

# Analysis of Guangzhou Residents' Willingness to Sign Family Physicians and Its Influencing Factors Based on Structural Equation Model

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**Abstract** Based on technology acceptance model, perceived risk, perceived ease of use, perceived usefulness, subjective norm and behavioral attitude are extracted as important factors affecting residents to sign the family physician. The close relationship between the factors is studied by constructing structural equation model (SEM). And the empirical test of fitted SEM shows that all the above factors have impact on residents' signing of family physicians directly or indirectly and the subjective norm plays the most important role in signing family physicians. In response to the above influencing factors of signing family doctor the related government department can take relevant measure to implement family doctor services efficiently.

**Keywords:** family physician, technology acceptance model, structural equation model, model test

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## 1. Introduction

Recently, some scholars have done a lot of research on family physician service level, service concept, service goal and social cognition. For example, Fishbein and Ajzen [1] formally put forward the Theory of Rational Behavior (TRA) and established a conceptual framework composed of belief factors, behavior attitudes, subjective norms, behavior intentions and actual behaviors. In this theory, people are assumed rational and the actual behavior of individuals is determined to some extent by behavioral intention, which in turn is determined by the individual's attitude to the behavior and subjective norms. In 1989 Davis [2] proposed the Technology Acceptance Model (TAM). It subdivides behavioral belief factors into perceived usefulness and perceived ease of use. The model assumes that the stronger is the user's attitude toward the use of a new technology, the stronger is his behavioral intention, and the higher is his behavior toward the use of the technology.

Also, Yang et al. [3] set up 11 first-class indicators when studying the impact of perceived risk cognition on user trust and behavior, namely perceived usefulness, perceived usefulness, subjective norm, financial risk, privacy risk, security risk, social risk, psychological risk, time risk, trust and behavioral intention. Moreover, the research on contracted services for family physicians in China is mainly focused on the practices of pension

services, chronic disease management and health management. The practices in different regions are different. It is difficult to dig out universally applicable experience from the research results that use less sample data and measurement methods.

In view of the high contracting rate in various regions of Guangzhou and the low utilization rate of family physicians' services, this paper aims to combine the characteristics of family physicians' service supply to analyze the key factors that affect the blocking of family physicians' contracting, and explore the innovative experience of family physicians in Guangzhou city. Based on the theoretical basis of TAM and TRA, this paper proposes a structural equation model to verify the specific factors and the degree of influence that affect Guangzhou residents' willingness to sign a contract for the family physicians system. It can facilitate the health care departments to improve the long-term stable service for family physicians and promote the institutionalization and legalization of classified diagnosis treatment in Chinese medical reform.

## 2. Sampling and Questionnaire Survey

### 2.1. Sample Size Determination

As the information of all sampling units cannot be mastered in the actual survey, the quota sampling method is adopted in this survey. This questionnaire survey takes

gender as the control variable and uses quota method to extract samples with sample size  $n=450$ . Considering that the gender difference in the degree of attention paid by family physicians has a greater impact on the survey results, this paper selects 1:2 as the ratio of men to women in the questionnaire according to the gender ratio in domestic work [4] shown in Table 1.

Table 1. Single Variable Quota Allocation Table

Gender	Gender Ratio in Domestic Work	Proportion of Questionnaires	Quota
male	1/3	1/3	150
female	2/3	2/3	300
Total	100%	100%	450

In this survey, a total of 476 questionnaires were distributed and 470 were returned, with a return rate of 98.7%. 434 of them were valid, and the effective rate was 92.3%. After screening, the gender ratio meets the gender ratio of housework. And the questionnaire structure of this survey is formed as Table 2.

Table 1. Questionnaire Structure

Part	Specific content
Part I: Basic Information	Residents' understanding of family physicians' signing services and ways of understanding.
	The situation of residents signing family physicians and signing methods.
	Family physicians make health assessment and health planning for contracted families.
	The demand of resident's contract family physicians and the factors affecting resident's contract.
	Medical problems residents want family physicians to improve.
Part II: Residents' Willingness to Use family physicians	Perceived usefulness, perceived ease of use, subjective norms, perceived risks, behavioral attitudes and behavioral intentions.
Part III: Basic Information	Gender, age, occupation, region, opinions and suggestions on family physicians system.

## 2.2. Reliability and Validity Test of Questionnaire

Table 2. Reliability and validity test results of all dimensions

	Cronbach's $\alpha$	C.R.	A.V.E.
PU	0.831	0.833	0.625
PE	0.721	0.747	0.500
SN	0.733	0.809	0.586
PR	0.696	0.735	0.502
AT	0.862	0.862	0.675
BI	0.903	0.869	0.689

In this study, Cronbach's  $\alpha$  coefficient and combination reliability are calculated and used to test the data of this questionnaire survey. From reliability and validity test result Table 3 one can see that Cronbach's  $\alpha$  of each dimension such as perceived usefulness, perceived ease of use and subjective norm is above or close to 0.7, and its combined reliability is greater than or equal to 0.7. This shows that the reliability quality of each dimension is high.

In terms of validity test, AVE in each dimension is greater than or equal to 0.5, which indicates that the measurement scale has good discrimination validity.

## 3. Theoretical Model

### 3.1. Theoretical Model Hypothesis

Residents' subjective norm refers to the external pressure on a certain behavior from the referenced individuals or groups around, which is expressed as mandatory norm and descriptive norm [5]. Mandatory norms are reflected in the residents' preference to sign up for family physicians services under the approval of their friends around them for a certain behavior. Descriptive norms are reflected in the fact that residents can better integrate into their surroundings when signing contracts under the herd mentality. According to the rational behavior theory and the technology acceptance theory, residents' subjective norm will change residents' attitude towards signing the contract through the residents' enhanced sense of usefulness in signing the family physicians service, thus improving residents' intention to sign the contract. To construct the relevant theoretical model we assume the following model hypotheses.

H1: Subjective norm has a positive effect on perceived usefulness directly.

H2: Perceived usefulness has a positive effect on residents' attitude toward using directly.

H3: Residents' attitude toward using have a positive effect on their behavioral intention directly.

For example, Yang et al. [3] shows that the perceived risk level of users is an important factor affecting their willingness to use Yu'e Bao, so perceived risk has a key impact on individual behavior. According to the theoretical behavior theory and its extension, when residents have a higher perceived risk to contracted family physicians services, residents' behavior attitude will change negatively and residents' perceived ease of use will be reduced at the same time. Perceived ease of use refers to the ease with which users think of using this technology. When residents' perceived ease of use for family physicians services increases, perceived usefulness will increase, which will also promote the positive change of their behavior attitude, thus promoting residents' willingness to sign contracts.

H4: Residents' perceived risk has a negative impact on their perceived ease of use directly.

H5: Residents' perceived ease of use has a positive effect on their perceived usefulness directly.

H6: Residents' perceived risk has a negative impact on their behavioral intention directly.

H7: Residents' perceived ease of use has a positive impact on their attitude toward using directly.

### 3.2. Construction of Theoretical Model

According to the above hypothesis analysis, this paper proposes a theoretical hypothesis model of residents' intention to use family physicians services as shown in Figure 1.

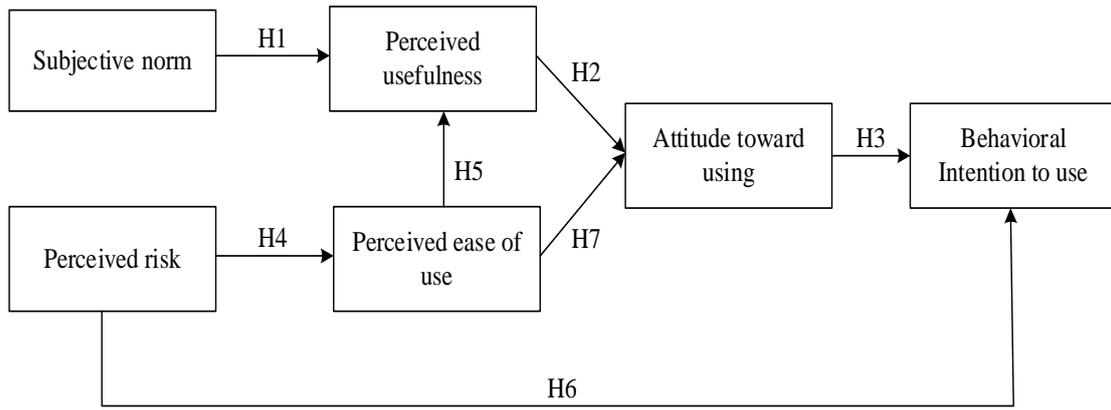


Figure 1. Theoretical Model

**3.3. Variable Definition and Its Measurement Index**

The variables involved in this model include perceived usefulness, perceived ease of use, subjective norm, perceived risk, behavioral attitude and behavioral intention. In order to make a comparative analysis with the

existing research and ensure the continuity of the research contents, this paper makes a summarized analysis of the measurement indexes of the above variables at home and abroad, and makes modifications in combination with the characteristics and specific conditions of family physicians services as shown in the following Table 4.

Table 4. Variable Definition and Its Measurement Index

Latent Variable	Coding	Measurement Problem Item	Literature Source
Perceived usefulness	PU1	I think family physicians can meet the needs of daily health care.	(Davis,1989) (Hassan, H. E.et al,2019[6])
	PU2	I think family physicians can effectively monitor personal health and prevent diseases.	
	PU3	I think the family physicians service can benefit the special group (lonely, widowed, disabled, pregnant, etc.).	
Perceived ease of use	PE1	The process of signing a family physicians is simple and quick.	(Davis,1989) (Senft, N.et al,2020[7])
	PE2	It is convenient to consult/see a doctor under the family physicians system.	
	PE3	I know and understand how to sign a family physicians.	
Subjective norm	SN1	If most people use family physicians service, then I will follow the contract to use it.	(Venkatesh, V. et al, 2000 [8]);
	SN2	The publicity and guidance from the community will make me more willing to sign a family physicians.	
	SN3	The recommendation of relatives, friends and colleagues will affect my signing of a family physicians.	
Perceived risk	PR1	I will worry that my personal information will be illegally used by family physicians.	(Hassan, A. M. et al,2006) [9]; (Chen et al, 2013) [10]
	PR2	I don't think the family physicians service is safe and reliable enough.	
	PR3	I don't think I can get an effective professional reply to the family physicians' consultation.	
Attitude toward using	AT1	I think family physicians are a service system benefiting the people.	(Fishbein M & Ajzen I,1980[11]); (Ajzen,1991[12])
	AT2	I think the family physicians system is feasible.	
	AT3	I am optimistic about the future development of family physicians service.	
Behavioral Intention to use	BI1	I am willing to understand and use the family physicians service.	(Jarvenpaa, S. L.et al, 2000 [13]);
	BI2	I am willing to recommend or share family physicians services with others.	
	BI3	I will use family physicians service in the future/I will continue to use family physicians service.	

# 4. Construction, Estimation and Evaluation of Structural Equation Model for Guangzhou Residents' Contracting with family physicians

## 4.1. Construction of Structural Equation Model

Structural equation model is a method to establish, estimate and test causal relationship model. Pereira et al. [14] uses SEM to investigate the complex associations between the condition of SMS factors and the occurrence of specific types of accident precursors in a quantitative manner. Mostafa et al. [15] revealed that work meaningfulness partially mediated the relationship between ethical leadership and engagement. Yang et al. [16] found that higher social support from family predicting higher trust in health information from family members. Tsui [17] explored the views and preferences of 400 college students on e-government service based on TAM. Measurement model uses observation variables to construct latent variables. The relationship between latent variables and observation variables constitutes the connotation of the whole conceptual model. The measurement model is usually expressed as

$$\begin{cases} x = \Lambda_x \xi + \delta \\ y = \Lambda_y \eta + \varepsilon \end{cases}$$

where x and y respectively represent specific measurable exogenous indexes and endogenous measurable variables;  $\xi$  and  $\eta$  respectively represent exogenous latent variables and endogenous latent variables;  $\Lambda_x$  and  $\Lambda_y$  respectively represent the relationship between exogenous measurable indicators and exogenous latent variables, and the relationship between endogenous indicators and endogenous latent variables;  $\delta$  and  $\varepsilon$  respectively represent the errors of the exogenous measurement model and the endogenous measurement model.

In the structural equation model, the structural model is mainly used to deal with the linear relationship between

latent variables. Because the structural model involves latent variables, the latent variables are also measured in the structural model. Therefore, the structural model actually includes the measurement relation and the structural relation. The structural model is usually expressed as

$$\eta = B\eta + \Gamma\xi + \zeta$$

In the formula, B is the structural coefficient matrix of endogenous latent variables;  $\Gamma$  is Structural coefficient matrix of exogenous latent variable and endogenous latent variable;  $\zeta$  is the equation error in the structural equation model, indicating the part that exogenous latent variables cannot explain endogenous latent variables.

## 4.2. Model Construction and Coefficient Estimation

A. Multiple collinearity diagnosis. First the preliminary fitting is made according to the previous theoretical model, and the observation indexes are also diagnosed with multicollinearity to test whether they are suitable for structural equation modeling. The results show that the variance inflation factor (VIF) ranges from 1.687 to 3.064, which is obviously less than the threshold value of 5, and the tolerance values are all greater than 0.2, which indicates that there is no collinearity problem of variables and is suitable for structural equation analysis.

B. Model revision. After preliminary fitting we find that perceived ease of use has no significant direct influence on behavior attitude. According to the TAM theoretical model, it is considered that perceived ease of use has an indirect effect on behavior attitude and behavior intention mainly through perceived usefulness. At the same time, we see that perceived risk has a direct impact on perceived ease of use and subjective norm has a direct impact on perceived usefulness. The path of the model is revised as shown in Figure 2.

C. Coefficient estimation and test. In this paper AMOS24.0 is used for structure analysis, and Maximum Likelihood Estimation (MLE) is used for parameter estimation of this structural equation model. The final results are shown in the following Table 5.

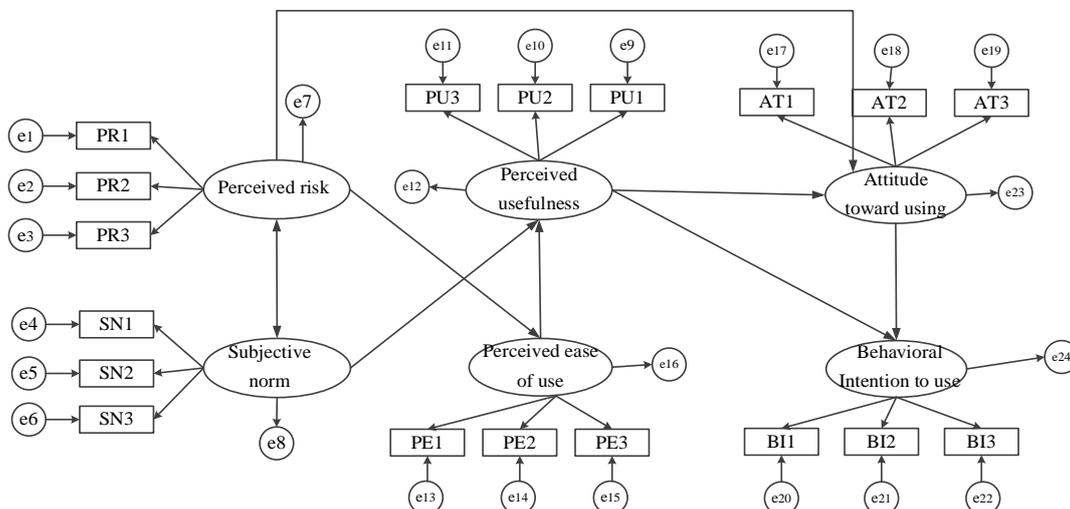


Figure 2. The modified path diagram

Table 5. Table of Regression Coefficient and Significance Test

			Estimate	S.E.	C.R.	P	Standardized estimate
Perceived risk	<---	Subjective norm	-.631	.060	-10.454	***	-.629
Perceived ease of use	<---	Perceived risk	-.362	.067	-5.394	***	-.367
Perceived ease of use	<---	Subjective norm	.551	.084	6.567	***	.557
Perceived usefulness	<---	Subjective norm	.213	.082	2.602	.009	.218
Perceived usefulness	<---	Perceived risk	-.310	.067	-4.648	***	-.318
Perceived usefulness	<---	Perceived ease of use	.402	.105	3.816	***	.406
Attitude toward using	<---	Perceived usefulness	.412	.066	6.228	***	.439
Attitude toward using	<---	Perceived risk	-.465	.066	-7.087	***	-.508
Behavioral Intention to use	<---	Attitude toward using	.558	.067	8.265	***	.475
Behavioral Intention to use	<---	Subjective norm	.540	.066	8.191	***	.502
SN3	<---	Subjective norm	1.000				.700
SN2	<---	Subjective norm	.960	.069	13.871	***	.771
SN1	<---	Subjective norm	1.136	.076	14.972	***	.821
PU1	<---	Perceived usefulness	1.000				.833
PU2	<---	Perceived usefulness	.972	.051	18.903	***	.807
PU3	<---	Perceived usefulness	.920	.057	16.218	***	.727
PE3	<---	Perceived ease of use	1.000				.594
PE2	<---	Perceived ease of use	.927	.082	11.346	***	.784
PE1	<---	Perceived ease of use	.936	.083	11.220	***	.729
AT1	<---	Attitude toward using	1.000				.804
AT2	<---	Attitude toward using	1.067	.056	19.222	***	.835
AT3	<---	Attitude toward using	1.118	.060	18.719	***	.826
PR3	<---	Perceived risk	1.000				.872
PR2	<---	Perceived risk	.864	.050	17.265	***	.765
PR1	<---	Perceived risk	.526	.067	7.856	***	.399
BI3	<---	Behavioral Intention to use	1.000				.836
BI2	<---	Behavioral Intention to use	1.025	.052	19.886	***	.824
BI1	<---	Behavioral Intention to use	1.006	.050	20.297	***	.830

Note: " \* \* \*" means p value is less than 0.001.

Table 5 lists all the regression coefficients estimated by the maximum likelihood method and the results of coefficient significance test on the parameters. The original assumption is that the regression coefficient is equal to 0, and the results show that all roads have reached the significance level of 1%. In addition, from Table 5 one can see that there is no standardized regression coefficient more than or close to 1 (usually 0.95 is the

highest acceptable threshold), there is no too large standard error, and there is no negative error variance.

### 4.3. Research Hypothesis Verification and Conduction Effect Analysis

(1) Research hypothesis verification. The final model fitting result is shown in Figure 3.

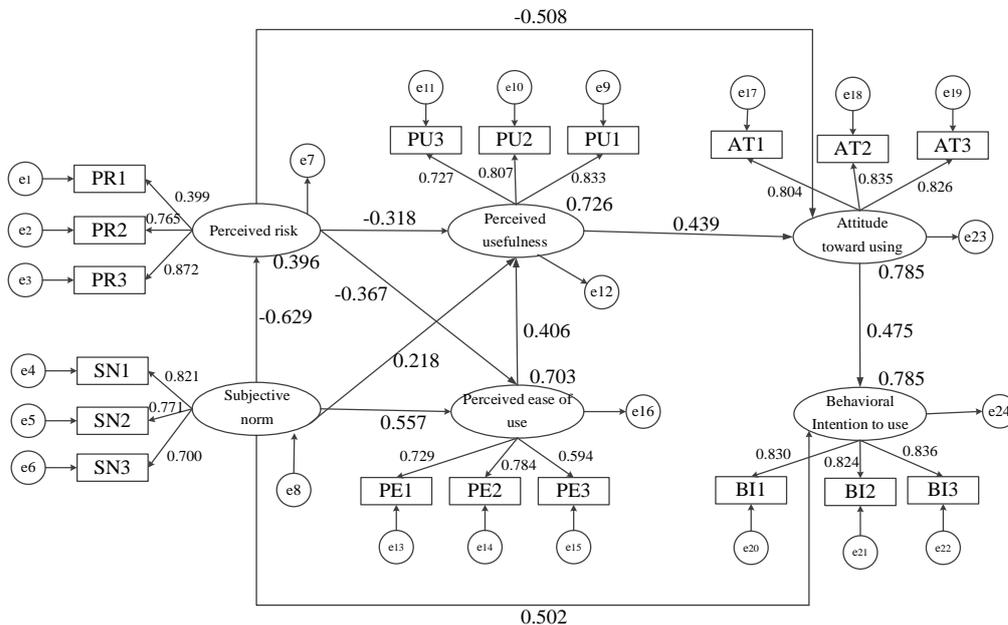


Figure 3. SEM model with standardized path

Combined with Figure 3 and Table 5, it can be verified that the seven hypotheses proposed in this paper are all listed, and the perceived risk and subjective norm have significant correlation characteristics among potential factors. The factor loads of all indicators are above 0.7 except PR1. Due to the indicator PR1 has great practical significance, it should also be considered in the model. The explanatory power of the whole model to endogenous variables are as follows: perceived ease of use ( $R^2=0.703$ ), perceived usefulness ( $R^2=0.726$ ), behavioral attitude ( $R^2=0.785$ ), behavioral intention ( $R^2=0.785$ ) and Perceived risk ( $R^2=0.396$ ).

(2) Model fitting index. The eight model fitting indexes selected in this paper are shown in Table 6. Among the three value-added fitness indexes, IFI, TLI and CFI are 0.952, 0.941 and 0.952 respectively, which are all greater than 0.9. The combination of the three fitness indexes shows that the fitting effect of the model in this paper is good, and the modified model in this paper is suitable for the observation data, which meets the requirements of empirical research.

Finally, three standardized effects including the standardized total effect, the standardized direct effect and the standardized indirect effect of the structural equation model are calculated and listed in Table 7.

Through the analysis of the empirical results one can see that the established H1-H6 in section 3.1 of this paper are valid. And we also find that H7 is invalid because residents just need to follow the doctor's recommendations for treatment or other medical services in the clinic. They also realize the advices of a family doctor are feasible and easy to understand, so residents' perceived ease of use

does not directly affect their attitude to sign a family doctor. In short, Perceived risk, perceived ease of use, perceived usefulness, subjective norm and behavioral attitude all have an impact on the behavioral intention of resident contracting family physicians directly or indirectly. The order of the degree of impact on behavioral intention is subjective norm, behavioral attitude, perceived risk, perceived usefulness and perceived ease of use. In the structural equation model constructed, subjective norms have the greatest impact on residents' signing of family physicians. The reason is that the signing of family physicians in our country is often carried out collectively by communities, villages and towns. People in the collective have many contacts, and residents are greatly influenced by the collective. Therefore, when the majority of the collective sign up for a family physicians, others are more likely to sign up for a family physicians.

Behavioral attitudes have a greater direct impact on behavioral intentions, indicating that the higher residents' evaluation of family physicians, the stronger the intention to sign a family physicians. Therefore, when implementing family contract signing, residents should really realize the benefits of family physicians. However, perceived risk will have a greater negative impact on behavior and attitude, reflecting residents' worries about the medical level and distrust of family physicians, and residents' willingness to sign contracts will also be hindered. Perceived ease of use indirectly affects the attitude of use through perceived usefulness, which indicates that the convenience and practicability of family physicians are still important factors influencing the signing of contracts.

Table 6. Model Fitting Index

Index	CMIN/DF	RMSEA	RMR	PNFI	PGFI	IFI	TLI	CFI
Index Value	2.779	0.064	0.030	0.757	0.672	0.952	0.941	0.952
Recommended Value	1~3	<0.08	<0.05	>0.5	>0.5	>0.9	>0.9	>0.9

Table 7. Standardized Effect of Fitting Model

Standardized Total Effects					
	SN	PR	PE	PU	AT
PR	-.629	.000	.000	.000	.000
PE	.788	-.367	.000	.000	.000
PU	.738	-.467	.406	.000	.000
AT	.644	-.714	.178	.439	.000
BI	.808	-.339	.085	.209	.475
Standardized Direct Effects					
	SN	PR	PE	PU	AT
PR	-.629	.000	.000	.000	.000
PE	.557	-.367	.000	.000	.000
PU	.218	-.318	.406	.000	.000
AT	.000	-.508	.000	.439	.000
BI	.502	.000	.000	.000	.475
Standardized Indirect Effects					
	SN	PR	PE	PU	AT
PR	.000	.000	.000	.000	.000
PE	.231	.000	.000	.000	.000
PU	.520	-.149	.000	.000	.000
AT	.644	-.205	.178	.000	.000
BI	.306	-.339	.085	.209	.000

Note: The row variables in the table are impact factors, and the column variables are impact factors.

## 5. Conclusion

This study mainly explores the influencing factors of residents signing up family physicians. We found that the evaluation of family physicians by people will greatly affect the willingness of others to sign a family physicians. Family physicians are services carried out on a community so the signed up residents' evaluations of family physicians will quickly spread throughout the community. However, there is a great difference between the official signing rate and the sampling rate according to our survey because not so much residents are aware of the family doctor's policy. Further, residents have preferences for signing up family physicians such as daily health protection, systematic health care for special groups, and health consultation. Therefore, in order to promote family doctor services the government's first task is to increase the publicity of family physicians and the number of family physicians as much as possible.

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