relationship between Hypertension Status and Lifestyle

		n	Prevalence, n (%)	Awareness, n (%)	Treatment, n (%)	Control, n (%)
High sodium intake	<i>P</i>		<0.0001	<0.0001	<0.0001	0.0565
	Yes	8795	3391 (38.6)	2320 (68.4)	2069 (61.0)	911 (26.9)
	No	21 882	5825 (26.6)	3079 (52.9)	2698 (46.3)	1460 (25.1)
Drinking regularly	<i>P</i>		<0.0001	0.2497	0.0275	<0.0001
	Yes	4696	1898 (40.4)	1090 (57.4)	939 (49.5)	372 (19.6)
	No	25 969	7312 (28.2)	4306 (58.9)	3825 (52.3)	1998 (27.3)
Smoking regularly	<i>P</i>		<0.0001	0.7007	0.8599	<0.0001
	Yes	6522	2499 (38.3)	1472 (58.9)	1289 (51.6)	563 (22.5)
	No	24 150	6714 (27.8)	3925 (58.5)	3477 (51.8)	1807 (26.9)
Exercising regularly	<i>P</i>		<0.0001	<0.0001	<0.0001	<0.0001
	Yes	12 260	4004 (32.7)	2680 (66.9)	2399 (59.9)	1266 (31.6)
	No	18 409	5211 (28.3)	2719 (52.2)	2368 (45.4)	1105 (21.2)
Measuring blood pressure regularly	<i>P</i>		<0.0001	<0.0001	<0.0001	<0.0001
	Yes	4915	2737 (55.7)	2389 (87.3)	2172 (79.4)	1012 (37.0)
	No	25 759	6477 (25.1)	3008 (46.4)	2593 (40.0)	1359 (21.0)
Medical check-up at least once per year	<i>P</i>		0.9250	<0.0001	<0.0001	<0.0001
	Yes	19 270	5792 (30.1)	3699 (63.9)	3264 (56.4)	1674 (28.9)
	No	11 411	3424 (30.0)	1700 (49.7)	1503 (43.9)	697 (20.4)

Multivariate analyses results were similar to univariate ones after adjusting the confounding factors.

Discussion

Governmental and institutional employees are a special population in China and it was necessary to explore whether there was a trend of high prevalence and low control of hypertension in this population as was found in the general population. Because BP measurement and demographic risk factor collection was based on strict quality control procedures and multivariate logistic analyses were used in our article, study results from such a large sample are representative and convincing.

In our survey, the prevalence rate of hypertension was 30.0% in Chinese governmental and institutional employees, which was similar to other survey results among the general population. For example, Janus et al¹⁸ reported one-third of participants in an Australian rural population aged 25 to 74 were hypertensive. The overall prevalence was 29.3% among American adults in the years 1999 to 2004.⁹ The prevalence of hypertension was 27.9%¹⁹ in China and was 29.1% among

the adults in Beijing.²⁰ Although the governmental and institutional employees were already within the healthcare system, hypertension was still a major public health problem in this special population.

Dickson et al²¹ mentioned that among all subjects in the United States with hypertension, 82% were aware of their illness and 79% were on treatment, and 39% had their hypertension controlled below 140/90 mm Hg at the time of the survey. But in China, the awareness rate, treatment rate, and control rate were lower. Zhao et al¹⁹ reported that the 3 rates were 60.71%, 49.65%, and 5.7% in a Chinese epidemiological study of 12 provinces, 1 autonomous region, and 1 municipality. In our survey, the awareness rate (58.6%), treatment rate (51.7%), and control rate (25.7%) were higher than those in other Chinese studies,^{20,22,23} perhaps because they had easier access to medical check-ups and healthcare knowledge.

Over 40% of subjects aged 45 years and older had hypertensive range BP (Table 2). Although the majority of these patients (63.0%) reported having been treated in the past, 72.8% were found not to have adequate control. Equally important was the finding that nearly one-quarter of subjects <45 years old had hypertension. In addition,

Table 4. Odds ratio and 95% CI From Multivariate Logistic Regression Models

Characteristics	Prevalence	Awareness	Treatment	Control
Male	1.652 (1.551, 1.760)	0.780 (0.695, 0.876)	0.853 (0.763, 0.953)	0.732 (0.655, 0.819)
Age (<45 yrs)	0.630 (0.594, 0.669)	0.600 (0.540, 0.667)	0.592 (0.535, 0.655)	1.035 (0.932, 1.151)
Education level (university or postgraduate)	0.759 (0.716, 0.804)	0.818 (0.736, 0.909)	0.790 (0.714, 0.874)	1.228 (1.105, 1.364)
Han nationality	1.087 (0.999, 1.181)	1.234 (1.060, 1.438)	1.143 (0.987, 1.326)	1.432 (1.216, 1.687)
Family history	1.883 (1.774, 1.998)	3.010 (2.705, 3.349)	2.440 (2.206, 2.699)	1.827 (1.643, 2.032)
High sodium intake	1.218 (1.144, 1.297)	1.409 (1.258, 1.578)	1.309 (1.176, 1.457)	0.989 (0.886, 1.105)
Drinking regularly	1.119 (1.031, 1.214)	0.809 (0.703, 0.932)	0.776 (0.678, 0.888)	0.682 (0.588, 0.792)
Smoking regularly	1.070 (0.993, 1.153)	1.021 (0.898, 1.161)	0.994 (0.879, 1.124)	0.936 (0.821, 1.067)
Exercising regularly	0.945 (0.891, 1.002)	1.396 (1.256, 1.551)	1.375 (1.244, 1.521)	1.444 (1.302, 1.600)
Measuring blood pressure regularly	3.082 (2.866, 3.314)	5.822 (5.071, 6.683)	4.220 (3.755, 4.751)	1.773 (1.590, 1.978)
Medical check-up at least once per year	1.019 (0.959, 1.083)	1.629 (1.461, 1.818)	1.483 (1.335, 1.648)	1.340 (1.199, 1.498)
Overweight	1.838 (1.726, 1.957)	1.198 (1.071, 1.339)	1.222 (1.098, 1.359)	0.782 (0.699, 0.874)
Obesity	3.161 (2.811, 3.554)	1.315 (1.093, 1.583)	1.343 (1.129, 1.598)	0.691 (0.577, 0.827)

hypertensive subjects in the younger age group were less likely to be aware of their elevated BP, and were also less likely to be taking antihypertensive medications than their older counterparts. Elderly people might pay more attention to their health, which resulted in their higher awareness rate and treatment rate. But these young patients would benefit most by appropriate therapy and, if treated, would have more control over their BP.⁸

In agreement with the results from other studies,^{19,24–26} this study also showed that female hypertensive subjects have more effectively controlled BP than their male counterparts. Although subjects with a family history of hypertension had 1.883 times more risk of hypertension as those without it, their awareness rate, treatment rate, and control rate were also higher. Maybe high prevalence of the disease in their families contributed to their better knowledge of hypertension and helped them to become more active about hypertension treatment. This trend was also mentioned in a Korean population in 2006.²⁷

The prevalence of obesity and being overweight was associated with a high level of awareness and subsequent treatment of hypertension. Unfortunately, despite greater awareness and treatment, a larger proportion of these subjects remained uncontrolled. Many studies^{27–30} got the same results as well. Although subjects without a bachelor's degree or higher have a higher awareness rate and treatment rate, they did not do better at keeping their blood pressure under control. This has also been mentioned in the Jackson Heart Study.³¹ Wu et al has mentioned

that reduced awareness and treatment were associated with a higher education level and low socioeconomic status individuals were more likely to be treated, but had poorer control.⁸ Poor compliance to treatment may reduce their control rate. Guidelines for early detection and regular treatment were found to be necessary to reduce noncompliance.

Regular smokers and alcohol drinkers had higher risk of hypertension prevalence, but worse control. Public health education to reduce smoking and excessive alcohol consumption should be established to achieve better control. People pay more attention to their medical condition after being diagnosed as hypertensive. So subjects who regularly measured their own BP had higher prevalence rates than others without this habit. Exercising regularly or accessing medical check-ups contributed to their awareness of their BP status, higher treatment rate, and control rate. Dickson et al also indicated that those who exercised more frequently tended to have a better control rate.²¹

Health education publications (50.6%) and families/friends (49.1%) were reported as the primary sources of information about hypertension. Doctors (32.2%) played a limited role in providing hypertension information. However, these proportions were higher than previous study results³² in the general population, which indicated that higher education levels gave them easier access to hypertension knowledge through various sources.

In conclusion, the percentages of hypertensive subjects who are aware, treated, and controlled are unacceptably low among Chinese governmental and institutional employees.

Apart from the elderly, attention should also be given to younger people <45 years old, who are suffering from hypertension, but either are not aware of it or take antihypertensive medication. Regular medical check-ups and measuring BP are necessary to improve awareness, treatment, and control of hypertension.

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