早稲田大学審査学位論文
博士（スポーツ科学）

The associations of depression, anxiety, self-efficacy, and family social support with self-care behaviors in patients with hypertension

高血圧患者における自己管理行動と精神心理的要因および社会的要因との関係

２０１５年１月

早稲田大学大学院　スポーツ科学研究科
胡　ファンファン
HU, Huanhuan

研究指導教員：　荒尾　孝　教授

The associations of depression, anxiety, self-efficacy, and family social support with self-care behaviors in patients with hypertension

A dissertation
Submitted to the Graduate School of Sport Sciences,
Waseda University in partial fulfillment of the requirements for the degree of

Doctor of Philosophy
in
Sport Sciences

by
Huanhuan Hu

Acknowledgements

I would like to acknowledge the following individuals for their contributions to completion of this dissertation and degree:

First and foremost, I would like to express my deep gratitude to my supervisor Prof. Takashi Arao for his incessant support, encouragement, guidance and advice in my educational journey throughout the whole Ph.D.-study.

I am grateful to Dr. Gang Li, Ms. Jiali Duan at Beijing Center for Disease Control and Prevention for their support during the field work.

Next, I thank my fellow PhD student (Mr. Munehiro Matsushita) and staff (Dr. Masaki Takahashi) at the Physical Activity Epidemiology Lab for constructive discussions and socializing.

Thanks to the Dissertation Committee for their patience, guidance and support throughout: Prof. Katsuhiko Suzuki and Prof. Koichiro Oka.

Last but not least I would like to thanks my mother and sister for their unconditional love, support and sacrifices. I feel that my father who passed away last year is looking at this work from the Heaven.

This work was supported by grant of GCOE in Waseda University.

The thesis is based on the following papers:

1. Huanhuan Hu, Gang Li, Takashi Arao. The association of family social support, depression, anxiety, and self-efficacy with specific hypertension self-care behaviors in Chinese local community, Journal of Human Hypertension, 2014, in press

2. Gang Li, Huanhuan Hu, Zhong Dong, Takashi Arao. Development of the Chinese family support scale in a sample of Chinese patients with hypertension. PLoS One, 2013; 8(12):e85682.

3. Huanhuan Hu, Gang Li, Takashi Arao, Jiali Duan. Validation of a Chinese Version of the Self-Efficacy for Managing Chronic Disease 6-Item Scale in Patients with Hypertension in Primary Care. ISRN Public Health, 2013. doi:10.1155/2013/298986

4. Huanhuan Hu, Gang Li, Takashi Arao. How hypertensive patients in the rural areas use home blood pressure monitoring and its relationship with medication adherence: a primary care survey in China. Open Journal of Preventive Medicine, 2013, 3(9):510-516.

5. Huanhuan Hu, Gang Li, Takashi Arao. Prevalence rates of self-care behaviors and related factors in a rural hypertension population: A questionnaire survey. International Journal of Hypertension, 2013. doi:10.1155/2013/526949

Table of Contents

List of tables

List of figures

Abstract

The current study was conducted to test the role of family social support, depression, anxiety, and self-efficacy on specific hypertension self-care behaviors. This study consisted of two parts. The first part was conducted to validate the Chinese Family Social Support Scale and the Chinese version of the self-efficacy for managing chronic disease 6-item scale) , which were used for assessing family social support and self-efficacy, respectively, in this study. The second part involved in examining relationships among psychosocial factors and specific self-care behaviors among hypertensive patients. Participants were recruited from a local community in Beijing. A total of 318 patients (289 recruited from community health center, 17 from referral, and 12 from the poster advertisement) participated in this study. The reliability and validity of the questionnaires for assessing family social support and self-efficacy was examined with the data from the subsample of patients (289 recruited from community health center). The full sample (318 patients) was analyzed in the second part.

The Chinese version of the self-efficacy for managing chronic disease 6-item scale displayed acceptable psychometric properties: the scale was two-dimensional, reproducible (intraclass correlation coefficients (ICC) =0.78; 95% CI, 0.70-0.84), and the reliability was good (Cronbach's alpha =0.88). For the Chinese Family Social Support Scale, exploratory factor analysis revealed a three-factor solution accounting for 62% of the total variance. The three underlying sub-scale dimensions were kinship, nuclear family, and social resources. The Chinese Family Support Scale had an acceptable internal consistency (Cronbach's alpha = 0.84) and test-retest reliability (ICC = 0.82).

The full sample analysis showed that for medically-related self-care behaviors, 61.3% of participants reported taking medication as prescribed, and 44.3% reported measuring blood pressure (BP) regularly. Adherence to lifestyle-related self-care behaviors was reported in

51.9%–81.1% of participants. The mean score of perceived family social support for hypertension treatment was 20.91 (maximum = 60). Adult children were identified as the primary support source. Approximately 22.3%, and 15.4% of participants reported symptoms of anxiety, and depression, respectively. Participants had moderately positive levels of confidence performing self-care (42.1 out of 60). After adjusting for demographic and health variables, a 10-unit increase in family social support increased the odds of taking medication by 1.39 (95% CI 1.03–1.87) and increased the odds for measuring BP regularly by 1.33 (95% CI 1.02–1.74). Depression and anxiety were not associated with any self-care behaviors. A10-unit increase in self-efficacy increased the adjusted odds ratio for performing physical exercise to 1.25 (95% CI 1.04–1.49).

In this sample of hypertensive patients, family social support was significantly associated with medication adherence and BP monitoring. Two other self-care behaviors (physical exercise, and following a low-salt diet) showed associations with family social support, which bordered statistical significance. Strategies to improve family social support should be developed to improve hypertension control. To understand the effects of family social support, depression, anxiety, and self-efficacy on self-care behaviors, prospective studies are needed.

1. Chapter 1 Introduction

1.1. Hypertension and self-care

1.1.1. Hypertension

Hypertension, known as high blood pressure (HBP), remains the most common risk factor leading to cardiovascular disease and remains one of the top risk factors for premature death around the worldwide. In 2008, World Health Organization reported that approximately 40% of adults aged 25 and above had been diagnosed with hypertension [1, 2], and that hypertension is responsible for at least 45% of death due to heart disease, and 51% of death due to stroke [1, 3]. This risk, however, does not need to be so high. The diagnosis of hypertension is relatively straightforward. Notably, patients can monitor their blood pressure (BP) at home. Further, there are dozens of effective antihypertensive drugs, many of which are available at a low cost. Besides that, lifestyle modifications (e.g. physical exercise, limiting alcohol intake and dietary salt reduction) can also lower BP [4]. However, the management of hypertension remains problematic. It is only in recent years that the control rate of hypertension reaches about 50% in a few developed countries (e.g. USA, Canada) [5]. The control rate is far less in other countries, especially in middle and low income countries [6, 7]. One study conducted in a rural population in China showed that only about 3.9% of the participants had their BP under control [8].

1.1.2. Self-care

The influential Wanless report suggested that the future costs of health care were very much dependent on ‘how well people become fully engaged with their own health’ [9]. Self-care strategies have been utilized effectively for chronic diseases (e.g. diabetes) [4]. Considering the high prevalence and poor management of hypertension, self-care may be a feasible option. Multiple studies have demonstrated the positive effects of self-care on treating and managing HBP [10-13]. Cumulative evidence suggests that HBP self-care is crucial for BP control and for preventing complications such as stroke and early death [10, 14, 15]. Self-care behaviors have

been documented as one of the main determinants of hypertension control [10-13]. To successfully control BP, patients must perform varying forms of self-care behaviors such as medication adherence, regular BP measurement, physical exercise, alcohol abstinence, non-smoking, and low-salt diet adherence [10].

1.2. Need for study

Despite the benefits of evidence-based hypertension self-care behaviors in improving BP [16, 17], hypertensive patients generally have low compliance with these behaviors [18, 19]. Recently, more effort has been made to improve patients' overall self-care [20, 21]; therefore, identifying and assessing factors that may influence patients' self-care behaviors is critical. Over the last three decades, the relationships among psychosocial factors such as family social support, depression, anxiety, self-efficacy, and self-care behaviors have received attention for individuals with chronic diseases [22, 23, 24]. So far, most studies on self-care were performed on patients with diabetes [22-25]. Few studies have examined the relationships these psychosocial factors have on hypertension self-care behaviors [26, 27]. Research on hypertension self-care behaviors is vital, given that it can provide information for developing policies on support for self-care, suggest what practical action can be taken, and provide ideas on how to support self-care.

1.2.1 Depression and anxiety among hypertension patients

Depression and anxiety appears to be common among people with chronic diseases [28]. Many studies identified depression and anxiety in patients is associated with a lower quality of life, and poor self-care [25, 29]. Like patients with other chronic disease, hypertension patients may also experience mental disorders. Some studies have shown a positive association between hypertension and anxiety [30,31]. Hypertension patients need to adhere to pharmacological and non-pharmacological therapies and these negative emotions may adversely influence their adherence to self-care [32]. Mixed results have been reported on the association between depression, anxiety, and self-care [33-36]. Drawing a causal relationship between depression, anxiety, and hypertension self-care may be difficult. Further research about interactions of depression, anxiety, and self-care, is needed.

To make cost-effective screening of mental health feasible, several questionnaires have been developed. The Hospital Anxiety and Depression Scale (HADS) has been widely used as a screening measure for both, dimensional and categorical aspects of anxiety and depression. The review by Bjelland and his colleagues confirms that HADS performs well in screening for the separate dimensions of anxiety and depression and caseness of anxiety disorders and depression in patients from nonpsychiatric hospital clinics [37]. It also points out that HADS seems to have at least as good screening properties as similar, but more comprehensive, instruments used for identification of anxiety disorders and depression. Thus, the Chinese version of HADS were used to assess the depression and anxiety symptoms among hypertension patients in this study.

1.2.2 Self-efficacy for managing hypertension

Self-efficacy, a widely used psychological concept, has been recognized as an essential prerequisite of effective self-care of chronic disease [38-40]. Several studies have underlined the association between self-efficacy and chronic disease self-care among hypertension, diabetes and arthritis [41-43]. In a study by Warren-Findlow and colleagues [26], hypertension self-efficacy is strongly associated with adherence to five of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure recommended self-care behaviors. Measuring the self-efficacy for self-care behaviors in hypertension patients is an important step towards improving hypertension control in individual or population level. The information gained from measurement of self-efficacy can help physicians or public health professionals to identify low self-efficacy patients and implement suitable interventions. Thus, there is a need for measure which could be used as a screening method both at research and clinical practices. Sorts of self-efficacy instruments have been developed and tested throughout the last two decades [44-46]. However, to date, no instrument has been standardized for measuring self-efficacy in hypertension patients. The choice of specific measure also depends on the intended

use of the information, patients' acceptance, and convenience of the tool [47].

The Self-Efficacy for Managing Chronic Disease 6-Item Scale (SES6C) is less burdensome for patients, and can effectively be used in research and clinical practices. This short instrument was developed and validated by the Stanford Patient Education Resource Center [48]. It encompasses several domains that are common across many chronic diseases including, symptom control, role function, emotional functioning and communicating with physicians. The German translation of this measure has been demonstrated to be a reliable and valid measure [49]. Until now, there is no Chinese version of the Self-Efficacy for Managing Chronic Disease 6-Item Scale (SES6C). Development of a Chinese version of the SES6C would allow Chinese investigators to participate in international research studies when this scale is proposed.

1.2.3 Family social support in hypertension management

Given the complexity of hypertension management and possible coexistence of mental disorders, many hypertensive patients may need support to manage their blood pressure successfully. Such support from family, friends, and professional organizations has received great attention in chronic disease care in the last decade [50,51]. A growing body of literature indicates that patients with higher levels of family support would be more likely to exhibit self-care behaviors frequently [52,53]. However, most of these studies focused on diabetes, and limited evidence from studies on patients with hypertension showed that family support might improve therapy compliance and health dietary habits [54,55].

In China, data on the association between hypertension self-care and family support are scarce. A recent systematic review suggested that few studies investigated family support among hypertensive patients, and the quality of such studies, was generally poor [56]. Lack of appropriate scales for measuring family support may be one of the reasons contributing to this. In the past decades, several family support scales have been developed, most of which were

developed in the western countries [57,58]. In China, families are tied closely by blood relationship and the “family first” ideology may motivate family members to help relatives suffering from a disease [59]. This traditional culture is different from that seen in the western countries, which makes it difficult to use these scales with the Chinese population. To know the association between family support, self-care, and outcome of hypertension, it is essential to have a reliable and valid family support scale that can be used with Chinese patients. In the current study, the Chinese Family Support Scale (CFSS) was developed to provide an instrument that is easy to use and interpret in epidemiological surveys with patients.

1.3. Study purposes

The final objective of this study was to examine relationships among psychosocial factors and specific self-care behaviors in hypertensive patients from a rural community in Beijing, China. In particular, this study aimed to:

1) Develop and validate the questionnaires for assessing family social support and self-efficacy for managing chronic diseases;
2) Examine relationships among psychosocial factors and specific self-care behaviors in hypertensive patients.

1.4. Overview and study design

This study consisted of two parts: 1) In part 1, we validated a Chinese version of self-efficacy scale for managing chronic disease and developed a Chinese family support scale, which were used for assessing self-efficacy and family social support in this study; 2) In part 2, we tested the role of depression, anxiety, self-efficacy, and family social support on specific hypertension self-care behaviors.

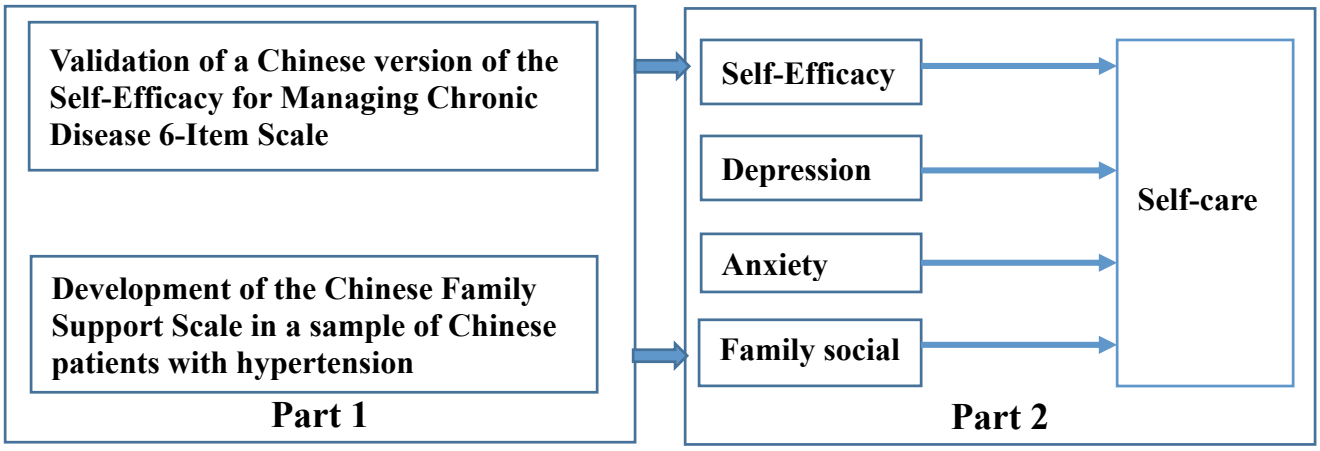

Figure 1 Overview of hypertension self-care study

1.5. Recruitment and study cohort

Eligible participants were aged ≥35 years and having hypertension for at least 12 months. Participants who could not communicate effectively with the study personnel or provide informed consent were excluded. We mainly recruited subjects for this study through a community health center, which is a public medical center providing medical and public health services to civilians. A total of 890 hypertensive patients were registered in the community health center. Physicians screened the registered patients for eligibility for the study, out of which143 patients without contact information were excluded. Of the remaining 747 patients, 456 patients met the inclusion criteria and were invited to participate in this study via telephone. As some hypertensive patients may have not attended the health clinic and were not registered, we also recruited subjects through word-of-mouth and put up a poster in the community to create awareness about the study.

Firstly, 523 individuals were invited to participate in the study. Of these patients, 456 were registered patients, 41 patients were recruited by referral from study participants who were already recruited, and 26 joined after viewing a poster advertisement in the community. After exclusion or drop out from the study, a final study population of 318 patients (289 recruited from registration, 17 from referral, and 12 from the poster advertisement) participated in this study. First, the 318 patients with hypertension completed a questionnaire assessing self-care, family social support, depression, anxiety, and self-efficacy. Second, to examine the test-retest reliability of self-efficacy scale and family social support scale, a subsample of patients (289 recruited from registration) were re-collected after two weeks.

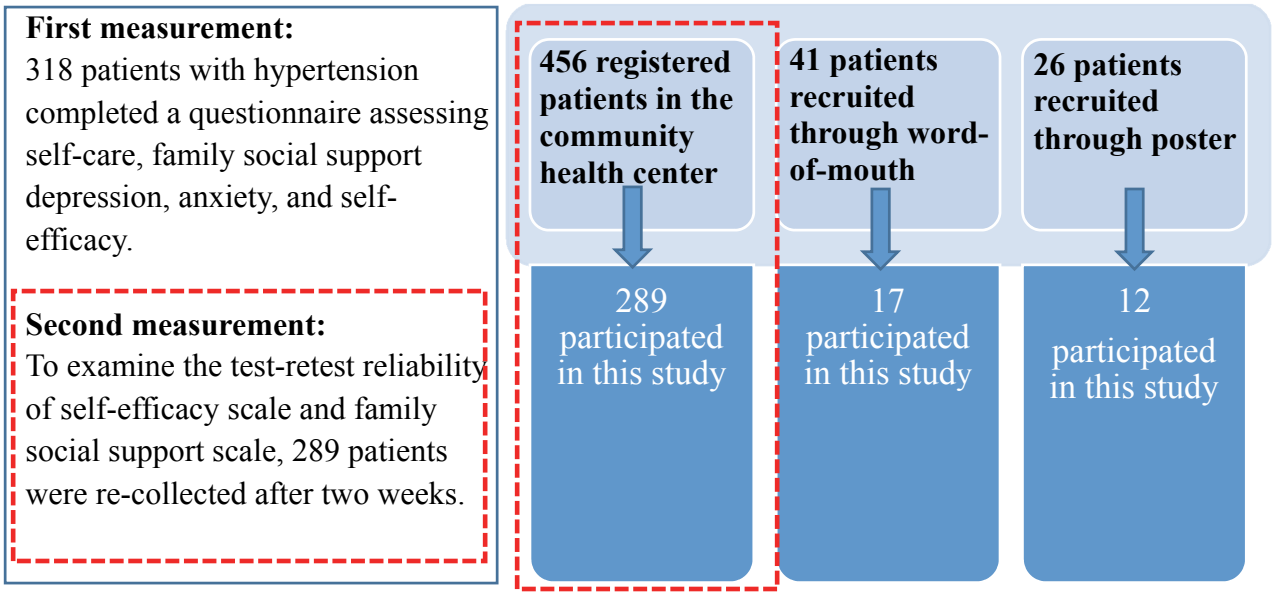

Figure 2 Recruitment and study cohort of hypertension self-care study

1.6. Research ethics

Approval for this study was obtained from the Ethical Review Board of Waseda University. Written informed consent was obtained from all participants prior to data collection. Participants were aware that they could stop the interview at any time and refuse to answer questions without a reason. At the end of the study, all participants were given a small gift for their participation.

2. Chapter 2 Development of measurements for psychological and social factors

2.1. Validation of a Chinese version of the Self-Efficacy for Managing Chronic Disease 6-Item Scale in patients with hypertension in primary care settings

2.1.1 Introduction

Measuring the self-efficacy for self-care behaviors in hypertension patients is an important step towards improving hypertension control in individual or population level. The information gained from measurement of self-efficacy can help physicians or public health professionals to identify low self-efficacy patients and implement suitable interventions. Thus, there is a need for measure which could be used as a screening method both at research and clinical practices.

The main objective of this study was to evaluate the validity and reliability of a Chinese version of the Self-Efficacy for Managing Chronic Disease 6-Item Scale (SES6C) in patients with hypertension. The secondary objective was to explore factors associated with self-efficacy measured with the SES6C.

2.1.2 Methods

Design and setting

In 2012, an observational cross-sectional study was conducted to assess the reliability and validity of SES6C in a hypertension population. A questionnaire survey was undertaken in a local community health center in Beijing, China.

Translation of the SES6C

The original version of the SES6C is free to use without permission. A forward and back translation was carried out to confirm accuracy. This is a minimum requirement for the cross-cultural adaptation of established scales [60]. The forward translation (English to Chinese) was undertaken by the first author of this manuscript. Translations were reviewed and discussed with the second author and one public health professional in meetings. A revised version was translated back by a PhD candidate in Nagoya University. All were fluent in English and

Chinese. The original and the back-translated English version were compared and inconsistencies were resolved through consensus meetings. The Chinese version was finalized when there was no dispute or new suggestion.

Participants

As we mentioned before, a total of 289 patients were recruited from the community health center. Among these participants, 262 of them completed the first questionnaire. Of the 140 patients conveniently selected for the second questionnaire to assess test-retest reliability, 127 of them provided complete answers.

Measurements

Self-Efficacy for Managing Chronic Disease 6-Item Scale

The SES6C is a measure of how confident patients with chronic disease are in doing certain activities. The measure consists of 6 items that are rated on a 10-point scale ranging from "Not at all confident" (1) to "totally confident" (10). The high internal consistency reliability of 0.91 and moderate correlation (r=0.58) with General Self-efficacy Scale indicates its validity and reliability are acceptable [48, 61]. The scale is interpreted by calculating a mean score over at least four of the six items thus allowing a maximum of two missing item responses. Higher number indicates higher self-efficacy.

The subjects in our study were mainly from rural areas, and had a low literacy rate. In order to make comprehension easier and improve the measurement accuracy, an interview guide for this scale was developed by the first author.

Hospital Anxiety and Depression Scale (HADS)

A large body of evidence shows that concept of self-efficacy has a general role on mental health [62-64]. Tahmassian and colleagues reported that there is a significant and negative relationship

between self-efficacy and depression (r=-0.42), and anxiety (r=-0.46) [65]. To investigate the concurrent validity of the SES6C, the validated Chinese version of HADS [66, 67] was used as an external criterion. The HADS is widely used as a screening measure for both dimensional and categorical aspects of anxiety and depression [37]. A greater score of the HADS represents a higher level of psychological distress.

In addition to abovementioned self-efficacy, anxiety and depression measures, demographic information was also collected in the questionnaire regarding respondents' age, gender, education level, marital status (1=married, 2=widowed, 3=divorced/separated and unmarried) ,smoking status (1=yes, 0=no), perceived health status (1=very good,2= good, 3=fair, 4=poor, and 5=very poor), regular exercise (1=yes, 0=no) as well as duration of hypertension.

Data management and statistical analyses

Data were double-entered and cross-checked using Epi Info version 6 statistical software. Descriptive statistics such as means, standard deviations, medians, percentages and range were used where appropriate. Exploratory factor analysis was performed on the items to test the SES6C underlying dimensions. Principal component analysis with varimax rotation was performed to extract the factors. Factors with an eigenvalue ≥1.0 were kept as part of the factor structure. Scale internal consistency reliability was determined by calculating Cronbach's alpha. Internal reliability is acceptable if the Cronbach's alpha coefficient is greater than 0.70 [68]. Test-retest reliability was evaluated using the intraclass correlation coefficient (ICC), and an ICC value of 0.40 represents moderate, 0.60 good, and 0.80 high agreement [69]. Concurrent validity was established by Pearson's correlations between the 6-Item SES6C and HADS. A moderate to high correlation between the relevant dimensions was deemed acceptable (r≥0.3) [70].

An explanatory analysis was performed to study whether the demographic and clinical variables

were associated with self-efficacy according to the SES6C. The factors explored were age, gender, smoking status, education level, marital status, regular exercise, perceived health status, duration of hypertension and psychological distress (HADS total score). Linear regression models were used. All factors were studied in univariable and multivariable analyses. Statistical analyses of the study were conducted by SPSS 19.0 for Windows (SPSS, Inc, Chicago, USA) and the significance level was set at 0.05.

2.1.3 Results

The characteristics of the study sample are shown in Table 1. Of the 262 respondents, 72.1% were female, and 74.8% had a lower educational level (≤6 years). Mean age was 63.4±9.7 years (range: 35-83 years). No significant differences based on age, gender, education level, marital status, smoking status or psychological distress were found between the participants who completed the questionnaire for a second time and those who did not. The participants who were retested had a longer duration of hypertension ($t = 2.38$; $P < 0.05$).

Table 1 Characteristics of the sample

	Total N=262(%)	Test N=135(%)	Retest N=127(%)
Age			
35-64	138 (52.6)	73 (54.1)	65 (51.2)
65-83	124 (47.3)	62 (45.9)	62 (48.8)
Mean (SD)	63.4 (±9.7)	62.9 (±10.5)	64.0 (±8.7)
Gender			
Male	73 (27.9)	46 (34.1)	27 (21.3)
Female	189 (72.1)	89 (65.9)	100 (78.7)
Level of education			
≤6 years	196 (74.8)	94 (69.6)	102 (80.3)
>6 years	66 (25.2)	41 (30.4)	25 (19.7)
Marital status			
Married	228 (87.0)	119 (88.1)	109 (85.8)
Others	34 (13.0)	16 (11.9)	18 (14.2)
Smoking status			
Yes	56 (21.4)	30 (22.2)	26 (20.5)
No	206 (78.6)	105 (77.8)	101 (79.5)
Years of hypertension, Mean (SD)	8.6 (±7.2)	7.5 (±6.4)	9.6 (±7.8)*
HADS, Mean (SD)	8.9 (±6.4)	8.6 (±6.1)	9.1 (±6.7)
HADS depression, Mean (SD)	4.5 (±3.5)	4.3 (±3.3)	4.6 (±3.6)
HADS anxiety, Mean (SD)	4.4 (±3.8)	4.3 (±3.6)	4.5 (±4.0)

* Significant at the 0.05 level.

Construct structure

Prior to performing factor analysis, the suitability of the data for such analysis was assessed using the Kaiser-Meyer-Olkin (KMO) method and Bartlett's test of sphericity. The KMO value of 0.80 and the statistical significance of Bartlett's test of sphericity ($\chi 2=941.04$; $P<0.001$) supported that the data were appropriate for exploratory factor analysis. Our factor analysis for the SES6C resulted in a two-factor solution (factor 1, 63.0%; factor 2, 16.8%) that accounted for 79.8% of the variance (Table 2).

Table 2 Corrected item-to-total correlation and factors loading of the SES6C

Items	Mean (SD)	Corrected Item-Total Correlation	Factor 1	Factor 2
1 How confident are you that you can keep the fatigue caused by your disease from interfering with the things you want to do?	6.5 (±2.7)	0.71	0.824	0.240
2 How confident are you that you can keep the physical discomfort or pain of your disease from interfering with he things you want to do?	6.3 (±2.7)	0.72	0.891	0.154
3 How confident are you that you can keep the emotional distress caused by your disease from interfering with the things you want to do?	6.5 (±2.7)	0.71	0.809	0.259
4 How confident are you that you can keep any other symptoms or health problems you have from interfering with the things you want to do?	6.6 (±2.6)	0.77	0.782	0.368
5 How confident are you that you can do the different tasks and activities needed to manage your health condition so as to reduce you need to see a doctor?	6.7 (±2.6)	0.61	0.243	0.911
6 How confident are you that you can Do things other than just taking medication to reduce how much you illness affects your everyday life?	6.8 (±2.5)	0.63	0.272	0.897

Concurrent validity

There were significantly correlations between the SES6C and the HADS total score (r=-0.30; *P*<0.001), HADS depression subscale (r=-0.23; p<0.001), and HADS anxiety subscale (r=-0.29; *P*<0.001) (Table 3). The negative correlation coefficients indicated the greater the level of self-efficacy rated using the SES6C the lower the level of anxiety and depression rated using HDAS.

Table 3 Correlations between self-efficacy and psychological distress

	Self-efficacy	Depression of HADS	Anxiety of HADS	Total score of HADS
Self-efficacy	1	-0.23*	-0.29*	-0.30*
Depression of HADS		1	0.54*	0.86*
Anxiety of HADS			1	0.90*
Total score of HADS				1

* Significant at the 0.001 level.

Internal consistency and test-retest reliability

Cronbach's alpha for the SES6C was 0.88 and the split-half was 0.80, representing an acceptable internal consistency. The item-total correlations ranged from 0.61 to 0.77 (Table 2). Retests for reliability were completed by 127 patients who completed the first questionnaires. The ICC was 0.78 (95% CI, 0.70-0.84) for the SES6C mean score. The ICC of individual item ranged from 0.68 to 0.76. All of these ICCs are in the good to excellent reliability range.

Related factors of self-efficacy

In univariable analysis, a statistically significant increase in self-efficacy was observed with regular exercise, lower HADS total score and better health status. After adjustment for all factors of self-efficacy, the factors significantly associated with self-efficacy were still regular exercise (β=0.659, P<0.01), HADS total score (β=-0.076, P<0.001) and health status (β=-0.530, P<0.001).

2.1.4 Discussion

This study validates the SES6C for use in the field of hypertension. The results of this study showed acceptable validity (two-dimensional structure, concurrent validity: r=-0.30, P<0.001) and high reliability (Cronbach's alpha =0.88, ICC=0.78; 95% CI, 0.70-0.84) of the SES6C.

In our sample, 456 registered patients were invited through telephone, 262 of them completed the interview. The response rate for this study was a little lower than expected, then some characteristics of the responders might be different from the rest of the patients.

Freund and colleagues [49] reported a one-dimensional structure derived from a sample of 244 participants, most of who were suffering from at least two co-occurring chronic conditions. In our sample, the results of factor analysis showed all items split into two factors. Although the potential reasons for the difference in the result are unclear, one possible explanation might be due to the context difference between item 5, 6 and other 4 items. Item 5 and 6 give more

emphasis to behavior attitude, however, the other 4 items emphasize more on psychological attitude. Another potential explanation is that the findings of factor analysis may be sample specific. Further study is needed to validate the structure of the SES6C.

A growing body of evidence suggests that self-efficacy is an important correlate of psychological well-being [63-65], though a causal relation requires further clarification. In our study, the concurrent validity of the SES6C was examined in relation to the HADS. The negative correlations between self-efficacy and depression and anxiety found in this study are consistent with the results in previous studies [63-65], suggesting acceptable concurrent validity and potential use as a research tool.

Self-efficacy has been recognized as a major predictor of self-care behavior for chronic disease management. In a longitudinal study of older women with heart disease, self-efficacy predicted the older women's adopting healthy diet and regular exercise [42]. Our exploratory analysis of factors of self-efficacy indicated those with higher self-efficacy reported better health status, regular exercise, and lower psychological distress. These findings are consistent with previous studies [71, 72]. Self-efficacy has been identified as a likely factor in the exercise behaviors of older men and women [73, 74]. In our study, about half of the participants were aged 65 and over. This may partly explain the significant association between self-efficacy and regular exercise in this study. Another possible explanation might be self-efficacy is behavior specific [71]. Patients might feel very efficacious about getting adequate exercise. Our results also provide further evidence that self-efficacy as a modifiable personal factor should be included either as intervention elements or evaluation measures in the future hypertension control program.

2.1.5 Conclusions

The findings from this validation study indicate that the SES6C is a reliable and valid measure at research and clinical practices. This economic, less burdensome instrument can be used in future hypertension control program for Chinese patients.

2.2. Development of the Chinese Family Support Scale in a sample of Chinese patients with hypertension

2.2.1 Introduction

In the past decades, several family support scales have been developed, most of which were developed in the western countries [57,58]. In China, families are tied closely by blood relationship and the "family first" ideology may motivate family members to help relatives suffering from a disease [59]. This traditional culture is different from that seen in the western countries, which makes it difficult to use these scales with the Chinese population. To know the association between family support, self-care, and outcome of hypertension, it is essential to have a reliable and valid family support scale that can be used for Chinese patients.

To the best of our knowledge, until this study was conducted, there was no validated family support scale for Chinese hypertensive patients for assessing the sense of support perceived from different family members and non-family members. The Chinese Family Support Scale (CFSS) was developed in the present study to provide an instrument that is easy to use and interpret in epidemiological surveys with patients. Further, the objective of this study was to examine the reliability and validity of the CFSS.

2.2.2 Methods

The Chinese Family Support Scale (CFSS)

The CFSS developed in this study is a 12-item measure of how helpful different sources of family support have been to the patients with hypertension. To avoid transient disturbances and reduce recall bias, the CFSS assesses the support that patients with hypertension perceived during the 6 months prior to data collection.

Instrument development

Items in the CFSS were derived from two sources: a review of previous family support scales reported in the literature [57-59] and discussions with public health professionals. At first, family

support resources were classified into four broad categories: family members, relatives, friends, and social organizations, and the items that fell into these categories were listed. Thus, a 17-item pool was built based on the literature review and existing knowledge about family support. These items were evaluated and discussed with the authors and two other public health professionals, during which each item was evaluated for its relevance to the concept of family support (0=not relevant, 1=a little relevant, 2=relevant, 3=very relevant). Following this, an average relevance score was calculated for each item, and items that scored 2 or more were retained in the CFSS. Data saturation was achieved after the second focus group meeting, as there was no recommendation for further inclusion or exclusion of items. Thus, 12 items were selected from the 17-item pool, which appeared in the final tool. The CFSS items and instructions were drafted according to the recommendations regarding cognitive burden, response format and layout, and question order [75, 76]. The twelve items assessed the perceived support from five key support resources: family members (4 items), formal kinship (2 items), informal kinship (3 items), social organizations (2 items), and professional agencies (1 item).

Scoring

The CFSS consisted 12 items rated on a 6-point Likert scale, ranging from "Not available" (0) to "Extremely helpful" (5). Participants had to circle the relevant response for each item. These scores were summed to yield a total CFSS score, which ranged from 0–60, a higher score indicating better family support.

Participants

As mentioned above, we recruited subjects for this study through the community health center. Among these participants, 282 of them completed the first questionnaire. Of the 144 patients conveniently selected for the second questionnaire to assess test-retest reliability, 136 of them

provided complete answers.

Assessment of validity and reliability of the CFSS

A cross-sectional design was used to assess the reliability and validity of the CFSS in a hypertensive population.

Assessment of validity

To assess the concurrent validity of the CFSS, the Hospital Anxiety and Depression Scale (HADS) [66, 67] was used as a criterion measure. Concurrent validity was examined by using the Spearman's correlation coefficient between the CFSS and HADS. To date, no tool has been identified as the most appropriate for measuring family support among patients with a chronic disease. It has been suggested that there is an important correlation between the support by family, peer and social organizations, and psychological well-being [77-79]. The HADS is widely used as a screening measure for both, dimensional and categorical aspects of anxiety and depression.

Construct validity was examined by factor analysis of the internal structure of the test. Prior to performing factor analysis, the suitability of the data for such analysis was assessed using the Kaiser-Meyer-Olkin (KMO>0.6) method and Bartlett's test of sphericity (P<0.05) [80]. Exploratory factor analysis was performed on the items to test the CFSS underlying dimensions of the CFSS. A principal component analysis with varimax rotation was performed to extract the factors, and factors with an eigenvalue ≥1.0 were kept as part of the factor structure. This scale was hypothesized to reflect a three-factor model of family support, assessing the following subscales: kinship (items: 1, 2, 3, 4), nuclear family (items: 5, 6), and social resources (items: 7, 8, 9, 10, 11, 12).

Assessment of reliability

To examine the test-retest reliability of the CFSS, data were re-collected after a two or three week interval from half the patients who were selected from those who had finished the first questionnaire, using convenience sampling. At the end of the first interview, 207 patients were asked if their blood pressure had remained stable for the previous month and if they would be willing to participate in a retest review. When the retest interview quota was complete, the reaming 75 patients were not asked to participate in a retest review. Test-retest reliability was assessed with intra-class correlation coefficient (ICC), where an ICC value of 0.40 represented moderate, 0.60 reflected good, and 0.80 reflected high agreement between the two test situations [69].

The reliability of the scale was examined using Cronbach's alpha for internal consistency and the Guttmann's "split-half" reliability. Internal consistency is considered acceptable if the Cronbach's alpha coefficient is greater than 0.70 [68].

Other measurements

In addition to above-mentioned family support, anxiety and depression measures, demographic information was also collected in the questionnaire including the respondent's age, sex, education level, occupation and marital status (married, widowed, divorced/separated and unmarried) as well as duration since hypertension was diagnosed.

Data management and statistical analysis

Data were double-entered and crosschecked using the statistical software Epi Info version 6. Descriptive statistics such as means, standard deviations, medians, percentages and range were used where appropriate. Values were considered statistically significant at $P<0.05$. All statistical analyses were performed using IBM SPSS, version 19 (SPSS Inc., Chicago, IL, U.S.A.).

2.2.3 Results

Sample characteristics

Table 4 displays characteristics of the study sample. Of the 282 respondents, 72.3% were female, and 70.6% reported to have received below 6 years of education. Mean age was 62.8±7.9 years (range: 35–83 years). Participants reported years of hypertension in the range of 1–41 years, with a mean of 7.9 ±6.7years. The mean HADS score was 8.15±6.38. The full-scale Cronbach's alpha for the HADS was 0.890, was 0.712 for the HADS depression subscale, and 0.773 for the HADS anxiety subscale in our sample. There were no statistically significant differences in age, level of education, anxiety and depression, and duration of hypertension between the test and retest group.

Table 4 Characteristics of the sample

	n (%) N=282
Age	
35-64	158 (56.0)
65-83	124 (44.0)
Mean (SD)	62.8 (±7.9)
Gender	
Male	78 (27.7)
Female	204 (72.3)
Level of education	
≤6 years	199 (70.6)
>6 years	83 (29.4)
Marital status	
Married	250 (88.7)
Others	32 (11.3)
Annual family income	
<50,000 yuan	274 (97.2)
≥50,000 yuan	8 (2.8)
Years of hypertension, Mean (SD)	8.2 (±7.1)
HADS, Mean (SD)	8.15 (±6.38)
HADS depression, Mean (SD)	4.02 (±3.48)
HADS anxiety, Mean (SD)	4.11 (±3.73)

Validity

Concurrent validity

The CFSS was found to have significant correlation with the HADS (Table 5). There were significant correlations between the CFSS and the full-scale HADS scores (r=-0.169; $P<0.01$), and the HADS depression subscale scores (r=-0.266; $P<0.01$). The negative correlation coefficients indicated that higher levels of depression were related to poorer support. No statistically significant correlations were found with the HADS anxiety subscale scores.

Table 5 Spearman correlations of the association between the CFSS and the HADS

CFSS	HADS		
	Anxiety subscale	Depression subscale	Total scores
Kinship	-0.081	-0.141*	-0.119*
Nuclear family	-0.039	-0.212**	-0.133*
Social resources	-0.039	-0.246**	-0.151*
Total scores	-0.049	-0.266**	-0.169**

Note. *p<0.05; **p<0.01

Construct validity

Both the KMO value (0.85) and the statistical significance of the Bartlett's test of sphericity ($\chi 2$=1422.34; P<0.001) supported that the data were appropriate for exploratory factor analysis. The result of the factor analysis for the CFSS has been presented in Table 6. Our factor analysis revealed a three-factor solution that accounted for 62% of the variance as follows: Factor 1, 41.1%; Factor 2, 10.1%; and Factor 3, 11.2%. The CFSS items 7 and 8 were observed to load on factor 1 and factor 3; item 9 was observed to load on factor 2 and factor 3. These factors will henceforth be referred to as subscales.

Table 6 Factor loading of the CFSS items after varimax rotation

Items	Factor 1	Factor 2	Factor 3
1 Your parents	0.835	0.025	0.050
2 Your spouse or partner's parents	0.847	0.038	0.029
3 Your relatives	0.534	0.385	0.323
4 Your spouse or partner's relatives	0.606	0.454	0.315
5 Your spouse or partner	0.157	0.739	-0.059
6 Your children	0.011	0.766	0.122
7 Your friends	0.496	0.398	0.562
8 Your spouse or partner's friends	0.508	0.430	0.538
9 Co workers	0.346	0.505	0.470
10 Community organizations	0.264	0.105	0.727
11 Professional agencies	-0.184	0.275	0.614
12 Other social organizations	0.111	-0.204	0.708

Reliability

Test-retest reliability

Retests for reliability were completed by 136 patients who completed the first questionnaires. The ICC was 0.820 for the CFSS total scores, 0.789 for the CFSS-kinship, 0.662 for the CFSS-nuclear family, and 0.864 for the CFSS-social resources. The ICC of individual item ranged from 0.628 to 0.862. All of these ICC scores indicate good to excellent reliability range.

Internal consistency reliability

The internal consistency of the CFSS was assessed with Cronbach's alpha and was verified after splitting the sample (Guttmann's "split-half"). Cronbach's alpha for the total score was 0.840 and the total score split-half was 0.750, representing an acceptable internal consistency. The alpha was 0.794 for the CFSS-kinship, 0.552 for the CFSS-nuclear family, and 0.798 for the CFSS-social resources. Except for items 5 and 11, the removal of one item resulted in lower alpha values in the case of all other items (Table 7). Replacing item 5 or 11 was found to increase the scale's validity, however, without important differences. The item-total correlation coefficients were above 0.20, which is recommended as the minimum value for including an item in a scale. The results indicated that the scale does not need any modification.

Table 7 Reliability analysis based on the corrected item-total correlation and Cronbach's alpha coefficient if item deleted

Items	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
1 Your parents	0.449	0.832
2 Your spouse or partner's parents	0.463	0.832
3 Your relatives	0.605	0.821
4 Your spouse or partner's relatives	0.710	0.815
5 Spouse or partner	0.377	0.847
6 Your children	0.408	0.839
7 Your friends	0.753	0.810
8 Your spouse or partner's friends	0.769	0.811
9 Co workers	0.660	0.819
10 Community organizations	0.534	0.826
11 Professional agencies	0.308	0.844
12 Other social organizations	0.282	0.843

2.2.4 Discussion

The CFSS was designed to assess the family support perceived by patients with hypertension, using a number of items to cover relevant aspects of support resources and simple response options. This was the first study to show that the 12-item CFSS demonstrated evidence of reliability and validity in measuring the support hypertension patients perceived.

The results of the factor analysis showed that all items loaded onto three different factors. Parents and relatives loaded together on kinship support (Factor 1), spouse and children also loaded together on nuclear family support (Factor 2), and social agencies, friends, and co-workers/neighbors together loaded on social support (Factor 3). Items referring to friends loaded on both, factor 1 and 3, while the item referring to co-workers/neighbors loaded on both, factor 2 and 3. As these sources of support are often not considered as family members, they may have reflected a source of social support. In the current study, parents were loaded together with relatives, and spouse was loaded together with children. This result may be explained by the characteristics of our sample and the culture-specific nature of the Chinese family system [59]. In our sample, nearly 70% of the participants were aged 60 or above, and among these older patients (≥60 years old), more than three-quarters of their parents were dead. These older patients were more likely to live with their adult children, and receive support from their children and spouse, rather than from their parents who were either dead or too old to provide support. Due to this, our findings were similar to those reported from another study carried out with Chinese patients [59], but the findings from the factor analysis may be sample specific. This suggests that future studies with younger patients may show different results.

The concurrent validity of the CFSS was examined in relation to the HADS. Findings demonstrated that the CFSS was negatively correlated with the depression subscale of HADS, as established in the literature, while it was not correlated with the anxiety subscale of HADS. The

correlation between the CFSS and HADS was not strong (0.169 and 0.266), which may be due to the context in which HADS was used. If a similar family support scale was chosen as a test of concurrent validity of the CFSS, the strength of the correlation may be stronger. Numerous studies have demonstrated an association between family support and depression [81-83]. A 23-year follow up study found that higher family support was associated with less depression and it predicted a steeper trajectory of recovery from depression [84]. Findings reported from various studies that invested the effects of social support on anxiety showed inconsistent and conflicting findings [81, 85-88]. The potential reasons for this are unclear. It appears that different types of support (such as instrumental, emotional, and informational) have different effects on individuals [22, 51, 89-93]. The current scale assesses only perceived disease-specific support and does not distinguish between the recognized types of support. Future studies that measure these specific types of support may be needed to explain the results reported in the current study and previous studies.

Overall, the reliability of the total and subscale scores was good. For internal consistency, the CFSS total score exceeded the alpha standard of 0.7 for most scales. A lower alpha coefficient for the CFSS-nuclear family was possibly due to the limited items in this construct. It is recommended that a 2 to 4 week interval between measurements is adequate for the test-retest. In this study, we used an interval of 2 to 3 weeks for this reliability. Patients were selected from those who were considered stable before taking the scale for the second time. The CFSS showed good to excellent reliability, indicating that the CFSS scores are stable over time.

This scale has many potential applications for hypertension control. For instance, it can be utilized to identify specific situations in which patients may have problems with family support. As a research tool, it can provide a valuable outcome variable. For instance, family support can

be assessed over time in response to mental health, self-care behaviors, and hypertension control. It may also be used in studies that seek to understand mediators or moderators of hypertension control. Finally, as a research tool, it can be used to assess the effectiveness of interventions or programs designed to enhance patients' family support.

2.2.5 Conclusions

The findings from this study examined the validity and reliability of the CFSC, indicated that the measurement of family social support in Chinese patients using this scale will provide reliable and valid data for research and clinical practice. It is a promising tool that can be easily incorporated into epidemiological surveys.

3. Chapter 3 Self-care behaviors among patients with hypertension

3.1. How hypertensive patients use home blood pressure monitoring

3.1.1 Introduction

One form of self-care, home blood pressure monitoring (HBPM), is becoming increasingly popular among hypertensive patients [94-96]. Evidence of the utility and benefits of HBPM is continually being reported [97-101]. HBPM can be used to aid in adjusting a therapeutic regimen in response to BP levels and may help individuals adjust their dietary intake, physical activity, and medication use more appropriately [102, 103]. Given the substantial mortality, morbidity, and cost associated with poorly controlled BP, research on HBPM, which is considered a low-cost strategy to improve hypertension control, should be given high priority.

The objectives of this study reported were to (1) explore how and why patients adopt HBPM, and (2) examine the association between HBPM and medication adherence.

3.1.2 Methods

In 2012, we conducted a cross-sectional survey in a rural community in Beijing, China, to obtain data on the self-care behaviors of hypertensive patients. Details of the study have been previously reported. A total of 318 patients participated in this study.

Questionnaire

The questionnaire was administrated verbally to the participants by trained interviewers at the study site. Respondents were categorized as HBPM users if they responded “yes” to the question, “Do you currently use a HBPM to evaluate your BP?” Participants who reported using a publicly available automated BP monitor stationed in stores were considered HBPM nonusers. Other survey questions queried about the frequency of BP measurements taken per week and per month, the type of monitor, where the monitor was obtained from, and their reasons for using an HBPM device.

Anthropometrics

All anthropometric measurements were carried out by trained field workers in the morning based on WHO recommendations [104]. Height was measured to the nearest 0.5 cm and weight, to the nearest 0.1 kg. Body mass index (BMI) was calculated as kilograms per meter squared (kg/m2). BMI was categorized as either normal weight (18.5–23.9 kg/m2), overweight (24.0–27.9kg/m2), obese (≥28.0 kg/m2) according to the Chinese BMI criteria [105].

Medication Use

Adherence to prescribed medication was tested using 5questions. Participants were asked to describe their physician-prescribed dose of antihypertensive medications, and their actual medication intake at home. For example, participants were asked, "How many types of medications were prescribed by your physician?" and "What is the prescribed dosage for each medication?" The prescribed dose was compared with the actual amount of medication intake at home. Participants who reported taking antihypertensive medications as pre-scribed were considered good adherents, and all others were poor adherents.

Data management and statistical analysis

Data were double-entered and crosschecked using the Epi Info version 6 statistical software. Participants with missing values were excluded from the analysis. Descriptive statistics were used to calculate percentages and mean values. Student's t-tests, Pearson's $\chi 2$-tests, and Fisher's exact tests, as appropriate, were used to assess the associations between HBPM users and non-users. We performed an exploratory analysis to deter-mine whether demographic and clinical variables were associated with medication adherence (good or poor). The risk factors explored were age, gender, level of education, marital status, perceived health status, duration of hypertension, HBPM use, and frequency of BP measurement. Binary logistic regression models were used, and all factors were studied in univariable and multivariable analyses. Values were

considered to be statistically significant at p= 0.05. All statistical analyses were performed using IBM SPSS, version 19 (SPSS Inc., Chicago, IL, U.S.A.).

3.1.3 Results

Characteristics of the sample

Demographic and clinical characteristics of the total population (n=318) are shown in Table 8. The majority of participants were female (71.7%), overweight or obese (72.4%), and non-smokers (79.2%). Participants had a mean age of 62.9 (±9.8) years (range, 35–83 years), and the number of years with hypertension ranged from1 to 41, with a mean of 8.2 (±7.1) years. Approximately 25.2% of all participants rated their health as good to very good, and 19.2% reported the presence of diabetes. The average time reported since last BP measurement was 23.3 (±40.1) days.

Table 8 Demographic and clinical characteristics of study population

	HBPM		Total (%)
	Users (%)	Nonusers (%)	
	N=78	N=240	N=318
Age			
35-64	41 (52.6)	136 (56.7)	177 (55.7)
65-83	37 (47.4)	104 (43.3)	141 (44.3)
Mean (SD)	62.8 (±9.8)	63.0 (±9.8)	62.9 (±9.8)
Gender			
Male	17 (21.8)	73 (30.4)	90 (28.3)
Female	61 (78.2)	167 (69.6)	228 (71.7)
Ethnicity			
Han	74 (94.9)	231 (96.2)	305 (95.9)
Others	4 (5.1)	9 (3.8)	13 (4.1)
Annual family income			
<50,000 yuan	76 (97.4)	233 (97.1)	309 (97.2)
≥50,000 yuan	2 (2.6)	7 (2.9)	9 (2.8)
Level of education			
≤6 years	49 (62.8)	173 (72.1)	222 (69.8)
>6 years	29 (37.2)	67 (27.9)	96 (30.2)
Marital status			
Married	70 (89.7)	211 (87.9)	281 (88.4)
Others	8 (10.3)	29 (12.1)	37 (11.6)
BMI			
<24.0 kg/m2	23 (29.4)	69 (28.7)	92 (28.9)
24.0≤BMI<28.0 kg/m2	28 (35.9)	93 (38.7)	121 (38.1)
BMI≥28.0 kg/m2	27 (34.6)	78 (32.5)	105 (33.0)
Current smoker	16 (20.5)	50 (20.8)	66 (20.8)
Self-rated health			
Good to very good	20 (25.6)	60 (25.0)	80 (25.2)
Fair to very poor	58 (74.4)	180 (75.0)	238 (74.8)
Days from last measurement Mean (SD)	15.5 (±20.7)	25.9 (±44.6)*	23.3(±40.1)
Years of hypertension, Mean (SD)	8.1 (±7.0)	8.3 (±7.1)	8.2 (±7.1)
Adherence to medication	49 (62.8)	146 (60.8)	195 (61.3)
Diabetes	19 (24.4)	42 (17.5)	61 (19.2)

* $P < 0.05$

Of the 318participants, 78 (24.5%) reported current use of a HBPM device. Approximately75% reported measuring their BP most frequently in public at a com-munity clinic or drug store. Patients using HBPM reported a shorter length of time since their last measurement than nonusers (P=0.006). No significant differences in ethnicity, annual family income, education lev-el, gender, and medication adherence were found between HBPM users and nonusers; however, patients using HBPM had a higher level of education than nonusers (37.2% vs 27.9%, *P*=0.155) and better medication adherence (62.8% vs 60.8%, *P*=0.790); there were also more women than men in this group (26.8% vs 18.9%, *P* =0.151).

Type and source of home BP monitors

The majority of participants using HBPM (66.2%) reported having a mercury sphygmomanometer, and 33.8% reported using an automatic HBPM device. Most HBPM devices were purchased at a pharmacy or department store, or were provided by a family member (15.6%). A smaller number of participants purchased their monitor via the Internet (5.2%) or obtained their monitor from a friend/colleague (5.2%) (Table 9).

Table 9 Use of home blood pressure monitoring among hypertensive patients

	N (%)
Source of monitor (n=77)	
Pharmacy	34 (44.2)
Departmental store	14 (18.2)
Internet	4 (5.2)
Family members	12 (15.6)
Friends/colleagues	4 (5.2)
Other	9 (11.7)
Reason for practising HBPM (n=78)	
Advised by doctor	4 (5.1)
For monitoring	33 (42.3)
Already had access	38 (48.7)
Other	3 (3.8)
Reason for not practising HBPM (n=226)	
Economic difficulty	38 (16.8)
Do not understand or know how	101 (44.7)
Not important for him	19 (8.4)
Other	68 (30.1)

Reasons for/not using HBPM

Among patients who reported using HBPM, almost half (48.7%) cited their primary reason as personal motivation for monitoring their BP, and 42.3% indicated that they used HBPM because they already had monitors in their home. Only 5.1% were advised to use a HBPM device by their doctor. Among the nonusers, the majority (44.7%) did not understand how to operate the device, 16.8% were unable to afford the device, and 8.4% did not think carrying out home BP measurements was important. Other reasons for not using HBPM included the accessibility of BP monitors at the community clinics and local stores or never having heard of HBPM devices (Table 9).

Frequency of performing BP measurement

Only 6.4% of HBPM users indicated measuring their BP every day or almost every day; however, 58.9%reported measuring their BP at least a few times per month and 10.2% stated rarely using their monitor. Among nonusers, a very small percentage (0.8%) indicated that they measure their BP every day or almost every day at the community clinical center and drug store, 42.2% measure their BP at least a few times per month, and nearly 29.2% rarely measure their BP. Significant difference in the frequency of BP measurement was found ($P<0.001$) between HBPM users and nonusers (Table 10).

Table 10 Frequency of performing blood pressure measurement in HBPM users and nonusers

	HBPM		Total (%)
	Users (%)	Nonusers (%)	
	N=78	N=240	N=318
Every day or almost every day	5 (6.4)	2 (0.8)	7 (2.2)
Once or more per week but not every day	31 (39.7)	36 (15.0)	67 (21.1)
Twice or trice per month	15 (19.2)	52 (21.7)	67 (21.1)
Once per month	19 (24.3)	80 (33.3)	99 (31.1)
A few times per year	5 (6.4)	35 (14.6)	40 (12.6)
Less than twice per year	3 (3.8)	35 (14.6)	38 (11.9)

Factors associated with medication adherence

In the univariable analysis, there was a statistically significant, increased risk of poor medication adherence for those with a shorter duration of hypertension and lower frequency of BP measurements (Table 11). After adjustment for all potential risk factors of poor adherence, duration of hypertension and frequency of BP measurement were significantly associated with adherence. For a duration of hypertension longer than 3 years, the odds of better adherence increased by 2.31 (adjusted OR, 3.31; 95% CI, 1.91–5.72; $P<0.001$). Patients who measured BP twice per month or more also tended to have a better adherence (adjusted OR, 2.33; 95% CI, 1.42–3.83; $P<0.001$).

Table 11 Determinants of medication adherence

	Poor adherence N=123 (%)	Good adherence N= 195 (%)	Non-adjusted OR[a] (CI 95%)	*P*
Age				
35-64	73 (59.3)	104 (53.3)	0.78 (0.50, 1.24)	0.293
65-83	50 (40.7)	91 (46.7)	1	
Gender				
Male	35 (28.5)	55 (28.2)	0.99 (0.60, 1.63)	0.962
Female	88 (71.5)	140 (71.8)	1	
Level of education				
>6 years	43 (35.0)	53 (27.2)	0.69 (0.43, 1.13)	0.142
≤6 years	80 (65.0)	142 (72.8)	1	
Self-rated health				
Good to very good	33 (26.8)	47 (24.1)	0.87 (0.52, 1.45)	0.585
Fair to very poor	90 (73.2)	148 (75.9)	1	
HBPM use				
Yes	29 (23.6)	49 (25.1)	1.09 (0.64, 1.84)	0.754
No	94 (76.4)	146 (74.9)	1	
Years of hypertension				
≥ 3 years	77 (62.6)	165 (84.6)	3.29 (1.93, 5.60)	<0.001
< 3 years	46 (37.4)	30 (15.4)	1	
Frequency of BP measurement				
≥ 2 times per month	39 (31.7)	102 (52.3)	2.36 (1.47, 3.79)	<0.001
< 2 times per month	84 (68.3)	93 (47.7)	1	

[a] Probability modeled is adherence='Good'.

3.1.4 Discussion

Although the significance and importance of HBPM for hypertensive control have been well understood, only a limited number of surveys on the prevalence of HBPM among hypertensive patients are available. Moreover, most of them these studies were carried out in developed countries. The prevalence of HBPM in this study was 24.5%, which was is lower than that in that in developed countries with a prevalence of 43.0%[96] and 74.7% [95]. Previous studies reported that patients with a higher education level, higher income, and younger age were more likely to adopt HBPM [94, 106-108]. Patients in our study lived in the rural areas in china and were typically older (62.9 ±9.8 years) with lower education levels (≤6 years; 69.8%) than those reported in the previous studies [94, 106-108]. Therefore, the lower prevalence of HBPM in this study could be partially due to these participants' socioeconomic status and demographic characteristics. A similar lower prevalence (24.0%) of HBPM was recently reported in Singapore [106].This finding in our study suggests that more health care and social supports should be provided to the hypertensive patients in rural areas in China.

Many of the limitations of traditional BP measurements outside of the home are overcome by HBPM use; however, 75% of our patients measured their BP at a community clinic or store. Respondents' reasons for not using HBPM provide some clues to this phenomenon. The low level of literacy (not knowing how to operate the device) among our study population is one possible explanation. Additionally, community clinics and stores are an accessible resource for measuring BP levels. Although the utilization of BP monitors in community health centers for hypertensive patients has been previously assessed [109], there are little data about the use of monitors stationed in stores. Further investigation is needed to determine whether monitors available in stores are reliable and easily accessible for BP measurement as well as whether these monitors can be used for hypertension management in rural areas.

More than half (66.2%) of our participants who self-monitored their BP levels used a manual BP device, whereas the remaining 33.8% of participants used automatic devices. This is contrary to other findings from developed countries [96, 108]. One possible reason is that automatic electronic BP devices are more expensive for people in rural areas. Another possible reason is that patients believe that manual devices are more reliable than the widely varying automated electronic BP monitors [110]. One study found a proportion of automated BP monitors used in a community inaccurate [111]. Instructions for automated devices regarding calibration, use, and target treatment should be provided to the hypertensive patients [107], although the optimum scheme of using HBPM devices needs further clarification.

Respondents' reasons for using HBPMs imply that most use them for self-monitoring without guidance from medical or nursing staff. Only 5.1% of the HBPM users cited doctor's advice as the reason for adopting HBPM use. Most respondents indicated that they monitored their BP because of personal interest. Self-monitoring of BP should be performed as a partnership between patients and health professionals for maximum benefit [107, 112]. Therefore, physicians in rural areas should consider asking if a hypertensive patient is using HBPM and offer guidance on how patients can best use this self-care strategy to improve or maintain BP control.

Among HBPM users and nonusers, there is considerable variation in the frequency of BP measurements. This finding was similar to that of other studies [96, 108]. The duration of hypertension, control level, and a variety of personal factors probably influence the frequency of BP monitoring [96]. Our results showed that approximately 34.5% of HBPM users reported measuring their BP once per month or not at all at home. We believe that physician consultation and guidance regarding proper HBPM use would increase the frequency of using HBPM to measure BP.

Exploratory analyses of risk factors of poor adherence by multivariable modeling indicated significant associations between the duration of hypertension, frequency of BP measurement, and medication adherence. Specifically, we found a decrease in the risk of poor adherence for patients with longer durations of hypertension and those who more frequently monitored their BP. However, the use of HBPM was not significantly associated with medication adherence. Although data on the effects of HBPM on patients' medication intake are inconsistent, it was noted that all the studies that utilized self-report measures or pharmacy refill data reported negative findings [113]. Our negative finding may be partly attributed to the self-reported method used to measure medication adherence. When HBPM was used with other interventions, including patient counseling and education, its efficacy for adherence was greater [113]. In our study, very few HBPM users were advised to use HBMP by their doctor. To improve the benefits of HBPM, doctors and nurses should be aware of HBPM use among their patients in order to advise and educate them appropriately.

3.1.5 Conclusions

In this study, 24.5% of patients in rural areas were practicing HBPM, and most patients used their monitor without the involvement of a health professional. Further studies are required to establish whether a relation-ship exists between HBPM when used in conjunction with professional guidance for improved hypertension control. Moreover, the role of community health centers and stores with BP monitors as easily accessible resources for BP monitoring in rural areas should be further explored.

3.2. Prevalence of self-care behaviors among hypertensive patients

3.2.1 Introduction

Studies on the prevalence, awareness, and treatment of hypertension in developing countries have been widely reported in recent years [7, 114, 115]. However, studies assessing what activities individuals engage in to help manage their BP, such as medication adherence, BP monitoring, and exercise practices are scarce [116]. Assessing the prevalence of self-care behaviors in hypertension patients is a first step towards a better understanding which factors may influence individuals engage in self-care activity. The objective of this study was to investigate the prevalence rates of self-care behaviors among hypertensive patients.

3.2.2 Methods

Participants

As already mentioned, a total of 318 patients (289 from registered patients, 17 from word-of-mouth, and 12 from the poster) participated in this study.

Instruments

The face-to-face questionnaire was structured using insights from literature reviews and discussions with public health professionals. Questions were divided into 3 domains: socio-demographic characteristics, hypertension related information, and self-care behaviors. Socio-demographic data included data on gender, age, educational level (≤6 and >6 years of education), annual family income (<5 and ≥5 × 10^5Yuan), and marital status. Hypertension-related questions included duration of hypertension, BP measure, body height, body weight, and perceived health status (very good, good, fair, poor, and very poor). Participants who reported a good or very good perceived health status were assigned a score of 1; all the others were assigned a score of 0. Six self-care behaviors were measured on the basis of the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure [10]. The self-care behaviors included adherence to medication schedule, low-salt diet intake, smoking

habit, alcohol consumption, regular BP measurements, and physical exercise.

Anthropometric

All measurements were conducted in the morning by trained field workers as per the WHO recommendations [104]. Height was measured to the nearest 0.5 cm and weight, to the nearest 0.1 kg. Body mass index (BMI) was calculated from the weight and height.BMI (kg/m2) was categorized as normal weight (18.5≤BMI<24), overweight (24≤BMI<28), and obese (BMI≥28) using the Chinese criteria [105].

Blood pressure measurement

BP was measured in a sitting position after at least 5 minutes of rest by using a standardized digital BP measuring machine (Omron Digital HEM-907). The second and third BP readings were averaged.

Adherence to medication regimen

The subjects' adherence to prescribed medication was tested using 5 items. Physicians were asked about the types of antihypertensive medications and doses prescribed to the participants, and the participants were asked about the actual usage of the medications at home. For example, the questions presented were "How many kinds of agents were prescribed by your physician?" and "What is the prescribed dosage for each agent per time?" The prescribed usage was compared with the actual usage at home. Participants who took their antihypertensive medications as prescribed by the physician were considered adherent; all others were considered non-adherent.

Other questionnaire parameters

Participants who reported avoiding salt intake while cooking and eating were considered to be adherent to a low-salt diet. Participants who did not smoke on a regular basis were considered to

be non-smokers. For alcohol intake, participants who reported no alcohol consumption were considered to be abstainers. For regular BP measurements, patients who reported measuring BP 2 or more times per month (at home, in the community clinical center, or in other settings) were considered to be adherent. Participants who reported performing physical exercise for 4 or more days per week were considered as adherent to the physical exercise recommendation; all others were considered non-adherent.

3.2.3 Results

Characteristics of the sample

Demographic and hypertension-related characteristics of the sample (n=318) are shown in Table 12. The average age of the participants was 62.9 (±9.8) years (range=35–83 years). Participants reported having hypertension for an average of 8.2 (±7.1) years (range, 1–41 years). In this sample, 12.9% of the participants had their BP under control. One-fourth rated their health as good to very good. No significant differences were found for age, education level, marital status, and other characteristics between the registered patients and other participants that were recruited through the poster and word of mouth, though registered patients had a lower percentage of diabetes than other participants (18.0 vs 31.0%, P =0.09) and a lower percentage of family history of hypertension (29.4 vs 44.8%, P =0.08).

Table 12 Characteristics of respondents in a rural hypertension population in Beijing, China

	Gender		Patients Sources		Total(%)
	Male(%)	Female(%)	Registered patients(%)	Other patients(%)	
	N=90	N=228	N=289	N=29	N=318
Age					
35-64	34 (37.8)	143 (62.7)	158 (54.7)	19 (65.5)	177 (55.7)
65-83	56 (62.2)	85 (37.3)	131 (45.3)	10 (34.5)	141 (44.3)
Mean (SD)	66.1 (±10.4)	61.7 (±9.3)	63.2 (±9.8)	60.7 (±9.8)	62.9 (±9.8)
Level of education					
≤6 years	61 (67.8)	161 (70.6)	204 (70.6)	18 (62.1)	222 (69.8)
>6 years	29 (32.2)	67 (29.4)	85 (29.4)	11(37.9)	96 (30.2)
Marital status					
Married	80 (88.9)	201 (88.2)	257 (88.9)	24 (82.8)	281 (88.4)
Others	10 (11.1)	27 (11.8)	32 (11.1)	5 (17.2)	37 (11.6)
Annual Family Income					
<50,000 yuan	86 (95.6)	223 (97.8)	281 (97.2)	28 (96.5)	309 (97.2)
≥50,000 yuan	4 (4.2)	5 (2.2)	8 (2.8)	1 (3.5)	9 (2.8)
BMI					
Normal weight (18.5≤BMI<24.0)	36 (40.0)	56 (24.5)	85 (29.4)	7 (24.1)	92 (28.9)
Overweight (24.0≤BMI<28.0)	34 (37.8)	87 (38.2)	111 (38.4)	10 (34.5)	121 (38.1)
Obese (BMI≥28.0)	20 (22.2)	85 (37.3)	93 (32.2)	12 (41.4)	105 (33.0)
Self-rated health					
Good to very good	26 (28.9)	54 (23.7)	75 (26.0)	5 (17.2)	79 (24.8)
Fair to very poor	64 (71.1)	174 (76.3)	214 (74.0)	24 (82.8)	239 (75.2)
Diabetes status					
Yes	11 (12.2)	50 (21.9)	52 (18.0)	9 (31.0)	61 (19.2)
No	79 (87.8)	178 (78.1)	237 (82.0)	20 (69.0)	257 (80.8)
Family history of hypertension	19 (21.1)	79 (34.7)	85 (29.4)	13 (44.8)	98 (30.8)
Control rate of BP	14 (15.6)	27 (11.8)	37 (12.8)	4 (13.8)	41 (12.9)
Years of hypertension, Mean (SD)	8.0 (±7.3)	8.3 (±7.0)	8.2 (±6.9)	8.2 (±8.7)	8.2 (±7.1)

All values are exact numbers/percentages except where noted.
The t-test is used when the dependent variable is a continuous variable.
Chi-square and Fisher Exact tests were used for categorical variables.

Prevalence rates of hypertension self-care behaviors

Approximately 81.1% of the participants reported that they avoided salt intake while cooking and eating. Approximately 79.2% of participants were non-smokers, and 77.9% of the participants abstained from drinking any alcohol. More than half of the sample (61.3%) reported being adherent to their anti hypertension medication protocols, and 51.9% of the subjects were engaging in physical exercise on most days of the week; additionally, 44.3% of the participants reported measuring BP twice or more per month either at home, at a community clinical center, or at some other setting.

Individual factors related to self-care

Using bivariate analyses, adherers and non-adherers in each of the hypertension self-care behaviors were compared using the demographic and health-related characteristics (see Table 13). Further results of multivariate analyses are shown in Table 14. Participants that maintained their medication schedule were more likely to have hypertension for a longer duration (OR 3.44, 95% CI 1.99–5.97). Older participants (≥65 years) were more likely to monitor BP (OR 1.80, 95% CI 1.08–2.99). Non-adherers of physical exercise were more likely to be men, though the difference was not significant (OR 0.60, 95% CI 0.36–1.01). Participants who were non-smokers or adhered to a low-salt diet were more likely to be older and women as compared to the non-adherent participants. In addition, participants who abstained from alcohol were more likely to be women.

Table 13 Differences between adherers and nonadherers to self-care behaviors in a rural hypertension population in Beijing, China

	Medication adherence		Regular BP measurement		Low-salt diet	
	Adherers (n=195)	Non-adherers (n=123)	Adherers (n=141)	Non-adherers (n=177)	Adherers (n=258)	Non-adherers (n=60)
Age mean, SD	63.4(9.7)	62.1(9.8)	64.9(8.9)	61.4(10.2)	63.3(9.4)	59.7(10.9)
Education mean, SD	4.5(3.65)	5.2(3.6)	4.6(3.6)	5.0(3.7)	4.8(3.7)	4.8(3.3)
Duration of Hypertension Mean, SD	8.3(6.3)	8.1(8.2)	8.7(7.3)	7.9(6.9)	8.4(6.8)	7.3(8.4)
BMI mean, SD	26.4(3.7)	26.4(3.9)	26.0(3.8)	26.7(3.7)	26.6(3.7)	25.7(4.1)
Gender						
Male	55(28.2)	35(28.5)	41(29.1)	49(27.7)	64(24.8)	26(43.3) *
Female	140(71.8)	88(71.5)	100(70.1)	128(72.3)	194(75.2)	34(56.7)
Marital status						
Married	170(87.2)	111(90.2)	120(85.1)	161(91.0)	229(88.8)	52(86.7)
Others	25(12.8)	12(9.8)	21(14.9)	16(9.0)	29(11.2)	8(13.3)
Self-rated health						
Good to very good	47(24.1)	32(26.1)	36(25.5)	43(24.3)	66(25.6)	13(21.7)
Fair to very poor	148(75.9)	91(73.9)	105(74.5)	134(75.7)	192(74.4)	47(78.3)
Diabetes status						
No	159(81.5)	98(79.7)	119(84.4)	138(78.0)	206(79.8)	51(85.0)
Yes	36(18.5)	25(20.3)	22(15.6)	39(22.0)	52(20.2)	9(15.0)
	Physical exercise		Non-smoking		Alcohol abstinence	
	Adherers (n=165)	Non-adherers (n=153)	Adherers (n=252)	Non-adherers (n=66)	Adherers (n=248)	Non-adherers (n=70)
Age mean, SD	62.8(9.9)	63.1(9.7)	62.7(9.6)	63.5(10.7)	62.4(9.5)	64.8(10.5)
Education mean, SD	4.9(3.7)	4.7(3.6)	4.7(3.6)	5.1(3.8)	4.9(3.6)	4.6(3.9)
Duration of Hypertension Mean, SD	7.3(6.5)	9.2(7.5)	8.4(6.9)	7.7(7.8)	8.3(7.0)	7.8(7.2)
BMI mean, SD	26.5(3.7)	26.3(3.8)	26.7(3.7)	25.1(3.8)	26.6(3.7)	25.8(4.0)
Gender						

Male	39(23.6)	51(33.3)	41(16.3)	49(74.2) *	46(18.6)	44(62.9) *
Female	126(76.4)	102(66.7)	211(83.7)	17(25.8)	202(81.4)	26(37.1)
Marital status						
Married	144(87.3)	137(89.5)	223(88.5)	58(87.9)	221(89.1)	60(85.7)
Others	21(12.7)	16(10.5)	29(11.5)	8(12.1)	27(10.9)	10(14.3)
Self-rated health						
Good to very good	42(25.5)	37(24.2)	62(24.6)	17(25.7)	57(23.0)	22(31.4)
Fair to very poor	123(74.5)	116(75.2)	190(75.4)	49(74.3)	191(77.0)	48(68.6)
Diabetes status						
No	128(77.6)	129(84.3)	201(79.8)	56(84.9)	199(80.2)	58(82.9)
Yes	37(22.4)	24(15.7)	51(20.2)	10(15.1)	49(19.8)	12(17.1)

All values are exact numbers/percentages except where noted.
The t-test is used when the dependent variable is a continuous variable.
Chi-square and Fisher Exact tests were used for categorical variables.
* Significant at $p < 0.05$.

Table 14 Associations between demographic and health characteristics and hypertension self-care behaviors in a rural hypertension population in Beijing, China

	Medication adherence OR (95% CI)	Regular BP measurement OR (95% CI)	Low-salt diet adherence OR (95% CI)	Physical exercise OR (95% CI)	Non-smoking OR (95% CI)	Alcohol abstinence OR (95% CI)
Age						
>= 65	1.11 (0.65,1.89)	1.80 (1.08,2.99)	3.88 (1.79,8.48)	1.25 (0.75,2.07)	2.29 (1.05,4.98)	1.26 (0.65,2.46)
<65	1.00	1.00	1.00	1.00	1.00	1.00
Gender						
Male	0.95 (0.55,1.65)	0.89 (0.53,1.51)	0.34 (0.17,0.72)	0.60 (0.36,1.01)	0.05 (0.03,0.11)	0.13 (0.070,0.24)
Female	1.00	1.00	1.00	1.00	1.00	1.00
Marital status						
Married	0.75 (0.35,1.61)	0.63 (0.31,1.28)	1.46 (0.56,3.85)	0.80 (0.39,1.64)	1.16 (0.40,3.35)	1.38 (0.58,3.28)
Others	1.00	1.00	1.00	1.00	1.00	1.00
Education						
≤6 years	1.32 (0.76,2.29)	1.28 (0.75,2.21)	0.51 (0.23,1.09)	0.74 (0.44,1.26)	0.79 (0.36,1.71)	0.78 (0.38,1.60)
>6 years	1.00	1.00	1.00	1.00	1.00	1.00
Self-rated health						
Good to very good	0.80 (0.46,1.39)	0.92 (0.54,1,56)	1.63 (0.72,3.69)	1.11 (0.66,1.88)	1.15 (0.54,2.46)	0.63 (0.33,1.21)
Fair to very poor	1.00	1.00	1.00	1.00	1.00	1.00
Diabetes status						
No	1.40 (0.76,2.57)	1.56 (0.85,2.86)	0.91 (0.38,2.16)	0.64 (0.35,1.15)	1.02 (0.41,2.51)	1.26 (0.57,2.78)
Yes	1.00	1.00	1.00	1.00	1.00	1.00
Duration of Hypertension						
≥3years	3.44 (1.99,5.97)	1.24 (0.72,2.14)	1.92 (0.93,3.98)	0.69 (0.40,1.18)	1.52 (0.70,3.28)	0.97 (0.48,1.96)
<3 years	1.00	1.00	1.00	1.00	1.00	1.00
BMI						
BMI≥28.0	0.99 (0.53,1.87)	0.94 (0.52,1.71)	1.36 (0.55,3.35)	1.03 (0.57,1.86)	1.70 (0.74,3.90)	1.52 (0.69,3.34)
24.0≤BMI<28.0	0.75 (0.41,1.35)	0.85 (0.48,1.49)	0.81 (0.36,1.80)	0.99 (0.56,1.73)	2.33 (1.05,5.17)	1.03 (0.51,2.07)
18.5≤BMI<24.0	1.00	1.00	1.00	1.00	1.00	1.00

For each self-care behavior, probability modeled is adherent='Yes'.

In our sample, 67 (21.1%) of the patients reported only using antihypertensive medicine when they thought their BP was high, and 56 (17.6%) patients reported not using any antihypertensive medicine. Of the 56 patients who did not use antihypertensive drugs, 25 (44.6%) of them thought their BP was not high and there was no need for treatment; and 20 (35.7%) participants did not recognize the importance of medicine for BP control.

In this study, 80.2% of the participants reported not monitoring BP at home and nearly 60% of these patients did not understand or know how to measure BP. Of the patients who self-monitored at home, 68.3% used a manual BP device, and 31.7% used an automated electronic BP device. Of the participants, 258(81.1%) reported avoiding salt intake while cooking and eating; 132 (51.2%) reported using a spoon while cooking; and 125 (48.4%) reported self-assessment of salt content while cooking. Among the non-adherers, about 66%reported that they or their family members like high salt food.

For physical exercise, 51.9%of the participants engaged in physical exercise on most days of the week. Slow walking (77.8%) was the most common physical activity in our sample.

3.2.4 Discussion

In this study, we aimed at determining the prevalence of self-care behaviors among hypertensive patients. In our sample, we found that the prevalence rates of recommended hypertension self-care activities were greater than 70% for behaviors related to smoking and alcohol consumption, rates were much lower for self-care activities relating to medication adherence, regular BP monitoring, and physical exercise.

Adherence to medication

It has been reported that antihypertensive treatment targeted to reduce systolic BP produced a 38% reduction in strokes [117]. In our sample, 61.3% of the participants reported taking antihypertensive medications as prescribed, which is higher than the values reported in previous

studies in China [6, 118-120]. However, the difference in study design, parameters measured, and populations often made comparisons difficult. Contrary to the reported high adherence to medication in this study, the control rate of BP was only12.9%. There are a number of possible explanations for this discrepancy. One potential explanation is that patients may be likely to report desirable behavior, and the adherence to medication was probably inflated in our study. Another potential explanation is that the treatment regimens that the patients received may not have been sufficient to maintain BP in the normal range. Given the high rate (38.7%) of poor adherence to medication and that 87.1%of the subjects had uncontrolled BP, there is a critical need for enhanced treatment programs for this population. We believe that health education on the importance of adherence to medication and effective communication between patients and physicians should be focused upon for further hypertension control in this population.

Access to BP monitoring

This survey found that 37.5% of the participants monitored BP at the community health clinic or pharmacy at least twice a month. Participants who reported monitoring BP at the community health clinic or pharmacy were mostly those who lived near these facilities. Further environmental interventions providing access to BP measurement devices may play an important role in the control of BP in rural communities.

Awareness and behavior relative to salt reduction

Almost80% of consumed salt is added during cooking or as a preservative of foods in rural areas of China [120, 121]. Recent surveys showed that the average salt intake is more than 10g/day in rural areas [120, 121].In our survey, it was difficult to assess the salt intake of the patients. Nonetheless, we found that in our sample, 81.1% of participants reported avoiding salt while cooking and eating. We noted that 51.2% of them added salt with a spoon, and 48.4%of them

reported adding salt as per their own preference while cooking. These findings imply that future intervention should include education for patients on how to restrict salt intake and perhaps, introduce the use of a specific salt spoon.

Physical exercise

In this sample, more than half of the participants reported participating in physical exercise. There is an ample amount of research that provides clear evidence on the positive effects of exercise on the chronic adaptation to BP. The ways by which physical activity can reduce BP may be partially explained by a decrease in systemic vascular resistance in which the autonomic nervous system and rennin-angiotensin system are most likely the underlying regulatory mechanisms [122]. However, the mechanisms related to the anti-hypertensive benefits of exercise are not completely understood. In addition to these physiological mechanisms that respond to exercise, loss of body weight by energy expenditure during exercise causes a reduction in BP [123].Few people were aware of their weight problem, even though 70% of participants were overweight or obese in our sample. The patients in rural areas may not be aware that their weight status influences their BP [124]. Recent research indicates that overweight or obesity in older adults may be overlooked by health care providers, and there was a need to increase the level of communication with patients about their weight status [20, 125].

Smoking and alcohol consumption

In this study, the rates of smoking and alcohol consumption were both higher in men than in women. The prevalence of smoking in older patients (those aged ≥65 years) is higher than that in people aged <65 years. These findings are consistent with a study reported by Li and colleagues [126].Multiple studies have shown that quitting smoking has proven health benefits, even at an old age [127, 128].In our sample, nearly 70% of the subjects had less than 6 years of education.

Considering that people with a lower education level have greater difficulty in quitting smoking, providing more education on the ill-effects of smoking and initiating other attempts for smoking cessation in may be required for hypertensive patients. Heavy alcohol intake has also been associated with the development of hypertension [129]. Thus, heavy alcohol users should be closely evaluated for signs of hypertension. It has been observed that moderate drinking can reduce the risk for coronary artery disease [130]. However, it is still unclear whether alcohol consumption is appropriate for those with hypertension and under medication [20].

Individual factors associated with self-care behaviors

The results from our analyses show that older age and female gender with a longer duration of hypertension were associated with better self-care behaviors. These findings were consistent with previous research [27, 120]. It is possible that patients who have endured hypertension longer have learned more about coping with hypertension. Social and cultural factors may discourage women from smoking and alcohol intake [131]. Thus, in order to promote self-care behavior, male patients who have been recently diagnosed with hypertension should be carefully evaluated.

3.2.5 Conclusions

Better adherence to self-care behaviors is one effective way to control hypertension. Although more than 70% of our participants abstained from smoking and alcohol consumption, the rate of adherence to medication, regular BP monitoring, and physical exercise still needs improvement. Patients with shorter history of hypertension, younger and being male have lower self-care behaviors. Primary care providers and public health practitioners should pay more attention to patients recently diagnosed with hypertension and younger, male patients.

4. Chapter 4 The associations of depression, anxiety, self-efficacy, and family social support with hypertension self-care

4.1. Introduction

To better understand self-care behaviors among hypertensive patients, we further analyzed the data on self-care, family social support, depression, anxiety, and self-efficacy, which were collected during the field survey. The objective of this study was to examine relationships among psychosocial factors and specific self-care behaviors among hypertensive patients.

4.2. Methods

Study population

We analyzed data from surveys of 318 hypertensive patients residing in a rural community in Beijing.

Study measures

Socio-demographic characteristics were determined through self-report, which included sex, age, educational level (≤6 or>6 years of education), annual family income (<5 or ≥5×10^5Yuan), and marital status. Height and weight were measured in the morning by trained field workers as per the World Health Organization recommendations [104]. Body mass index (BMI) was calculated from the weight and height. BP was measured in a sitting position after at least 5 minutes of rest using a standardized digital BP measuring device (Omron Digital HEM-907). Other health variables (diabetes status, and years of hypertension diagnosis) were also collected.

Hypertension self-care behaviors (medication adherence, regular BP measurement, physical exercise, alcohol abstinence, non-smoking, and low-salt diet adherence) were assessed with face-to-face questionnaires that collected self-reported data.

Family social support for hypertension treatment was assessed using the validated Chinese Family Support Scale that consists of 12 items rated on a 6-point Likert scale ranging from “not available(0)” to “extremely helpful(5)” . Exploratory factor analysis revealed a three-factor

solution accounting for 62% of the total variance. The three underlying sub-scale dimensions were kinship, nuclear family, and social resources. The Chinese Family Support Scale had an acceptable internal consistency (Cronbach's alpha = 0.84) and test-retest reliability (ICC = 0.82).

The Hospital Anxiety and Depression Scale, which is a validated screening tool for symptom severity in cases with anxiety and depression [66], was used to assess levels of psychological distress. This scale contains an anxiety subscale and depression subscale; both subscales contain7 items each of which are rated 0–3, so the total possible scores range from 0–21 for anxiety and 0–21 for depression. A score between 0 and 8 for either subscale was regarded as within the normal range, a score between 9 and 10 indicated the presence of the respective state, and a score of 11 or higher suggested the presence of a mood disorder.

A validated Chinese version of the Self-Efficacy for Managing Chronic Disease 6-Item Scale was used to measure patient confidence in performing certain activities.

Statistical analysis

Descriptive statistics were generated with sample size, percentage, and mean. Tests such as chi-square and t-tests were used where appropriate. Pearson's correlation analysis was used to explore relationships among family social support, depression, anxiety, and self-efficacy.

The self-care behaviors (medication adherence, regular BP measurement, physical exercise, alcohol abstinence, non-smoking, and low-salt diet adherence) were the dependent variables and were treated as binary variables ("Yes"= adherent or "No"). Each self-care behavior was separately analyzed using logistic regression models.

The principal independent variables (family social support, depression, anxiety, and self-efficacy), which were measured with Likert scales, were treated as continuous variables. Other independent variables were chosen on the basis of previously analyzed results and were limited

in number by our sample size; these included age, sex, diabetes status, and years of hypertension diagnosis.

In model 1s, the associations between self-care behaviors and family social support, depression, anxiety, and self-efficacy were assessed in separate models after adjusting for demographic and health variables. In the multivariate models (models 2 and 3), the condition index was used to assess the degree of collinearity. A condition index of 30 to 100 indicates moderate to strong collinearity. All statistical analyses were performed using IBM SPSS version 19 (SPSS Inc., Chicago, IL, USA).The significance threshold for all tests was 0.05.

4.3. Results

Information about demographic and hypertension variables is presented in Table 15. For medically-related self-care behaviors, 61.3% of participants reported taking medication as prescribed, and 44.3% reported measuring BP regularly. Adherence to lifestyle-related self-care behaviors was reported in 51.9%–81.1% of participants (Table 16).

Table 15 Sample Characteristics (n = 318)

	N (%) or mean (SD)
Gender	
Female	228 (71.7)
Age	62.9 (±9.8)
Level of education	
≤6 years	222 (69.8)
Annual family income	
$<5\times10^5$Yuan	309 (97.2)
Married or partnered	
Yes	281 (88.4)
BMI	
Normal weight (18.5≤BMI<24.0)	92 (28.9)
Overweight (24.0≤BMI<28.0)	121 (38.1)
Obese (BMI≥28.0)	105 (33.0)
Diabetes	
Yes	61 (19.2)
Years since hypertension diagnosis	8.2 (±7.1)
Control rate of hypertension	42 (12.9)

Table 16 Self-care behavior, family social support, and Psychological factors

Measurements	N (%) or mean (SD)
self-care behavior	
1 Medication adherence (take medication as prescribed)	195 (61.3)
2 Regular BP measurement (measure BP two or more times per month)	141 (44.3)
3 Physical exercise (participants who reported performing physical exercise for 4 or more days per week)	165 (51.9)
4 Alcohol abstinence (participants who reported no alcohol consumption were considered to be abstainers.)	248 (77.9)
5 Non-smoking (participants who did not smoke on a regular basis)	252 (79.2)
6 Low-salt diet adherence (participants who reported avoiding salt intake while cooking and eating)	258 (81.1)
Family social support	
1 Your parents	0.55 (0.50)
2 Your spouse or partner's parents	0.46 (0.93)
3 Your relatives	1.68 (1.13)
4 Your spouse or partner's relatives	1.42 (1.07)
5 Spouse or partner	2.98 (1.74)
6 Your adult children	3.25 (1.54)
7 Your friends	1.56 (1.16)
8 Your spouse or partner's friends	1.33 (1.06)
9 Co workers	1.77 (1.04)
10 Community organizations	1.61 (1.13)
11 Professional agencies	2.85 (1.26)
12 Other social organizations	1.39 (1.08)
Total score	20.91 (8.72)
Anxiety and depression	
HADS-A score	4.30 (3.98)
HADS-D score	4.07 (3.43)
HADS-A≥8	71 (22.3)
HADS-D≥8	49 (15.4)
Co morbidity (depression≥8 and anxiety≥8)	24 (7.5)
Self-efficacy	
Total score	42.1(13.3)

HADS: Hospital Anxiety and Depression Scale; HADS-A: HADS-anxiety; HADS-D: HADS-depression.

The perceived level of family social support for hypertension treatment from different support sources varied from 0.46 to 3.25 (highest level of support = 5) on the Likert scale, and the mean total score was 20.91 (maximum = 60). Adult children were identified as the primary support source (mean =3.25 out of 5) followed by spouse/partner (mean = 2.98 out of 5) and professional agencies (mean = 2.85 out of 5). No statistically significant differences between total measures of family social support and the demographic variables age, sex, marriage status, education, and years since diagnosis were found.

According to the scores of the Hospital Anxiety and Depression Scale, 22.3%, 15.4%, and 7.5% of participants reported symptoms of anxiety, depression, and both anxiety and depression, respectively. Analysis into the relationship between depression/anxiety and demographic variables revealed that patients who were not married or partnered had a higher prevalence of depression (13.5%, married or partnered vs.29.7%, not married or partnered; $\chi 2= 5.58$, $P=0.01$). Age, sex, education, and years since diagnosis did not achieve statistical significance.

Patients with hypertension had moderately positive levels of confidence performing certain activities (42.1 ±13.3 out of 60). Patients with higher levels of education (>6 years) showed a higher self-efficacy than those with lower levels of education (≤6 years) ($t = 2.35$, $P = 0.02$). No statistically significant difference was found between self-efficacy and age, sex, marital status, or years since diagnosis.

Family social support, depression, anxiety, and self-efficacy

Family social support was negatively correlated with depression ($r = -0.26$, $P < 0.001$), but not significantly correlated with anxiety ($r = -0.11$, $P > 0.05$). In addition, self-efficacy was negatively correlated with depression ($r = -0.33$, $P < 0.001$) and anxiety ($r = -0.31$, $P < 0.001$). Anxiety was positively correlated with depression ($r = 0.55$, $P < 0.001$) (Table 17).

Table 17 Relationships among family social support, depression, anxiety, and self-efficacy

	Family social support	Depression	Anxiety	Self-efficacy
Family social support	1	-0.26*	-0.11	0.09
Depression		1	0.55*	-0.33*
Anxiety			1	-0.31*
Self-efficacy				1

*Significant at the 0.001 level.

Association between family social support, depression, anxiety, self-efficacy, and performance of self-care behaviors

The less than 30 condition index in models 2 (24.0) and 3 (22.8) suggest that the degree of collinearity was acceptable. In models 1s and 2, psychological factors were not significantly associated with any self-care behaviors (Table 18). After removing psychological factors in model 3 and adjusting for demographic and health variables, each 10-unit increase in family social support was associated with an increased odds of 1.39 (95% CI 1.03–1.87) and 1.33 (95% CI 1.02–1.74) for medication adherence and measuring BP regularly, respectively. Moreover, a10-unit increase in self-efficacy was related to an increased odds of 1.25 (95% CI 1.04–1.49) for performing regular physical exercise. No multiplicative interaction was found for family social support on self-efficacy when added to model 3.

Table 18 Associations of family social support, depression, anxiety, and self-efficacy with hypertension self-care behavior adherence

	Medication adherence OR (95% CI)	Regular BP measurement OR (95% CI)	Physical exercise OR (95% CI)	Alcohol abstinence OR (95% CI)	Non-smoking OR (95% CI)	Low-salt diet adherence OR (95% CI)
【Model 1s】						
Family social support	1.39 (1.04-1.87)*	1.34 (1.03-1.75)*	1.30 (1.00-1.70)	0.93 (0.67-1.28)	1.15 (0.80-1.65)	1.43 (1.00-2.05)
Depression	1.11 (0.57-2.12)	1.32 (0.70-2.44)	0.63 (0.34-1.18)	0.67 (0.31-1.45)	0.59 (0.25-1.38)	0.60 (0.29-1.26)
Anxiety	0.79 (0.34-1.39)	0.96 (0.56-1.67)	0.84 (0.49-1.45)	1.62 (0.75-3.47)	1.51 (0.66-3.48)	0.72 (0.37-1.40)
Self-efficacy	0.99 (0.84-1.17)	1.08 (0.92-1.27)	1.29 (1.09-1.51)*	0.90 (0.73-1.11)	0.95 (0.76-1.20)	1.21 (1.00-1.48)
【Model 2】						
Family social support	1.42 (1.05-1.92)*	1.39 (1.06-1.83)*	1.25 (0.95-1.64)	0.91 (0.65-1.26)	1.12 (0.77-1.63)	1.37 (0.94-1.98)
Depression	1.41 (0.65-3.03)	2.04 (0.98-4.16)	0.80 (0.39-1.64)	0.51 (0.21-1.21)	0.44 (0.16-1.17)	0.74 (0.317-1.73)
Anxiety	0.92 (0.48-1.75)	0.76 (0.40-1.43)	1.05 (0.56-1.92)	1.60 (0.68-3.77)	1.87 (0.70-4.98)	0.87 (0.41-1.88)
Self-efficacy	1.01 (0.84-1.22)	1.07 (0.89-1.28)	1.24 (1.03-1.48)*	0.92 (0.73-1.16)	0.96 (0.75-1.24)	1.11 (0.89-1.38)
【Model 3】						
Family social support	1.39 (1.03-1.87)*	1.33 (1.02-1.74)*	1.26 (0.97-1.65)	0.94 (0.68-1.31)	1.16 (0.81-1.68)	1.39 (0.97-2.0)
Self-efficacy	1.00 (0.84-1.20)	1.05 (0.88-1.25)	1.25 (1.04-1.49)*	0.92 (0.75-1.15)	0.96 (0.75-1.23)	1.13 (0.92-1.40)

*CI dose not cross 1

Model 1s Family social support: adjusted for demographics (gender and age), and health factors (diabetes status and years of hypertension diagnosis), + social support (0-60 scale, per 10 units)

Model 1s Depression: adjusted for demographics (gender and age), and health factors (diabetes status and years of hypertension diagnosis), +depressive symptoms (1: HADS-D≥8; 0: HADS-D<8; Reference group: 0)

Model 1s Anxiety: adjusted for demographics (gender and age), and health factors (diabetes status and years of hypertension diagnosis), +anxious symptoms (1: HADS-A≥8; 0: HADS-A<8; Reference group: 0)

Model 1s Self-efficacy: adjusted for demographics (gender and age), and health factors (diabetes status and years of hypertension diagnosis), +self-efficacy (0-60 scale, per 10 units)

Model 2 adjusted for demographics (gender and age), and health factors (diabetes status and years of hypertension diagnosis) + depressive symptoms (1: HADS-D≥8; 0: HADS-D<8; Reference group: 0) +anxious symptoms (1: HADS-A≥8; 0: HADS-A<8; Reference group: 0) +self-efficacy (0-60 scale, per 10 units)

Model 3 adjusted for demographics (gender and age), and health factors (diabetes status and years of hypertension diagnosis) +self-efficacy (0-60 scale, per 10 units)

For each self-care behavior, probability modeled is adherent='Yes'.

4.4. Discussion

In this study, we aimed to examine the relationships of family social support, depression, anxiety, and self-efficacy with a wide variety of self-care behaviors in our sample of hypertensive patient. In all 3 adjusted models, family social support was positively associated with taking medication and monitoring BP, and self-efficacy was positively associated with performing physical exercise.

Family social support has been linked to many benefits of both physical and mental health [23, 132]. Patients in our sample reported that their adult children and spouse or partner were the main source of support. These findings were similar to those from other previous studies conducted in China [133, 134]. Family serves as the main source of support to the elderly with the spouse and adult children playing central roles. Moreover, patients perceived receiving little support from members outside of their family, except from professional agencies. This may be due to an insufficient number of formal support services that are available to the elderly, which cause patients to have to rely on their children or spouse for informational, instrumental, and emotional supports [133]. In this study, 2 self-care behaviors (physical exercise, and following a low-salt diet) showed associations with family social support, which bordered statistical significance. Family social support might be associated with these self-care behaviors, but statistical significance was not detected, possibly owing to our limited sample size [23]. Moreover, different types of support may have different effects on individuals [90, 91]. The scale used in this study only assessed perceived levels of disease-specific support and could not distinguish between the recognized types of support.

Compared to healthy participants in a previous study [135], we found an increased prevalence of depression and anxiety. Psychological distress has been suggested to impair self-care in patients with chronic illness by adversely affecting memory, energy, and executive function [136].In

model 1s, neither depression nor anxiety were associated with any self-care behaviors in this study. Similar findings were also reported in other studies investigating depression/anxiety and self-care [29, 137]. Possible causes or reasons for this discrepancy may be differences between study populations, instruments employed for measuring psychological status, or the specific chronic disease that was surveyed [29, 137].We also noted that depression and anxiety seemed to work in contrast for each self-care behavior, yet lacking statistical significance. To confirm the relationships between psychological distress and self-care behaviors, further studies are needed.

The self-efficacy among our samples was low (42.1 ±13.3 out of 60 points) and was similar to that reported in a previous study [49]. Self-efficacy has been associated with several self-care behaviors such as engaging in physical exercise [27, 138], eating a healthy diet [27, 139], and adherence to medication [66]. Our results indicated that self-efficacy was positively associated with physical exercise in every model. In model 1s, self-efficacy was also associated with a low-salt diet, yet without statistical significance (odds ratio1.21, 95%CI1.00–1.48). Compared to other self-care behaviors, physical exercise was one of the most commonly reported factors in previous studies [26, 138].One possible explanation for the strong association between physical exercise and self-efficacy might be that self-efficacy is behavior specific [71]. Patients might feel very efficacious about getting adequate exercise. In this study, no other self-care behaviors were associated with self-efficacy. One reason maybe that our analysis lacked statistical power. Moreover, our measures of self-care and self-efficacy may not be specific enough to detect these associations.

According to the social cognitive theory, psychological factors may mediate the effect that family social support has on self-care behaviors [22, 140]. In this study, model 2 and 3 examined the effects of psychological factors on the relationships between family social support and each

of the self-care behaviors. These analyses revealed that the relationship between family social support with taking medication and monitoring BP did not change from model 1s to models 2 and 3. In addition, none of the psychological factors were significantly associated with any of the self-care behaviors in all models, except for self-efficacy that was positively related with physical exercise. Further analyses in model 2 and 3 into the interactive effect of family social support on self-efficacy were not significant. Therefore, psychological factors did not affect the odds ratios of family social support. These findings may also suggest that family social support is helpful toward improving self-care behaviors and successful experiences of improving one's self-care may partly contribute to improved self-efficacy. However, the relationships among these social, psychological, and behavioral factors should be further examined in prospective studies.

4.5. Conclusions

In this sample of hypertensive patients, family social support was positively associated with medication adherence and BP monitoring, but was not significantly associated with other self-care behaviors. Strategies to improve family social support should be developed to improve hypertension control. To understand the effects of family social support, depression, anxiety, and self-efficacy on self-care behaviors, prospective studies are needed.

5. Chapter 5 Discussion and conclusions

5.1. Discussion

Measurement tools for assessing psychological and social factors

A growing body of evidence suggests that self-efficacy and family social support are related with self-care behaviors. In this study, we validated a Chinese Family Support Scale and a Chinese version of the Self-Efficacy for Managing Chronic Disease 6-Item Scale in patients with hypertension. Overall, these scales showed the moderate to high reliability and validity, which can be used for assessing the self-efficacy and family social support in Chinese hypertension patients. The two scales were used for the first time in this study, therefore further evaluation on these scales is needed to produce more valid and reliable scores.

Self-care and BP control

The current study reported the use of self-care behaviors among patients with hypertension, and examined the role of family social support, depression, anxiety, and self-efficacy on specific hypertension self-care behaviors. Previous studies have found that hypertension self-care are critical for BP management [16, 17]. Our findings reported moderate self-care behaviors among the patients with hypertension. Although studies suggest that self-care behaviors will result in optimal BP control [16, 17], poor BP control remains a significant problem in our study population. It is possible that self-care was overestimated in our study. For example, response bias can occur due to the respondent's tendency to over-report good behavior. We also need to be aware that the amount and quality of self-care is important in lowering BP, which was not measured in this study. In the future study, the amount and quality of self-care should be considered.

Factors associated with self-care

Recent reviews have highlighted the importance of extending consideration beyond individual

factors which determine self-care, to examine wider influences such as the health service, the family and the wider social context [141]. In the individual level, we found that patients with shorter history of hypertension, younger and being male have lower self-care behaviors. Self-efficacy were significantly associated with regular exercise. Compared to healthy participants in a previous study [135], we found an increased prevalence of depression and anxiety. However, neither depression nor anxiety were associated with any self-care behaviors in this study. Similar findings were also reported in other studies investigating depression/anxiety and self-care [25, 137]. Possible causes or reasons for this discrepancy may be differences between study populations, instruments employed for measuring psychological status, or the specific chronic disease that was surveyed [25, 137]. To confirm the relationships between psychological distress and self-care behaviors, further studies are needed. In social context, we found that family social support was significantly associated with medication adherence and BP monitoring. Two other self-care behaviors (physical exercise, and following a low-salt diet) also showed associations with family social support, which bordered statistical significance. The current findings provide strong evidence that supporting self-care should be considered when designing programs for improving self-care among hypertensive patients.

Supporting self-care

Given complexity of self-care management, many patients may need support from family members, friends, and professional organizations to manage their illness successfully. Support for self -care is increasingly viewed as a core component of the management of long term conditions [20]. In the present study, we found that family social support plays an important role in hypertension self-care. Adult children were identified as the primary support source followed by spouse/partner and professional agencies. Professionals broadly value self-care. However, the

current involvement level of health professionals in supporting self-care may not be enough [20]. In our study, only 5.1% of the HBPM users cited doctor's advice as the reason for adopting HBPM use. It was acknowledged that self-monitoring of BP should be performed as a partnership between patients and health professionals for maximum benefit [19, 53]. Besides support from family members and professionals, other factors, such as neighborhood environment and community resources, are also critical for some self-care behaviors (i.e., healthful eating and physical activity) [20]. To better support self-care, future approaches need to target patients, family members, professionals, healthcare organizations, and local communities. How to effectively organize and deliver self-care support is an important next step.

5.2. Limitations

Several limitations must be acknowledged. First, our study may have been underpowered to detect some statistically significant associations owing to the small sample size. Second, this was a cross-sectional analysis, so causality cannot be determined. Third, data were obtained through a self-report questionnaire; therefore, recall bias could have influenced the results. The Chinese Family Support Scale was used for the first time. Further evaluation of this scale is needed to produce more valid and reliable family social support scores. Last, we used our own criteria to assess adherence for each item on the survey; thus, our results may be affected by the lack of established adherence criteria.

5.3. Conclusions

Based on the findings from the present study, we concluded:

1. The SES6C is acceptable, valid and repeatable for hypertension patients. This economic, less burdensome instrument can be used in future hypertension control program for Chinese patients.

2. The12-item Chinese Family Support Scale is acceptable for measuring the perceived family support in hypertension patients. It is a promising tool which can be easily incorporated into epidemiological surveys.
3. Patients with shorter history of hypertension, younger and being male have lower self-care behaviors. Primary care providers and public health practitioners should pay more attention to patients recently diagnosed with hypertension and younger, male patients.
4. Self-efficacy were significantly associated with regular exercise. Self-efficacy as a modifiable personal factor should be included either as intervention elements or evaluation measures in the future hypertension control program.
5. Only 5.1% of the HBPM users cited doctor's advice as the reason for adopting HBPM use. Therefore, physicians in rural areas should consider asking if a hypertensive patient is using HBPM and offer guidance on how patients can best use this self-care strategy to improve or maintain BP control.
6. This study showed that family social support was positively associated with medication adherence and regular blood pressure measurement among hypertensive patients. Strategies to improve family social support should be developed to improve hypertension control. To understand the effects of family social support, depression, anxiety, and self-efficacy on self-care behaviors, prospective studies are needed.

5.4. Perspectives and future research

Despite the above-mentioned limitations, our findings have important implications for future hypertension self-care research and interventions. Prospective studies that assess how self-care behaviors develop and are maintained, how family/social support, self-efficacy, mental health influence the development and maintenance of self-care behaviors over time, and how BP change with self-care behaviors over time, a key next step in understanding of self-care.

Studies need to move beyond assessing whether support affects hypertension self-care and focus on how to effectively support self-care. Despite the need for supporting self-care, currently, little is known about approaches that are most effective at supporting self-care. Therefore, research needs to further find ways to effectively deliver support for improving hypertension self-care.

Reference list

1 World Health Organization. A global brief on hypertension, silent killer, global public health crisis. 2013.

http://www.who.int/cardiovascular_diseases/publications/global_brief_hypertension/en/

[Accessed 2014-07-01]

2 World Health Organization. Global status report on noncommunicable diseases 2010. Geneva, World Health Organization, 2011.

3 Causes of Death 2008 [online database]. Geneva, World Health Organization.

http ://www.who.int/healthinfo/global_burden_disease/cod_2008_sources_methods.pdf.

[Accessed 2014-07-01]

4 Feldman RD. Self care-based management of hypertension: a work-in-progress. SelfCare, 2010; 1(4):124-132.

5 Leenen FH, Schiffrin EL. Control rates of hypertension in North America. Hypertension, 2010; 56(4):571-572.

6 Dong GH, Sun ZQ, Zhang XZ, Li JJ, Zheng LQ, Li J, Hu DY, Sun YX. Prevalence, awareness, treatment & control of hypertension in rural Liaoning province, China. Indian J Med Res, 2008; 128(2):122-127.

7 Son PT, Quang NN, Viet NL, Khai PG, Wall S, Weinehall L, Bonita R, Byass P. Prevalence, awareness, treatment and control of hypertension in Vietnam-results from a national survey. J Hum Hypertens, 2012; 26(4):268-280.

8 Li H, Meng Q, Sun X, Salter A, Briggs NE, Hiller JE. Prevalence, awareness, treatment, and control of hypertension in rural China: results from Shandong Province. J Hypertens, 2010; 28(3):432-438.

9 Wanless D. Securing our Future Health: taking a long term view. London. HM Treasury,

2002.

10 Chobanian AV, Bakris GL, Black HR, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, E valuation, and Treatment of High Blood Pressure: the JNC 7 report. JAMA, 2003; 289: 2560-2572.

11 Dickinson HO, Mason JM, Nicolson DJ, Campbell F, Beyer FR, Cook JV, Williams B, Ford GA. Lifestyle interventions to reduce raised blood pressure: a systematic review of randomized controlled trials. J Hypertens, 2006; 24(2):215-233.

12 McManus RJ, Mant J, Bray EP, Holder R, Jones MI, Greenfield S, Kaambwa B, Banting M, Bryan S, Little P, Williams B, Hobbs FD. Telemonitoring and self-management in the control of hypertension (TASMINH2): a randomised controlled trial. Lancet, 2010; 376(9736):163-172.

13 Bosworth HB, Dubard CA, Ruppenkamp J, Trygstad T, Hewson DL, Jackson GL. Evaluation of a self-management implementation intervention to improve hypertension control among patients in Medicaid. Transl Behav Med, 2011; 1(1):191-199.

14 Fan AZ, Mallawaarachchi DS, Gilbertz D, Li Y, Mokdad AH. Lifestyle behaviors and receipt of preventive health care services among hypertensive Americans aged 45 years or older in 2007. Prev Med, 2010; 50(3):138-142.

15 Schroeder K, Fahey T, Ebrahim S. How can we improve adherence to blood pressure-lowering medication in ambulatory care? Systematic review of randomized controlled trials. Arch Intern Med, 2004; 164(7):722-732.

16 Cléroux J, Feldman RD, Petrella RJ. Lifestyle modifications to prevent and control hypertension. 4. Recommendations on physical exercise training. Canadian Hypertension Society, Canadian Coalition for High Blood Pressure Prevention and Control, Laboratory Centre for Disease Control at Health Canada, Heart and Stroke Foundation of Canada. CMAJ 1999; 160

(9Suppl): 21-28.

17 Sacks FM, Svetkey LP, Vollmer WM, Appel LJ, Bray GA, Harsha D, et al. Effects on blood pressure of reduced dietary sodium and the Dietary Approaches to Stop Hypertension (DASH) diet. DASH-Sodium Collaborative Research Group. N Engl J Med, 2001; 344: 3-10.

18 Warren-Findlow J, Seymour RB. Prevalence Rates of Hypertension Self-care Activities Among African Americans. J Natl Med Assoc 2011; 103: 503-512.

19 Peters RM, Templin TN. Measuring blood pressure knowledge and self-care behaviors of African Americans. Res Nurs Health 2008; 31: 543-552.

20 Kennedy A, Rogers A, Bower P. Support for self-care for patients with chronic disease. BMJ 2007; 335: 968-970.

21 Lawn S, McMillan J, Pulvirenti M. Chronic condition self-management: expectations of responsibility. Patient Educ Couns 2011; 84: 5-8.

22 Rosland AM, Kieffer E, Israel B, Cofield M, Palmisano G, Sinco B, et al. When is social support important? The association of family support and professional support with specific diabetes self-management behaviors. J Gen Intern Med 2008; 23: 1992-1999.

23 Lin EH, Katon W, Von Korff M, Rutter C, Simon GE, Oliver M, et al. Relationship of depression and diabetes self-care, medication adherence, and preventive care. Diabetes Care. 2004; 27: 2154-2160.

24 Wu SF, Huang YC, Lee MC, Wang TJ, Tung HH, Wu MP. Self-efficacy, self-care behavior, anxiety, and depression in Taiwanese with type 2 diabetes: A cross-sectional survey. Nurs Health Sci 2013; Doi: 10.1111/nhs.12022.

25 Wu SF, Huang YC, Liang SY, Wang TJ, Lee MC, Tung HH. Relationships among depression, anxiety, self-care behavior and diabetes education difficulties in patients with type-2 diabetes: a

cross-sectional questionnaire survey. Int J Nurs Stud 2011; 48: 1376-1383.

26 Warren-Findlow J, Seymour RB, Brunner Huber LR. The Association Between Self-Efficacy and Hypertension Self-Care Activities Among African American Adults. J Community Health 2012; 37: 15-24.

27 Lee JE, Han HR, Song H, Kim J, Kim KB, Ryu JP, et al. Correlates of self-care behaviors for managing hypertension among Korean Americans: a questionnaire survey. Int J Nurs Stud 2010; 47: 411-417.

28 Clarke DM, Currie KC. Depression, anxiety and their relationship with chronic diseases: a review of the epidemiology, risk and treatment evidence. Med J Aust 2009; 190 (7Suppl): 54-60.

29 Jain A, Lolak S. Psychiatric aspects of chronic lung disease. Curr Psychiatry Rep 2009; 11: 219-225.

30 Saboya PM, Zimmermann PR, Bodanese LC. Association between anxiety or depressive symptoms and arterial hypertension, and their impact on the quality of life. Int J Psychiatry Med 2010;40(3):307-320.

31 Grimsrud A, Stein DJ, Seedat S, Williams D, Myer L. The association between hypertension and depression and anxiety disorders: results from a nationally-representative sample of South African adults. PLoS One 2009; 4(5):e5552.

32 Duvdevany I, Cohen M, Minsker-Valtzer A, Lorber M. Psychological correlates of adherence to self-care, disease activity and functioning in persons with systemic lupus erythematosus. Lupus 2011; 20(1):14-22.

33 De Jong MJ, Moser DK, Chung ML, Wu J. Non-adherence to prescribed medications mediates the link between anxiety and event-free survival in patients with heart failure. Circulation 2008; 118:S769–S770.

34 Schweitzer R, Head KB, Dwyer J. Psychological factors and treatment adherence behavior in patients with chronic heart failure. J Cardiovasc Nurs 2007; 22(1):76–83.

35 Kim HK, Park JH. Differences in adherence to antihypertensive medication regimens according to psychiatric diagnosis: results of a Korean population-based study. Psychosom Med 2010; 72(1):80–87.

36 Kretchy IA, Owusu-Daaku FT, Danquah SA. Mental health in hypertension: assessing symptoms of anxiety, depression and stress on anti-hypertensive medication adherence. Int J Ment Health Syst 2014; 21;8:25.

37 Bjelland I, Dahl AA, Haug TT, Neckelmann D. The validity of the Hospital Anxiety and Depression Scale. An updated literature review. J Psychosom Res 2002; 52(2):69-77.

38 Bodenheimer T, Lorig K, Holman H, Grumbach K. Patient self-management of chronic disease in primary care. JAMA 2002; 288(19):2469-2475.

39 Du S, Yuan C. Evaluation of patient self-management outcomes in health care: a systematic review. Int Nurs Rev 2010; 57(2):159-167.

40 Leventhal H, Weinman J, Leventhal EA, Phillips LA. Health Psychology: the Search for Pathways between Behavior and Health. Annu Rev Psychol 2008; 59:477-505.

41 Marks R, Allegrante JP, Lorig K. A review and synthesis of research evidence for self-efficacy-enhancing interventions for reducing chronic disability: implications for health education practice (part II). Health Promot Pract 2005;n6(2):148-156.

42 Farrell K, Wicks MN, Martin JC. Chronic disease self-management improved with enhanced self-efficacy. Clin Nurs Res 2004; 13(4):289-308.

43 Bosworth HB, Oddone EZ. A model of psychosocial and cultural antecedents of blood pressure control. J Natl Med Assoc 2002; 94(4):236-248.

44 Lorig K, Chastain RL, Ung E, Shoor S, Holman HR. Development and evaluation of a scale to measure perceived self-efficacy in people with arthritis. Arthritis Rheum, 1989; 32(1):37-44.

45 Bijl JV, Poelgeest-Eeltink AV, Shortridge-Baggett L. The psychometric properties of the diabetes management self-efficacy scale for patients with type 2 diabetes mellitus. J Adv Nurs, 1999; 30(2):352-359.

46 Webel AR, Okonsky J. Psychometric properties of a Symptom Management Self-Efficacy Scale for women living with HIV/AIDS. J Pain Symptom Manage, 2011; 41(3):549-557.

47 Farmer KC. Methods for measuring and monitoring medication regimen adherence in clinical trials and clinical practice. Clin Ther, 1999; 21(6):1074-1090.

48 Stanford Patient Education Research Center. Self-Efficacy for Managing Chronic Disease 6-item Scale. http://patienteducation.stanford.edu/research/secd6.html. [Accessed 2012-06-07]

49 Freund T, Gensichen J, Goetz K, Szecsenyi J, Mahler C. Evaluating self-efficacy for managing chronic disease: psychometric properties of the six-item Self-Efficacy Scale in Germany. J Eval Clin Pract, 2013; 19(1):39-43.

50 Hogan BE, Linden W, Naiarian B. Social support interventions: do they work? Clin Psychol Rev 2002; 22: 383-442.

51 Gorman BK, Sivaganesan A. The role of social support and integration for understanding socioeconomic disparities in self-rated health and hypertension. Soc Sci Med 2007; 65: 958-975.

52 Mollaoglu M. Perceived social support, anxiety, and self-care among patients receiving Hemodialysis. Dialysis and Transplantation Journal 2006; 35:144-155.

53 Baumann LC, Dang TT. Helping patients with chronic conditions overcome barriers to self-care. Nurse Pract 2012; 37:32-38.

54 Marín-Reyes F, Rodríguez-Morán M. Family support of treatment compliance in essential

arterial hypertension. Salud Publica Mex 2001; 43:336-339.

55 Wilson DK, Ampey-Thornhill G. The role of gender and family support on dietary compliance in an African American adolescent hypertension prevention study. Ann Behav Med 2001; 23:59-67.

56 Lu Z, Cao S, Chai Y, Liang Y, Bachmann M, et al. Effectiveness of interventions for hypertension care in the community-a meta-analysis of controlled studies in China. BMC Health Serv Res 2012; 12:216.

57 Hanley B, Tasse MJ, Aman MG, Pace P. Psychometric properties of the Family Support Scale with head start families. J Child Fam Stud, 1998; 7: 69-77.

58 Tselebis A, Anagnostopoulou T, Bratis D, Moulou A, Maria A, et al. The 13 item Family Support Scale: reliability and validity of the Greek translation in a sample of Greek health care professionals. Asia Pac Fam Med, 2011; 10:3.

59 Jiang XL, Sombat C, Sirirat P, Cheng YJ, Yin L, et al. Family support and self-care behavior of Chinese chronic obstructive pulmonary disease patients. Nurs Health Sci, 2002; 4: 41-49.

60 Brislin RW. Back-translation for cross-cultural research. Journal of Cross-Cultural Psychology, 1970; 1: 185-216.

61 Lorig KR, Sobel DS, Ritter PL, Laurent D, Hobbs M. Effect of a self-management program on patients with chronic disease. Eff Clin Pract, 2001; 4(6):256-262.

62 Chang Y, Wang PC, Li HH, Liu YC. Relations among depression, self-efficacy and optimism in a sample of nurses in Taiwan. J Nurs Manag, 2011; 19(6):769-776.

63 Maciejewski PK, Prigerson HG, Mazure CM. Self-efficacy as a mediator between stressful life events and depressive symptoms. Differences based on history of prior depression. Br J Psychiatry, 2000; 176:373-378.

64 Muris P. Relationships between self-efficacy and symptoms of anxiety disorders and depression in a normal adolescent sample. Personality and Individual Differences, 2002; 32: 337-348.

65 Tahmassian K, Jalali Moghadam N. Relationship between self-efficacy and symptoms of anxiety, depression, worry and social avoidance in a normal sample of students. Iran J Psychiatry Behav Sci, 2011; 5(2):91-98.

66 Wang W, Chair SY, Thompson DR, Twinn SF. A psychometric evaluation of the Chinese version of the Hospital Anxiety and Depression Scale in patients with coronary heart disease. J Clin Nurs, 2009; 18(17):2436-2443.

67 Leung CM, Wing YK, Kwong PK, Lo A, Shum K. Validation of the Chinese-Cantonese version of the hospital anxiety and depression scale and comparison with the Hamilton Rating Scale of Depression. Acta Psychiatr Scand, 1999; 100(6):456-461.

68 Bland JM, Altman DG. Cronbach's alpha. BMJ, 1997; 314(7080):572.

69 Wilson KA, Dowling AJ, Abdolell M, Tannock IF. Perception of quality of life by patients, partners and treating physicians. Qual Life Res, 2000; 9(9):1041-1052.

70 Wang W, Thompson DR, Chair SY, Hare DL. A psychometric evaluation of a Chinese version of the Cardiac Depression Scale. J Psychosom Res, 2008; 65(2):123-129.

71 Clark NM, Dodge JA. Exploring self-efficacy as a predictor of disease management. Health Educ Behav, 1999; 26(1):72-89.

72 Cross MJ, March LM, Lapsley HM, Byrne E, Brooks PM. Patient self-efficacy and health locus of control: relationships with health status and arthritis-related expenditure. Rheumatology (Oxford), 2006; 45(1):92-96.

73 Gill DL, Kelley BC, Williams K, Martin JJ. The relationship of self-efficacy and perceived

well-being to physical activity and stair climbing in older adults. Res Q Exerc Sport, 1994; 65(4):367-371.

74 Grembowski D, Patrick D, Diehr P, Durham M, Beresford S, Kay E, Hecht J. Self-efficacy and health behavior among older adults. J Health Soc Behav, 1993; 34(2):89-104.

75 DeVellis RF. Scale Development: Theory and Applications. 2011, Thousand Oaks: SAGE Publication Inc.

76 Jenkins CR, Dillman DA. Towards a theory of self-administered questionnaire design. In Survey measurement and process quality. 1977, New York: John Wiley and Sons. pp. 165-196.

77 Cornwell EY, Waite LJ. Social disconnectedness, perceived Isolation, and health among alder adults. J Health Soc Behav, 2009; 50: 31-48.

78 Thoits PA. Mechanisms linking social ties and support to physical and mental Health. J Health Soc Behav, 2011; 52: 145–161.

79 Smith KP, Christakis NA. Social Networks and Health. Annu Rev Sociol, 2008; 34: 405-429.

80 Tabachnick BG, Fiddell LS. Using Multivariate Statistics. 2007, Boston, MA: Allyn and Bacon.1008 p.

81 Friedmann E, Son H, Thomas SA, Chapa DW, Lee HJ. Poor social support is associated with increases in depression but not anxiety over 2 years in heart failure outpatients. J Cardiovasc Nurs, 2013. doi: 10.1097/JCN.0b013e318276fa07.

82 Namkee G. Choia, Jung-Hwa Hab. Relationship between spouse/partner support and depressive symptoms in older adults: Gender difference. Aging Ment Health, 2011; 15: 307–317.

83 Kendler KS, Gardner CO, Prescott CA. Toward a comprehensive developmental model for major depression in men. Am J Psychiatry, 2006; 163: 115-124.

84 Kamen C, Cosgrove V, McKellar J, Cronkite R, Moos R. Family support and depressive

symptoms: a 23-year follow-up. J Clin Psychol, 2011; 67: 215-223.

85 Bailey JJ, Sabbagh M, Loiselle CG, Boileau J, McVey L. (2010) Supporting families in the ICU: A descriptive correlational study of informational support, anxiety, and satisfaction with care. Intensive Crit Care Nurs 26:114-122.

86 Capitão CG, Bueno MF, Jr ÍF. (2012) Assessment of anxiety and perception of family support in hypertensive patients. International Journal of Current Research 4: 255-260.

87 Verma R, Anand KS. (2012) Gender differences in anxiety and depression among the caregivers of patients with dementia. Advances in Alzheimer's Disease 1: 17-21.

88 Dinicola G, Julian L, Gregorich SE, Blanc PD, Katz PP. (2013) The role of social support in anxiety for persons with COPD. J Psychosom Res 74: 110-115.

89 Hogan BE, Linden W, Naiarian B. Social support interventions: do they work? Clin Psychol Rev, 2002; 22: 383-442.

90 Cornwell EY, Waite LJ. Social network resources and management of hypertension. J Health Sci Behav, 2012; 53: 215-231.

91 Rosland AM, Piette JD. Emerging models for mobilizing family support for chronic disease management: a structured review. Chronic Illn, 2010; 6: 7-21.

92 Fisher L, Weihs KL. Can addressing family relationships improve outcomes in chronic disease? Report of the national working group on family-based interventions in chronic disease. J Fam Pract, 2000; 49: 561-566.

93 Costa Rdos S, Noqueira LT. Family support in the control of hypertension. Rev Lat Am Enfermagem, 2008; 16: 871-876.

94 Cuspidi C, Meani S, Lonati L, Fusi V, Magnaghi G, Garavelli G, Palumbo G, Pini C, Vaccarella A, Parati G, Leonetti G, Zanchetti A; Lombardy Regional Section of the Italian

Hypertension Society. Prevalence of home blood pressure measurement among selected hypertensive patients: results of a multicenter survey from six hospital outpatient hypertension clinics in Italy. Blood Press, 2005; 14(4):251-256.

95 Logan AG, Dunai A, McIsaac WJ, Irvine MJ, Tisler A. Attitudes of primary care physicians and their patients about home blood pressure monitoring in Ontario. J Hypertens, 2008; 26(3):446-452.

96 Viera AJ, Cohen LW, Mitchell CM, Sloane PD. How and why do patients use home blood pressure monitors? Blood Press Monit, 2008; 13(3):133-137.

97 Verberk WJ, Kroon AA, Kessels AG, de Leeuw PW. Home blood pressure measurement: a systematic review. J Am Coll Cardiol, 2005; 46(5):743-751.

98 Cappuccio FP, Kerry SM, Forbes L, Donald A. Blood pressure control by home monitoring: meta-analysis of randomised trials. BMJ, 2004; 329(7458):145

99 Cuspidi C, Meani S, Fusi V, Salerno M, Valerio C, Severgnini B, Catini E, Leonetti G, Magrini F, Zanchetti A. Home blood pressure measurement and its relationship with blood pressure control in a large selected hypertensive population. J Hum Hypertens, 2004; 18(10):725-731.

100 Bobrie G, Chatellier G, Genes N, Clerson P, Vaur L, Vaisse B, Menard J, Mallion JM. Cardiovascular prognosis of "masked hypertension" detected by blood pressure self-measurement in elderly treated hypertensive patients. JAMA, 2004; 291(11):1342-1349.

101 Staessen JA, Den Hond E, Celis H, Fagard R, Keary L, Vandenhoven G, O'Brien ET; Treatment of Hypertension Based on Home or Office Blood Pressure (THOP) Trial Investigators. Antihypertensive treatment based on blood pressure measurement at home or in the physician's office: a randomized controlled trial. JAMA, 2004; 291(8):955-964.

102 Abdullah A, Othman S. The influence of self-owned home blood pressure monitoring (HBPM) on primary care patients with hypertension: a qualitative study. BMC Fam Pract, 2011; 12:143.

103 Bosworth HB, Powers BJ, Olsen MK, McCant F, Grubber J, Smith V, Gentry PW, Rose C, Van Houtven C, Wang V, Goldstein MK, Oddone EZ. Home blood pressure management and improved blood pressure control: results from a randomized controlled trial. Arch Intern Med, 2011; 171(13):1173-1180.

104 World Health Organization. Physical status: the use and interpretation of anthropometry report of a WHO expert committee. WHO Technical Report Series, WHO: Geneva, 1995.

105 Chen C, Lu FC; Department of Disease Control Ministry of Health, PR China. The guidelines for prevention and control of overweight and obesity in Chinese adults. Biomed Environ Sci, 2004; 17 Suppl:1-36.

106 Tan NC, Khin LW, Pagi R. Home blood-pressure monitoring among hypertensive patients in an Asian population. J Hum Hypertens, 2005; 19(7):559-564.

107 McManus RJ, Ryan A, Greenfield S, Pattison HM, Clifford S, Marriott J, Wilson S. Self measurement of blood pressure: a community survey. J Hum Hypertens, 2007; 21(9):741-743.

108 Baral-Grant S, Haque MS, Nouwen A, Greenfield SM, McManus RJ. Self-Monitoring of Blood Pressure in Hypertension: A UK Primary Care Survey. Int J Hypertens, 2012; 2012:582068.

109 Chai Y, Xu H, Wang W, Liu B, Yang D, Fan H, Song F, Lu Z. A survey of factors associated with the utilization of community health centers for managing hypertensive patients in Chengdu, China. PLoS One, 2011; 6(7):e21718.

110 Wan Y, Heneghan C, Stevens R, McManus RJ, Ward A, Perera R, Thompson M, Tarassenko

L, Mant D. Determining which automatic digital blood pressure device performs adequately: a systematic review. J Hum Hypertens, 2010; 24(7):431-438.

111 Hahn LP, Folsom AR, Sprafka JM, Prineas RJ. Prevalence and accuracy of home sphygmomanometers in an urban population. Am J Public Health, 1987; 77(11):1459-1461.

112 Pickering TG, Miller NH, Ogedegbe G, Krakoff LR, Artinian NT, Goff D; American Heart Association; American Society of Hypertension; Preventive Cardiovascular Nurses Association. Call to action on use and reimbursement for home blood pressure monitoring: executive summary: a joint scientific statement from the American Heart Association, American Society Of Hypertension, and Preventive Cardiovascular Nurses Association. Hypertension, 2008; 52(1):1-9.

113 Ogedegbe G, Schoenthaler A. A systematic review of the effects of home blood pressure monitoring on medication adherence. J Clin Hypertens (Greenwich), 2006; 8(3):174-180.

114 Agyemang C, Bruijnzeels MA, Owusu-Dabo E. Factors associated with hypertension awareness, treatment, and control in Ghana, West Africa. J Hum Hypertens, 2006; 20(1):67-71.

115 Gupta R. Trends in hypertension epidemiology in India. J Hum Hypertens, 2004; 18(2):73-78.

116 Osamor PE, Owumi BE. Factors associated with treatment compliance in hypertension in southwest Nigeria. J Health Popul Nutr, 2011; 29(6):619-628.

117 Liu L, Wang JG, Gong L, Liu G, Staessen JA. Comparison of active treatment and placebo in older Chinese patients with isolated systolic hypertension. Systolic Hypertension in China (Syst-China) Collaborative Group. J Hypertens, 1998; 16(12 Pt 1):1823-1829.

118 Zhang M, Meng Y, Yang Y, Liu Y, Dong C, Xiao J, Zhao L, Li F. Major inducing factors of hypertensive complications and the interventions required to reduce their prevalence: an

epidemiological study of hypertension in a rural population in China. BMC Public Health, 2011; 11:301.

119 Wu Y, Huxley R, Li L, Anna V, Xie G, Yao C, Woodward M, Li X, Chalmers J, Gao R, Kong L, Yang X; China NNHS Steering Committee; China NNHS Working Group. Prevalence, awareness, treatment, and control of hypertension in China: data from the China National Nutrition and Health Survey 2002. Circulation, 2008; 118(25):2679-2686.

120 Sun Z, Zheng L, Detrano R, Zhang X, Xu C, Li J, Hu D, Sun Y. Incidence and predictors of hypertension among rural Chinese adults: results from Liaoning province. Ann Fam Med, 2010; 8(1):19-24.

121 GS Ma, Q. Zhou, YP Li, et al. The salt consumption of residents in China. Chinese Journal of Prevention and Control of Chronic Non-Communicable Diseases, 2008; 16(4): 331-333.

122 Cornelissen VA, Fagard RH. Effects of endurance training on blood pressure, blood pressure-regulating mechanisms, and cardiovascular risk factors. Hypertension, 2005; 46(4):667-675.

123 Blumenthal JA, Sherwood A, Gullette EC, Babyak M, Waugh R, Georgiades A, Craighead LW, Tweedy D, Feinglos M, Appelbaum M, Hayano J, Hinderliter A. Exercise and weight loss reduce blood pressure in men and women with mild hypertension: effects on cardiovascular, metabolic, and hemodynamic functioning. Arch Intern Med, 2000; 160(13):1947-1958.

124 Stevens VJ, Obarzanek E, Cook NR, Lee IM, Appel LJ, Smith West D, Milas NC, Mattfeldt-Beman M, Belden L, Bragg C, Millstone M, Raczynski J, Brewer A, Singh B, Cohen J; Trials for the Hypertension Prevention Research Group. Long-term weight loss and changes in blood pressure: results of the Trials of Hypertension Prevention, phase II. Ann Intern Med, 200; 134(1):1-11.

125 Clune A, Fischer JG, Lee JS, Reddy S, Johnson MA, Hausman DB. Prevalence and predictors of recommendations to lose weight in overweight and obese older adults in Georgia senior centers. Prev Med, 2010; 51(1):27-30.

126 Li Q, Hsia J, Yang G. Prevalence of smoking in China in 2010. N Engl J Med, 2011; 364(25):2469-2470.

127 Taylor DH Jr, Hasselblad V, Henley SJ, Thun MJ, Sloan FA. Benefits of smoking cessation for longevity. Am J Public Health, 2002; 92(6):990-996.

128 Connett JE, Murray RP, Buist AS, Wise RA, Bailey WC, Lindgren PG, Owens GR; Lung Health Study Research Group. Changes in smoking status affect women more than men: results of the Lung Health Study. Am J Epidemiol, 2003; 157(11):973-979.

129 Klatsky AL. Alcohol and cardiovascular health. Physiol Behav, 2010; 100(1):76-81.

130Sesso HD, Cook NR, Buring JE, Manson JE, Gaziano JM. Alcohol consumption and the risk of hypertension in women and men. Hypertension, 2008; 51(4):1080-1087.

131 Yang G, Kong L, Zhao W, Wan X, Zhai Y, Chen LC, Koplan JP. Emergence of chronic non-communicable diseases in China. Lancet, 2008; 372(9650):1697-1705.

132 Gallant MP. The Influence of Social Support on Chronic Illness Self-Management: A Review and Directions for Research. Health Educ Behav, 2003; 30: 170-195.

133 Zhu S, Hu J, Efird J T. Role of social support in cognitive function among elders in central China. J Clin Nurs, 2012; 21: 2118-2125.

134 Wang HL, Xiong Q, Levkoff SE, Yu X. Social Support, Health Service Use and Mental Health Among Caregivers of the Elderly in Rural China. Ageing Int, 2010; 35: 72-84.

135 Lou P, Zhu Y, Chen P, Zhang P, Yu J, Zhang N, et al. Prevalence and correlations with depression, anxiety, and other features in outpatients with chronic obstructive pulmonary disease

in China: a cross-sectional case control study. BMC Pulm Med, 2012; 12:53.

136 Katon WJ. Epidemiology and treatment of depression in patients with chronic medical illness. Dialogues Clin Neurosci, 2011; 13: 7-23.

137 Conn VS, Taylor SG, Wiman P. Anxiety, Depression, Quality of Life, and Self-Care Among Survivors of Myocardial Infarction. Issues Ment Health Nurs, 1991; 12: 321-331.

138 Martin MY, Person SD, Kratt P, Prayor-Patterson H, Kim Y, Salas M, et al. Relationship of health behavior theories with self-efficacy among insufficiently active hypertensive African–American women. Patient Educ Couns, 2008; 72: 137-145.

139 Mishali M, Omer H, Heymann AD. The importance of measuring self-efficacy in patients with diabetes. Fam Pract, 2011; 28: 82-87.

140 Anderson ES, Wojcik JR, Winett RA, Williams DM. Social-cognitive determinants of physical activity: the influence of social support, self-efficacy, outcome expectations, and self-regulation among participants in a church-based health promotion study. Health Psychol, 2006; 25: 510-520.

141 P Bower, T Blakeman, A Kennedy, J Protheroe, G Richardson, A Rogers, C Sanders. What influences people to self-care. http://www.population-health. manchester. ac. uk/ primarycare/ npcrdcarchive/Publications/WHAT_INFLUENCES_PEOPLE_TO_SELF_CARE_MARCH_2009.pdf [Accessed 2014-06-01]

Appendices

Appendix A

STANFORD
PATIENT EDUCATION
RESEARCH CENTER

Self-Efficacy for Managing Chronic Disease 6-Item Scale

We would like to know how confident you are in doing certain activities. For each of the following questions, please choose the number that corresponds to your confidence that you can do the tasks regularly at the present time.

1. How confident are you that you can keep the fatigue caused by your disease from interfering with the things you want to do?

not at all confident | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | totally confident

2. How confident are you that you can keep the physical discomfort or pain of your disease from interfering with the things you want to do?

not at all confident | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | totally confident

3. How confident are you that you can keep the emotional distress caused by your disease from interfering with the things you want to do?

not at all confident | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | totally confident

4. How confident are you that you can keep any other symptoms or health problems you have from interfering with the things you want to do?

not at all confident | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | totally confident

5. How confident are you that you can do the different tasks and activities needed to manage your health condition so as to reduce you need to see a doctor?

not at all confident | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | totally confident

6. How confident are you that you can do things other than just taking medication to reduce how much you illness affects your everyday life?

not at all confident | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | totally confident

Scoring

The score for each item is the number circled. If two consecutive numbers are circled, code the lower number (less self-efficacy). If the numbers are not consecutive, do not score the item. The score for the scale is the mean of the six items. If more than two items are missing, do not score the scale. Higher number indicates higher self-efficacy.

Appendix B

Chinese Family Support Scale

	Family support scale					
	The purpose of this survey is to understand the support you perceived for hypertension control from your family members, friends or other social agencies during the previous 6 months Please read the items and rate how you feel about each item.					
	Not available	Not at all helpful	Sometimes helpful	Generally helpful	Very helpful	Extremely helpful
1 Your parents	0	1	2	3	4	5
2 Your spouse or partner's parents	0	1	2	3	4	5
3Your relatives	0	1	2	3	4	5
4Your spouse or partner's relatives	0	1	2	3	4	5
5Spouse or partner	0	1	2	3	4	5
6Your friends	0	1	2	3	4	5
7Your spouse or partner's friends	0	1	2	3	4	5
8 Your children	0	1	2	3	4	5
9 Co workers	0	1	2	3	4	5
10Community organizations	0	1	2	3	4	5
11Professional agencies	0	1	2	3	4	5
12Other social organizations	0	1	2	3	4	5

Appendix C

Hypertension self-care study

Have the nature and risks of this study been explained to the patient and written informed consent obtained? ☐ Yes ☐ No If 'No', do not proceed.

Date informed consent was signed: ☐☐☐☐ year ☐☐ month ☐☐ day

Inclusion criteria		
All answers must be 'YES' for the patient to be included in the study.	Yes	No
1 Patients must be males or females >=35years of age.	☐	☐
2 Duration of hypertension >=12 months		
3 Patients must be able to communicate effectively with the study personnel.	☐	☐
4 Patients must be adequately informed of the nature and risks of the study and give written informed consent prior to screening.	☐	☐
Exclusion criteria		
All answers must be 'NO' for the patient to be included in the study.	Yes	No
1 Patients with any history of alcohol abuse, illicit drug use, significant mental illness, physical dependence to any opioid in the past year, or any history of drug use or addiction in the past year.	☐	☐
2 Women who are pregnant or breast-feeding.	☐	☐
3 Inability to complete the interview	☐	☐
4Patients who, in the opinion of the Investigator, have any other medical condition which renders the patient unable to complete the study or which would interfere with optimal participation in the study or produce significant risk to the patient.	☐	☐

Was the subject included in the study? ☐ Yes ☐ No

If 'No', stop interview.

Demographics

1 Age: ☐☐ years

2 Race: ☐ Han ☐ Other, please specify_____

3 Gender: ☐ Male ☐ Female

4 Education: ☐☐ years

5 Marital status: ☐ Single ☐ Married/co-habiting ☐ Divorced/separated

☐ Widowed

6 Occupation: ☐ Farmer ☐ Driver ☐ Shop keeper ☐ Worker

☐ Education/art/community service ☐ Office occupations

☐ Unemployed ☐ Retirement

7 How many of every week (7days) did you smoke on average ☐ days

8 How many of every week (7days) did you drink any alcohol on average ☐ days

9 Home income: ☐ Less than 50,000yuan ☐ 50,000yuan ~

10 Medical insurance: ☐ Yes ☐ No

11 How you rate your present health: ☐ Very good ☐ Good ☐ Fair

☐ Poor ☐ Very poor

Hypertension/Diabetes history

12 Date hypertension was diagnosed: ☐☐☐☐ / ☐☐ / ☐☐

13 Readings hypertension was diagnosed: Systolic:_____ mmHg

Diastolic:_____ mmHg

14 Hypertension type: ☐ Primary ☐ Secondary ☐ Unknown

15 Family history of hypertension: ☐ Father ☐ Mother ☐ Siblings
☐ Children ☐ Spouse ☐ None

16 Did patient have Diabetes? ☐ **Yes** ☐ No If '**Yes**', complete below.

17 Diabetes Type: ☐ TypeI ☐ TypeII

Vital signs

18Height: ☐☐☐ cm 19 Weight: ☐☐☐ ☐ kg

20 Heart rate: ☐☐☐ bpm 21Waist circumference: ☐☐.☐ cm

Blood pressure measurement

Please take BP measurements after resting for 5 minutes and take 3 readings 2 minutes apart

Systolic Diastolic

22 Seated BP: Reading 1: ☐☐☐/☐☐☐ mmHg

Reading 2: ☐☐☐/☐☐☐ mmHg

Reading3 : ☐☐☐/☐☐☐ mmHg

23Frequency BP measurement: ☐ per week ☐ per month ☐ per year
☐ **rarely** ☐ **never**

24Place BP measurement: ☐ home ☐ community ☐ clinical center
☐ hospital ☐ other

25Reason for BP is **rarely** (or **never**) measured:

☐ Economic difficulty ☐ Far to get to hospital
☐ Not important for him ☐ Other, please specify_____

Home Blood pressure monitoring

26Are you taking your own measurements of BP within the home

☐ Yes ☐ **No**

27 If so, how often do you take the measurement of BP at home

Frequency use monitor: ☐ per week ☐ per month ☐ arely

28Reason for home BP monitor: ☐

1 Advised by doctor

2 Felt unwell concerned

3 For monitoring

4 Already had access

5Other, please specify_____

29Type of monitor: ☐

1 Manual sphygmomanometers

2 Electronic sphygmomanometers

30Source of monitor: ☐

1 Pharmacies 2 Postal ordered 3 Internet 4Family members

5Friends 6 Other, please specify _____

31Reason for no home BP monitoring: ☐

1 Economic difficulty 2 Do not understand or know how

3 Not important for him 4Other,please specify_____

Adherence to medication

32Do you take anti hypertension medications now? ☐ Yes ☐ No

33How many kinds of medication used now ☐

1. One 2. Two 3. Three 4. More than three

34Adherence to medication:

Drug name	Drug type	Cost per month	Suggested frequency		Suggested dosage	frequency		dosage	Reasons for non-adherence
			day	week		day	week		

35Main reason for no medication ☐

1 Side effects 2 Not important for him 3 Economic difficulty

4 Far to get to hospital 5 Do not believe western medication

6 Other, please specify_____

Salt restriction

36Hypertension patients should restrict salt intake to less than 5 grams of table salt per day: ☐ Yes ☐ No ☐ Unknown

37Do you restrict table salt intake: ☐ Yes ☐ No

38How you restrict table salt intake: Salt spoon Visual assessment Other

39Main reason for salt restriction: ☐

1 Advised by doctor 2 For my own health 3 Advised by family members

4 Other, please specify_____

40How you feel your blood pressure control after salt restriction: ☐

1 Better 2 No change 3 Worse

41Main reason for no salt intake restriction: ☐

1 Do not understand or know how 2 Not important for him

3 I like high salt foods 4 Family members like high salt food

5 Other, please specify_____

Leisure time physical activity

42Do you have leisure time physical activity? ☐ Yes ☐ No

43How many of the past 7 days did you do at least 30 minutes total of physical exercise? ☐ Days