Hypertension Prevalence, Awareness, Treatment, and Control Following China’s Healthcare Reform

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BACKGROUND
In 2009, China started an impressive national healthcare system reform. One of the key components is to promote equity in access to essential healthcare services including chronic disease management. We assessed the changes in hypertension management and its equity before and after China’s healthcare reform in 2009.

METHODS
We used data from the 2008 and 2012 waves of the China Health and Retirement Longitudinal Study (CHARLS). The surveys were conducted in Zhejiang and Gansu provinces, containing 1,961 and 1,836 respondents aged 45 and older in 2008 and 2012 respectively. We measured the prevalence of hypertension, and proportions of respondents with hypertension aware of their conditions, receiving treatment and under effective control, separately for 2008 and 2012. We also reported these measures in provinces and rural/urban areas.

RESULTS
From 2008 to 2012, the age standardized prevalence of hypertension was steady at 46.2%, but hypertension management improved substantially. Among those with hypertension, the proportion of patients aware of their conditions increased from 57.8% to 69.9%, the proportion of patients receiving treatment increased from 38.1% to 56.1%, and the proportion of patients with hypertension under effective control increased from 21.7% to 36.4%. The highest improvement was found in rural areas of the underdeveloped province, which indicated that the inequity across regions declined over time.

CONCLUSIONS
Among Chinese population aged 45 and older in Zhejiang and Gansu provinces, hypertension management improved following healthcare reform. The rate of improvement was faster in rural and underdeveloped areas, possibly related to additional governmental subsidies to these areas.

Keywords: blood pressure; China; equity; healthcare reform; hypertension; public health.

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In China, the prevalence of hypertension in adults almost doubled from 18% in 2002 to 34% in 2010, and hypertension affected 337 million Chinese in 2010. It was estimated that in China, 2.33 million cardiovascular deaths were attributable to hypertension in 2005, of which 1.27 million were premature death. And 50% of myocardial infarction and 70% of stroke were associated with hypertension. Timely and effective prevention and control of hypertension is essential to prevent more severe cardiovascular related diseases. However, the management of hypertension was poor in China: for example, between 2000 and 2009, over half of patients with hypertension were undiagnosed and therefore unaware of their conditions, about 30% of patients with hypertension received treatment, and only 8% were well controlled. Furthermore, inequality in hypertension management was prevalent. Poor or rural residents were much less likely to be aware of their conditions, receive treatment and get hypertension effectively controlled, compared to those living in urban or rich provinces.

In response to these challenges, the Chinese government started a national scale healthcare system reform in 2009. During the 3-year implementation plan between 2009 and 2011, the Chinese government committed to spending 850 billion Yuan (US$137 billion, US$1 = Chinese Yuan 6.2). One of the key reform components is to promote equal access to essential public health services, which will be achieved through establishment of health records for all citizens, screening and management for chronic diseases, and health education. To implement these public health services, the government provided the subsidy about 15 Yuan per capita for primary healthcare providers in 2009 and the subsidy amount further increased to 25 Yuan in 2011. The central government provides its subsidy toward the poor regions, whereas subsidies in rich regions are only slightly increased.
from local governments. These government subsidies are offered for primary care providers to deliver a defined package of essential public health services to all residents free of charge, which covers health records, health education, and chronic disease management. The reform was designed to better manage the chronic diseases such as hypertension and improve equity in access to chronic care.

Has the China’s new healthcare system reform improved the management of chronic diseases, in particular hypertension? Little evidence exists so far to measure the change in hypertension treatment and control. We use 2008 and 2012 pilot survey data from the China Health and Retirement Longitudinal Study (CHARLS) to compare the changes in hypertension management and equity issues before and after the recent reform.

METHODS

Study design and data

We used 2008 and 2012 pilot survey data from the CHARLS, which has been described previously in details and is publicly available. (The CHARLS data can be downloaded from the following website: http://charls.ccer.edu.cn/en.) CHARLS is based on the US Health and Retirement Study as a broad-purposed social science and health longitudinal survey of the elderly in China. The subjects in the CHARLS pilot samples are representative of individuals aged 45 and older who reside in Gansu and Zhejiang provinces in China. These 2 provinces were chosen because they are on the 2 opposite sides of the socioeconomic development spectrum in China. Zhejiang, located in the developed coastal region, is one of the richest provinces, and Gansu, located in the less developed western region, is one of the poorest and the most rural provinces.

The CHARLS pilot sample was drawn using the stratified 4-stage cluster sampling method. In each province, 16 county-level units (rural counties or urban districts) were randomly selected by Probability Proportional to Size, stratified by regions and urban/rural. Within each county-level unit, 3 primary sampling units—administrative villages in rural areas or neighborhoods in urban areas—were randomly selected by Probability Proportional to Size. Within each primary sampling unit, 25–36 households were randomly selected from a complete list of dwellings generated from Google Earth maps. If a selected household had members older than 45, CHARLS randomly selected one of them to be a main respondent and also interviewed his or her spouse.

Data were collected through face-to-face interviews, and 84.8% of the eligible participants completed an interviewer-administered questionnaire. For each respondent, systolic and diastolic blood pressures (BP) were measured 3 times in the sitting position after 5 minutes’ rest by a trained nurse using an HEM-7112 electronic monitor (Omron, Kyoto, Japan). The mean of the 3 readings was recorded as their BP values.

The first wave was conducted from July to September 2008, covering a total sample of 2,685 individuals, which consisted of 1,425 respondents in Zhejiang and 1,260 in Gansu province. And 2,385 of originally 2,685 respondents (88.8%) were followed up from July to September 2012. Among all respondents, 1,961 and 1,836 respondents provided complete BP measures in 2008 and 2012 respectively. In our analysis, we only used those respondents with BP measurements.

Measures

Hypertension was defined as the mean systolic BP ≥ 140 mm Hg, the mean diastolic BP ≥ 90 mm Hg, and/or current treatment with antihypertensive medication. The management of hypertension is measured by awareness, treatment, and effective control among all respondents with hypertension. According to the Chinese Guidelines for the Prevention and Treatment of Hypertension, patients with hypertension were defined as being aware of their hypertension if they were previously diagnosed as hypertension by physicians. Treatment of hypertension was defined as self-reported current use of antihypertensive medication. Hypertension was considered controlled if the respondents’ BP was less than 140/90 mm Hg.

Statistical analysis

Survey data were weighted according to the multistage stratified sampling design. The weights took account of the representativeness of the results and the missing BP measurements. Descriptive statistics were used to compare the prevalence, awareness, treatment, and control of hypertension between 2008 and 2012. Percentages and their 95% confidence intervals (CIs) were calculated with age standardization, and the China 2010 census population data were used for the standardization. To examine the changes in equity following healthcare reform, the percentages of hypertension management were stratified by poor/rich province and rural/urban residence to see whether the disparities between the 2 groups had reduced over time. Inferential statistics were estimated by 2-sided χ² tests. All statistical analyses were performed using STATA 12.0.

RESULTS

The summary characteristics of the respondents in 2008 and 2012 are presented in Supplementary Table S1. The proportion of rural residences, marital status, and education were similar among subjects between 2008 and 2012. The household income per capita in Zhejiang was over 3 times higher than that in Gansu, and the gap remained in 2012. The proportion of smokers decreased significantly from 30.1% to 25.7%, whereas overweight and drinking habits remained almost unchanged.

Figure 1a presents the comparison of hypertension prevalence and management before and after healthcare reform with all subjects regardless of province. The data were presented as weighted and age standardized percentages with 95% CIs. From 2008 to 2012, the age standardized prevalence rate of hypertension was steady at 46.2%, but hypertension management improved substantially as a response to the reform. Among those with hypertension, the proportion of patients aware of their conditions increased significantly from...
Hou et al.

57.8% (95% CI = 51.9–63.8) to 69.9% (95% CI = 64.2–75.6) (P < 0.001), the proportion of patients receiving treatment increased from 38.1% (95% CI = 31.4–44.8) to 56.1% (95% CI = 49.4–62.8) (P < 0.001), and the proportion of patients with hypertension under effective control increased from 21.7% (95% CI = 16.4–26.9) to 36.4% (95% CI = 29.9–42.9) (P < 0.001). In addition, the highest improvement was found in rural areas of the underdeveloped Gansu province, which indicated that the inequity across regions declined over time. In rural Gansu, the proportion of awareness raised from 46.3% (95% CI = 37.0–55.6) to 68.7% (95% CI = 61.2–76.2) (P < 0.001), and the proportion of treatment raised from 26.1% (95% CI = 21.3–30.9) to 49.0% (95% CI = 39.2–58.8) (P < 0.001), which led to almost twice increase of effective control of hypertension (Figure 1c2).

Figure 1b compares the improvement of hypertension management between provinces over time. For hypertension awareness and treatment, more significant improvement had been found in underdeveloped Gansu than developed Zhejiang province between 2008 and 2012, which indicated the narrowed inequity between provinces over time.

With regard to inequity between rural and urban areas, there was no significant rural–urban disparity of hypertension management in developed Zhejiang province for both 2008 and 2012 waves (Figure 1c1). However, the rural–urban disparity greatly reduced in underdeveloped Gansu province between 2008 and 2012 (Figure 1c2).

**DISCUSSION**

Taking hypertension as an example, we examined trends in the management of chronic diseases and its equity following China’s healthcare system reform. We found that the management of hypertension, including awareness, treatment, and BP control, improved considerably 3 years after China’s reform. The largest improvement was found in rural areas, particularly in Gansu, an underdeveloped province. Moreover, the inequity between rich and poor provinces, as well as between rural and urban areas had been reduced over time.

After initiating healthcare reform that includes subsidies to underdeveloped and rural areas, the improvements of hypertension management and the equity in access to public health services have been observed in China. To achieve the equity, subsidies from the central government had been mainly targeted to underdeveloped regions for the management of chronic diseases. In our study, poor Gansu province received the subsidy from the central government, but rich Zhejiang province did not. A recent study reported that the proportion of individuals having a personal health record increased from 30% in 2008 to 72% in 2010 in rural areas, with major gains in underdeveloped regions. Establishing these health records will help to identify chronic diseases in the early stage and therefore improve their management.

However, the hypertension in China still had not been managed as effectively as in the developed countries. In our study, 30% of subjects with hypertension were unaware of their conditions and 64% did not control their BP effectively (P < 0.001). The major reason for poor management in China was possibly a shortage of human resources. Retention of public health professionals to primary care institutions seems difficult, especially in remote rural regions. It had been estimated that in rural areas, only

![Figure 1. Weighted and age-adjusted prevalence, awareness, treatment, and control of hypertension among residents aged 45 and older between 2008 and 2012: (a) total population; (b) by poor Gansu/rich Zhejiang provinces; and (c) by rural/urban areas in each province.](https://academic.oup.com/ajh/article-abstract/29/4/428/2195504)
of hypertension management. Therefore the regular follow-up services, a key element in management of chronic diseases, were hard to be delivered timely. Further healthcare system reform should focus on gross-root human resource in public health.

We also found that the rate of effective control of hypertension in Gansu province was still much lower than that in Zhejiang in 2011, indicating large provincial disparities. This can be partly explained by different lifestyles across provinces. For example, residents in Gansu province are more likely to take high-salt diet than residents in Zhejiang, which possibly led to lower control rate of BP in Gansu. So the lifestyle modification is another concern for combating chronic diseases, which needs appropriate health education interventions.

Our study had 2 main limitations. First, we do not attempt to study causal effects from the policy changes on the outcomes. Our results are merely correlation. Second, since the data are only from population aged 45 and older from 2 provinces, the findings can only be generalized to this population.

In conclusion, among Chinese population aged 45 and older in Zhejiang and Gansu provinces, hypertension management improved following China’s healthcare reform. In addition, the rate of improvement was faster in rural and underdeveloped areas, compared to the urban and developed areas, which may be related to additional governmental subsides to underdeveloped and rural areas.

SUPPLEMENTARY MATERIAL

Supplementary materials are available at American Journal of Hypertension (http://ajh.oxfordjournals.org).

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DISCLOSURE

The authors declared no conflict of interest.

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