

## **Prevalence of hypertension in Chinese population aged over 40 and subgroup of survival stroke patients.**

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### **Abstract**

**Background:** Hypertension is one of the leading causes of disease burden across the world. In China, the latest nationwide survey of prevalence of hypertension was ten year ago. More information about hypertension prevalence in China could help to improve overall antihypertensive health care.

**Methods:** The total population included 421 selected resident communities from 16 provinces was 1196422. This screening program was supported by Ministry of Health as one of national actions of stroke prevention and control and led directly by the office of China Stroke and High Risk Population Screening Program affiliated to Ministry of Health of China with close collaboration of local governments of the 16 selected provinces from April 2012 to Dec 2012.

**Results:** The prevalence rates of hypertension patients in study population aged 40 and older were 22.9 % in total, 21.8% in men and 23.9 % in women. The prevalence rate of hypertension increased remarkably from 10.0% in population age 40-49 to 42.6% in population age 70-79. The rate decreased to 36.2% in population age 80 and over. Urban population had higher prevalence rate of hypertension than rural population did (23.1% vs 22.6%). Population in eastern coastal China had higher prevalence rates of hypertension than western China (26.6%, 21.7%). 76.3% of the survival stroke patients had hypertension.

**Conclusions:** The prevalence rates of hypertension patients in study population aged 40 and older were 22.9 % in total, 21.8% in men and 23.9 % in women. Urban population had higher prevalence rate of hypertension than rural population did. Population in eastern coastal China had higher prevalence rates of hypertension than western China.

**Keywords:** Hypertension, Stroke, Prevalence, China.

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### **Introduction**

Throughout the world, cardiovascular diseases have become a major public health problem and have been recognized as a leading cause of death and disability in most developed and some developing countries [1,2]. Hypertension is the most common risk factor for cardiovascular diseases [3]. It is estimated that about 25% of the world's adult population have hypertension, and it will be likely to increase 29% by 2025 [4].

These observations indicate the high burden of hypertension in the general population. Since the geographic, demographic and socioeconomic characteristics are different throughout China, the prevalence and awareness rates, treatments, and control of hypertension may differ widely [5]. Our study selected 421 resident communities from 16 provinces and analyzed the prevalence of hypertension in different areas of China. The 1991 National Investigation Data suggested that the prevalence of hypertension among Chinese adult population was 11.2%,

with 16.3% in urban and 11.1% in rural areas [6]. A national epidemiology study in 2002 showed that almost 18% of Chinese people aged 15 years and older were hypertensive. The prevalence of hypertension is 19.3% in urban areas, and 18.6% in rural areas [7]. Over the decade, the prevalence of hypertension across China has increased significantly. Hypertension is the leading modifiable risk factor for cardiovascular disease, involved in approximately 54 % of stroke cases and 47 % of ischemic heart disease incidences worldwide [8]. The low rates of hypertension treatment and control are the main causes of the high stroke incidence in China. The control rate of hypertension is as low as 5 % in China [9]. Most of the previous studies on hypertension were conducted in communities or in general populations. Few studies have investigated the hypertension in stroke patients. In 2012, Ministry of Health of China conducted a national stroke and common risk factors screening and prevention program as one of the key national efforts in primary and secondary prevention of stroke. Main purpose of this current study is to provide the estimation of prevalence rate of hypertension in population age over 40 in China, and among survival stroke patients. The prevalence rates of hypertension among sub-populations with different characteristics will provide further important information and specific guiding in hypertension prevention, and secondary prevention of stroke.

## **Method**

### ***Study population***

Among 31 provinces of China, 16 provinces were selected. Within the 16 selected provinces, 116 administration areas and 421 resident communities were further selected. The total population of the 421 selected resident communities registered in local government office was 1362350. The mean response rate was 87.8%. The total number of study population included in final analysis for prevalence rate of hypertension was 1196422.

### ***Ethics statement***

Written informed consent was obtained from all subjects and their assigned surrogate decision-makers. This study was approved by the Ethics Committee of Stroke Screening and Prevention Project, the Ministry of health.

### ***Organizing and implementing of hypertension and stroke screening***

This screening program was supported by Ministry of Health as one of national actions of stroke prevention and control and led directly by the office of China Stroke and High Risk Population Screening Program affiliated to Ministry of Health of China with close collaboration of local governments of the 16 selected provinces from April 2012 to Dec. 2012.

A steering committee included key neurologists, epidemiologists in China has been established to provide technique support to this program. Research teams for field

works were organized by local governments and composed by neurologists from local large teaching hospitals of university, staffs from chronic diseases divisions of CDCs, physicians and nurses from community hospitals and also postgraduate students of department of neurology from teaching hospitals of universities. All residents aged 40 or older in selected communities were invited to join the screening program which was conducted in the nearby community hospitals or health stations. The participants were asked by trained researchers for the questions regarding the history of stroke, hypertension according a standardized questionnaire.

### ***Definition of stroke history and hypertension***

The history of hypertension and stroke was received by a combination of self-report and the judgment of a physician or neurologist or both. The hypertension was defined according Chinese guidelines for hypertension management 2010 [10], criteria as SBP  $\geq$  140mmHg or DBP  $\geq$  90mmHg, or taking blood pressure lowering drug. The stroke defined according WHO criteria "rapidly developing clinical signs of focal (or global) disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin".

### ***Data management and analysis***

The data were collected between April 1, 2012 and December 31, 2012. After the survey, a sub-sample of respondents were selected randomly from all respondents and asked to undergo second interviews. Each of these was conducted by telephone. All collected data were inputted through internet-based databases directly by the interviewers by March 28, 2013. The data was checked variable by variable for completeness and potential errors repeatedly by experienced data management staffs according a standardized working process. And the authors had access to identifying information during or after data collection. Crude prevalence rate was estimated by using number of patients with hypertension as a nominate and all participants joining screening as a denominate. Direct standardization method was used for the estimation of standardized prevalence rate. The proportions of sub-population divided by age groups in sixth census of China were used as reference proportions for the calculation of standardized prevalence rates of hypertension. Chi-square statistics for continuous variables, Statistical significance was defined as a p-value  $<$  0.05. SPSS 16.0 was used for all data analyses.

## **Results**

### ***Study population***

The total number of population that completed the first stage screening of hypertension was 1196422. Table 1 presented the composition of the population in term of distribution of gender, age, and residents of urban or rural. The corresponding compositions of Chinese population aged 40 and older in the sixth census of China in 2010 were listed as a reference of

comparison with the national representatives' population. Compared with the population of sixth national census, the study population had more women (53.4% in this study vs.

49.6% in census population), less population aged 40 to 49 (26.8 vs. 41.1% in men and 22.6% vs. 40.0% in women), and a little more population from urban (62.4% vs. 47.9%).

**Table 1.** Composition of Study Population.

	Male			Female			Total		
	N	%	%*	N	%	%*	N	%	%*
Total	558033	46.6	50.3	638389	53.4	49.7	1196422	100.0	100%
Age(years)									
40-49	149335	26.8	41.1	144003	22.6	40.0	313338	26.2	40.6
50-59	164865	29.5	28.5	189243	29.6	27.9	354108	29.6	28.2
60-69	139133	24.9	17.7	163266	25.6	17.4	302399	25.3	17.6
70-74	76037	13.6	9.7	87379	13.7	10.3	163416	13.7	10.0
≥80	28663	5.1	3.1	34498	5.4	4.3	63161	5.3	3.7
Urban and Rural									
Urban							746565	62.4	47.9
Rural							449857	37.6	52.1

%,proportion in study population; %\*,proportion in population of sixth national census

**Table 2.** Prevalence Rates of hypertension.

	Population	hypertention cases	%	95%CI	Standardized Rate <sup>a</sup>	P
Total	1196422	274396	22.9	22.9-23.0	20.4	
Sex						<0.001
male	558033	121770	21.8	21.7-21.9		
female	638389	152626	23.9	23.8-24.0		
Age(years)						<0.001
40-49	313338	31403	10.0	9.9-10.1		
50-59	354108	68435	19.3	19.2-19.5		
60-69	302399	90569	30.0	29.8-30.1		
70-79	143416	61137	42.6	42.4-42.9		
≥80	63161	22852	36.2	35.8-36.6		
Urban and Rural						<0.001
Urban	746565	172706	23.1	23.0-23.3		
Rural	449857	101690	22.6	22.5-22.7		

<sup>a</sup>Standardized by composition of age in the sixth national census

### Prevalence rate of hypertension

Totally 274396 hypertension patients were identified by the screening among 1196422 study population. The crude prevalence rates of hypertension patients in study population aged 40 and older were 22.9% in total (Standardized rate: 20.4%), 21.8% in men and 23.9% in women. The prevalence rate of hypertension increased remarkably from 10.0% in

population age 40-49 to 42.6% in population age 70-79. The rate decreased to 36.2% in population age 80 and over. Urban population had higher prevalence rate of hypertension than rural population did. (Table 2) Among the traditional eastern coastal and western part of China, population in eastern coastal China (Shandong, Jiangsu, Zhejiang) had higher prevalence

rates of hypertension than western China (Sichuan, Shanxi, Gansu, Xinjiang) (Table 3).

**Table 3.** prevalence of hypertension among eastern and western of China.

	Total	hypertension	%	95%CI	p
Eastern	344536	91651	26.6	26.5-26.7	<0.001
Western	251810	54636	21.7	21.5-21.9	

Eastern coastal China include Shandong, Jiangsu and Zhejiang; western China include Sichuan, shanxi, gansu and xinjiang.

**Hypertension in survival stroke patients in China**

Among the 19472 survival stroke patients identified by the screening, 76.3% of the stroke patients had hypertension, 75.7 % in men and 76.9% in women. Rural stroke population had higher prevalence rate of hypertension than urban stroke population did (78% vs 75.2%) (Table 4).

**Table 4.** hypertension among the survival stroke patients.

	Stroke				
	Total	Hypertention	%	95%CI	P
Total	19472	14851	76.3	75.7-76.0	
Gender					0.046
Male	10488	7940	75.7	74.9-76.5	
Female	8984	6911	76.9	76.1-77.8	
Urban and Rural					<0.001
Urban	11964	8997	75.2	74.4-76.0	
Rural	7508	5854	78.0	77.0-78.9	

**Conclusion**

In our epidemiologic study throughout China, The prevalence rates of hypertension patients in study population aged 40 and older were 22.9% in total, 21.8% in men and 23.9% in women. The prevalence rate of hypertension increased remarkably from 10.0% in population age 40-49 to 42.6% in population age 70-79. The rate decreased to 36.2% in population age 80 and over. Urban population had higher prevalence rate of hypertension than rural population did. Population in eastern coastal China had higher prevalence rates of hypertension than western China.

**Discussion**

There are no nationwide data regarding the prevalence of hypertension in China in the last decade. This is the systematic- epidemiological studies covered 16 provinces and municipalities in China. All data was collected between April 2012 and Dec. 2012. Therefore, it is possible to provide a reliable estimate of prevalence of hypertension in China. In our

study, 22.1% of Chinese aged 40 years and older were hypertensive. Prevalence of hypertension in Chinese aged 15 years and older has been on the rise in recent decades, national sampling studies from 1958–1959, 1979–1980, 1991 and 2002 [11–13] reported prevalence of 5.1%, 7.7%, 13.7% and 17.6% respectively. Recent meta-analysis indicates that 21.5% Chinese city residents older than 15 years and 22.8% in rural area aged 18 years is hypertensive [14,15].

Although varying methodologies make comparisons complex, in our nationwide epidemiologic study, the prevalence of hypertension still increase in recent years. From the Study on global ageing and adult health (SAGE) China Wave 1 in 2010, Self-reported prevalence of hypertension aged 50 years and older was 26.7%, which is similar to our study [16]. But the prevalence of hypertension based on measurements was 59.7%, over two times higher than the self-reported rate in the SAGE-China Wave 1 study.

The prevalence from measured blood pressure was slightly higher than the findings from repeated measurements in the 2002 China National Nutrition and Health Survey (NNHS, 2002), where 50% of men and 52% of women aged 60 years or older, had hypertension [17]. The results from another national survey study using repeated blood pressure measurements (chronic disease risk factor surveillance in China, 2007), showed the overall prevalence of hypertension in Chinese aged 60 to 69 years to be 56.9% in both sexes [18].

All these results showed repeated blood pressure measurements are necessary for people over 50 years old. Effective treatment and prevention measures focusing on the high-risk populations will have a profound and favorable impact on public health. Previous studies have found rates of hypertension to be higher in men than in women at younger ages, while the reverse was true in older participants [19,20]. Although our study cannot show any information about age groups in separate sex, it showed that the prevalence of hypertension is higher in women than in men in general, 23.9% and 21.8% respectively. And this consistent with the SAGE-China Wave 1 study, which the prevalence in women and men was 29.7% vs 23.9% [16]. Recent meta-analysis indicates that 21.5% in urban older than 15 years and 22.8% in rural area aged 18 years is hypertensive. An epidemiological study of 14 provinces reported that hypertension prevalence was higher in northern China than Southern China [21].

In our study, the prevalence of hypertension is higher in urban than in rural (23.1% vs 22.6%). This difference has been show in the SAGE-China Wave 1 study. [16] And in eastern coastal China, relative rapid economic development region, the prevalence of hypertension is higher than in western China (26.6% vs 21.7%). Possible explanations for this difference in hypertension prevalence were economic development, urbanization, lifestyle changes including low levels of physical activity, air pollution, overweight, obesity, eating preference and habit and deterioration of ecological environments, and another possible reason may be persons who live in rural areas being less willing to tell interviewers about their illness due to low education level, traditional understanding of diseases.

These need more detailed studies to detect the risk factors related to hypertension. Hypertension is the most common modifiable risk factor for stroke [22]. Hypertension is the most important potentially reversible risk factor for stroke in all age groups, with a continuous association between both systolic and diastolic BPs and risk of stroke, particularly for intracerebral haemorrhage [23]. Hypertension is also associated with increased risk of recurrent stroke [24]. In our study, the prevalence of hypertension in survival stroke patients is 76.3%, and higher in rural area than urban area (78% vs 75.2%). All the results showed hypertension is the most common risk factor in stroke. And in rural area, more individual didn't realize and control hypertension, so the percent of hypertension is higher in stroke patients than in urban area.

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