

# Hypertension Prevalence, Awareness, Treatment and Control in the Urban District of Wuhan, China: Implications for Community Nursing Practice

Li Sj<sup>1\*</sup>, Sit Whj<sup>2</sup>, Gong Jie<sup>3</sup>, Wong Mye<sup>4</sup>, Zheng Yi<sup>5</sup> and Wong Thomas<sup>6</sup>

<sup>1</sup>Lecturer, School of Nursing, The Hong Kong Polytechnic University, Hong Kong

<sup>2</sup>Associate Professor, The Nethersole School of Nursing, The Chinese University of Hong Kong, Hong Kong

<sup>3</sup>MD, Wuhan Center for Disease Prevention and Control, Wuhan, Hubei, China

<sup>4</sup>Assistant Professor, Department of Health and Physical Education, The Hong Kong Institute of Education, Hong Kong

<sup>5</sup>MD, Director of Community Health Service Center of Shouyi Road, Wuhan, Hubei, China

<sup>6</sup>President & Chair Professor, Tung Wah College, Hong Kong

## Abstract

**Background:** Hypertension is a significant public health challenge contributing to cardiovascular disease and stroke, and leads to premature mortality and disability both globally and locally.

**Objective:** To estimate the prevalence of hypertension and to determine the awareness, treatment and control of hypertension in an urban Chinese population.

**Methods:** A cross-sectional, quantitative survey design. A total of 1448 community residents were recruited from the SuiGuoHu district using a stratified random sampling strategy. Data were collected using self-report questionnaires and health examination.

**Results:** The prevalence of hypertension was 35.4%, significantly higher in women (40.8%) than in men (30.7%) ( $P < 0.001$ ). More than one third (37.9%) of those with hypertension were not compliant with prescribed medications, significantly higher among women (44.4%) than men (28.6%). Approximately 68% were aware, with women (75.6%) significantly higher than men (60.3%) ( $P < 0.001$ ). The treatment rates were 87.7% and women were less likely (46.7%) to have their blood pressure controlled than men (47.2%).

**Conclusions:** Our findings indicated that hypertension was highly prevalent. The rates of awareness, treatment and control were also higher than in previous China surveys. Overall, the present study showed that more women than men suffered from hypertension and were treated. However, women were less likely to be compliant with medication or have their blood pressure under control. This information is important in enabling community health nurses to play a vital role as a source of primary and secondary prevention of CVD to design a culturally sensitive program targeted at high-risk populations like older women and those living alone, so as to diminish the prevalence of hypertension and reduce the burden of CVD in urban areas, Wuhan of China.

**Keywords:** Hypertension; Prevalence; Awareness; Treatment; Control; Community health nursing; China

**Abbreviations:** HT: Hypertension; PreHT: Prehypertension; JNC: Joint National Committee; CVD: Cardiovascular Disease; BP: Blood Pressure; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; WHO: World Health Organization; ISH: International Society of Hypertension

## Introduction

Cardiovascular disease (CVD) is one of the top three causes of death in China [1-3]. And the mortality of cardiovascular disease is 23.1%, that of cancer is 22.3%, and for cerebrovascular disease (CVD), 21.3% [4]. Hypertension is a major risk factor for CVD, accounting for about 45% of global CVD morbidity and mortality [5,6] in many developing countries, including China [7]. Data from national surveys suggest that the prevalence of hypertension in the adult Chinese population has increased dramatically, from 5.11% in 1959 to 17.65% in 2002 according to the China National Nutrition and Health Survey [8].

The recent Chinese guideline for managing hypertension suggests a treatment goal of lowering blood pressure to 140/90 mm Hg or below for the general hypertensive population [8]. However, less than one quarter (24%) of the hypertensive population is aware, 78% of these are treated, and only 19% are controlled [9]. That means only a small proportion of affected individuals with hypertension have their condition under control.

Improving the population control of hypertension, as is highly

recommended by the World Health Organization/International Society of Hypertension (ISH) WHO/ISH, requires increased awareness among the general population [2,5]. However, there is lack of local data regarding prevalence, awareness, treatment and control in Wuhan, China.

The objectives of this study were twofold:

- 1) to estimate the prevalence and distribution of hypertension, and
- 2) to determine the status of awareness, treatment and control of hypertension among men and women in an urban district of Wuhan, China.

To ascertain the up-to-date local situation of hypertension, it is important for nurses to collect the most recent data in order to design

**\*Corresponding author:** LI SJ, School of Nursing, The Hong Kong Polytechnic University, Hung Hum, Kowloon, Hong Kong, Tel: 00852-34003915; Fax: 00852-23341124, E-mail: [hssjli@inet.polyu.edu.hk](mailto:hssjli@inet.polyu.edu.hk)

**Received** January 03, 2012; **Accepted** February 09, 2012; **Published** February 12, 2012

**Citation:** Sj L, Whj S, Jie G, Mye W, Zheng Yi, et al. (2012) Hypertension Prevalence, Awareness, Treatment and Control in the Urban District of Wuhan, China: Implications for Community Nursing Practice. J Nursing Care 1:106. doi:[10.4172/jnc.1000106](https://doi.org/10.4172/jnc.1000106)

**Copyright:** © 2012 Sj L, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

an effective hypertension prevention program and reduce both the prevalence of hypertension and the burden of CVD.

## Methods

### Design

This study was part of a large cross-sectional descriptive, stratified random sampling survey that has been reported elsewhere [10].

### Study population

Stratified random sampling was conducted in order to enhance representativeness [11]. The sampling frame was built based on the postal codes of the district population database from January 2008, and was further stratified by gender and age distribution according to the population statistics of Wuhan [10].

A population of 75,315 residents aged over 34 and was living in the SuiGuoHu Community Health Center in an urban district of Wuhan. This population was first divided into 8 strata according to the location of the residents' homes, and the proportional allocations from site one to eight were then decided. The rates for each stratum were 4.80%, 9.80%, 13.70%, 13.40%, 10.20%, 16.90%, 9.60%, and 22.0%, respectively. As a proportionate stratified sample, approximately 1500 participants were needed. This study targeted adults who were living in the community and aged from 35 to 74. Non-Chinese, frequent travelers, those hospitalized, and those with cognitive impairment or unable to communicate verbally were excluded. Finally a total of 1448 community residents completed this study.

### Data collection

The survey was conducted from April to December 2008, covering the SuiGuoHu district. Data were collected in health examination rooms at the SuiGuoHu Community Health Center or its affiliated local health stations within the catchment areas of the participants' residential addresses. For the homebound, interviews and health examinations were undertaken in their homes. Data were collected by trained research assistants using self-report questionnaires including personal demographic data and clinical condition. Health examination involved the measurement of blood pressure [10].

**Self-report questionnaire:** Data were collected by trained research assistants using self-report standard questionnaires and health examination focusing on blood pressure measurement. The self-report questionnaire included the social demographic information, blood pressure (BP) and lifestyle habits of the participants.

**Blood pressure measurement:** Two sitting blood pressure measurements were obtained by trained healthcare providers using a standardized mercury sphygmomanometer, guided by the protocol and instructed by the first two authors prior to the main study. Information on history of hypertension and use of antihypertensive medications was obtained. The participants were asked to remain in a seated position for 5 minutes before their blood pressure was measured. The mean of the two sitting measures with a 30-second interval was applied. The cuff size was chosen according to the participants' upper arm circumference, to ensure that the cuff did not overlap. The inter-rater reliability of the physical examination covering the BP measurement ranged from 0.91-1 [10].

**Lifestyle habits:** The information obtained included two major aspects: eating habits and physical activity. Eating habits were measured on a 5-point Likert scale (0-4) to state the frequency of taking salted/preserved food (0 = less than once per month, 1 = from twice to three

times per month, 2 = from twice to three times per week, 3 = four times per week, and 4 = more than four times per week). Each participant was asked to report the number of minutes spent exercising per day (duration) and per week (frequency), and the perceived intensity that he/she devoted to (1) leisure-time exercise, and (2) work-related physical activity. The level of perceived intensity of the work-related physical activity was divided into three levels (light, moderate and vigorous) based on The Borg Rating of Perceived Exertion (RPE) [12]. The perceived intensity in the light level referred to normal heart rates and breathing without sweating, in the moderate one it referred to a slight increase in heart rates and breathing, and some sweating; finally, the vigorous level meant a large increase in heart rates, as well as heavy breathing and sweating in the current study.

**Definitions of the terms:** Physical activity is considered as any body movement produced by skeletal muscles that require energy expenditure as recommended by the World Health Organization (WHO) [13]. Normal BP is defined as systolic BP <120 and diastolic BP <80 mm Hg, preHT referred to systolic BP 120-139 or diastolic BP 80-89 mm Hg, and HT was defined as 1) an average of two properly measured seated BP readings with an average systolic BP (SBP)  $\geq$ 140 mm Hg, and/or diastolic BP (DBP)  $\geq$ 90 mm Hg, 2) self-reported current treatment for hypertension with antihypertensive medication according to the Seventh report of Joint National Committee (JNC VII) [14].

Awareness of hypertension (HT) was defined as being perceived by the participants who were diagnosed as hypertension by medical doctors. Treatment of hypertension (HT) was defined as those being aware of their prior diagnosis of hypertension and who were using prescribed antihypertensive medications. Control of hypertension (HT) was defined as those who were treated and taking prescribed antihypertensive medications and maintaining their blood pressure at a normal level (DBP <90mmHg and SBP <140 mmHg). Medication compliance was examined for those who were aware and taking prescribed anti-hypertensive medication. All the above information is based on the InterASIA Collaborative Group [15] at the time of interviews.

### Statistical analysis

Descriptive statistics such as mean, rate, and proportion were used to summarize sample characteristics and to estimate the prevalence rates of hypertension and frequency of awareness, treatment, control and compliance to treatment. Chi-square was used to compare the difference between men and women and to assess age trend of those variables. The value of  $p < 0.05$  was considered to be significant. The Statistical Package for Social Sciences (SPSS) 15.0 was used to perform the analysis.

### Ethical considerations

Ethical approval was obtained prior to data collection from the human subjects, ethics review committee of The Hong Kong Polytechnic University, and permission from the administrators of the SuiGuoHu Community Health Center and nine related health service stations. The purpose and background of the study was introduced by trained research assistants, and participants were informed that they had the right to reject or withdraw from the study at any time. The questionnaire was administered after the consent form was obtained. To assure anonymity, code numbers were placed on the completed questionnaires. All the completed questionnaires were kept in a safe place to ensure confidentiality [10].

## Results

Demographic information, blood pressure conditions and lifestyle habits of the participants were shown in Table 1. Overall, the mean age of the participants was 50.6±11.4 (mean ± SD) years. The mean for the women (54.8±11.4) was statistically significantly higher than that of the men (47.1±10.1). A total of 19.2% of the population had attended post-secondary school, and significantly more women (22.8%) had received lower education (primary or below) than men (6.0%). The majority (91.5%) were married or living together (95.2% of the men and 87.1% of the women), and significantly more women (12.9%) were single/separated or widowed than men (4.8%). In addition, more than half (54.2%) of the households' income was below 1000 RMB per month, and in particular, more women (71.4%) had lower household incomes than men (39.5%). The majority had medical insurance (76.4% of the men and 78.1% of the women).

	Men	Women	Overall
<b>Number of participants, n (%)</b>	787 (54.4)	661 (45.6)	1448 (100.0)
Age (years), Mean (SD) ***	47.1 (10.1)	54.8 (11.4)	50.6 (11.4)
Education level, n (%)***			
Primary or below	47 (6.0)	151 (22.8)	198 (13.7)
Secondary	569 (72.3)	403 (61.0)	972 (67.1)
Post-secondary	171(21.7)	107 (16.2)	278 (19.2)
Marital status, n (%) ***			
Married / living together	749 (95.2)	576 (87.1)	1325 (91.5)
Single / separated / divorced	38 (4.8)	85 (12.9)	123 (8.5)
Household income (RMB/month), n (%) ***			
Over 2500 RMB	56 (7.1)	17 (2.6)	73 (5.0)
1000-2500 RMB	420 (53.4)	170 (25.7)	590 (40.7)
1001 RMB or less	311 (39.5)	474 (71.7)	785 (54.2)
Insurance, n (%)			
Yes	601 (76.4)	516 (78.1)	1117 (77.1)
No	186 (23.6)	145 (21.9)	331 (22.9)
<b>BP conditions, n (%)</b>			
Family history of hypertension			
Yes	284 (36.1)	241 (36.5)	525 (36.3)
No	503 (63.9)	420 (63.5)	923 (63.7)
Blood pressure status			
Normal Blood Pressure	152 (19.4)	166 (25.1)	318 (22.0)
Pre-hypertension	393 (49.9)	225 (34.1)	618 (42.6)
Hypertension	242 (30.7)	270 (40.8)	512 (35.4)
Years of hypertension, n (%)	(N = 242)	(N = 270)	(N = 512)
<5	58 (24.0)	55 (20.4)	113 (37.0)
5-9	27 (11.2)	40 (14.8)	67 (22.0)
10-19	27 (11.1)	40 (23.3)	67 (22.0)
≥20	22 (9.1)	36 (21.1)	58 (19.0)
Don't know / forgotten	108 (44.6)	99 (36.7)	207 (40.4)
<b>Lifestyle habits, n (%)</b>			
Eating habit (salted/preserved food)			
Once or twice per month	226 (28.7)	253 (38.3)	479 (33.1)
Two to three times per week	332 (42.2)	241 (36.5)	573 (39.6)
Almost everyday	229 (27.3)	167 (25.3)	396 (27.3)
Leisure-time exercise habit			
No	525 (58.3)	319 (48.3)	844 (58.3)
Yes	262 (33.3)	342 (51.7)	604 (41.7)
Work-related physical activity			
Light / sedentary	203 (25.8)	173 (26.2)	376 (26.0)

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001

**Table 1:** Social Demographic Information, BP conditions and Lifestyle Habits.

In terms of their blood pressure condition, about one third (36.3%) reported that they had family history. Approximately 22.0% of the studied population had normal BP, 42.6% had preHT, and 35.4% had hypertension. For those who were suffering from HT, 40% did not know about their condition, 37% had known for less than 5 years, and 19% had known for more than 20 years.

Furthermore, most participants (66.9%) reported consuming salted or preserved food two or more times per week. More than half of the participants (58.3%) reported that they had no leisure-time exercise habit, and a quarter (26.0%) reported engaging in light physical activity.

Table 2 displayed the normal BP, preHT, and prevalence of HT by age and sex. The preHT rate decreased progressively across the entire age range, with the youngest age group (35 to 44 years) being the highest (55.0%), and the prevalence was higher among men (57.5%) than women (47.6%) in this age group.

The overall prevalence of hypertension was significantly higher in women (40.8%) than men (30.7%) (P<0.001). And for every age group up to 64 years, men had a higher age-specific rate of hypertension than women, but the reverse was true among those aged 65 years and above (women 62.9%, and men 57.4%). In addition, the pattern of prevalence of HT increased across the entire age range (from 15.1% to 61.3%), and the difference between men and women changed according to the different age groups (Figure 1).

Table 3 revealed the prevalence, awareness, treatment, control, and medication compliance of hypertension in men and women. It showed that 68.4% of the studied population that could be classified as hypertensive being aware of their previous diagnosis of hypertension. Rates of awareness were higher in women (75.6%) than in men (60.3%) (P<0.001). The percentage of hypertensive individuals receiving antihypertensive medication was 87.7%, and a higher proportion of women (88.2%) were treated than men (87.0%), although no significant difference was noted (P=0.726). The rate of hypertensive individuals whose BPs were under control (SBP<140 mmHg and DBP <90 mmHg) was 46.9%. Better control rates (systolic BP<140 mmHg and diastolic BP<90 mmHg) were found in men (47.2%) than in women (46.7%), but no significant difference was demonstrated (P=0.920). For medication compliance, more than half of the participants (62.1%) took prescribed anti-hypertensive medications, but significantly fewer women (55.6%) than men (71.4%) were adherent to medication.

Finally, table 4 showed age trend of awareness, treatment and control of hypertension. The rates of awareness and treatment increased across the entire age range (from age group of 35-44 to that of 65 and above) both in men (from 32.9% to 82.1% in awareness, and from 70.8% to 87.5% in treatment) and women (from 42.9% to 89.5% in awareness and from 66.7% to 89.4% in treatment), but the control rates decreased across the above entire age range in both men (from 58.8% to 35.7%) and women (from 50.0% to 39.3%) (Figure 2).

## Discussion

This study used a stratified random sampling representing the Chinese adult population in a district of the city of Wuhan, China. A well-planned training process was conducted using standard protocol and instruments to ensure the quality of the data collection procedures [10]. Of the 1750 recruited participants, 1500 consented to participate in the study, yielding a participation rate of 85.7% which the response rate was satisfactory. Two blood pressure measurements and detailed documentation of participants' history of hypertension and their antihypertensive medication use were carefully examined. Gu and colleagues [15] have stressed that this process is particularly important



because the evidence may provide reliable and valid estimates of detection, treatment and control of HT in the general Chinese population [15].

The prevalence of hypertension was higher (35.4%) in the present study than in the previous Chinese national study (13.6%) conducted in 1991 by National Survey [16], the InterAsia study (27.2%) conducted in 2000-2001 by the PRC National Blood Pressure Survey Research Group [15], and a recent survey (30.0%) undertaken in Beijing [17]. It is also higher than those in Asian developing countries like Korea (33.7%) [18], Malaysia (27.8%) [19], Turkey (31.8%) [20] and Iran (17.3%) [21].

The increase in the prevalence hypertensive participants was found which may attribute to the higher proportion of participants who were physically inactive in their leisure time, and the high dietary intake of salted and preserved food. Previous studies have also stated that the rapid development of the economy; related changes in lifestyle, and an increase in life expectancy and work-related stress that are highly related to the development of hypertension [10, 15, 18].

The percentage of hypertension awareness, treatment and control was also found to be higher (68.4%, 87.7%, and 46.9%) in the present study than in the previous national studies in 1991 (26.3%, 12.1% and

2.8%) [22] and 2000-2001 (44.7%, 28.2% and 8.1%) [15] and the most recent study conducted in Beijing (58.6%, 51.7% and 25.7%) [17]. Likewise, findings are similar in some developing countries, like Korea [18], Malaysia [19], Turkey [20] and Iran [21].

The improvement of HT awareness, treatment and control found in this study might suggest recent rapid improvements in the management of hypertension in local primary healthcare services such as in Wuhan since 2006 [3]. According to the government policy of 2006 on mid-west capacity-building projects and key requirements in developing community healthcare services, the Wuhan Health Bureau has published a "Guideline of Community Public Health Service Delivery", which has been used to guide the implementation of basic public health services. Before initiating this program, a training program for family doctors has been conducted, covering residents' health profiles, HT management, and health promotion and education in the community. Such programs have contributed to the improvement of HT treatment and control in the local areas of Wuhan.

We also found that women were more likely than men to be aware (75.6% versus 60.3%,  $P < 0.001$ ) and using prescribed antihypertensive medication to manage high BP (88.2% versus 87.0%). These findings are also consistent with those of the InterAsia study conducted in

Age Group (Years)	Normal BP			PreHT			HT		
	Men	Women	Overall	Men	Women	Overall	Men	Women	Overall
35-44	111(25.6)	62(42.8)	173(29.9)*	249(57.5)	69(47.6)	318(55.0)*	73(16.9)	14(9.7)	87(15.1)*
45-54	28(12.8)	48(25.3)	76(18.6)*	103(47.0)	67(35.3)	170(41.6)*	88(40.2)	75(39.5)	163(39.9)
55-64	9(13.4)	37(23.3)	46(20.4)	16(23.9)	46(28.9)	62(27.4)	42(62.7)	76(47.8)	118(52.2)*
65 and over	4(5.9)	19(11.4)	23(9.8)	25(36.8)	43(25.7)	68(28.9)	39(57.4)	105(62.9)	144(61.3)
Total	152(19.3)#	166(25.1)#	318(22.0)**	393(49.9)#	225(34.0)#	618(42.6)**	242(30.7)#	270(40.8)#	512(35.4)**

Notes: Values are number of subjects (%); The levels of mean SBP/DBP were given in mm Hg. Normal BP referred to systolic BP<120 and diastolic BP<80 mm Hg; PreHT referred to systolic BP 120-139 or diastolic BP 80-89 mm Hg. HT was defined as 1) an average of two properly measured seated BP readings with an average systolic BP (SBP)  $\geq 140$  mm Hg, and/or diastolic BP (DBP)  $\geq 90$  mm Hg, 2) self-reported current treatment for hypertension with antihypertensive medication according to the Seventh report of Joint National Committee (JNC VII) [14]. #  $p$  values for age trend, #  $p < 0.05$ ; \*  $p$  values for gender comparison, \*  $p < 0.05$

Table 2: Blood Pressure Status of the Participants by Age Group and Sex.

	Men	Women	Overall	$\chi^2$	$P$ value
Prevalence	30.7(242/787)	40.8 (270/661)	35.4 (512/1448)	16.026	<0.0001
Awareness	60.3 (146/242)	75.6 (204/270)	68.4 (350/512)	13.677	<0.0001
Treatment	87.0 (127/146)	88.2 (180/240)	87.7 (307/350)	0.123	0.726
Control	47.2 (60/127)	46.7 (84/180)	46.9 (144/307)	0.010	0.920
Medication compliance	71.4 (90/127)	55.6 (100/180)	62.1 (190/307)	7.934	0.0049

Note: Number of participants was presented in parenthesis; awareness of hypertension (HT) was defined as being perceived by the participants who were diagnosed as hypertension by medical doctors. Treatment of hypertension (HT) was defined as those being aware of their prior diagnosis of hypertension and using prescribed antihypertensive medications. Control of hypertension (HT) was defined as those who were treated and taking prescribed antihypertensive medications and maintaining their blood pressure at a normal level (DBP <90mmHg and SBP <140 mmHg), and medication compliance was examined for those who were aware and taking prescribed anti-hypertensive medication according to InterASIA Collaborative Group [15]

Table 3: Prevalence, Awareness, Treatment, Control, and Medication Compliance of Hypertension in Men and Women.

Age Group (Years)	Awareness			Treatment			Control		
	Men	Women	Overall	Men	Women	Overall	Men	Women	Overall
35-44	24(32.9)	6(42.9)	30(34.5)	17(70.8)	4(66.7)	21(70.0)	10(58.8)	2(50.0)	12(57.1)
45-54	57(64.8)	50(66.7)	107(65.6)	51(89.5)	41(82.0)	92(86.0)	27(52.9)	21(51.2)	48(52.2)
55-64	33(78.6)	54(71.1)	87(73.7)	31(93.9)	51(94.4)	82(94.3)	13(41.9)	28(54.9)	41(50.0)
65 and above	32(82.1)	94(89.5)	126(87.5)	28(87.5)	84(89.4)	112(88.9)	10(35.7)	33(39.3)	43(38.4)
$\chi^2$	37.243	23.240	72.681	39.499	22.409	70.850	7.325	3.358	11.755
$P$ value	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$	0.062	0.340	0.008

Note: Values are number of subjects (%); awareness of HT was defined as being perceived by the participants who were diagnosed as hypertension by medical doctors. Treatment of HT was defined as those being aware of their prior diagnosis of hypertension and using prescribed antihypertensive medications. Control of HT was defined as those who were treated and taking prescribed antihypertensive medications and maintaining their blood pressure at a normal level (DBP <90mmHg and SBP <140 mmHg) according to InterASIA Collaborative Group [15]

Table 4: Age Trend of Awareness, Treatment and Control of Hypertension among Individuals with Hypertension, by Sex.

2000-2001 [15]. Another report reviewed the status of cardiovascular disease, showing that there was a high prevalence of hypertension and a low rate of hypertension awareness, treatment and control in Chinese women [23]. However, in a report by Gu and his colleagues [15], more women than men have had their blood pressure under control, while our study showed the opposite. That was more women were treated using antihypertensive medication, but they were less likely to adhere to prescribed medication.

Two major factors might explain this poorer compliance behavior in women. First, it is mostly related to socio-demographic factors such as older age, lower level of education and financial income, and living alone which are related to women who often delay in health-seeking behavior such as compliance with medication [24]. Secondly, this noncompliance behavior is mostly related to its culturally related factors, such as lower perceived vulnerability, higher perceived benefit of Chinese herbal medicine, and lower perceived benefit of Western medications [25], and value of prescribed traditional Chinese family role (e.g., they often pay more attention to family members than themselves, and ignore their own medication) [26]. These factors may become barriers to medication compliance among these Chinese women. This finding suggests that hypertension intervention is necessary not only in connection with compliance with treatment therapy but also integrating with the psycho-social and cultural factors as a whole so as to enhance women's compliance and improve hypertension control in primary care setting.

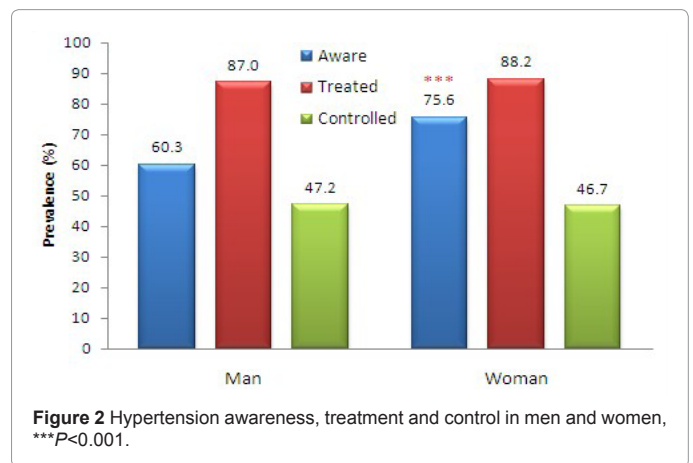
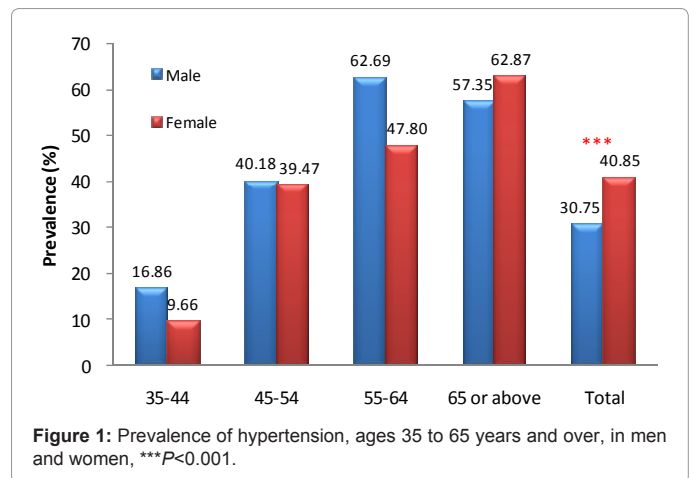
Researchers have also acknowledged that the selection of sampling strategy and use of the standard protocol might influence the estimation of prevalence, awareness, treatment and control [15], so caution should be taken into account when comparing the findings between the present data and previous studies. For example, we used a stratified sampling method in a district with eight sites and a sample of 1448 participants with the mean age of 50.6 years (SD=11.4). And the age was not adjusted by the local population, therefore it appeared to be older than the non-sampling of individuals 18 and above from both urban and rural areas in the InterAsia study [15].

This study had several limitations. First, although the stratified sampling method was useful in enabling researchers to improve the precision of the information and to enhance the representativeness of the final sample [11], it also required tremendous administrative effort compared with a simple random sample, and might produce a selection bias. Secondly, although the definition of HT has been used in the standardized guidelines, the purpose of the blood pressure measurement was only to screen participants for the potential problem of HT rather than to make a diagnostic examination under this study.

Although it had several limitations, the stratified random sampling survey might capture the accurate status of prevalence, awareness, treatment and control of hypertension in an urban Chinese population. Our findings indicated that even though the prevalence of hypertension remained high, the rates of awareness, treatment and control were also relatively higher than in previous China surveys. Further investigation is needed to evaluate the existing hypertension prevention programs in terms of the program design, the process of implementation, and outcome evaluation and their impact on hypertension control.

### Implication for community health nursing practice

This investigation of 1448 community residents added important and up-to-date information to the body of knowledge on the local situation of hypertension prevalence, awareness, treatment and control. Even though higher prevalence was found in women than in



men, women were more likely to be aware and treated, but less likely to have their blood pressure controlled. This reliable information was essential to the development of health policies for local government in the prevention and control of this condition, and to designing primary and secondary hypertension prevention programs targeted at women.

The challenge of hypertension prevention is considerable for nurses who are working in community practice and the hypertension prevention field. Hayman and Hughes [27] highlight a great need for nurses to collaborate closely with policymakers, government officials, other healthcare providers and clients in order to implement the prevention program effectively and efficiently. They further encourage the development of nurses who are capable of playing a leadership role in developing population-based and high-risk oriented primary and secondary hypertension prevention programs to diminish the burden of CVD.

According to Berra and colleagues [28], Chinese nurses who are working in the community are well-positioned to use nurse-led programs and work together with other primary healthcare providers to enhance medication compliance and promote physical activity and good nutrition behaviors. This joint effort will assist us in building our capacity and contribute to reducing the prevalence and improving control of hypertension.

### Conclusions

Our study showed that the prevalence of hypertension was 35.4%, significantly higher in women (40.8%) than in men (30.7%) (P<0.001).

More than one third (37.9%) of those with hypertension were not compliant with prescribed medications, significantly higher among women (44.4%) than men (28.6%). Approximately 68% were aware, with women (75.6%) significantly higher than men (60.3%) ( $P < 0.001$ ). The treatment rates were 87.7% and women were less likely (46.7%) to have their blood pressure controlled than men (47.2%). This information is significant. First, it verified that HT was highly prevalent in this district, and that the rates of awareness, treatment and control were relatively higher than in previous China surveys, perhaps thanks to the recent rapid development of community-based healthcare service programs for improving the management of hypertension. The current findings contributed significant baseline information for policymakers and healthcare providers. It may suggest that population-based and high-risk population CVD prevention programs can be effective in improving control of hypertension.

Secondly, it also indicated that more women than men suffered from hypertension and were treated with antihypertensives. However, they were less likely to comply with their medication or have their blood pressure controlled. It is necessary for community nurses to design a culturally sensitive program targeted at high-risk populations like older women and those living alone, who will benefit from enhancing their compliance to prescribed medication, further improving control of women's hypertension and reducing the burden of CVD in local communities in China.

#### Acknowledgements

This project is supported by a grant (GU508) from the School of Nursing, The Hong Kong Polytechnic University. The authors thank directors of the Center: Dr. Wu Zhiping and Dr. Chen Yanli, and all health care providers and staff from Suiquohu Community Health Center and its 9 health stations for their support and participation in the process of subject recruitment and data collection. Special thanks deliver to Ms. Ada Tam, Ms. Esther Chan and Dr. Yan Ya Qiong for their efforts in double data entry, quality checking and data management. We are grateful for all residents who participated in the study. There is no conflict of interest in this article publication.

#### References

1. China Statistical Yearbook (2010) National Bureau of Statistics. Beijing, China Statistics Press.
2. World Health Organization (WHO) (1996) Hypertension Control. Report of a WHO Expert Committee. *World Health Organ Tech Rep Ser* 862: 1-83.
3. People's Republic of China, Ministry of Health (2010) Community-based healthcare service utilization.
4. Liu LS, Gong LL (2005) Chinese guideline of hypertension treatment and prevention: The Guideline Revised Version Committee of Chinese Hypertension Treatment and Prevention. Minister of Health, People's Republic of China, Treatment and Prevention Research Center of Minister of Health, Hypertension Alliance (China). Beijing: Ding-Xiang-Yuan Medical Forum Publishing.
5. Whitworth JA; World Health Organization, International Society of Hypertension Writing Group (2003) 2003 World Health Organization (WHO)/International Society of Hypertension (ISH) statement on management of hypertension. *J Hypertens* 21: 1983-1992.
6. D'Agostino RB Sr, Vasan RS, Pencina MJ, Wolf PA, Cobain M, et al. (2008) General cardiovascular risk profile for use in primary care: the Framingham Heart Study. *Circulation* 117: 743-753.
7. Kearney PM, Whelton M, Reynolds K, Whelton PK, He J (2004) Worldwide prevalence of hypertension: a systematic review. *J Hypertens* 22: 11-19.
8. Liu LS, Wang W, Yao CH (2009) Chinese guideline for the prevention and treatment of hypertension. Joint issue by Ministry of Health, Bureau for Disease Prevention & Control, Center of National Cardiovascular Diseases and Chinese Hypertension Alliance. Beijing: Ding-Xiang-Yuan Medical Forum Publishing.
9. Wu Y, Huxley R, Li L, Anna V, Xie G, et al. (2008) Prevalence, awareness, treatment, and control of hypertension in China: data from the China National Nutrition and Health Survey 2002. *Circulation* 118: 2679-2686.
10. Sit WH, Li SJ, Zheng YL, Wong MYE, Wu ZP, et al. (2010) Prevalence and Risk Factors Associated With Prehypertension: Identification of Foci for Primary Prevention of Hypertension. *J Cardiovasc Nurs* 25: 461-469.
11. Polit DF, Beck CT (2008) *Nursing research: generating and assessing evidence for nursing practice* (8th edn), Wolters Kluwer Health/Lippincott Williams & Wilkins, Philadelphia.
12. Borg G (1998) Borg's Perceived Exertion and Pain Scales. Human Kinetics, Champaign.
13. World Health Organization (WHO) (2011) Global strategy on diet, physical activity and health: Physical activity.
14. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, et al. (2003) The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA* 289: 2560-2572.
15. Gu D, Reynolds K, Wu X, Chen J, InterASIA Collaborative Group et al. (2002) Prevalence, awareness, treatment, and control of hypertension in china. *Hypertension* 40: 920-927.
16. PRC National Blood Pressure Survey Cooperative Group (1995) Prevalence and development trends of hypertension in China (in Chinese). *Chinese Journal of Hypertension* S1.
17. Xu T, Wang Y, Li W, Chen WW, Zhu M, et al. (2010) Survey of prevalence, awareness, treatment, and control of hypertension among Chinese governmental and institutional employees in Beijing. *Clin Cardiol* 33: 66-72.
18. Jo I, Ahn YL, Lee J, Shin KR, Lee HK, et al. (2001) Prevalence, awareness, treatment, control and risk factors of hypertension in Korea: the Ansan study. *J Hypertens* 19: 1523-1532.
19. Rampal L, Rampal S, Azhar MZ, Rahmand AR (2008) Prevalence, awareness, treatment and control of hypertension in Malaysia: A national study of 16,440 subjects. *Public Health* 122: 11-18.
20. Altun B, Arici M, Nergizoğlu G, Derici U, Karatan O, et al. (2005) Prevalence, awareness, treatment and control of hypertension in Turkey (the PatenT study) in 2003. *J Hypertens* 23: 1817-1823.
21. Shirani S, Kelishadi R, Sarrafzadegan N, Khosravi A, Sadri G, et al. (2009) Awareness, treatment and control of hypertension, dyslipidaemia and diabetes mellitus in an Iranian population: the IHHP study. *East Mediterr Health J* 15:1455-1463.
22. PRC National Blood Pressure Survey Cooperative Group (1995) Hypertension prevalence and the status of people awareness, treatment and control in China: a national-wide survey in 1991. *Chinese Journal of Hypertension* S1.
23. Cao Y, DiGiacomo M, Du HY, Ollerton E, Davidson P (2008) Cardiovascular disease in Chinese women: an emerging high-risk population and implications for nursing practice. *J Cardiovasc Nurs* 23: 386-394.
24. Lefler LL, Bondy KN (2004) Women's delay in seeking treatment with myocardial infarction: a meta-synthesis. *J Cardiovasc Nurs* 19: 251-268.
25. Li WW, Stewart AL, Stotts N, Froelicher ES (2006) Cultural factors associated with antihypertensive medication adherence in Chinese Immigrants. *J Cardiovasc Nurs* 21: 354-362.
26. Li SJ (2005) A community-based and family-centered care approach for stroke survivors in Wuhan city of China. *PolyU Library* 2: 30.
27. Hayman LL, Hughes S (2005) The global burden of cardiovascular disease: opportunities for nurses and nursing. *J Cardiovasc Nurs* 20: 374-375.
28. Berra K, Houston N, Jennings C (2011) Nurse-based models for cardiovascular disease prevention: from research to clinical practice. *Eur J Cardiovasc Nurs* 10: 42-50.