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Stated preferences for family physician contract services: A survey of the elderly in rural China

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Stated preferences for family physician contract services: A survey of the elderly in rural China

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ABSTRACT

Objective A number of factors contribute to the utilization of Family Physician Contract

Services (FPCS) in China. This study aims to measure the preference of the elderly for the

FPCS and identify the key factors (and their relative importance) that may guide

policymakers in more accurately providing the FPCS.

Participants and methods A discrete choice experiment (DCE) was performed to elicit the

preferences for FPCS among the rural elderly in China. Attributes and levels were established

based on qualitative methods. Four attributes were included: service type, service package,

physician's reputation, and annual contract costs. A D-efficient design was used to create a

set of profiles that represented FPCS. The survey was conducted face to face using a sample

of participants aged 60 and above in rural areas of Anhui Province. The data were analyzed

using a latent class logit (LCL) model.

Results A total of 545 valid questionnaires were included in the analysis. The average age of

the participants was 69.44 (SD 5.80). Two latent classes were identified with the LCL model.

All four attributes proved statistically significant at the level of both the population mean and

the two classes. The rural elderly showed a preference for FPCS with a good reputation, lower

annual contract costs, the basic service with the add-on of chronic disease service, and home visit.

Age, gender, education, self-reported health status, and the number of chronic diseases were

found to be associated with latent class membership.

Conclusion In this study, the physician's reputation had the largest impact on the rural

elderly's choice of FPCS. Recommendations included the need to strengthen family physician

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team training, greater attention devoted to improvement at the medical technical level and

family physician service approaches, and increased FPCS efficiency for the care of the rural

elderly.

Keywords family physician contract services, discrete choice experiment, rural elderly, latent

class logit model, Chinese healthcare

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Strengths and limitations of this study

▸ A discrete choice experiment was used to provide preference information on family

physician contract services of rural elderly in China.

▸ We explored preference heterogeneity according to the respondents' sociodemographic

characteristics.

▸ This study only estimated the preference of rural elderly people for the family physician

contract services in a single province of China.

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INTRODUCTION

To achieve efficient and quality care, a multi-tiered healthcare system is widely adopted

around the world with primary care as the first point of contact for people in need of

healthcare.[1] In China, the general population is free to choose health care facilities without

being restricted by a gatekeeping mechanism. However, residents prefer to seek care in

second or tertiary hospitals rather than in primary care facilities. This is despite primary care

facilities providing care that is usually more accessible and less costly.[2,3] In the health system

in China, primary care facilities consist of township hospitals and village clinics in rural

areas.

To strengthen primary care facilities and direct patients toward the lower levels of care, the

Chinese government proposed to establish a hierarchical diagnosis and treatment system in a

new round of medical reform in 2009.[4] And the Family Physician Contract Services (FPCS)

were established in June 2016. The target groups of FPCS included the general and priority

population which includes the elderly, women, children, and patients with chronic diseases.

Residents voluntarily sign a contract with a chosen family physician, and in turn receive

treatment and primary health care services in a community setting from the family physician

team. This team consists of general practitioners, nurses, and public health workers.[5]

Contracted residents pay some of the annual contract costs and public medical insurance

covers the remainder. Following the implementation of this national policy, 10 model cities

were initially selected to implement a pilot program of FPCS in 2016, and then the program

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was expanded to more cities. The government increased financial investment in primary care

facilities to facilitate the implementation of the FPCS.[6] The annual contract costs varied from

region to region.

By 2017 the contract sign-up rates for the general and priority groups had reached 35% and

65%, respectively.[7] Whilst these numbers are not low, evidence suggested that patients had

not been successfully redirected from high-level hospitals to primary care as intended by the

policy.[7-11] A study found that 70% of the respondents preferred tertiary hospitals over family

physician for first-contact care.[8] Patients' reluctance to visit family physician has been a

significant obstacle to the success of FPCS and the promotion of primary care.[3]

In order to effectively implement FPCS, it is important to understand how Chinese patients

feel about FPCS from a consumer perspective. Research on patient preference for FPCS is

limited. Only two studies (one study is set in Shanghai and the other is set in Sichuan)

explored this topic focusing on eliciting the factors that influence patients' decisions to use

family physician.[12,13] However, these studies did not allow participants to trade-off between

factors and thus could not generate their relative importance.

This study used a discrete choice experiment (DCE) survey to elicit patient preferences for

the factors (or attributes) associated with FPCS among the rural elderly in China. It aimed to

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answer three questions: (1) what factors affect patient choice to use FPCS?; (2) what is the

relative importance between these factors?; and (3) how much are they willing to pay for a

desirable feature of the FPCS? The findings have important implications for policymakers

aiming to improve the utilization of FPCS and the delivery of precision healthcare services

for the elderly in China.

METHODS

Discrete Choice Experiment Design

The DCE approach has been widely adopted in eliciting patient preference in healthcare.[3,14-16]

We selected the attributes and their corresponding levels through a systematic review of

journal articles and policy documents about FPCS as well as expert consultations (experts in

the field of health economics and primary healthcare research).[17-19] Four attributes were

included in the DCE: service type (clinic visit, home visit), service package (basic service,

basic service and chronic disease service, basic service and traditional Chinese medicine

(TCM) service, basic service and personalized service), physician's reputation which refers to

the physician's skill level, service attitude and the patient's trust (good, average, poor), and

annual contract costs is the patient pays to utilize the services (20CNY/3 USD, 40 CNY/6

USD, 60 CNY/9 USD, 80CNY/12 USD; the average annual exchange rate between USD and

CNY in 2019 was USD 1 = CNY 6.908[20]). A more detailed explanation of attributes and

levels (eTable 1) and service packages (eTable 2) is in the supplementary document**.**

The number of attributes and levels ($4^2 \times 3^1 \times 2^1$) was deemed impractical for a full-factorial

design due to a large number of choice tasks.[21] Therefore, we used the Ngene software

(version 1.1.2, ChoiceMetrics) to create an efficient design that maximized the D-efficiency[17].

The final questionnaire consisted of six pairs of choice sets. An opt-out option was included

for each choice set. Compared to those that do not present an opt-out option, DCE that have

opt-out options have resulted in a lower risk of overestimating attribute influence.[22-24]

Respondents were asked to choose plan 1, plan 2, or the opt-out option.

To test the respondents' comprehension of the task and assess the validity of the questionnaire,

one rationality test choice set was added.[25] In the test choice set, plan 2 is dominated by plan 1

across all attributes. The respondent was considered to have failed the test if they did not

choose the plan 1.[26,27] Multiple versions of the questionnaire were generated, each with a

computer-generated random sequence of the choice sets. To test the quality and feasibility of

the questionnaire, we conducted a pilot test of 50 volunteers in a community to test the

understanding, and the validity of the questionnaire content as well as the time it takes to

complete the questionnaire. Subsequently, we made minor adjustments to the content of the

questionnaire. Face-to-face interviews with participants were used for pilot tests and formal

data collection.

Data collection

This study was conducted in Anhui Province, located in the southeast of China. The province

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has a population of over 63 million and the majority of the residents are middle or lower

income earners. We used a multi-stage stratified random sampling method to select one city

from each of the three geographical areas (south, central, and north). Three to five rural towns

were randomly selected from each city. All the elderly permanent residents (defined as an

annual resident of six months or more) were invited to participate in the survey. Face-to-face

interviews were conducted with participants at the village clinics or in their homes. The

participants were instructed to answer the survey questions carefully as each of their choices

would contribute to the development of relevant FPCS policies. Socio-demographic

information also was collected including: age, gender, education, marital status, household

composition, self-reported health status, and the number of chronic diseases. Data collection

was conducted from July to August in 2019. This research project was approved by the Ethics

Committee of Anhui Medical University (No: 2020H011).

Statistical analysis

DCE data were analyzed based on the random utility theory,[28] wherein the utility that

respondent i derives from choosing alternative j in choice set t is given by

$$U_{ijt} = X_{ijt}\beta_i + \varepsilon_{ijt}; \; i = 1, \; ..., 545; \; j = 1, 2, 3; \; t = 1, ..., 6$$

where β_i is a vector of coefficients, and X_{ijt} is a vector of variables representing attributes

of alternative j. If the random term ε_{ijt} is assumed to be independently and identically

distributed according to the type I extreme value distribution, then the model becomes the

conditional logit (CLOGIT).[29] The latent class logit (LCL) model was also used to explore the

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preference heterogeneity among the respondents.[30] It provided a framework for understanding

the latent segmentation of respondent preferences. The number of classes was determined

based on the Bayesian Information Criterion (BIC).[31] Both models were estimated using the

Stata software (version 16, StataCorp).[29] Statistical significance was set at α =0.05.

The attribute "cost" was analyzed as a continuous variable and other attributes were included

as dummy variables due to their categorical nature. Under the LCL model, we estimated

preference coefficients for each class and then produced their weighted average over classes

as the overall population mean. A positive regression coefficient suggested that respondents

preferred an increased value for an attribute, whereas a negative coefficient suggested that

respondents preferred a decreased value for an attribute.

We calculated the relative importance (RI) of each attribute as the proportion of the sum of its

utility ranges to obtain an understanding of the difference each attribute could represent in the

total utility of the program design.[32-34] The formula is as follows:

$$RI_k = \left(\frac{A_k}{\sum_{k=1}^{4} A_k}\right) \times 100\%$$

where A_k is the difference between the highest and lowest score among attributes for the k

th attribute. We then estimated the mean RI for each class and the population mean.

We also derived the relative value attached to each attribute, which is potentially useful for

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pricing policy making because it measures respondents' willingness to pay (WTP) for a

desirable feature of the service.[35,36] We derived WTP as the negative ratio of the non-cost

attribute coefficient to the contract costs coefficient.

A posterior analysis was undertaken to know who the respondents are in a specific class [29].

We estimated the posterior probability of respondent i for each class by using the Bayes rule.

A multinomial logit (MNL) model was estimated to describe each class using individual

characteristics. The explanatory variables used in the classes' characterization are

documented in the supplement (eTable 3). After the MNL regression, the average marginal

effect for each variable was estimated for each class. Finally, we produced a profile of

membership in each class by estimating the expected values of the statistically significant

predictors in the membership function.[37]

Patient and public involvement

Patients were the participants in this study, and not involved in creating the survey instrument

in this study.

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RESULTS

Sample Characteristics

A total of 545 questionnaires were included in the analysis (Table 1) with a response rate of

97.85%. The average age of the participants was 69.44 ±5.80 years. A slight majority

(53.05%) of them were male. A little more than half of the respondents had an education level

of primary school or above (58.53%). The vast majority of the respondents (77.06%) were

married and 55.96% of all the participants lived with spouses. A little more than one-third

(32.48%) and only 4.04% respectively of the respondents indicated that they were healthy and

very healthy on the day of the survey. A total of 70.83% of the respondents reported at least

one chronic disease.

Table 1. Sample demographic characteristics (n=545)

	n (%) / Mean (SD)
Age (in years)	69.44(5.80)
Gender	
Male	289(53.03)
Female	256(46.97)
Education	
No school education	226(41.47)
Primary school	217(39.82)
Junior high school or above	102(18.71)
Marital status	
Married	420(77.06)
Other [a]	125(22.94)
Household	
Single	86(15.78)
Spouse only	305(55.96)
Other [b]	154(28.26)
Self-reported health status	
Very unhealthy	20(3.67)
Unhealthy	187(34.31)
Moderately healthy	139(25.5)

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Healthy	177(32.48)
Very healthy	22(4.04)
Number of chronic diseases	
0	159(29.17)
1	196(35.96)
2	107(19.63)
≥3	83(15.23)

SD: standard deviation.

[a] : Other marital status includes unmarried, widowed and divorced

[b] : Other household members include children only or spouse and children

Preferences

LCL dominated CLOGIT estimates (reported in eTable 4 in the supplement) based on BIC so

only the former results are reported. A two-class LCL model was chosen based on BIC and its

estimates were reported in Table 2. Class 1 accounted for 83.1% and class 2 for 16.9% of the

population. Apart from the service package attribute in class 2, all four attributes were

statistically significant in each class. Those in class 1 prioritized service package and annual

contract costs more than class 2. By contrast, those in class 2 gave greater priority to service

type and physician's reputation.

The total sample and both classes preferred home visit as opposed to clinic visit, a "good"

physician's reputation, and lower contract costs. The population mean and class 1 preferred

the service package that included an add-on of the chronic disease service to the basic service.

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Table 2. The two-class latent class logit model estimates and willingness to pay

		Class 1		Class 2		Mean preference [b]	
		Est	SE	Est	SE	Est	SE
Share		0.831***	0.019	0.169***	0.019		
Asc1		2.799***	0.478	−0.309***	0.479	1.937***	0.400
Asc2		2.649***	0.477	−2.248***	0.415	1.823***	0.397
Service type	Clinic visit [a]						
	Home visit	0.629***	0.136	0.769***	0.211	0.653***	0.114
Service package	Basic service [a]						
	+ Chronic disease service	1.183***	0.151	0.575	0.408	1.081***	0.145
	+ Traditional Chinese medicine service	0.442*	0.257	0.522	0.328	0.455**	0.216
	+ Personalized service	0.669***	0.2	0.456	0.318	0.633***	0.176
Physician's reputation	Poor [a]						
	Average	1.148***	0.441	1.580***	0.343	1.221***	0.364
	Good	2.404***	0.405	2.696***	0.301	2.454***	0.332
Annual contract costs		-0.025***	0.006	−0.016**	0.006	−0.023***	0.005

Willingness to pay（CNY）[c]

		Class 1		Class 2		Mean preference [b]	
Service type	Clinic visit [a]						
	Home visit	25.192**	11.463	47.935**	24.389	29.029**	9.914
Service package	Basic service [a]						
	+ Chronic disease service	47.378**	17.1	35.827	24.959	45.429**	14.857
	+ Traditional Chinese medicine service	17.678**	6.612	32.541	23.211	20.186**	6.643
	+ Personalized service	26.769*	13.808	28.440	21.792	27.051**	12.079
Physician's reputation	Poor [a]						
	Average	45.969*	24.567	98.501**	46.602	54.831**	21.103
	Good	96.258**	31.002	168.066**	66.766	108.373***	27.03

ASC: alternative specific constant; Est: Estimate; SE: standard error

*** p<0.01; ** p<0.05; * p<0.1

[a]: reference

[b]: weighted average of coefficients over two classes

[c]: According to the Organization for Economic Co-operation and Development (OECD) data
(https://data.oecd.org/conversion/exchange-rates.htm), the average annual exchange rate between USD
and CNY in 2019 was: USD 1 = CNY 6.908, Accessed March 30, 2021.

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Relative importance

We derived the relative importance score for each attribute for the population and the two

classes (Figure 2). For the population, physician's reputation was the most influential attribute.

The second was annual contract costs. Service type was the least important. Class 1 was the

same as the mean population. Class 2 regarded physician's reputation as the most important

and service package proved the least important.

Willingness to pay

We also estimated WTP for each attribute level (Table 2). On average, respondents were

willing to pay 29 CNY (4 USD) more for a "home visit" than a "clinic visit". They also were

willing to pay 45 CNY (7 USD) more for a "basic service with chronic disease service", 20

CNY (3 USD) more for a "basic service with TCM service", and 27 CNY (4 USD) more for a

"basic service with personalized service" than the "basic service". Moreover, they were

willing to pay an additional 55 CNY (8 USD) for a physician with "average" reputation and

108 CNY (16 USD) for one with "good" reputation than a physician with a "poor" reputation.

Class membership profile

We reported the results in the form of average marginal effects for ease of interpretation

(eTable 5 in the supplement). The results suggested that age, gender, education, self-reported

health status, and the number of chronic diseases were statistically significant predictors of

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class membership. Respondents who were older than 65, male, with a lower education level,

self-reported to be "healthy", and with less than one chronic disease were more likely to be

assigned to class 1. The expected values for the five significant predictors are in Figure 3.

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DISCUSSION

The underuse of primary care services has become one of the major challenges the Chinese

healthcare system is facing today. Whilst the FPCS proposed in 2016 seems promising,

patients still preferred visiting high-level hospitals even for mild diseases. Understanding

patient preference for the attributes associated with FPCS is therefore important as this allows

us to make more informed policy design to improve the appeal of the services and retain

patients at primary care. To this aim, this study carried out a DCE survey to examine elderly

residents' preferences for FPCS.

Our results suggested that all four attributes (service type, service package, physician's

reputation, annual contract costs) had a significant impact on patient choice. At the population

mean, the physician's reputation scored highest in relative importance. Physicians' medical

skill level and service attitudes have been recognized as important indicators of healthcare

quality.[9,38,39] Other study has shown that patients also preferred doctors from public hospitals

because they believed that the doctors possessed greater skills than those from a primary care

clinic.[40]

The annual contract cost was the second most important attribute. This preference also could

be explained in part by the fact that FPCS is a public health service project and funded by

social medical insurance. As reported in a study that the importance of out-of-pocket was

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ranked next to the travel time in the severe scenario.[41] Other literature results also suggested

that although the contract cost was not the most important attribute, increasing the contract

costs would significantly decrease the willingness to sign a contract.[38] Therefore, it is

suggested that more financial support may be helpful to increase the signing rate of FPCS.

The elderly preferred services for chronic diseases over personalized services. More than 70%

of the rural elderly suffered from at least one chronic disease. Many studies have indicated

that the family physician system has been effective for the management of chronic diseases

because it provided continuous, personalized, and comprehensive services in addition to

integrated prevention and treatment.[42-44] Furthermore, the rural elderly have had a low

education level, which often complicates an understanding and acceptance of an appropriate

combination of personalized services.[45] The majority of the participants in this study did not

choose traditional Chinese medicine service over other services package, despite its proven

effectiveness for the cure and treatment of chronic disease in other studies.[46-47] Therefore, an

argument could be made for the need to offer an additional chronic disease service to the

original basic service.

Although the elderly preferred home visit compared to clinic visit, this attribute was the least

important which is consistent with those from previous studies.[45] Some expressed concerns

about home visit, including the lack of appropriate medicine provided as well as the lack of

relationship with the doctors. They also worried that home visit would reveal their poor

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physical health to others. Therefore, policymakers could focus on the improvement of the

quality of services provided rather than a wider range of service types.

The heterogeneous nature of preferences is an important consideration for policymakers who

strive to improve the delivery of personalized primary healthcare services. In this study,

gender, age, education, self-reported health status, and the number of chronic diseases were

identified as important indicators of that heterogeneity. Results from previous studies were

consistent with our findings.[5,12,48,49] Healthy older men with lower education levels who did

not have chronic diseases were more likely to focus on the quality of the services they chose.

However, younger women with chronic diseases and who had higher levels of education

prioritized service types and their costs. Thus, efforts should be made to improve the quality

of FPCS, make the costs of service reasonable and provide personalized service types to the

elderly patients with different characteristics.

CONCLUSION

Our study suggests that the reputation of the doctor could be one of the most important factors

for elderly patients in their choice of family physician contract services. The findings suggest

a need to strengthen the training of the family physician team to meet the potential demand

for their services. Particular attention should be paid to developing the physicians' medical

skills and doctor-patient communication skills as the ways to improve service quality. Annual

contract costs and the service package options could also be important factors in deciding to

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utilize family physician contract services.

LIMITATIONS

This study had several limitations. Firstly, we were unable to include more attributes because

of the limitations inherent to a DCE; the total number of attributes and levels that could be

reasonably included while maintaining respondent comprehension and data quality was

limited.[50] Secondly, the reliance on self-reported data created the risk of hypothetical bias.

Thirdly, this study only estimated the preference of rural elderly people for the FPCS in a

single province of China. Nevertheless, expanding the research to other provinces and

undertaking comparison between rural and urban areas are on our research agenda.

Competing Interests None declared.

Patient consent for publication Not required.

Ethics approval This research was approved by the Ethics Committee of Anhui Medical University (No: 2020H011).

Data availability statement The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Figure1. An example of one choice set used in the discrete choice experiment

Attributes	Plan1	Plan 2
Service type	Home visit	Home visit
Service package	Basic service + Chronic disease service	Basic service + Personalized service
Physician's reputation	Good	Average
Annual contract costs	40 CNY (6 USD)	80 CNY (12 USD)
Which would you choose?	□	□
Now suppose you can also choose not to sign up with a family physician, noting that your diseases would not get better, what would you prefer?		
1. I would still prefer the plan I choose above □		
2. I would choose neither □		

Figure 2. Relative importance score of the attributes at the two classes and mean population

Class 1

Class 2

Mean

Figure 3. Profile of latent class membership at the two classes

	class1	class2
Age: >65	70.82%	66.50%
Gender: female	46.89%	47.40%
Education: primary school or above	56.13%	70.35%
Self-reported health status: healthy	63.18%	56.28%
Number of chronic diseases: ≥2	33.73%	40.45%

reference: Age≤65; Gender=male; Education=no school education; Self-reported health status=unhealthy; Number of chronic diseases≤1

supplemental materials:

eTable 1 The detailed explanation of attributes and levels

eTable 2 The content of family physician contract service package

eTable 3 Variables of classes characterization

eTable 4 Elder's preference for family doctor contract services based on conditional logit model

eTable 5 Class membership: average marginal effects

1

eTable 1 The detailed explanation of attributes and levels

Attributes	Explanations
Service type	Medical services type provided by the family physician to the elderly, including 2 levels: 1= Clinic visit 2= Home visit
Service package	Medical services were provided by family physician such as diagnosis and treatment of common and frequently-occurring diseases, as well as treatment of chronic diseases and traditional Chinese medicine (TCM) with a definite diagnosis, including 4 levels: 1= Basic service 2= Basic service +Chronic diseases service 3= Basic service +Traditional Chinese medicine (TCM) service 4= Basic service +Personalized service
Physician's reputation	Reflecting the reputation of family physician and his or her team, the patient's trust in the family physician, or the evaluation of the family physician services by others. The evaluation content includes the physicians' technical level, service attitude, and so on, including 3 levels: 1= Good 2= Average 3= Poor

2

Annual contract costs[a]	Patients sign contracts with family physician and pay a certain cost every year to enjoy the corresponding services provided by family physician, including 4 levels: 1= 20 CNY(3 USD) 2= 40 CNY(6 USD) 3= 60 CNY(9 USD) 4= 80 CNY(12 USD)

[a]: The average annual exchange rate between USD and CNY in 2019 was: USD 1 = CNY 6.908(Organisation for Economic Co-operation and Development data. Available online: https://data.oecd.org/conversion/exchange-rates.htm. Accessed March 30, 2021)

3

eTable 2 The content of family physician service package

Service package	Content	
Basic service	**Basic health service:** • The treatment of common and frequent occurring diseases, nursing care, and the treatment of chronic diseases with a clear diagnosis • First aid care • Home medical and referral services such as home visits, home nursing, home beds, etc. • Rehabilitation medical services • Traditional Chinese medicine services **Public health service:** • Resident health records, health guidance, health education • One physical exam per year for people over 65 years old • Follow up guidance and one physical examination for patients with severe mental illness	
Basic service +Chronic diseases service	Physical exam (height, weight, vision, blood pressure, body temperature, electrocardiogram, color doppler ultrasound (limited to one site), blood glucose/blood lipid, liver and kidney function, hematuria routine)	
	Whole-course standardized services (mainly for patients with chronic diseases such as hypertension and diabetes)	
	Long-term prescription service (continuation of the prescription and medication service of the higher level hospital)	
	One time expert diagnosis and treatment per year	
Basic service +Traditional Chinese medicine (TCM) service	Annual cupping therapy	A maximum of three choices
	Annual treatment of winter diseases in summer	
	Annual fumigation	
	Annual cervical, shoulder, and lumbar traction	

4

	Annual physical therapy	
Basic service +Personalized service	According to their own health needs, residents are free to choose the combination of chronic disease services offered and TCM services offered, with a maximum of three choices. Examples of combinations include: • Annual diagnosis and treatment of chronic disease by expert + Annual TCM cupping + Annual TCM fumigation • Annual diagnosis and treatment of chronic disease by expert + Annual TCM treatment of winter diseases in summer • Annual physical examination of chronic diseases + Annual TCM fumigation • Long-term prescription of chronic disease + Annual TCM cupping + Annual TCM cervical, shoulder, and lumbar traction • Whole-course standardized services of chronic disease + Annual TCM cervical, shoulder, and lumbar traction + Annual TCM physical therapy • Annual diagnosis and treatment of chronic disease by expert + Annual TCM cupping + Annual TCM physical therapy • Annual chronic disease long-term prescription + Annual TCM fumigation	

5

eTable 3 Variables of classes characterization

Variables	Variable assignment
Age	0= ≤65*
	1= >65
Gender	0= Male*
	1= Female
Education	0= No school education*
	1= Primary school or above
Self-reported health statu[a]	0= Unhealthy*
	1= Healthy
Number of chronic diseases	0= ≤1*
	1= ≥2

[a]：Self- reported health statu is the physical health status of the respondents on the day of the survey. Likert scale was used to measure their physical health status. 1-5 is very unhealthy, unhealthy, moderately healthy, healthy, and very healthy respectively. Unhealth includes very unhealthy and unhealthy, healthy includes moderately healthy, healthy, and very healthy.

*: reference

6

eTable 4 Preference for family doctor contract services based on conditional logit model

		Est	SE
ASC1		2.378***	0.185
ASC2		2.254***	0.178
Service type	Clinic visit [a]		
	Home visit	0.608***	0.060
Service package	Basic service [a]		
	+ Chronic disease service	1.105***	0.076
	+ Traditional Chinese medicine service	0.463***	0.086
	+ Personalized service	0.559***	0.104
Physician's reputation	Poor [a]		
	Average	0.376**	0.164
	Good	1.609***	0.151
Annual contract costs		-0.026***	0.002
Number of observations			9810
Log pseudolikelihood			-2656.7801

ASC: Alternative specific constant; Est: Estimate; SE: Standard error

*** $p<0.01$; ** $p<0.05$; * $p<0.1$

[a]: reference

7

eTable 5 Class membership: average marginal effects

	Class1		Class2	
	Est	SE	Est	SE
Age: >65	0.035***	0.009	-0.035***	0.009
Gender: Female	-0.030***	0.008	0.030***	0.008
Education: Primary school or above	-0.100***	0.007	0.100***	0.007
Self-reported health statu: Healthy	0.028***	0.009	-0.028***	0.009
Number of chronic diseases: ≥2	-0.031***	0.009	0.031***	0.009

Est: Estimate; SE: Standard error

Reference: Age≤65; Gender=male; Education=no school education; Self-reported health statu=unhealth; Number of chronic diseases≤1

*** p<0.01;** p<0.05;* p<0.1

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Stated preferences for family doctor contract services: A survey of the rural elderly in Anhui province, China

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Stated preferences for family doctor contract services: A survey of the rural elderly in Anhui province, China

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1   **ABSTRACT**

2   **Objective** A number of factors contribute to the utilization of Family Doctor Contract

3   Services (FDCS) in China. This study aims to measure the preferences of the elderly for the

4   FDCS and identify the key factors (and their relative importance) that may guide

5   policymakers in more accurately providing the FDCS.

6   **Participants and methods** A discrete choice experiment (DCE) was performed to elicit the

7   preferences for FDCS among the rural elderly in China. Attributes and levels were established

8   based on qualitative methods. Four attributes were included: service type, service package,

9   physician's reputation, and annual contract costs. A D-efficient design was used to create a set

10   of profiles that represented FDCS. The survey was conducted face to face using a sample of

11   participants aged 60 and above in rural areas of Anhui Province. The data were analyzed

12   using a latent class logit (LCL) model.

13   **Results** A total of 545 valid questionnaires were included in the analysis. The average age of

14   the participants was 69.44 (SD 5.80). Two latent classes were identified with the LCL model.

15   All four attributes proved statistically significant at the level of both the population mean and

16   the two classes. The rural elderly showed a preference for FDCS with a relatively good

17   reputation, lower annual contract costs, the basic service with the add-on of chronic disease

18   service, and home visit. Age, gender, education, self-reported health status, and the number of

19   chronic diseases were found to be associated with latent class membership.

20   **Conclusion** In this study, the physician's reputation had the largest impact on the rural

21   elderly's choice of FDCS. Policy recommendations included the need to strengthen family

22 doctor team training, devote greater attention to improving the family doctor's medical skills

23 and service approaches, and increased FDCS efficiency for the care of the rural elderly.

24 **Keywords** family doctor contract services, discrete choice experiment, rural elderly, latent

25 class logit model, Chinese healthcare

27   **Strengths and limitations of this study**

28   • The first study to examine patient preferences for the contents of services within the

29   Family Doctor Contract Services scheme

30   • A carefully designed and implemented discrete choice experiment to generate reliable

31   preference data from a vulnerable group in China

32   • Possible hypothetical bias and data quality issues caused by fatigue and cognitive

33   constraints

34   • Results only representative of the rural region of Anhui province

36 **INTRODUCTION**

37 To achieve efficient and quality care, a multi-tiered healthcare system is widely adopted

38 around the world with primary care as the first point of contact for people in need of

39 healthcare.[1] In China, the general population is free to choose healthcare facilities without

40 being restricted by a gatekeeping mechanism. However, residents prefer to seek care in

41 secondary or tertiary hospitals rather than in primary care facilities. This is despite primary

42 care facilities providing care that is usually more accessible and less costly.[2,3] In the health

43 system in China, primary care facilities consist of township hospitals and village clinics in

44 rural areas.

45

46 To strengthen primary care facilities and direct patients to the primary medical institutions for

47 treatment, the Chinese government proposed to establish a hierarchical diagnosis and

48 treatment system in a new round of medical reform in 2009.[4] And the Family Doctor Contract

49 Services (FDCS) scheme was established in June 2016 to strengthen the gatekeeping

50 mechanism. The target groups of FDCS included the general and priority population which

51 includes the elderly, women, children, and patients with chronic diseases. Residents

52 voluntarily sign a contract with a chosen family doctor team, and in turn receive treatment and

53 primary healthcare services in a community setting. This family doctor team consists of

54 general practitioners, nurses, and public health workers. The contract is of one year duration

55 with its fee charged annually according to the chosen services. Part of the contract is covered

56 by the government, thus the annual contract fee varied from region to region depending on the

57 financial revenue of the regional government. Following the implementation of this national

58 policy, 200 model cities were initially selected to implement a pilot program of FDCS in

59 2016, and then the program was expanded to more cities. The government increased financial

60 investment in primary care facilities to facilitate the implementation of the FDCS.

61

62 By 2017 the contract sign-up rates for the general and priority groups had reached 35% and

63 65%, respectively.[5] Whilst these numbers are not low, evidence suggested that patients had

64 not been successfully redirected from high-level hospitals to primary care as intended by the

65 policy.[5,6] A study found that 70% of the respondents preferred tertiary hospitals over family

66 doctor for first-contact care.[6] Reluctance of patients to visit family doctor has been a

67 significant obstacle to the success of FDCS and the promotion of primary care.[3]

68

69 In order to effectively implement FDCS, it is important to understand how Chinese patients

70 feel about FDCS from a consumer perspective. There has been a growing number of studies

71 on consumer preferences for the attributes of primary care services in China.[2,7-9] The general

72 finding is that, when choosing primary care facilities, Chinese patients value the quality and

73 attitude of doctors, out-of-pocket costs, travel time, total visit time, etc. These results cannot

74 be directly transferred to the case of FDCS as it is a primary care service in the form of

75 contract with specific types of services agreed upon signing. The research on FDCS has been

76 focused on its implementation[10-14] and policy impact.[15-18] There is also a small number of

77 studies on the association between patient characteristics and usage of FDCS.[19,20] Only one

78   study elicited consumer preference for the attributes of FDCS by undertaking a discrete

79   choice experiment (DCE) with 609 rural residents in Shandong Province, China.[21] However,

80   it did not include any attribute related to the contents of the services such as type of services

81   and the service packages.

82

83   The DCE method has been used extensively to evaluate patient choice within healthcare

84   systems.[22,23] It is a technique for eliciting stated preferences, using hypothetical scenarios with

85   products (or services) described by various attributes and levels, and asks respondents to

86   choose their most preferred. The method is particularly useful when evaluating policy within

87   markets with restricted choice, and where the characteristics driving real choices are not

88   observed or attributes of interest are not measured or lack variation (e.g: the price in the real

89   market often does not vary much within a period of time). Moreover, estimates are not

90   affected by confounding factors given they are extracted from a controlled experiment. These

91   advantages of DCEs well suited the objectives of this research.

92

93   In this study we undertook a DCE to elicit patient preferences for the attributes associated

94   with FDCS among the rural elderly in Anhui province, China. While the FPCS program aims

95   for full population coverage, at the current stage the focus is the priority groups primarily

96   including the elderly and those with chronic conditions. These two groups also largely overlap

97   each other. In Anhui province, where our study was carried out, over 90 percent of the people

98   who signed up the program fell into these two groups. Other priority groups are pregnant

8 / 31

99   women and women in childbed, and children with likely different care needs. To design a

100 DCE with attributes that are general enough to accommodate the care needs from all the

101 groups is not only challenging but also less useful in helping design targeted policies. We

102 therefore focused on elderly people in this study.

103

104 We aimed to answer three questions: (1) what factors affect patient choice to use FDCS?; (2)

105 what is the relative importance between these factors?; and (3) how much are they willing to

106 pay for a desirable feature of the FDCS? The findings have important implications for

107 policymakers aiming to improve the utilization of FDCS and the delivery of precision

108 healthcare services for the elderly in China.

1
2
3
4   110   **METHODS**
5
6
7   111   **Discrete Choice Experiment Design**
8
9
10   112   The DCE approach has been widely adopted in eliciting patient preference in healthcare.[24,25]
11
12   113   We selected the attributes and their corresponding levels through a systematic review of
13
14   114   journal articles and policy documents about FDCS as well as expert consultations (experts in
15
16   115   the field of health economics and primary healthcare research).[26,27] Four attributes were
17
18   116   included in the final DCE (Figure 1): The first is "service type", representing the type of
19
20   117   medical services provided by the family doctor to the elderly, including clinic visit and home
21
22   118   visit. The second is "service package", representing the content of the services, including four
23
24   119   levels: basic service, basic service and chronic disease service, basic service and traditional
25
26   120   Chinese medicine (TCM) service, and basic service and personalized service. The third is
27
28   121   "physician's reputation" which refers to the residents' evaluation of the skill level, service
29
30   122   attitude and quality of the family doctor team. The levels of this attribute include relatively
31
32   123   good, average, and relatively poor. The fourth is annual contract costs, representing the out-
33
34   124   of-pocket cost for signing up to the contract. It is a relatively small component of the total
35
36   125   costs which are mainly covered by the government. The levels include 20 CNY (3 USD), 40
37
38   126   CNY (6 USD), 60 CNY (9 USD), and 80 CNY (12 USD); the average annual exchange rate
39
40   127   between USD and CNY in 2019 was 1 USD = 6.908 CNY.[28] The levels chosen in our study
41
42   128   reflect the actual contract costs in those rural regions where we sampled. A detailed
43
44   129   explanation of attributes and levels (eTable 1) and service packages (eTable 2) as well as the
45
46   130   final questionnaire are in the supplementary document**.**

10 / 31

131

132   The number of attributes and levels ($4^2 \times 3^1 \times 2^1$) was deemed impractical for a full-factorial

133   design due to a large number of choice tasks.[29] Therefore, we used the Ngene software

134   (version 1.1.2, ChoiceMetrics) to create an efficient design that maximized the D-efficiency[27].

135   An opt-out option was included for each choice set. Compared to those that do not present an

136   opt-out option, DCE that have opt-out options have resulted in a lower risk of overestimating

137   attribute influence.[30] Respondents were asked to choose plan 1, plan 2, or the opt-out option.

138

139   To test the respondents' comprehension of the task and assess the validity of the

140   questionnaire, one rationality test choice set was added. In the test choice set, plan 2 is

141   dominated by plan 1 across all attributes. The respondent was considered to have failed the

142   test if they did not choose the plan 1.[31] Multiple versions of the questionnaire were generated,

143   each with a computer-generated random sequence of the choice sets. To test the quality and

144   feasibility of the questionnaire, we conducted a pilot test of 50 volunteers in a community to

145   test the understanding, and the validity of the questionnaire content as well as the time it takes

146   to complete the questionnaire. In the pilot, we considered one additional attribute called

147   "diagnosis and treatment time" and there were eight choice sets. While the participants could

148   understand the choice tasks well, it turned out to be difficult for them to trade-off across five

149   attributes and some also found it cognitively demanding to complete eight choice sets (plus

150   the testing one). We therefore decided to drop the "diagnosis and treatment time" attribute

151   which was considered the least important attribute by most participants in the pilot and to

152   reduce the number of choice sets from eight to six. We made some other minor adjustments

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153 on wording based on the feedback from the pilot testing. Face-to-face interviews with

154 participants were used for both pilot tests and formal data collection.

155

156 **Data collection**

157 This study was conducted in Anhui Province, located in the southeast of China. The province

158 has a population of over 63 million and the majority of the residents are middle-or-lower

159 income earners. Multi-stage random sampling was used to choose a representative sample of

160 the rural elderly population in Anhui which is traditionally divided into three geographical

161 areas: the northern, central and southern region (Figure 2). We first randomly selected three

162 cities, Fuyang, Lu'an, and Xuancheng, from each region, and then randomly selected a county

163 from each city: Yingzhou, Jin'an, and Jingxian. According to the sample size requirement of

164 DCE studies, we aimed for around 200 respondents in each county. We did so by randomly

165 choosing two villages in Yingzhou (a relatively populous county), four villages in Jin'an, and

166 four villages in Jingxian. Respondents were eligible for our study if they: (1) were over 60

167 years old; (2) had spent more than 6 months in the current year at the registered place of

168 residence; and (3) could complete the questionnaire independently. From July to August in

169 2019, a team of trained postgraduate students from Anhui Medical University visited the

170 chosen ten villages. With the help of the village committee, eligible respondents were

171 identified, and face-to-face interviews were conducted either at the village committee office

172 or at the respondent's home. At the start of an interview, respondents were told that their

173 participation were completely voluntary, and they were allowed to leave the interview at any

174   time.

175

176   When selecting the interviewers, we chose the students from the local counties where data

177   would be collected since they can communicate with the elderly residents using the local

178   dialect. A standard interview manual was used in the training workshop where the selected

179   students were paired to simulate the interview process (one student played the role of the

180   interviewer while the other the interviewee). These students had another chance to practice at

181   the pilot stage when the interview manual was also updated.

182

183   The interview manual mainly included: (1) the introduction about the family doctor contract

184   services program, (2) the explanation on the types of services to be provided after signing the

185   contract, (3) the structure of the questionnaire and the detailed definition of each attribute of

186   the DCE, and (4) instructions on how to help participants understand the choice task through

187   the warm-up exercise. The manual also explained the interview steps and the order of the

188   choice sets to be presented. There were instructions on terminating the interview if it was

189   clear that the participant could not understand the choice tasks or found it difficult to

190   complete the choice tasks.

191

192   The participants were instructed to answer the survey questions carefully as each of their

193   choices would contribute to the development of relevant FDCS policies (this is a "cheap talk"

13 / 31

194 approach to engage the participants).[32] Socio-demographic information was also collected

195 including: age, gender, education, marital status, household composition, self-reported health

196 status, and the number of chronic diseases. This research project was approved by the Ethics

197 Committee of Anhui Medical University (No: 2020H011).

198

Statistical analysis

200 DCE data were analyzed based on random utility theory, where the utility that respondent i

201 derives from choosing alternative j in choice set t is given by

202 $$U_{ijt} = X_{ijt}\beta_i + \varepsilon_{ijt}; i = 1, ..., 545; j = 1, 2, 3; t = 1, ..., 6$$

203 where β_i is a vector of coefficients, and X_{ijt} is a vector of variables representing attributes

204 of alternative j. If the random term ε_{ijt} is assumed to be independently and identically

205 distributed according to the type I extreme value distribution, then the model becomes the

206 conditional logit (CLOGIT). The latent class logit (LCL) model was also used to explore the

207 preference heterogeneity among the respondents.[33] It provided a framework for understanding

208 the latent segmentation of respondent preferences. The number of classes was determined

209 based on the Bayesian Information Criterion (BIC).[34] Both models were estimated using the

210 Stata software (version 16, StataCorp).[35] Statistical significance was set at α =0.05.

211

212 The attribute "cost" was analyzed as a continuous variable and other attributes were included

213 as dummy variables due to their categorical nature. Under the LCL model, we estimated

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214   preference coefficients for each class and then produced their weighted average over classes

215   as the overall population mean. A positive regression coefficient suggested that respondents

216   preferred an increased value for an attribute, whereas a negative coefficient suggested that

217   respondents preferred a decreased value for an attribute.

218

219   We calculated the relative importance (RI) of each attribute as the proportion of the sum of its

220   utility ranges to obtain an understanding of the difference each attribute could represent in the

221   total utility of the program design.[36] The formula is as follows:

$$RI_k = \left(\frac{A_k}{\sum_{k=1}^{4} A_k} \right) \times 100\%$$

223   where A_k is the difference between the highest and lowest score among attributes for the kth

224   attribute. We then estimated the mean RI for each class and the population mean.

225

226   We also derived the relative value attached to each attribute, which is potentially useful for

227   pricing policy making because it measures respondents' willingness to pay (WTP) for a

228   desirable feature of the service.[37] We derived WTP as the negative ratio of the non-cost

229   attribute coefficient to the contract costs coefficient.

230

231   A posterior analysis was undertaken to know who the respondents are in a specific class [35].

232   We estimated the posterior probability of respondent i for each class by using the Bayes rule.

15 / 31

233   A multinomial logit (MNL) model was estimated to describe each class using individual

234   characteristics. The covariates used in the classes' characterization are documented in the

235   supplement (eTable 3). After the MNL regression, the average marginal effect for each

236   variable was estimated for each class. Finally, we produced a profile of membership in each

237   class by estimating the expected values of the statistically significant predictors in the

238   membership function.[38]

239

240   **Patient and public involvement**

241   Patients were the participants in this study, and not involved in creating the survey instrument

242   in this study.

244   **RESULTS**

245   **Sample Characteristics**

246   The questionnaire was administered to 612 elderly residents, among which 12 were urban

247   dwellers living in the village at the time of data collection, 44 were incomplete, and 11 failed

248   the rationality test. A total of 545 questionnaires were included in the analysis (Table 1). The

249   average age of the participants was 69.44 ±5.80 years. A slight majority (53.05%) of them

250   were male. A little more than half of the respondents had an education level of primary school

251   or above (58.53%). The vast majority of the respondents (77.06%) were married and 55.96%

252   of all the participants lived with spouses. A little more than one-third (32.48%) and only

253   4.04% of respondents indicated that they were healthy or very healthy respectively on the day

254   of the survey. A total of 70.83% of the respondents reported to have at least one chronic

255   disease.

256   **Table 1. Sample demographic characteristics (n=545)**

	n (%) / Mean (SD)
Age (in years)	69.44(5.80)
Gender	
Male	289(53.03)
Female	256(46.97)
Education	
No school education	226(41.47)
Primary school	217(39.82)
Junior high school or above	102(18.71)
Marital status	
Married	420(77.06)
Other [a]	125(22.94)
Household	
Single	86(15.78)
Spouse only	305(55.96)
Other [b]	154(28.26)
Self-reported health status	

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	Very unhealthy	20(3.67)
	Unhealthy	187(34.31)
	Moderately healthy	139(25.5)
	Healthy	177(32.48)
	Very healthy	22(4.04)
Number of chronic diseases		
	0	159(29.17)
	1	196(35.96)
	2	107(19.63)
	≥3	83(15.23)
Region		
	Yingzhou, Fuyang (north)	197 (36.15)
	Jin'an, Lu'an (central)	176 (32.29)
	Jingxian, Xuancheng (south)	172 (31.56)

257 SD: standard deviation.

258 [a]: Other marital status includes unmarried, widowed and divorced

259 [b]: Other household members include children only or spouse and children

260

261 **Preferences**

262 LCL dominated CLOGIT estimates (eTable 4 in the supplement) based on BIC so only the

263 former results are reported. A two-class LCL model was chosen based on BIC and its

264 estimates were reported in Table 2. Class 1 accounted for 83.1% and class 2 for 16.9% of the

265 population. Apart from the service package attribute in class 2, all four attributes were

266 statistically significant in each class. Those in class 1 prioritized service package and annual

267 contract costs more than class 2. By contrast, those in class 2 gave greater priority to service

268 type and physician's reputation.

269

270 The total sample and both classes preferred home visit as opposed to clinic visit, a "relatively

271 good" physician's reputation, and lower contract costs. The population mean and class 1

272   preferred the service package that included an add-on of the chronic disease service to the

273   basic service.

274   **Table 2. The two-class latent class logit model estimates and willingness to pay**

		Class 1		Class 2		Mean preference [b]	
		Est	SE	Est	SE	Est	SE
Share		0.831***	0.019	0.169***	0.019		
Asc1		2.799***	0.478	−0.309***	0.479	1.937***	0.400
Asc2		2.649***	0.477	−2.248***	0.415	1.823***	0.397
Service type	Clinic visit [a]						
	Home visit	0.629***	0.136	0.769***	0.211	0.653***	0.114
Service package	Basic service [a]						
	+ Chronic disease service	1.183***	0.151	0.575	0.408	1.081***	0.145
	+ Traditional Chinese medicine service	0.442*	0.257	0.522	0.328	0.455**	0.216
	+ Personalized service	0.669***	0.2	0.456	0.318	0.633***	0.176
Physician's reputation	Relatively poor [a]						
	Average	1.148***	0.441	1.580***	0.343	1.221***	0.364
	Relatively good	2.404***	0.405	2.696***	0.301	2.454***	0.332
Annual contract costs		-0.025***	0.006	−0.016**	0.006	−0.023***	0.005

Willingness to pay（CNY）[c]

		Class 1		Class 2		Mean preference [b]	
Service type	Clinic visit [a]						
	Home visit	25.192**	11.463	47.935**	24.389	29.029**	9.914
Service package	Basic service [a]						
	+ Chronic disease service	47.378**	17.1	35.827	24.959	45.429**	14.857
	+ Traditional Chinese medicine service	17.678**	6.612	32.541	23.211	20.186**	6.643
	+ Personalized service	26.769*	13.808	28.440	21.792	27.051**	12.079
Physician's reputation	Relatively poor [a]						
	Average	45.969*	24.567	98.501**	46.602	54.831**	21.103
	Relatively good	96.258**	31.002	168.066**	66.766	108.373***	27.03

275   ASC: alternative specific constant; Est: Estimate; SE: standard error
276   *** p<0.01; ** p<0.05; * p<0.1
277   [a]: reference
278   [b]: weighted average of coefficients over two classes
279   [c]: According to the Organization for Economic Co-operation and Development (OECD) data
280   (https://data.oecd.org/conversion/exchange-rates.htm), the average annual exchange rate between USD
281   and CNY in 2019 was: USD 1 = CNY 6.908, Accessed March 30, 2021.

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Relative importance

We derived the relative importance for each attribute for the population and the two classes

(Figure 3). For the population, physician's reputation was the most influential attribute. The

second was annual contract costs. Service type was the least important. Class 1 was the same

as the mean population. Class 2 regarded physician's reputation as the most important and

service package proved the least important.

Willingness to pay

We also estimated WTP for each attribute level (Table 2). On average, respondents were

willing to pay 29 CNY (4 USD) more for a "home visit" than a "clinic visit". They also were

willing to pay 45 CNY (7 USD) more for a "basic service with chronic disease service", 20

CNY (3 USD) more for a "basic service with TCM service", and 27 CNY (4 USD) more for a

"basic service with personalized service" than the "basic service". Moreover, they were

willing to pay an additional 55 CNY (8 USD) for a physician with "average" reputation and

108 CNY (16 USD) for one with "relatively good" reputation than a physician with a

"relatively poor" reputation.

Class membership profile

We reported the results in the form of average marginal effects for ease of interpretation

(eTable 5 in the supplement). The results suggested that age, gender, education, self-reported

health status, and the number of chronic diseases were statistically significant predictors of

20 / 31

304   class membership. Respondents who were older than 65, male, with a lower education level,

305   self-reported to be "healthy", and with less than one chronic disease were more likely to be

306   assigned to class 1. The expected values for the five significant predictors are in Figure 4.

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308 **DISCUSSION**

309 The underuse of primary care services has become one of the major challenges the Chinese

310 healthcare system is facing today. Whilst the FDCS proposed in 2016 seems promising,

311 patients still preferred visiting high-level hospitals even for mild diseases. Understanding

312 patient preference for the attributes associated with FDCS is therefore important as this allows

313 us to make more informed policy design to provide more effective basic health services and

314 guide residents to the primary health service institutions. To this aim, this study carried out a

315 DCE survey to examine elderly residents' preferences for FDCS.

316

317 Our results suggested that all four attributes (service type, service package, physician's

318 reputation, annual contract costs) had a significant impact on patient choice. The rural elderly

319 most valued the physician's reputation, defined as the competence and attitude of family

320 doctors. This finding is consistent with previous non-DCE studies which reported that patients

321 preferred doctors from secondary or tertiary hospitals because they believed that they possess

322 greater skills than those from primary care clinics.[39] It is also in line with another DCE study

323 of FDCS conducted in rural area of Shandong Province which included two attributes

324 measuring competence and attitudes of doctors separately.[21]

325

326 The annual contract cost was the second most important attribute. As reported in a study that

327 the importance of out-of-pocket was ranked next to the travel time in the severe health state

22 / 31

328   scenario.[9] The Shandong DCE study also suggested that increasing the contract cost would

329   significantly decrease the willingness to sign a contract with the family doctor team.[21]

330

331   Our study is the first to examine the patient preferences for the service contents of the FDCS.

332   The rural elderly preferred services for chronic diseases over personalized services. Many

333   studies have indicated that the family doctor system has been effective in the management of

334   chronic diseases as it provides continuous, personalized, and comprehensive services in

335   addition to integrated prevention and treatment.[40-42] Over 70% of the participants in our study

336   suffered from at least one chronic disease. Furthermore, the rural elderly have had a low

337   education level, which often complicates the understanding and acceptance of an appropriate

338   combination of personalized services.[43] The majority of the participants in this study did not

339   choose traditional Chinese medicine service over other services package, despite its proven

340   effectiveness for the cure and treatment of chronic disease in other studies.[44,45] Therefore, an

341   argument could be made for the need to offer an additional chronic disease service to the

342   basic service.

343

344   Although the rural elderly preferred home visit compared to clinic visit, this attribute was the

345   least important which is consistent with those from previous studies.[43] Some expressed

346   concerns about home visit, including the lack of appropriate medicine provided as well as the

347   lack of relationship with the physicians. They also worried that home visit would reveal their

348   poor physical health to others. Therefore, policymakers could focus on improving the quality

349   of services provided rather than a wider range of service types.

350

351   The heterogeneous nature of preferences is an important consideration for policymakers who

352   strive to improve the delivery of personalized primary healthcare services. In this study,

353   gender, age, education, self-reported health status, and the number of chronic diseases were

354   identified as important indicators of that heterogeneity. Results from previous studies were

355   consistent with our findings.[46-49] Healthy older men with lower education levels who did not

356   have chronic diseases were more likely to focus on the quality of the services they chose.

357   However, younger women with chronic diseases and who had higher levels of education

358   prioritized service types and their costs. Thus, efforts should be made to improve the quality

359   of FDCS, make the costs of service reasonable and provide personalized service types to the

360   elderly patients with different characteristics.

361

363   **CONCLUSION**

364   Our study suggests that the reputation of the physician could be one of the most important

365   factors for elderly patients in their choice of family doctor contract services. The findings

366   suggest a need to strengthen the training of the family doctor team to meet the potential

367   demand for their services. Particular attention should be paid to developing the doctors'

368   medical skills and doctor-patient communication skills as ways to improve service quality.

369   Annual contract costs and the service package options could also be important factors in

370   deciding to utilize family doctor contract services.

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373 **LIMITATIONS**

374 The research team have made extensive efforts to ensure the quality of data. Only 11 of the

375 participants failed the rationality test suggesting the methods implemented were effective and

376 participants were overall engaged with the choice tasks. Nevertheless, this study still has

377 several limitations. First, we were unable to include more attributes because of the limitations

378 inherent to a DCE; the total number of attributes and levels that could be reasonably included

379 while maintaining respondent comprehension and data quality was limited.[50] Second, the

380 reliance on self-reported data created the risk of hypothetical bias. Third, the quality of the

381 data may be affected by fatigue and cognitive constraints since the participants are the elderly

382 with chronic conditions and a low education level. Fourth, this study only estimated the

383 preference of rural elderly for the FDCS in a single province of China. Expanding the

384 research to other provinces and undertaking comparison between rural and urban areas are

385 warranted.

400 **Data availability statement** The datasets used and/or analyzed during the current study are

401 available from the corresponding author on reasonable request.

402

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528

529 **Figure 1. An example of one choice set used in the discrete choice experiment**
530
531 **Figure 2. Locations of sampling**
532
533 **Figure 3. Relative importance of the attributes within each latent class and at the mean**
534
535 **Figure 4. Profile of latent class membership for each class**
536 **Note:** reference: Age≤65; Gender=male; Education=no school education; Self-reported health
537 status=unhealthy; Number of chronic diseases≤1
538 %: The posterior probability of being assigned to a class.
539

31 / 31

Attributes	Plan1	Plan 2
Service type	Home visit	Home visit
Service package	Basic service + Chronic disease service	Basic service + Personalized service
Physician's reputation	Relatively good	Average
Annual contract costs	40 CNY (6 USD)	80 CNY (12 USD)
Which would you choose?	（　）	（　）
Now suppose you can also choose not to sign up with a family doctor, noting that your diseases would not get better, what would you prefer?		
1. I would still prefer the plan I choose above　（　）		
2. I would choose neither　（　）		

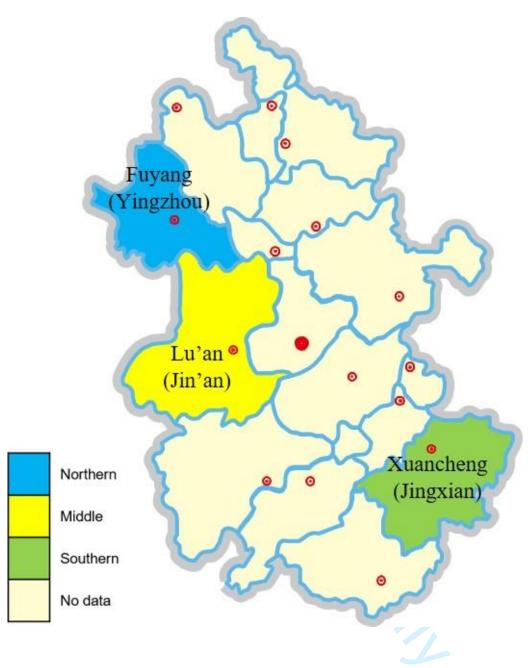**Figure 1. An example of one choice set used in the discrete choice experiment**

Figure 2. Locations of sampling

Class 1

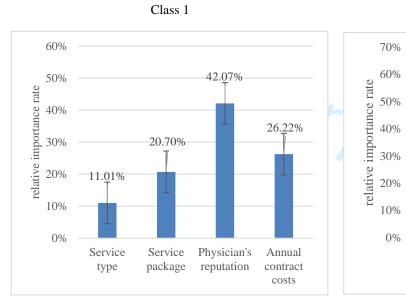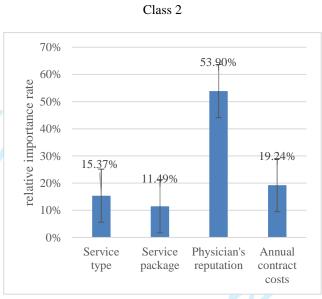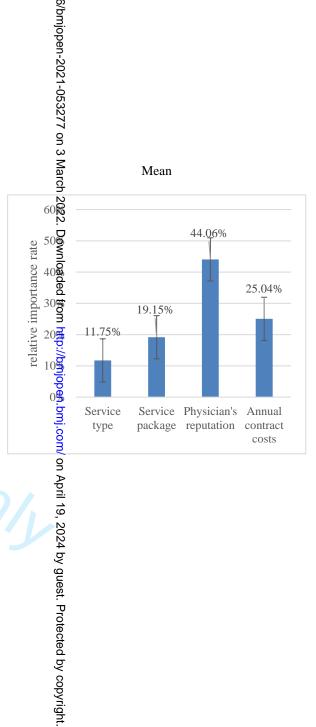Class 2

Mean

Figure 3. Relative importance of the attributes within each latent class and at the mean

Figure 4. Profile of latent class membership for each class

Note: reference: Age≤65; Gender=male; Education=no school education; Self-reported health status=unhealthy; Number of chronic diseases≤1

%: The posterior probability of being assigned to a class.

Supplemental materials:

eTable 1 The detailed explanation of attributes and levels

eTable 2 The content of family doctor contract service package

eTable 3 Covariates in the membership function

eTable 4 Preference estimates based on the conditional logit model

eTable 5 Average marginal effects of covariates on class memberships

Final questionnaire (the translated version)

1

eTable 1 The detailed explanation of attributes and levels

Attributes	Explanations
Service type	Medical services type provided by the family doctor to the elderly, including 2 levels: 1= Clinic visit 2= Home visit
Service package	Medical services were provided by family doctor such as diagnosis and treatment of common and frequently-occurring diseases, as well as treatment of chronic diseases and traditional Chinese medicine (TCM) with a definite diagnosis, including 4 levels: 1= Basic service 2= Basic service +Chronic diseases service 3= Basic service +Traditional Chinese medicine (TCM) service 4= Basic service +Personalized service
Physician's reputation	The residents' evaluation of the quality of physicians. More specifically, this attribute describes different levels of medical training experience and expertise, service attitude and care quality from the family doctor team, including 3 levels: 1= Relatively Good 2= Average 3= Relatively Poor
Annual contract costs[a]	Annual contract costs is the contracted fees per year paid by the contracted residents out-of-pocket to the family doctor team. The levels of contract cost attribute were determined according to actual cost standard in rural Anhui, including 4 levels: 1= 20 CNY(3 USD) 2= 40 CNY(6 USD) 3= 60 CNY(9 USD) 4= 80 CNY(12 USD)

[a]: The average annual exchange rate between USD and CNY in 2019 was: USD 1 = CNY 6.908(Organisation for Economic Co-operation and Development data. Available online: https://data.oecd.org/conversion/exchange-rates.htm. Accessed March 30, 2021)

2

1 **eTable 2 The content of family doctor service package**

Service package	Content	
Basic service	**Basic health service:** • The treatment of common and frequent occurring diseases, nursing care, and the treatment of chronic diseases with a clear diagnosis • First aid care • Home medical and referral services such as home visits, home nursing, home beds, etc. • Rehabilitation medical services • Traditional Chinese medicine services **Public health service:** • Resident health records, health guidance, health education • One physical exam per year for people over 65 years old • Follow up guidance and one physical examination for patients with severe mental illness	
Basic service +Chronic diseases service	Physical exam (height, weight, vision, blood pressure, body temperature, electrocardiogram, color doppler ultrasound (limited to one site), blood glucose/blood lipid, liver and kidney function, hematuria routine)	
	Whole-course standardized services (mainly for patients with chronic diseases such as hypertension and diabetes)	
	Long-term prescription service (continuation of the prescription and medication service of the higher level hospital)	
	One time expert diagnosis and treatment per year	
Basic service +Traditional Chinese medicine (TCM) service	Annual cupping therapy	A maximum of three choices
	Annual treatment of winter diseases in summer	
	Annual fumigation	
	Annual cervical, shoulder, and lumbar traction	
	Annual physical therapy	
Basic service +Personalized service	According to their own health needs, residents are free to choose the combination of chronic disease services offered and TCM services offered, with a maximum of three choices. Examples of combinations include: • Annual diagnosis and treatment of chronic disease by expert + Annual TCM cupping + Annual TCM fumigation • Annual diagnosis and treatment of chronic disease by expert + Annual TCM treatment of winter diseases in summer • Annual physical examination of chronic diseases + Annual TCM fumigation • Long-term prescription of chronic disease + Annual TCM cupping + Annual TCM cervical, shoulder, and lumbar traction • Whole-course standardized services of chronic disease + Annual TCM cervical, shoulder, and lumbar traction + Annual TCM physical therapy • Annual diagnosis and treatment of chronic disease by expert + Annual TCM cupping + Annual TCM physical therapy • Annual chronic disease long-term prescription + Annual TCM fumigation	

3

eTable 3 Covariates in the membership function

Variables	Variable assignment
Age	0= ≤65*
	1= >65
Gender	0= Male*
	1= Female
Education	0= No school education*
	1= Primary school or above
Self-reported health statu[a]	0= Unhealthy*
	1= Healthy
Number of chronic diseases	0= ≤1*
	1= ≥2

[a]：Self- reported health statu is the physical health status of the respondents on the day of the survey. Likert scale was used to measure their physical health status. 1-5 is very unhealthy, unhealthy, moderately healthy, healthy, and very healthy respectively. Unhealth includes very unhealthy and unhealthy, healthy includes moderately healthy, healthy, and very healthy.

*: reference

4

eTable 4 Preference estimates based on the conditional logit model

		Est	SE
ASC1		2.378***	0.185
ASC2		2.254***	0.178
Service type	Clinic visit [a]		
	Home visit	0.608***	0.060
Service package	Basic service [a]		
	Basic service + Chronic disease service	1.105***	0.076
	Basic service + Traditional Chinese medicine service	0.463***	0.086
	Basic service + Personalized service	0.559***	0.104
Physician's reputation	Relatively poor [a]		
	Average	0.376**	0.164
	Relatively good	1.609***	0.151
Annual contract costs		-0.026***	0.002
Number of observations			9810
Log pseudolikelihood			-2656.7801

ASC: Alternative specific constant; Est: Estimate; SE: Standard error

*** p<0.01; ** p<0.05; * p<0.1

[a]: reference

eTable 5 Class membership: average marginal effects

	Class1		Class2	
	Est	SE	Est	SE
Age: >65	0.035***	0.009	-0.035***	0.009
Gender: Female	-0.030***	0.008	0.030***	0.008
Education: Primary school or above	-0.100***	0.007	0.100***	0.007
Self-reported health statu: Healthy	0.028***	0.009	-0.028***	0.009
Number of chronic diseases: ≥2	-0.031***	0.009	0.031***	0.009

Est: Estimate; SE: Standard error

Reference: Age≤65; Gender=male; Education=no school education; Self-reported health statu=unhealth; Number of chronic diseases≤1

*** p<0.01;** p<0.05;* p<0.1

Questionnaire

Dear residents:

In order to improve the quality and efficiency of family doctor contract services, and to understand the elderly residents' choices for the use of family doctor contract services, this study hopes to generate knowledge regarding your service needs. Each of your choices is very important. We ensure that your answers are kept confidential. Thank you very much for your cooperation!

If you are willing to help us complete the question and answer, please sign your name! Thank you very much!

_____

一、 **Demographic characteristics**

1. Gender: ①Male； ②Female

2. Date of birth: _____Year_____Month

3. Education:

①No school education; ②Primary school; ③Junior high school; ④High school/ technical secondary school; ⑤College; ⑥Bachelor degree and above

4. Your marital status:

①Unmarried; ②Married; ③Widowed; ④Divorced; ⑤Other

5. Who do you live with now?

①Living alone; ②Living with spouse; ③Living with children; ④Living with spouse and children; ⑤Other

6. What is your main source of income?

①Labor income; ②Retirement pension; ③Minimum living allowance; ④Support by relatives; ⑤Property income (renting/selling a house/land, etc.); ⑥Others (career insurance, laid-off living expenses, retired living expenses, etc.)

7. In 2018, how much is your own economic income (including various sources) (excluding other family members)?

①<6500 CNY; ②6500-14999 CNY; ③15000-24999 CNY; ④25000-75000 CNY; ⑤>75000 CNY

8. In 2018, how much did you spend on medical treatment (personal payment) in total?

①<500 CNY; ②500-999 CNY; ③1000-1999 CNY; ④2000-4999 CNY; ⑤5000-9999 CNY; ⑥>10000 CNY

9. Have you participated in the following medical insurance? (Multiple choice)

①Not insured; ②Urban employees' basic medical insurance; ③Urban residents' basic medical insurance;④New rural cooperative medical care; ⑤Medical insurance for urban and rural residents

10. Have you purchased commercial medical insurance?

①Yes; ②No

11. What is your evaluation of your health in the past year?

① Very unhealthy; ②Unhealthy; ③Moderately healthy; ④Healthy; ⑤Very healthy

7

12. **If you give a score to your health status, from 0 to 100 (0 represents the worst status, 100 represents the best status), would you score your health status now?**_____

13. **Do you suffer from the following chronic diseases diagnosed by medical institutions at the county level and above (please mark × if not; multiple choices are allowed)?**

①Type 1 or 2 diabetes; ②High blood pressure; ③High blood lipids; ④Chronic hepatitis; ⑤Heart disease (coronary heart disease/angina pectoris, etc.); ⑥Malignant tumor, location; ⑦Chronic lung disease (tuberculosis, chronic obstructive pulmonary disease, etc.); ⑧Others

14. **What do you think of the severity of your chronic disease?**

①Almost effect; ②Slight degree; ③Generally serious; ④Seriously; ⑤Very serious

15. **How do you envaluate the effect of dignosed chronic diseases on your life?**

① Almost impact; ②Slight impact; ③General impact; ④Comparative impact; ⑤Serious impact

16. **Have you taken medicines on time and in quantity for a long period of time in the past year?**

①Yes; ②No

二、 **Family doctor contract service knowledge and willingness to sign**

1. **How many minutes does it take from your home to the nearest village clinic?**

① <15; ②15-30; ③>30

2. **Are you willing to conduct the first diagnosis at a village clinic?**

① Unwilling; ②It doesn't matter; ③Yes

3. **What is the longest time (minutes) you are willing to wait for a clinic visit in the village?**

① <5; ②5-10; ③11-20; ④21-30; ⑤>30

4. **Have you ever had a referral experience from a village clinicto a higher-level institution?**

① Yes; ②No

5. **Are you satisfied with the services of village doctors?**

① Very dissatisfied; ②Not satisfied; ③General; ④Satisfied; ⑤Very satisfied

6. **Are you aware of** Family Doctor Contract Services**?**

① Yes; ②No

7. **Are you willing to sign a contract with a regular family doctor team? (Select "①" to jump to 10)**

① Unwilling; ②Yes but worries; ③Yes

8. **Have you signed up for Family Doctor Contract Services? (Choose "①" to continue to answer 9, choose "②" to skip to 10)**

① Yes; ②No;

9. **What is the main reason you signed thefamily doctor team?**

8

①The community doctor is fixed and understands the patient's condition; ②Convenient service (short distance for treatment/short waiting time/easy to make an appointment); ③Low price and low cost; ④Good service attitude; ⑤Other, please specify

10. What is the main reason for you not to sign a family doctor team?

① I don't understand the policy of Family Doctor Contract Services; ②Do not trust the family doctor who may delay the process of my recovery; ③Difficulty in referral; ④The level of diagnosis and treatment in village clinic is low; ⑤Medical equipment in the village clinic is out of date; ⑥Insufficient medicines are provided; ⑦Worry that the free choice of medical treatment will be affected after signing the contract; ⑧Others, please specify

三、   **Preference measure**

Suppose you now have two Family Doctor Contract Services plans to choose from, plan 1 and plan 2. There are differences between the two plans in terms of service type, service package, doctor's reputation, and annual contract costs. It is assumed that, except for the four attributes listed, the other conditions of plan 1 and plan 2 are the same. Please choose one plan that you prefer based on your personal preferences. Each of your choices will affect the formulation of policies related to family doctor contract service. Please consider your choices carefully.

◇**Warm -up choice set**

Attributes	Plan1	Plan 2
Service type	Home visit	Clinic visit
Service package	Basic service	Basic service
Physician's reputation	Average	Relatively poor
Annual contract costs	80 CNY (12 USD)	40 CNY (6 USD)
Which would you choose?	( )	( )
Now suppose you can also choose not to sign up with a family doctor, noting that your diseases would not get better, what would you prefer?		
1. I Would still prefer the plan I choose above ( )		
2. I Would choose neither ( )		

1. **Choice set 1**

Attributes	Plan1	Plan 2
Service type	Clinic visit	Clinic visit
Service package	Basic service + Personalized service	Basic service + Traditional Chinese medicine (TCM) service
Physician's reputation	Relatively poor	Relatively poor
Annual contract costs	20 CNY (3 USD)	40 CNY (6 USD)
Which would you choose?	( )	( )
Now suppose you can also choose not to sign up with a family doctor, noting that your diseases would not get better, what would you prefer?		
1. I Would still prefer the plan I choose above ( )		
2. I Would choose neither ( )		

9

2. **Choice set 2**

Attributes	Plan1	Plan 2
Service type	Home visit	Clinic visit
Service package	Basic service	Basic service + Chronic disease service
Physician's reputation	Relatively poor	Relatively poor
Annual contract costs	80 CNY (12 USD)	80 CNY (12 USD)
Which would you choose?	( )	( )
Now suppose you can also choose not to sign up with a family doctor, noting that your diseases would not get better, what would you prefer?		
1. I Would still prefer the plan I choose above ( )		
2. I Would choose neither ( )		

3. **Choice set 3**

Attributes	Plan1	Plan 2
Service type	Home visit	Home visit
Service package	Basic service + Chronic disease service	Basic service + Personalized service
Physician's reputation	Relatively good	Average
Annual contract costs	40 CNY (6 USD)	80 CNY (12 USD)
Which would you choose?	( )	( )
Now suppose you can also choose not to sign up with a family doctor, noting that your diseases would not get better, what would you prefer?		
1. I Would still prefer the plan I choose above ( )		
2. I Would choose neither ( )		

4. **Choice set 4 (test choice set)**

Attributes	Plan1	Plan 2
Service type	Home visit	Home visit
Service package	Basic service	Basic service
Physician's reputation	Relatively good	Relatively good
Annual contract costs	40 CNY (6 USD)	80 CNY (12 USD)
Which would you choose?	( )	( )
Now suppose you can also choose not to sign up with a family doctor, noting that your diseases would not get better, what would you prefer?		
1. I Would still prefer the plan I choose above ( )		
2. I Would choose neither ( )		

5. **Choice set 5**

Attributes	Plan1	Plan 2
Service type	Clinic visit	Home visit

10

Service package	Basic service + Personalized service	Basic service + Personalized service
Physician's reputation	Average	Relatively good
Annual contract costs	60 CNY (9 USD)	60 CNY (9 USD)
Which would you choose?	( )	( )
Now suppose you can also choose not to sign up with a family doctor, noting that your diseases would not get better, what would you prefer?		
1. I Would still prefer the plan I choose above ( )		
2. I Would choose neither ( )		

6. **Choice set 6**

Attributes	Plan1	Plan 2
Service type	Clinic visit	Home visit
Service package	Basic service + Traditional Chinese medicine (TCM) service	Basic service + Traditional Chinese medicine (TCM) service
Physician's reputation	Relatively good	Average
Annual contract costs	80 CNY (12 USD)	20 CNY (3 USD)
Which would you choose?	( )	( )
Now suppose you can also choose not to sign up with a family doctor, noting that your diseases would not get better, what would you prefer?		
1. I Would still prefer the plan I choose above ( )		
2. I Would choose neither ( )		

7. **Choice set 7**

Attributes	Plan1	Plan 2
Service type	Home visit	Clinic visit
Service package	Basic service + Traditional Chinese medicine (TCM) service	Basic service
Physician's reputation	Average	Relatively good
Annual contract costs	60 CNY (9 USD)	60 CNY (9 USD)
Which would you choose?	( )	( )
Now suppose you can also choose not to sign up with a family doctor, noting that your diseases would not get better, what would you prefer?		
1. I Would still prefer the plan I choose above ( )		
2. I Would choose neither ( )		

8. **You have completed all the choice tasks, are you clear about the decision making process? (If you choose ①/ ②, skip to 10)**

① Very unclear; ②Unclear; ③General; ④Clear; ⑤Very clear

9. **Do you find these choice tasks difficult? (If you choose ①/② to continue to answer 10, choose ③/④/⑤ to skip to 11)**

11

①Very difficult; ②Difficult; ③General; ④Easy; ⑤Very easy

10. Why do you feel that the selection process is unclear/difficult?_____.

11. Which of the following criteria did you choose when you made your choice?

①Look at each option carefully; ②Look only at the most important option for me, please explain_____;③ The options you care about are different each time; ④Others, please specify_____.

12. Please rate the four attributes in the plan according to their importance (tick √ in the corresponding box)

Attribute	Very unimportant	Unimportant	General	Important	Very Important
Service type					
Service package					
Doctor's reputation					
Annual contract costs					

13. Is the survey subject certain when making the choices? (Filled by investigator)

① Very uncertain; ②Uncertain; ③Neither; ④Certain; ⑤Very certain

Thank you again for participating in our survey!

Interviewer: _____   **Survey date:** _____year ـــــــــmonth ـــــــــday
Quality control officer: _____   **Audit date:** _____year ـــــــــmonth ـــــــــday

12

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1	See manuscript
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3-4	
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	6-9	
Objectives	3	State specific objectives, including any prespecified hypotheses	9	
Methods				
Study design	4	Present key elements of study design early in the paper	10-12	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	12-14	
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	12-14	
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	-	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	-	
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	-	
Bias	9	Describe any efforts to address potential sources of bias	-	
Study size	10	Explain how the study size was arrived at	12-14	

Continued on next page

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	-
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	14-16
		(*b*) Describe any methods used to examine subgroups and interactions	14-16
		(*c*) Explain how missing data were addressed	14-16
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed	14-16
		Case-control study—If applicable, explain how matching of cases and controls was addressed	
		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	-
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	-
		(b) Give reasons for non-participation at each stage	-
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	17-18
		(b) Indicate number of participants with missing data for each variable of interest	17-18
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	-
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	-
		*Case-control study—*Report numbers in each exposure category, or summary measures of exposure	-
		*Cross-sectional study—*Report numbers of outcome events or summary measures	-
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	18-21
		(*b*) Report category boundaries when continuous variables were categorized	-
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-

Continued on next page

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	22-25
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	26
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	22-25
Generalisability	21	Discuss the generalisability (external validity) of the study results	22-25
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	27

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.