

# Study on the application effect of family doctor contract service mode of "basic package + personalized package" in elderly hypertension management: Chinese experience

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## Research Article

**Keywords:** Family doctor, Old people, Hypertension, "Basic package + personalized package", Community health services

**Posted Date:** April 15th, 2022

**DOI:** <https://doi.org/10.21203/rs.3.rs-1546479/v1>

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# Abstract

## Background

At present, there is no relevant research on the application effect of "basic package + personalized package" family doctor contract service mode in hypertension management, therefore, this study intended to evaluate the application effect of this service model in the management of hypertension patients. We speculated that the implementation of this mode would improve the health outcomes of elderly patients with hypertension.

## Methods

Patients with hypertension who participated in family doctor contract services in a community health service center in Chengdu, Southwest China from January 1, 2018 to December 31, 2020 were selected as the subjects of the study. According to the inclusion and exclusion criteria of the study, a total of 968 patients were included. The patients were divided into observation group and control group according to the type of service package they received. The primary outcomes included mean blood pressure (systolic, diastolic) and the rate of blood pressure control, Secondary outcomes included the level of cardiovascular disease risk and the level of self-management ability. All outcomes were assessed at baseline and 6 months after signing up.

## Results

Of the 10,970 patients screened for eligibility, 968 (8.8%) were enrolled and divided into observation group (receiving "basic package + personalized package [hypertension]" service) (n = 403) and control group (receiving "basic package" service) (n = 565) according to the type of service package they received. Participants in the observation group compared with the control group showed better improvement in mean systolic blood pressure, the rate of blood pressure control, the level of cardiovascular disease risk, and the level of self-management ability at 6 months after signing up (Mean systolic blood pressure,  $P = 0.023$ ; the rate of blood pressure control,  $P < 0.001$ ; the level of cardiovascular disease risk,  $P < 0.001$ ; the level of self-management ability,  $P < 0.001$ ). There was no significant difference in mean diastolic blood pressure between the two groups ( $P = 0.735$ ).

## Conclusions

The family doctor contract service model of "basic package + personalized package (hypertension)" has a good application effect in the management of elderly hypertension, which can improve the average blood pressure, the rate of blood pressure control, the level of cardiovascular disease risk and the level of self-management ability of elderly hypertension patients.

# 1 Introduction

China is entering a rapidly aging society in the 21st century. From 2015 to 2050, Chinese aging rate (the proportion of the population aged 60 and above) is expected to increase by 2.39% annually, which is 1.5 times the world average and 2.6 times the average of developed countries<sup>[1]</sup>. With the deepening of the degree of aging, the prevalence of chronic diseases in the elderly showed a significant increasing trend, from 53.88% in 2003 to 64.54% in 2008 and then to 74.20% in 2010, with a net growth rate of 20.32% in 7 years<sup>[2-4]</sup>. The results of the China PEACE (Patient-Centered Evaluative Assessment of Cardiac Events) million-population Project (2014.9.15-2017.6.20) showed that the treatment rate of elderly patients with hypertension (residents aged 65–75 years) is less than 5%, and the control rate is less than 10%<sup>[5]</sup>. The serious situation of elderly hypertension treatment and management in China is mainly caused by the contradiction between the tense medical and health service resources and the increasing burden of elderly hypertension disease, and optimizing the allocation of medical and health resources is an effective way to alleviate this contradiction<sup>[7]</sup>. In 2002, the World Health Organization (WHO) proposed the Innovative Care for Chronic Conditions Framework (ICCC) for low-and middle-income countries, which proposed to actively engage chronically ill patients with contracted services based on the community. Thus, the important role of grass-roots health service institutions in the prevention and control of chronic diseases was emphasized<sup>[6]</sup>. As a developing country, community is still the main place for chronic disease prevention and control in China. In view of this, the Chinese government pointed out that the main measures for chronic disease management in China are to promote the sinking of medical and health service resources, strengthen the construction of basic medical and health service system, promote the transformation of its service mode, and establish and improve the family doctor contract service mode<sup>[8]</sup>. Therefore, it is particularly important to integrate China's existing community chronic disease management resources for the elderly, accelerate the promotion of family doctor contract services, and explore a community chronic disease management model suitable for China's national conditions.

Family doctors play a key role as "gatekeepers" in primary health care<sup>[9]</sup>. Therefore, health workers should actively explore the community chronic disease health management model with family doctors as the main body of the service. China's contract family doctor service is a basic medical and health service model with Chinese characteristics, which integrates basic medical services and public health services with general practitioners as the main body, primary-level medical institutions as the service places, contractual services as the characteristics, and aims to solve the common health problems of residents<sup>[10-11]</sup>.

Overseas family doctor service started earlier and has been widely used in the management of chronic diseases such as hypertension and diabetes<sup>[12-13]</sup>. China's family doctor service model is based on China's national conditions, which is fundamentally different from foreign models, and developed late. China's family doctor service began in 2009<sup>[14]</sup>, and in 2011, The State Council issued the "Guiding Opinions on the Establishment of the General Practitioner System", proposing the establishment of a

general practitioner system suitable for China's national conditions. Since then, family doctor service has been steadily promoted<sup>[15]</sup>. Up to now, China has formed six typical family doctor contract service modes, including "1 + 1 + 1" combined contract service mode, "three division co-management" contract service mode, "Integration of medical care" contract service mode, "prepayment of total amount per-head" contract service mode, "basic package + personalized package" contract service mode and Luohu model<sup>[16]</sup>. The related research on family doctor contract service modes in China is mainly published in Chinese, less in the world and involves many chronic diseases, such as diabetes, hypertension, osteoporosis and chronic heart failure<sup>[17-27]</sup>. Among them, the "1 + 1 + 1" combined contract service mode and the "three division co-management" contract service mode have been proved to effectively control the blood sugar level of diabetic patients, improve their quality of life and self-management ability<sup>[17, 23]</sup>, and can also improve the blood pressure level, medication compliance, self-care ability and depression of patients with hypertension<sup>[18, 21]</sup>. Studies have also demonstrated that the "Integration of medical care" contract service mode can improve medication compliance, hemoglobin A1c levels, and disease awareness in type 2 diabetes patients<sup>[24, 25]</sup>. The "basic package + personalized package" service model is based on the Iceberg Theory and Knowledge-Attitude-Practice Theory. It improves the health status of patients by providing basic medical services and personalized health services for patients with chronic diseases. However, there are few studies on its application effect in the management of patients with chronic diseases. this study found two studies on the effectiveness of this model in the management of patients with type 2 diabetes. Li L et al<sup>[26]</sup> found that the family doctor contract service of "basic package + personalized package" can effectively improve the medication compliance and self-management ability of type 2 diabetes patients, and improve the glucose metabolism and lipid metabolism of patients. Xiulan L<sup>[27]</sup> found that personalized family doctor contract service model can significantly improve the disease awareness rate of diabetic patients and improve their blood glucose control level. At present, there is no relevant research on the application effect of "basic package + personalized package" family doctor contract service mode in hypertension management, therefore, this study intended to retrospectively study the hypertension cases contracted by family doctors in order to evaluate the application effect of this service model in the management of hypertension patients and explore the outcomes related to the application of this model. We speculated that the implementation of this mode would improve the health outcomes of elderly patients with hypertension.

## 2 Methods

### 2.1 Research Design

The study is a community-based retrospective controlled study. The trial protocol was established, according to the ethical guidelines of the Helsinki Declaration and was approved by the Institutional Review Board of West China Hospital of Sichuan University (Approval number:2020.1037). No informed consent was required, because the data are anonymous.

### 2.2 Object of study

In this study, due to the limitation of research conditions, the convenient sampling strategy was used to select the hypertensive patients who participated in family doctor contract services in a community health service center in Chengdu, Southwest China from January 1, 2018 to December 31, 2020 as the study subjects. The sample size was calculated by the following formula based on the blood pressure control rate:  $n = (U_{\alpha} + U_{\beta})^2 2P(1-P)/(P_1 - P_2)^2$ , according to the pre-experimental results, the blood pressure control rate of the observation group was 58.2%, and that of the control group was 35.2%,  $\alpha = 0.05$ ,  $1 - \beta = 90\%$ , the estimated sample size was 99 in each group. Finally, according to the inclusion and exclusion criteria, a total of 968 patients were included, including 403 cases in the observation group and 565 cases in the control group.

**Inclusion criteria:**(1) It meets the diagnostic criteria of hypertension in the "Guidelines for the Prevention and Treatment of Hypertension in China(2010 revision)"; (2) Age  $\geq 65$  years; (3) Detailed clinical data and basic data of patients; (4) Living with family members;(5) Junior high school education or above.

**Exclusion criteria:**(1) Secondary hypertension, pregnancy Induced hypertension or patients with a particular type of hypertension caused by drugs and other factors; (2) Patients With mental illness; (3) Patients with cognitive dysfunction; (4) Patients who are unable to express themselves in words; (5) Patients with malignant diseases such as tumors, who are receiving chemotherapy or other critical conditions. Relevant information is obtained from the patients' electronic health records.

## 2.3 Divide into groups

As for the family doctor contract service model involved in this study, patients can voluntarily choose the type of contract service package according to their own needs. For patients with hypertension, there are two options, one is "basic package" service, and the other is "basic package + personalized package (hypertension)" service. According to the type of contract service package they received, the study subjects were divided into observation group(receiving "basic package + personalized package [hypertension]" service) and control group(receiving "basic package" service)

## 2.4 Procedures

### "Basic package + personalized package (hypertension)" family doctor contract service model

The service undertaker of the "basic package + personalized package (hypertension)" family doctor contracted service model is the family doctor team of the community health service center (including family doctors, nurses, public health professionals, health management professionals and other professionals), it mainly provides basic public health services and service package services (basic package + personalized package [hypertension]) for patients with hypertension. At the same time, the community health service center and the superior hospital form a compact regional medical community, which is conducive to improving the service level of the family doctor team. And the payment methods of the service mainly include government subsidies, medical insurance payment and patient self-payment (Fig. 1).

## **Theoretical basis for the family doctor contract service mode of "basic package + personalized package"**

There are two main theories that best illustrate family doctor contract service mode of "basic package + personalized package" : the Iceberg Theory and Knowledge-Attitude-Practice Theory. Iceberg Theory proposed by Satya describes behavior and coping styles, feelings and views, expectations and aspirations, and self-efficacy in chronic diseases management<sup>[42]</sup>. Family doctor team members can further understand patients' disease feelings and views through disease assessment, and provide personalized health guidance to patients in combination with their expectations and aspirations, so as to improve their self-efficacy in disease management and promote the change of their health behaviors and coping styles. Knowledge-Attitude-Practice Theory divides the change of human behavior into three continuous processes: acquiring knowledge, generating belief and forming behavior<sup>[35]</sup>. Family doctor team members provide personalized, continuous and systematic health follow-up guidance to patients to promote them to form beliefs, so as to promote the change of their health behaviors, which in turn is conducive to the patient's health and overall quality of life.

### **Control group**

#### **"Basic package" service**

Basic package service includes the following: (1) Establishing electronic health records that include basic information, health checks, management records and other medical services; (2) Face to face follow-up 4 times; (3) Traditional Chinese medicine intervention; (4) Physical examination: oral examination, visual examination, motor examination, etc; (5) Interpret the results of physical examination and provide health guidance 1 time.

### **Observation group**

#### **"Basic package service + personalized package (hypertension)" service**

The basic package service is the same as that of the control group.

The personalized package (hypertension) service includes the following: After the staff assess the condition of patients with hypertension, they give personalized health follow-up guidance to the patient according to the assessment results and in combination with the patients' individual differences and wishes, and reassess after a certain period of time.

Hypertension assessment includes three levels: risk factor assessment, diagnostic assessment, and self-management ability assessment. (1) Risk factor assessment includes: personal characteristics, genetic factors, complications and bad living habits<sup>[28]</sup>(Table S1);(2) Diagnostic assessment includes: ☐ Establishing the classification of blood pressure level; ☐ Look for other cardiovascular disease risk factors and related disease history, and assess the patient's cardiovascular disease risk level (Table S2;Table S3); (3) Self-management ability assessment: The self-management ability of patients with hypertension was assessed by the self-management scale for patients with hypertension prepared by Ning L et al<sup>[29]</sup>. The

scale includes 4 dimensions (treatment management dimension, diet and exercise management dimension, lifestyle management dimension and risk factor management dimension), with a total of 21 items. Likert 5-level scoring method is used, ranging from "never" to "always" (1–5 points), with a total score of 21–105 points. The questionnaire score adopts positive scoring. The higher the score, the stronger the self-management ability of the research object. The scale is suitable for Chinese cultural characteristics, and has good reliability and validity. The total Cronbach's  $\alpha$  coefficient is 0.85, the total folding coefficient value is 0.86, and the average content validity index (CVI) of all items is 0.98.

Hypertension health follow-up guidance: (1) Follow-up: ☒ Staff: Public health professionals; ☒ Methods and frequency: Telephone follow-up is conducted once a month, outpatient follow-up is conducted once a quarter, and household follow-up is conducted once every two weeks (The three methods complement each other); ☒ Content: including symptoms, signs, medication, lifestyle, target organ damage and associated diseases (Table S4); (2) Guidance: ☒ Staff: Family doctor, nurse, public health professionals and health management professionals; ☒ Content: including medication guidance, blood pressure monitoring guidance, lifestyle guidance, self-observation and treatment of the disease guidance and follow-up guidance (Table S5). No matter what service package is selected, the community health service center will conduct a free hypertension assessment before and half a year after the signing of the contract.

## 2.5 Intervention fidelity

In this study, the contract services of family doctors received by the observation group and the control group were provided by two different family doctor teams. The family doctor teams received a three-month training before the formal implementation of the contract service. In order to ensure the quality of contract services, the community health service center had designated two general nurses with intermediate or above professional titles and specially trained to supervise the service process of the family doctor teams. At the same time, the self-designed structured questionnaire (the average content validity index [CVI] of all items is 0.95) was used to regularly (once / half a month) investigate the signing awareness, feeling and satisfaction of the signing service objects. The family doctor teams met weekly to discuss services. In addition, the reasons for the termination of the contract objects would be collected for assessment.

## 2.6 Study measures

The data measured in the study included general clinical data, primary outcome indicators and secondary outcome indicators. Relevant indicators were measured before the start of the first family doctor contract service (baseline) and 6 months after the contract.

### 2.6.1 General clinical data

The general clinical data of the subjects included gender, smoking, drinking, diet, exercise, mental status, overweight or obesity, family history of hypertension, and complications (type 2 diabetes, dyslipidemia, coronary heart disease, chronic renal insufficiency, heart failure, stroke).

## 2.6.2 Primary outcomes

The primary outcomes included mean blood pressure and rate of blood pressure control. Blood pressure was measured by an electronic sphygmomanometer at home. The average blood pressure value at baseline is the average value of the five blood pressure measurements closest to the start time node of the contract service within 12 months before the start of the contract service, and the average blood pressure value at the six months after signing up is the average value of the five blood pressure measurements from the six months after the contract. Blood pressure control rate refers to the percentage of subjects with average blood pressure < 140 / 90mmHg.

## 2.6.3 Secondary outcomes

Secondary outcomes included the cardiovascular disease risk stratification and self-management ability classification. Subjects in the study were stratified in cardiovascular disease risk level according to the criteria of "Guidelines for The Prevention and Treatment of Hypertension in China" (2010 Revision) (Table S3); The self-management ability score obtained from the above assessment<sup>[29]</sup> was standardized according to the method of literature<sup>[30]</sup>, and the standardized score = actual score / highest score × 100%, and further divided the self-management ability level into "low, medium and high" according to the standard of "< 60% is the low level, 60% – 79% is the medium level, and ≥ 80% is the high level".

## 2.7 Statistical analysis

SPSS 25.0 (IBM) was used for statistical analysis, and the difference was statistically significant ( $P < .05$ ). General clinical data of the observation group and control group were analyzed by Pearson's Chi-square test. Analysis of the primary outcome indicators of the subjects: Mean blood pressure was compared between groups using two independent sample T-tests, and mean blood pressure was compared within the group at baseline and 6 months after signing the contract using a paired T-test; Pearson's chi square test was used for inter-group comparison of blood pressure control rate, and McNemar's test was used for intra-group comparison of blood pressure control rate at baseline and 6 months after signing the contract. Analysis of the secondary outcome indicators: Two independent sample Mann Whitney U test was used to compare the secondary outcome indicators (cardiovascular disease risk level stratification and self-management ability level classification) between groups; Secondary outcome measures (cardiovascular disease risk level stratification and self-management ability level classification) were compared between baseline and 6 months after signing the contract, using paired sample marginal homogeneity test.

## 3 Results

A total of 10970 patients were included in the eligibility assessment, of which 968 (8.8%) met the criteria of this study. According to the type of contracted service package, the subjects were divided into observation group (received "basic package + personalized package [hypertension] service", 403 patients) and control group (received "basic package" service, 565 patients). There was no significant difference in

the characteristics of general clinical data between the observation group and the control group (Table 1). Research flow chart (Fig. 2).

Table 1  
General clinical data of subjects (baseline characteristics)

object of study	Observation group (n = 403)	Control group (n = 565)	p*
Male, n(%)	186(46.2)	249(44.1)	0.521
Smoking, n(%)	125(31.0)	147(26.0)	0.088
Excessive drinking, n(%)	77(19.1)	85(15.0)	0.095
balanced diet, n(%)	273(67.7)	388(68.7)	0.759
Regular exercise, n(%)	302(74.9)	409(72.4)	0.376
Overweight or obese, n(%)	217(53.8)	295(52.2)	0.616
Chronic stress, n(%)	98(24.3)	113(20.0)	0.109
Family history of hypertension, n(%)	161(40.0)	254(45.0)	0.121
The diagnosis was more than 1 cases of hypertension related secondary diseases and / or type 2 diabetes and / or dyslipidemia, n(%)	203(50.4)	302(53.5)	0.344
-Type 2 diabetes, n(%)	137(34.0)	205(36.3)	0.463
-Dyslipidemia, n(%)	103(25.6)	121(21.4)	0.132
-Coronary heart disease, n(%)	67(16.6)	84(14.9)	0.457
-Chronic renal insufficiency, n(%)	114(28.3)	158(28.0)	0.912
-Cardiac insufficiency, n(%)	48(11.9)	73(12.9)	0.640
-Stroke, n(%)	24(6.0)	31(5.5)	0.756
*Comparison of data between observation group and control group: Pearson's chi square test			

### 3.1 Primary outcomes

For the mean blood pressure, the t-test results of two independent samples showed that there was no significant difference in systolic and diastolic blood pressure between the observation group and the control group at baseline ( $P > 0.05$ ), but there was significant difference in systolic blood pressure between

the observation group and the control group 6 months after signing the contract ( $P < 0.05$ ), the systolic blood pressure in the observation group was lower than that in the control group, but there was still no significant difference in diastolic blood pressure between the two groups ( $P > 0.05$ ) (Table 2). The results of paired t-test showed that there was significant difference in mean blood pressure (systolic and diastolic blood pressure) between the observation group at baseline and 6 months after signing the contract ( $P < 0.05$ ), systolic and diastolic blood pressure at 6 months after signing the contract were lower than baseline; The mean blood pressure (systolic and diastolic blood pressure) of the control group at baseline and 6 months after signing the contract was also statistically significant ( $P < 0.05$ ), Systolic and diastolic blood pressure at 6 months after signing were lower than baseline (Table 2).

For blood pressure control rate, Pearson's chi square test showed that there was no significant difference in blood pressure control rate between the observation group and the control group at baseline ( $P > 0.05$ ), the difference of blood pressure control rate between the two groups 6 months after signing the contract was statistically significant ( $P < 0.05$ ), the blood pressure control rate of the observation group was higher (Table 2). McNemar's test results showed that there was significant difference in blood pressure control rate between the observation group at baseline and 6 months after signing the contract ( $P < 0.05$ ), the blood pressure control rate at 6 months after signing the contract was higher than that at baseline; The difference of blood pressure control rate between the control group at baseline and 6 months after signing the contract was also statistically significant ( $P < 0.05$ ), the blood pressure control rate at 6 months after signing the contract was higher than that at baseline (Table 2).

Table 2  
Analysis of Primary outcome indicators of subjects

variable	baseline	Six months after signing the contract	P
<b>Mean blood pressure, mmHg, <math>\bar{x} \pm s</math></b>			
<b>-systolic pressure, mmHg, <math>\bar{x} \pm s</math></b>			
-Observation group(n = 403)	143.7 $\pm$ 11.4	131.6 $\pm$ 12.0	< 0.001 <sup>#</sup>
-control group (n = 565)	142.1 $\pm$ 22.1	132.7 $\pm$ 18.8	< 0.001 <sup>#</sup>
P	0.123 <sup>*</sup>	0.023 <sup>*</sup>	
<b>- diastolic pressure, mmHg, <math>\bar{x} \pm s</math></b>			
-Observation group(n = 403)	81.5 $\pm$ 7.2	74.9 $\pm$ 7.6	< 0.001 <sup>#</sup>
-control group (n = 565)	80.6 $\pm$ 9.4	74.8 $\pm$ 7.0	< 0.001 <sup>#</sup>
P	0.138 <sup>*</sup>	0.735 <sup>*</sup>	
<b>Rate of blood pressure control, n(%)</b>			
-Observation group(n = 403)	103(25.6)	308(76.4)	< 0.001 <sup>**</sup>
-control group (n = 565)	129(22.8)	256(45.3)	< 0.001 <sup>**</sup>
P	0.327 <sup>&amp;</sup>	< 0.001 <sup>&amp;</sup>	
*Comparison of data between observation group and control group: two independent sample t-test;			
<sup>#</sup> Data comparison between baseline and 6 months after signing the contract: paired t-test;			
<sup>&amp;</sup> Comparison of data between observation group and control group: Pearson's chi square test;			
<sup>**</sup> Comparison between baseline and 6 months after signing the contract: McNemar's test			

## 3.2 Secondary outcomes

For cardiovascular disease risk stratification, the results of Mann Whitney U test of two independent samples showed that there was no significant difference in the stratification of cardiovascular disease risk levels between the observation group and the control group at baseline (P > 0.05). 6 months after

signing the contract, the hierarchical difference of cardiovascular disease risk level between the two groups was statistically significant ( $P < 0.05$ ), overall, the risk level of cardiovascular disease in the observation group was lower than that in the control group (Table 3). The results of paired sample marginal homogeneity test showed that there was significant difference in the stratification of cardiovascular disease risk level between the observation group at baseline and 6 months after signing the contract ( $P < 0.05$ ), the risk level of cardiovascular disease 6 months after signing the contract was lower than that at baseline; There was also a statistically significant difference in the stratification of cardiovascular disease risk levels between baseline and 6 months after signing the contract in the control group ( $P < 0.05$ ), the risk level of cardiovascular disease 6 months after signing the contract was lower than the baseline.(Table 3).

For self-management ability level classification, the Mann Whitney U test results of two independent samples showed that there was no significant difference in the level of self-management ability between the observation group and the control group at baseline( $P > 0.05$ ), there was significant difference in the level of self-management ability between the two groups at 6 months after signing the contract ( $P < 0.05$ ), in general, the level of self-management ability in the observation group was higher than that in the control group (Table 3). The results of paired sample marginal homogeneity test showed that there was significant difference in the level of self-management ability between the observation group at baseline and 6 months after signing the contract ( $P < 0.05$ ), the level of self-management ability 6 months after signing the contract was higher than the baseline on the whole; The difference of self-management ability level between baseline and 6 months after signing the contract in the control group was also statistically significant ( $P < 0.05$ ), but 6 months after signing the contract, the level of self-management ability is lower than the baseline on the whole (Table 3).

Table 3  
Analysis of secondary outcome indicators of subjects

variable		baseline	Six months after signing the contract	p*
<b>Stratification of cardiovascular disease risk levels, n(%)</b>				
	Medium risk, n(%)	242(60.1)	322(79.9)	< 0.001
-Observation group(n = 403)	High risk, n(%)	150(37.2)	77(19.1)	
	Very high risk, n(%)	11(2.7)	4(1.0)	
	Medium risk, n(%)	316(55.9)	353(62.5)	< 0.001
-control group(n = 565)	High risk, n(%)	227(40.2)	199(35.2)	
	Very high risk, n(%)	22(3.9)	13(2.3)	
p#		0.170	< 0.001	
<b>Level of self-management ability, n(%)</b>				
	low level, n(%)	106(26.3)	51(12.7)	< 0.001
-Observation group(n = 403)	Medium level, n(%)	262(65.0)	308(76.4)	
	High level, n(%)	35(8.7)	44(10.9)	
	low level, n(%)	136(24.1)	149(26.4)	< 0.001
-control group(n = 565)	Medium level, n(%)	350(61.9)	370(65.5)	
	High level, n(%)	79(14.0)	46(8.1)	
p#		0.065	< 0.001	
*Comparison of data between baseline and 6 months after signing the contract: paired sample marginal homogeneity test;#Comparison of data between observation group and control group: Mann Whitney U test of two independent samples				

## 4 Discussion

This study demonstrated that the "basic package + personalized package (hypertension)" family doctor contracting service could improve the mean blood pressure (systolic and diastolic blood pressure), blood

pressure control rate, cardiovascular disease risk level and self-management ability level in elderly patients with hypertension. And it was better than the "basic package" family doctor contract service in improving systolic blood pressure, blood pressure control rate, cardiovascular disease risk level and self-management ability level in elderly patients with hypertension.

Compared with the "basic package" service, the "basic package + personalized package (hypertension)" family doctor contract service proposed in this study is more significant in reducing the average blood pressure (systolic blood pressure) and improving the blood pressure control rate of elderly patients with hypertension, which suggests that the family doctor contract service which is added personalized scheme has a better effect on blood pressure control. A scholar pointed out that poor compliance is the main reason for the unsatisfactory treatment effect and repeated condition of patients with chronic diseases<sup>[7]</sup>. The personalized scheme proposed in this study takes into account the individual differences of patients and combined with the wishes of patients, which is conducive to improving the compliance of patients' disease management, which may be the main reason for the improvement of patients' blood pressure control. At the same time, studies have shown that customized personalized intervention can enable patients to obtain more disease management information<sup>[31]</sup>, which may also be another reason for the improvement of patients' blood pressure control. Sarah Melville et al. <sup>[32]</sup> also proposed that personalized medical plan is a new trend in the treatment of hypertension, especially in refractory hypertension. It is worth mentioning that one study have shown that home blood pressure monitoring can improve blood pressure control in patients with hypertension<sup>[33]</sup>. The "basic package + personalized package (hypertension)" service scheme proposed in this study includes home blood pressure monitoring guidance, which may also be a reason for the improvement of blood pressure control in patients.

Studies have shown that there is a close and direct positive correlation between blood pressure level and cardiovascular disease risk<sup>[34]</sup>, and the proportion of deaths from cardiovascular and cerebrovascular diseases in China has exceeded 40% of the total deaths<sup>[28]</sup>. Therefore, the main goal of treating hypertension is to prevent the occurrence of cardiovascular disease. The contract service of "basic package + personalized package (hypertension)" family doctor proposed in this study can reduce the risk of cardiovascular disease in elderly patients with hypertension, which may be largely related to the improvement of blood pressure level. A scholar pointed out that the poor self-management ability of elderly patients with chronic diseases is a major reason why the situation of chronic disease treatment and management in China is not optimistic<sup>[7]</sup>. Therefore, improving the self-management ability of elderly patients with chronic diseases has become a key link in chronic disease management in China. The "basic package + personalized package (hypertension)" family doctor contract service proposed by this study can improve the self-management ability of elderly patients with hypertension, which may be related to the following reasons: Firstly, the self-management ability assessment is included in the "basic package + personalized package (hypertension)" family doctor contract service, which is conducive to the family doctor team to grasp the overall situation of the patient's self-management ability, so as to take timely and targeted measures to improve the patient's self-management ability. Second, according to the "Knowledge-Attitude-Practice Theory Model", the premise of behavior change is to acquire knowledge and

form belief, and the three are progressive at all levels. Only when knowledge is sublimated into belief can it promote behavior change in a positive attitude and way<sup>[35]</sup>. The contract service mode of "basic package + personalized package" proposed by this study adopts the long-term contract management mode and regular follow-up to provide personalized health guidance for patients, which has the advantages of continuity, progression and systematicness; At the same time, experts from tertiary hospitals are invited to give lectures and provide health consulting services from time to time to provide patients with more professional and cutting-edge health knowledge and guidance. In this way, patients not only acquire disease management knowledge, but also continuously strengthen their awareness of self-management, so as to form beliefs and promote the establishment of good self-management behavior of patients. The main place of chronic disease management is still the family environment. Moreover, one study have shown that family members can affect patients' self-efficacy in disease management, and then affect patients' self-management ability<sup>[36]</sup>. This study not only provides health guidance to patients, but also provides corresponding health guidance to family members. Family members mainly play the role of supervisor, reminder and motivator in disease management, while the main manager is still the patients themselves, which may also be a factor in the improvement of patients' self-management ability.

There are great differences between China's medical and health service system and that of developed countries. Firstly, there is a serious problem of uneven regional distribution of medical and health resources in China; Second, Chinese residents tend to go to high-level hospitals, and their trust in grass-roots hospitals is low; Third, the service ability and level of staff in grass-roots health service institutions in China are low; Finally, the medical insurance fund does not cover all family doctor signing projects. Therefore, the family doctor contract service model implemented in China is different from that in foreign countries. It is established based on China's national conditions and highlights Chinese characteristics. The characteristics of contract services of family doctors in China are mainly reflected in the following aspects: 1. The undertaker of contract services: Community health service center with the general practitioner team as the service provider; 2. Contract service content: While promoting basic services such as basic medical treatment, public health and health management<sup>[37]</sup>, we should develop characteristic services such as traditional Chinese medical physiotherapy services and personalized package services for chronic diseases<sup>[16]</sup>, so as to increase the attraction of grass-roots health service institutions. 3. Medical consortium form of contract services: China has formed four types of medical consortia: cross regional specialist alliance, urban medical group, telemedicine cooperation network and county medical community<sup>[38]</sup>, which is conducive to improving the service capacity and level of grass-roots health service institutions and optimizing the allocation of medical and health resources, so as to improve residents' trust in grass-roots health service institutions; 4. Payment form of contract service fee: Take the form of government financial investment, medical insurance fund, new rural cooperative medical fund and individual payment<sup>[39]</sup>, so as to provide economic guarantee for family doctor contract services. However, at present, the cost of personalized package service is still mainly borne by residents themselves. Therefore, in order to improve the signing rate of personalized package service, some

changes need to be made from government finance and medical insurance fund in the future to subsidize the cost of personalized package service as much as possible.

The "basic package + personalized package" family doctor contract service model involved in this study is an innovative practice in the exploration of family doctor contract service model in China, which has the following advantages: 1. Different contract service packages meet the personalized needs of residents, enrich the connotation of family doctor contract service, and help to improve the attraction of signing service; 2. The whole population service mode is conducive to the promotion of primary prevention in chronic disease management, so as to reduce the prevalence of chronic diseases<sup>[16]</sup>; 3. Health management takes the form of continuity, which helps to improve the functional status and quality of life of patients with chronic diseases<sup>[40]</sup>; 4. Form a close regional medical community with tertiary hospitals to essentially promote the establishment of a hierarchical diagnosis and treatment system of "first diagnosis at the grass-roots level, two-way referral, separate treatment of acute and chronic diseases and upper and lower linkage" for patients with chronic diseases<sup>[38]</sup>; 5. The family doctor team is composed of multidisciplinary personnel, which is conducive to improving the quality of life and treatment compliance of patients with chronic diseases<sup>[41]</sup>.

This study also has some limitations. Firstly, this study is not a randomized controlled trial, and the choice of contract service type depends on the preference of patients. However, because the contract service of family doctors in China follows the principle of voluntary signing, it is difficult to carry out randomized controlled trials. Second, participants of our study were from one general Community Health Centre in Southwest China, which might limit the generalization of the results. Third, the services of the observation group and the control group were provided by two different family doctor teams, which may have a certain impact on the results due to the differences in the internal work mode, efficiency and personnel enthusiasm of the family doctor team, however, this study also took a series of measures such as unified training, process supervision and effect evaluation to reduce this impact. Finally, due to the limitation of research resources, this study did not carry out cost-benefit analysis, further research can be carried out in the future to evaluate the economic benefits of family doctor contract service model.

## 5 Conclusion

This study shows that the "basic package + personalized package (hypertension)" family doctor contract service model has a good application effect in the management of elderly hypertension, which can improve the average blood pressure, blood pressure control rate, cardiovascular disease risk level and self-management ability of elderly patients with hypertension. The results of this study can provide reference for countries or regions with similar social and medical background to China to establish primary health care system with family doctor services as the mainstay.

## Declarations

### Funding Sources

This research was supported by the key R & D project of Sichuan Province (No. 2021YFS0022). The funders had no roles in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

### **Competing interests**

The authors declare that they have no competing interests

### **Disclosures**

None

### **Acknowledgements**

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### **Authors' contributions**

Qiuqing Du, Jiayi Ye, Ka Li wrote the article, this article was modified by Jinhua Feng, Shilin Gao produced the chart for this article, all authors read and approved the final manuscript.

### **Availability of data and materials**

Availability of data and materials: The data sets generated/analysed in this study will be anonymised and deposited in a repository at Yulin Community Health Service Center in Chengdu, China. Bona-fide researchers can contact the corresponding author (Ka Li) to use the data and materials but are required to clearly specify the research question a priori. No consent was provided for sharing data with third parties.

### **Ethics approval and consent to participate**

All procedures performed in this study involving human participants were in accordance with the Declaration of Helsinki. Ethical approval was granted by the Institutional Review Board of West China Hospital of Sichuan University (reference number:2020.1037). Informed consent was waived because the data are anonymous, as agreed by the Institutional Review Board of West China Hospital of Sichuan University.

### **Consent for publication**

Not applicable

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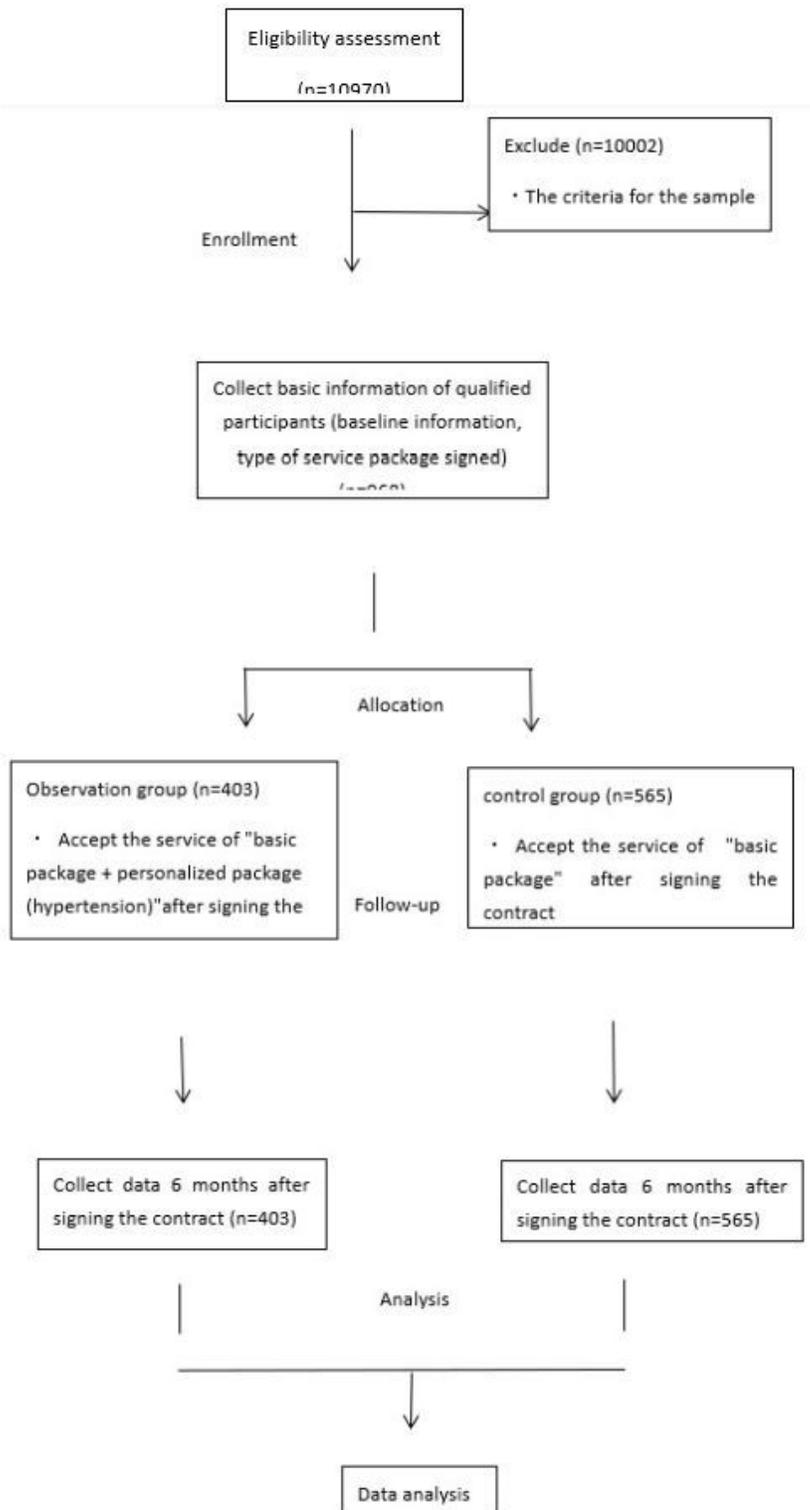
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## Figures

### Figure 1

"Basic package + personalized package (hypertension)" family doctor contract service model



**Figure 2**

Research flow chart

## Supplementary Files

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