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a cross-sectional study

BMJ Open Residents' willingness towards firstcontact with primary health care under uncertainty in healthcare: a crosssectional study in rural China

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ABSTRACT

Objective To estimate Chinese rural residents' willingness degree of initially contacting primary healthcare (PHC) under uncertainty in healthcare and to explore its influencing factors.

Setting This study collected primary data from rural residents in Dangyang, Hubei Province in China.

Participants The study investigated 782 residents and 701 finished the survey. The response rate was 89.64%. A further 27 residents failed the internal consistency test, so the effective sample size was 674.

Design In this cross-sectional study, residents' willingness was reflected by the threshold of disease severity for PHC (TDSP), the individual maximal disease scope for considering PHC based on residents' decisionmaking framework. TDSP was measured through scenario tests. Univariate analysis and unordered multiple logistic regression were used to explore the influencing factors of three-level TDSP: low, general, and high.

Results Only 28.2% of respondents had high TDSP and high willingness towards PHC. Compared with general TDSP, respondents who were younger than 40 (OR 7.344, 95% CI 2.463 to 21.894), rich (OR 1.913, 95% CI 1.083 to 3.379), highly risk-averse (OR 1.958, 95% CI 1.016 to 3.774), had substitute medical decision-maker (OR value of parent/child was 2.738, 95% Cl 1.386 to 5.411) and had no visits to PHC in the last 6 months (OR 2.098, 95% CI 1.316 to 3.346) tended to have low TDSP and low willingness towards PHC. Compared with general TDSP. no factors were found to significantly influence respondents' high TDSP.

Conclusions TDSP can be a good indicator of residents' willingness. TDSP results demonstrate rural residents' generally low willingness towards first-contact with PHC that some residents refuse to consider PHC even for mild diseases. This study provides practical significance for elaborating the underutilisation of PHC from resident decision-making and offers advice to policymakers and researchers for future modifications.

INTRODUCTION

Uncertainty in healthcare, which signals an unknown probability of risk, pertains to nearly every health-related activity such as whether a patient has a particular disease and how that condition will evolve.¹ Uncertainty can

- Yan Zhang
 Image: Contract Stream Contend Contract Stream Contend Contract Strea

and increased judgmental bias, which may bring about defensive decision-making and ≥ behaviour.² ³ Moreover, residents' reactions to uncertainty can be further extended with the increasing freedom of choice of doctors, **g** which has been emphasised by many countries and regions for promoting institutional competition and patients' satisfaction.4-7 Residents can freely determine their healthcare providers according to their estimations, even though governments have encouraged them to first visit primary healthcare (PHC), of the gatekeeper of the national health system, g care providers according to their estimations, for initial diagnosis and referral suggestions. $\overline{\mathbf{g}}$ As a result, residents always subjectively bypass PHC and contact high-level hospitals first even for minor diseases.⁸ In Korea, about 15% of outpatient visits that were eligible for primary institutions chose high-level hospitals.⁹ Under the Japanese free-access healthcare system, undertaking the gatekeeping function of PHC was also a challenge.⁶ The underuse of PHC can be more serious in China, especially

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in rural areas. There is inevitably an increased burden on patients, a waste of limited healthcare resources and inequities among patients when everyone wants to directly get access to high-level hospitals.

In rural China, a tiered healthcare delivery system geographically consisting of county hospitals, township health centres (THC) and village clinics (PHC includes village clinics and THC) has been extensively promoted to provide a full range of health services to local residents.¹⁰⁻¹² Those medical institutions have different responsibilities. PHC institutions are expected to provide preventative and initial care for residents as well as treatment of common diseases, whereas county hospitals are responsible for intractable diseases and emergency issues.¹³ Residents' first-contact with PHC is the key to ensuring the fulfilment of the tiered healthcare delivery system and residents' sequential medical appointments. However, there were 4.25 billion visits of PHC institutions in 2021, accounting for 50.12% of all medical visits, 3.95% lower than the proportion in 2017.¹⁴ Many rural residents only consider county hospitals or above for first-contact regardless of their actual disease situation even if PHC is well capable after years of improving quality and enlarging service scope.¹⁵⁻¹⁸ It is evident that only strengthening PHC in directing patient flow and enhancing the tiered healthcare delivery system is insufficient. The prominent problem is that residents have the freedom to make medical choices, but their considerations and subjective demands for healthcare under uncertainty may not overlap perfectly with the government's ideal expectation.¹³

Therefore, it is necessary to understand residents' decision-making process in China. According to Andersen's behavioural model, residents identify their health demands first before utilising health services, which means they primarily make subjective judgements about the disease condition and its severity.¹⁹ Then residents compare the perceived disease severity with the perceived capacity of PHC, a stable perception of PHC's ability to treat diseases. Residents may be willing to visit PHC first only when they perceive that PHC is capable of treating their diseases, which is the prerequisite decision-making process for generating willingness towards PHC, though residents may still ultimately go to other institutions weighing up situational factors under the freedom of choice of doctors.¹³

This study invents a new method to reflect residents' willingness towards PHC based on their decision-making framework. Due to inadequate medical knowledge and avoidance responses caused by uncertainty in healthcare, residents' perceptions of disease severity often deviate from their objective disease severity, and the degree of deviation varies with personal characteristics.¹ Among the spectrum of diseases of different severity, there exists an approximate severity of objective diseases that in individual resident's mind is so serious that the maximum capacity of PHC exactly cannot handle. We call this objective and abstract upper limit of severity the threshold of

and data

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disease severity for PHC (TDSP), and we measure this by what we call standardised disease severity. Therefore, TDSP can represent the objective and maximal disease scope for individual resident to consider PHC. More importantly, it is a reflection of residents' degree of willingness towards first-contact with PHC.

Although previous studies have noticed the importance of residents' first-contact with PHC, few studies have noticed the possible impact of the spectrum of diseases and different disease severity on residents' willingness towards PHC.^{20 21} Moreover, despite the continuous focus on patients' underuse of PHC and patients' low willingness towards first-contact with PHC, the problem has not towards PHC.^{20 21} Moreover, despite the continuous focus been ameliorated.¹⁴⁻¹⁸ This study primarily summarises **2** residents' decision-making process of medical choices 8 under uncertainty and attempts to essentially elaborate the gap between residents' current status of PHC utilisation and policy expectations in order to provide references for improving willingness towards PHC from the perspective of residents.²² Therefore, this study applied a theoretical framework and standardised tools to measure Bul TDSP among rural residents through scenario tests. Our for uses related to text study has two objectives: (1) to describe rural residents' willingness towards PHC under uncertainty through their corresponding TDSP level; (2) to explore the influencing factors of TDSP to make future recommendations.

MATERIALS AND METHODS Principle of TDSP

TDSP is generated based on two factors: residents' perceived disease severity and perceived capacity of PHC (figure 1). In figure 1, the horizontal and vertical axes both represent standardised disease severity with values from 0 to 1. The capacity of PHC can be understood as



Figure 1 TDSP schematic diagram. PHC, primary healthcare; TDSP, threshold of disease severity for PHC.

by PHC, so the vertical axis connects the disease severity with the capacity of PHC. The curve that depicts the trend of residents' perceived disease severity as disease severity increases is L1. The resident's perceived capacity of PHC is L2, and the horizontal coordinate of the intersection P of L2 and L1 is TDSP. Each resident has a unique L1, L2 and TDSP.

TDSP with an interval between 0 and 1 is the antecedent factor for generating willingness towards PHC. Only when the objective disease severity is lower than the TDSP will the resident include PHC as an alternative plan. The higher the TDSP, the more likely the resident is to consider first-contact with PHC when the disease is relatively serious, and the higher the willingness degree towards PHC. For example, an individual with a TDSP value of 0.4 will consider PHC if the disease scope is between 0 and 0.4 severity, and her willingness to attend PHC first is higher than those with a TDSP of 0.3 or 0.2.

Standardised tool for TDSP

This study applied a standardised disease severity framework already developed based on the incidence of common diseases, clinical pathways and government guidelines.^{23 24} The principle is to equate the standardised disease severity with the difficulty of treating the disease and to roughly grade it through standard treatment combinations, including examinations, operations and the performing institutions. The increasing complexity of treatment combinations is indicative of the increasing standardised disease severity addressed. As for a patient's single consultation, the treatment combinations are categorised into nine situations from the mildest small outpatient clinic (0.1), general outpatient clinic (0.2), to the extremely severe acute and critical care (0.9) (see online supplemental annex 1). A single situation represents a range of disease severity (±0.05), not a specific degree, and the disease severity can be specially adjusted for treatment complexity and duration. The most complex situation within the capacity of PHC is minor inpatient surgery (0.6) according to government guidelines, which means that PHC is capable of treating diseases of 0-0.55 severity when the critical value (0.6) is removed to be conservative.

Measurement of TDSP

To estimate patients' perception of disease severity and plot L1, scenario tests were conducted among respondents based on 10 diseases including common cold (D1), gastritis (D2), gastroenteritis (D3), urticaria (D4), otitis media (D5), furuncle (D6), haemorrhoids (D7), fracture (D8), coronary heart disease (D9) and acute simple appendicitis (D10). The 10 typical diseases were selected based on clinicians' recommendations according to situation categorisations and prevalence among residents. Specific treatment complexity was taken into account to differentiate disease severity. In scenario tests, residents were assumed to suffer from the given symptoms of each of the 10 diseases and were asked to choose their intended

treatment with reasonable interpretations. For example, they wanted to get a transfusion or only take medicine to cure colds (online supplemental file annex 2 for details). To draw L1, a horizontal coordinate from 0.1 to 0.55 was established according to 10 diseases with 0.05 being the interval, and the vertical coordinate was the perceived disease severity of the 10 diseases in line with individual resident's choice. For example, a cold normally required a small outpatient medication prescription with a severity of 0.1, but the resident believed that the cold required an **-**X-ray with a perceived severity of 0.4, so the point (0.1,tected 0.4) was one of the 10 bases for fitting curve the resident's L1. For each individual, a total of 10 points were generated to simulate L1.

As for curve fitting, L1 was fitted, respectively, based 8 opyri on four basic functions: linear, logarithmic, exponential and power functions, yielding four functional expressions for individual L1. The four functions can mainly cover the possible directions and shapes of L1. Then the fitting results were screened according to the following criteria: (1) the function with outliers was excluded; (2) $R2 \ge 0.7$, and the function with the largest R2 was selected; (3) when (1) and (2) were not met, the case was separately checked and analysed to adjust the fitting function.

To estimate resident's perception of the capacity of PHC and plot L2 for each individual, residents were asked to choose the most complex treatment combinations they would like to use in PHC, which demonstrated the ç maximum standardised disease severity they might want e to be treated by PHC. Moreover, to measure residents' perceived capacity of PHC accurately, for each treatment combination they chose, residents could express their intention of three levels: strong, medium and weak (table 1).

TDSP was divided into three levels: low TDSP (0-0.3), general TDSP (0.3–0.55) and high TDSP (>0.55) because ≥ the willingness degree reflected by TDSP intervals can be more accurate and practical than specific values. According to government guidelines for PHC construcğ tion, the cut-off value of 0.3 (standard outpatient clinic) represents the lower limit of the capacity of PHC. Residents who had such minor diseases and refused to consider visiting PHC were classified as having low TDSP and low willingness. The cut-off value of 0.55 (minor inpatient surgery) represents the upper limit of the capacity of PHC. Residents who had diseases more serious than 0.55 and still considered visiting PHC were classified as having high TDSP and high willingness. While residents who scored 0.3–0.55 had low but reasonable willingness **3** towards PHC because different PHC institutions accessed routinely by residents were inconsistent in capacity.

Research setting and data sources

We conducted a cross-sectional study in Dangyang, a typical rural area in Hubei Province in central China, with a rural population of 331349 and a gross domestic product per capita higher than the national average.²⁵ We used the stratified sampling method to randomly

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Table 1 Estimation of reside	nts' perceived capacity of PHC		
Situation categorisation	Treatment combinations utilisation*	Attitude	Standardised disease severity
Standard outpatient clinic	Willing to do minor examinations+general outpatient	Weak	0.25
	treatment+medication in PHC	Medium	0.3
		High	0.35
Outpatient surgery	Willing to do minor examinations+minor	Weak	0.35
	operations+outpatient medication in PHC	Medium	0.4
		High	0.45
Inpatient internal medicine	Willing to accept inpatient monitoring, care and treatment services in PHC	Weak	0.45
		Medium	0.5
		High	0.55
Minor inpatient surgery	Willing to accept minor surgery+inpatient monitoring,	Weak	0.55
	care and treatment services in PHC	Medium	0.6
		High	0.65
*Investigators would help particip PHC, primary healthcare.	ants to tell the connotations and differences between treatment	combinations.	

select three villages from each of the 10 townships in Dangyang. The household survey was conducted in each selected village. Respondents were investigated through face-to-face questionnaire interviews by uniformly trained investigators. Inclusion criteria: (1) > 18 years of age; (2)permanent residents of the area (living in Dangyang for≥6 months); (3) voluntary participation in the study. Exclusion criteria: presence of cognitive impairment. A total of 782 residents were investigated and 701 residents finished the survey, so the response rate was 89.64%. Moreover, 27 respondents did not pass the internal consistency test, so the effective sample size for this study was 674.

Questionnaire design and variables

The questionnaire was self-designed based on government guidelines, previous literature and expert consultations. We conducted a pilot study to verify the consistency between TDSP and residents' self-assessed willingness towards PHC and to test the reliability and validity of the questionnaire. The final version of the questionnaire contained three sections: fundamental personal characteristics, scenario tests and estimation of residents' perceived capacity of PHC. Fundamental personal characteristics identified as independent variables were mainly from three aspects: (1) sociodemographic characteristics including gender, age, education, marital status, employment, economic status and chronic disease status; (2) health-seeking objective factors including county hospital acquaintance and substitute medical decision-maker; (3) health-seeking subjective factors including expected price to cure colds, watching health video frequency, attitudes towards the tiered healthcare delivery system, level of risk aversion and experience of visiting PHC in the last 6 months. The dependent variable was the three-level TDSP.

Patient and public involvement

Patients were not involved in the design and conduct of this research. Residents participated in the pilot study and interviews to ensure the final version of the questionnaire. We also involved experts in health economics and clinicians in the design of this research and survey tool.

Statistical analysis

and data The software SPSS V.26.0 was used to create a database and analyse data with a double check to ensure the quality. Sample descriptions were listed to depict the fundamental characteristics of respondents. Univariate analysis was performed using the χ^2 test and variance analysis. Al training, and The unordered multiple logistic regression method was used to analyse the predictors of three-level TDSP.

RESULTS

Description of TDSP and willingness degree

sim TDSP distribution is shown in figure 2. Among 674 valid respondents, the mean of TDSP was roughly 0.434±0.179, with an upper quartile of 0.285 and a lower quartile of 0.559. The two frequency peaks of TDSP occurred in the intervals of 0.15–0.2 and 0.5–0.55, and the percentage of TDSP below 0.2 and 0.55 was 19.0% and 71.8%, respectively. In general, the overall level of TDSP was relatively **3** low. Only 190 (28.2%) respondents had a high TDSP more than 0.55, and there were 176 (26.1%) respondents who had low willingness towards first-contact with PHC with TDSP less than 0.3.

Baseline characteristics and univariate analysis of TDSP level

Table 2 presents the baseline characteristics of respondents and the results of univariate analysis of their TDSP level. Among 674 respondents, elders over 60 years of

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Figure 2 TDSP distribution diagram. TDSP, threshold of disease severity for primary healthcare.

age accounted for 49.9%. Moreover, respondents under 40 tended to have a higher possibility of low TDSP. As for economics, rich respondents were more likely to have low TDSP, while average and poor respondents tended to occupy a higher proportion of general and high TDSP. When faced with consultation choice, the vast majority of respondents made decisions by themselves. Respondents who had not visited PHC in the last 6 months accounted for 68.5%. Respondents had a strong level of risk aversion accounting for 15.9%, and they were more likely to have low TDSP. In addition, results showed that there were no statistically (p>0.05) significant differences for gender, chronic diseases, expected price to cure colds and attitudes towards the tiered healthcare delivery system.

Table 3 presents the results of the multiple unordered logistic regression model and identifies the predictors of TDSP level. Compared with respondents with general TDSP, factors including age, economics, medical decision maker, level of risk aversion and experience of visiting PHC in the last 6 months significantly (p<0.05) contributed to low TDSP of respondents. Respondents aged under 40, 40-60 and 60-75 were, respectively, 7.34, 2.51 and 4.18 times more likely to have a low TDSP compared with respondents aged 75 and over. Compared with respondents who just finished primary school, those who completed junior school had significantly lower TDSP. Moreover, rich respondents were 1.91 times more likely to have low TDSP than respondents of average economic level. Respondents who were strongly risk-averse were 1.96 times more likely to have a low TDSP than those who were low risk-averse. While respondents with no experience of visiting PHC in the last 6 months were two times as likely to have a low TDSP as those who had such experience. However, compared with respondents with general TDSP, we found no factors that could significantly contribute to high TDSP.

DISCUSSION AND CONCLUSIONS Discussion

Respondents' overall TDSP was relatively low, indicating their willingness to seek primary care was deficient. More than 70% of respondents did not have a high TDSP. The general overestimation of disease severity and the underestimation of PHC capacity together manifest as low TDSP, which explains residents' preferences and habitual visits to larger hospitals first even for treating mild diseases.^{26 27} Although no research directly proved the results, previous research corroborated the findings of this study. Research stated that patients' health condition and disease percep-tion could influence their willingness to seek primary care Š and that patients' willingness to first visit PHC was insufficient and even continuously decreasing.^{13 28–30} Under the 8 freedom of choice of doctors without strict stipulations about referral or triage of patients, the advocacy of the tiered healthcare delivery system cannot effectively guide patients' decision-making process. Residents' lack of awareness of PHC capacity results in the distrust of PHC, which has been regarded as the most immediate reason for residents to skip PHC.^{31 32} In addition, residents' misconceptions about disease severity under uncertainty use are perhaps also essential and fundamental reasons for them bypassing PHC.

Low TDSP level is the focus of this study. Compared with respondents with general TDSP, age, education, economics, substitute medical decision-maker, level of 5 risk aversion and experience for visiting PHC signifitext cantly influenced low TDSP. Respondents older than 75 years old with common diseases were more willing to go to PHC first. As people age, they become more tolerant of diseases, and PHC can be more convenient for them in terms of their visit frequency, distance and medical \exists costs. However, these advantages are not similarly attractive to young residents. As for economics, rich respondents' probability of low TDSP was more than two times that of poor respondents. Rich respondents were inclined to consider PHC only when undergoing a really minor ng, disease. Research also proved that better economic condition was positively correlated with residents' willingness towards high-level hospitals.³³ Higher income represents insensitivity to healthcare costs and high demand for quality health resources, which can simplify the decisionmaking process directed to high-level hospitals.³⁴ Moreover, high risk-averse respondents were more likely to have low TDSP. Residents' aversive reactions to uncertainty and its unknown risk can lead to an increased focus on their a disease severity and a careful decision-making process.²⁷³⁵ Patients would rather choose high-level hospitals to bear high financial costs than take the little risk of medical delay, which is to 'pay for the peace of mind'. We also found that respondents who had no visits to PHC in the last 6 months tended to have low TDSP. Personal experi-

ence may modify residents' understanding of PHC institu-

tions and mitigate their perceived risk of seeking primary

care. However, this study found no significant relation-

ship between individual chronic disease condition and

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		TDSP level				
Characteristic	N (%)	Low (%)	General (%)	High (%)	χ²	P value
Sex					5.174	0.075
Female	328 (48.7)	98 (55.7)	146 (47.4)	84 (44.2)		
Male	346 (51.3)	78 (44.3)	162 (52.6)	106 (55.8)		
Age					29.154	< 0.001
<40	77 (11.4)	37(21)	23 (7.5)	170 (8.9)		
40–59	261 (38.7)	63 (35.8)	125 (40.6)	73 (38.4)		
60–74	270 (40.1)	69 (39.1)	121 (39.3)	80 (42.2)		
≥75	66 (9.8)	7 (4)	39 (12.7)	20 (10.5)		
Education					25.283	<0.001
Primary school	263(39)	42 (23.9)	140 (45.5)	81 (42.6)		
Junior school	245 (36.4)	77 (43.8)	101 (32.8)	67 (35.3)		
Senior school	129 (19.1)	42 (23.9)	55 (17.9)	32 (16.8)		
College and above	37 (5.5)	15 (8.5)	12 (3.9)	10 (5.3)		
Marital status				. ,	10.138	0.038
Married	620(92)	157 (89.2)	287 (93.2)	176 (92.6)		
Unmarried	22 (3.3)	12 (6.8)	5 (1.6)	5 (2.6)		
Divorced or widowed	32 (4.7)	7 (4)	16 (5.2)	9 (4.7)		
Employment					21.594	0.001*
Farming or workers	381 (56.5)	82 (46.6)	190 (61.7)	109 (57.4)		
Individual business, work in enterprises	143 (21.2)	48 (27.3)	54 (17.5)	41 (21.6)		
Retirement	136 (20.2)	36 (20.5)	61 (19.8)	39 (20.5)		
Others	14 (2.1)	10 (5.7)	3 (1)	1 (0.5)		
Economics					13.778	0.008
Rich	101(15)	38 (21.6)	33 (10.7)	30 (15.8)		
Average	483 (71.7)	120 (68.2)	224 (72.7)	139 (73.2)		
Poor	90 (13.4)	18 (10.2)	51 (16.6)	21 (11.1)		
Chronic diseases					6.017	0.198
0	340 (50.4)	102(58)	144 (46.8)	94 (49.5)		
1 or 2	277 (41.1)	60 (34.1)	136 (44.2)	81 (42.6)		
More than 2	57 (8.5)	14(8)	28 (9.1)	15 (7.9)		
County hospital acquaintanc	e				6.515	0.038
Yes	122 (18.1)	43 (24.4)	50 (16.2)	29 (15.3)		
No	552 (81.9)	133 (75.6)	258 (83.8)	161 (84.7)		
Substitute medical decision-	maker				11.199	0.024
No (oneself)	541 (80.3)	128 (72.7)	253 (82.1)	160 (84.2)		
Partner	70 (10.4)	22 (12.5)	29 (9.4)	19(10)		
Parent/child	63 (9.3)	26 (14.8)	26 (8.4)	11 (5.8)		
Expected price for outpatient	t				15.291	0.018
50 yuan	286 (42.4)	63 (48.1)	148 (39.5)	75 (42.4)		
100 yuan	246 (36.5)	80 (29.2)	90(40)	76 (36.5)		
300 yuan	103 (15.3)	25 (16.9)	52 (13.7)	26 (15.3)		
500 yuan	39 (5.8)	8 (5.8)	18 (6.8)	13 (5.8)		
Watching health video	. ,	· /			10.048	0.04
9						

Table 2 Continued

		TDSP level				
Characteristic	N (%)	Low (%)	General (%)	High (%)	χ ²	P value
Always	104 (15.4)	34 (11.4)	35 (18.4)	35 (15.4)		
Occasionally	227 (33.7)	65 (34.1)	105(30)	57 (33.7)		
Rarely	343 (50.9)	77 (54.5)	168 (51.6)	98 (50.9)		
Attitudes towards tiered heal	thcare system				6.448	0.168
Agree	588 (87.2)	145 (89.3)	275 (88.4)	168 (87.2)		
Disagree	50 (7.4)	18 (5.5)	17 (7.9)	15 (7.4)		
Indifferent	36 (5.3)	13 (5.2)	16 (3.7)	7 (5.3)		
Level of risk aversion					13.43	0.009
Strong	107 (15.9)	42(13)	40 (13.2)	25 (15.9)		
Middle	413 (61.3)	104 (62.7)	193 (61.1)	116 (61.3)		
Low	154 (22.8)	30 (24.4))	75 (25.8)	49 (22.8)		
Experience of visiting PHC in	the last 6 months				12.582	0.002
Yes	212 (31.4)	37 (36.4)	112 (33.2)	63 (31.5)		
No	462 (68.6)	139 (63.6)	196 (66.8)	127 (68.5)		

Predictors of TDSP level of first-contact with PHC.

*Cases where the expected value is less than 5, corrected with Fisher's exact test.

PHC, primary healthcare; TDSP, threshold of disease severity for PHC.

Table 3 Predictors of TDSP level in the multiple unordered logistic regression model

	Low TDSP				High TDSP				
					-			Р	
Characteristic	β	OR	95% CI	P value	β	OR	95% CI	value	
Age (*≥75)									
<40	1.994	7.344	2.463 to 21.894	<0.001	0.233	1.262	0.486 to 3.274	0.633	
40–59	0.919	2.508	0.978 to 6.429	0.056	0.002	1.002	0.516 to 1.947	0.995	
60–74	1.430	4.181	1.680 to 10.405	0.002	0.266	1.304	0.692 to 2.458	0.411	
Education (*primary school)									
Junior school	0.913	2.491	1.501 to 4.136	<0.001	0.112	1.053	1.053 to 0.361	0.924	
Senior school	0.553	1.739	0.923 to 3.273	0.087	-0.089	0.915	0.512 to 1.635	0.764	
College and above	0.319	1.376	0.484 to 3.914	0.550	0.052	1.119	0.716 to 1.747	0.621	
Economics (*average)									
Rich	0.649	1.913	1.083 to 3.379	0.025	0.420	1.521	0.867 to 2.670	0.144	
Poor	-0.201	0.818	0.441 to 1.517	0.524	-0.453	0.636	0.363 to 1.114	0.114	
Substitute medical decision maker (*oneself)									
Parent/child	1.007	2.738	1.386 to 5.411	0.004	-0.387	0.679	0.316 to 1.460	0.322	
Partner	0.709	2.032	1.071 to 3.856	0.030	0.135	1.145	0.613 to 2.139	0.672	
Level of risk aversion (*low)									
Strong	0.672	1.958	1.016 to 3.774	0.045	-0.09	0.914	0.482 to 1.731	0.782	
Middle	0.135	1.144	0.683 to 1.917	0.609	-0.130	0.878	0.567 to 1.360	0.560	
Experience of visiting PHC in the last 6 months (*yes)									
No	0.741	2.098	1.316 to 3.346	0.002	0.138	1.148	0.773 to 1.705	0.494	
*Indicates the reference group.									

PHC, primary healthcare; TDSP, threshold of disease severity for PHC.

their TDSP level. The Chinese government has dedicated itself to constructing PHC for managing chronic diseases sustainably, which has also been regarded as an opportunity to develop the gatekeeping function of PHC.^{36 37} By the goal, a previous study found that rural residents with chronic diseases had stronger acceptance of the tiered healthcare system and were less likely to skip PHC.³⁸ As for our findings, chances are that the management of chronic diseases has not been fully underlined in study areas

Results also suggested that 28.2% of respondents had high TDSP, which meant they continuously considered PHC first when their disease was relatively severe. The high willingness towards PHC is beneficial to residents' sequential and effective utilisation of medical resources according to the advocacy of the tiered healthcare delivery system. However, compared with respondents with general TDSP, we did not find factors that could significantly influence high TDSP. Possibly, residents' high TDSP is mainly due to individual estimates of disease severity rather than other factors. However, residents with high TDSP might underestimate severe diseases and have the risk of delaying treatment in PHC, even though PHC brings convenience and good health accessibility to them.¹² Special attention needs to be paid to providing serious patients with appropriate referrals to high-level hospitals.

Rural residents' average low willingness towards firstcontact with PHC reflects the dilemma of 'matching supply and demand' between residents and the government. The conflict lies in the fact that the government makes plans based on the population's probability of disease and group objective health needs, while the individual resident moves based on her subjective judgement and perceived health demand.³⁹ Under the freedom of choice of doctors residents are responsible for determining their healthcare providers, but their perception of disease severity is inherently biased and difficult to match with the treatment combinations they truly deserve. Moreover, the category of PHC in rural areas depends on the geographical location, rather than the disease varieties, indicating that PHC may remain ambiguous in its quality and service scope to residents.⁴⁰ In this way, residents' preference for high-level hospitals can arise due to risk aversion and insufficient confidence towards PHC.^{41 42}

To modify rural residents' willingness towards PHC in an attempt to promote health equity and the efficient use of health resources, we make the following recommendations. First, the example of the UK's well-established gatekeeping mechanism provides meaningful references.⁴³ The establishment of a disease triage mechanism with both professionalism and accessibility is a feasible solution, and web-based intelligent healthcare consultation can be an effective form of triage.44 45 Video and graphic information can eliminate the restriction of time and space, and the consultation suggestions given by intelligence can help control residents' uncertainty. By narrowing down the gap between residents' perceived

health demands and their objective health needs, it can guide residents to make rational medical decisions and accordingly increase their willingness towards firstcontact with PHC, so that the tiered healthcare delivery system can be facilitated efficiently.⁴⁶ Second, what residents think and perceive plays an intrinsic role in leading their rational decision-making. Promoting the scientific knowledge of common diseases and the accurate cognition of PHC among rural residents can probably relieve their psychological stress about common diseases and **u** motivate them to contact PHC first for minor diseases. Third, empowering general practitioners by promoting basic clinical skills and in-depth doctor-patient communication may improve patients' experience of visiting PHC and make residents trust PHC more.⁴⁷ A good experience copyright, includ at PHC may change residents' impressions and shift the previous habitual visits to high-level hospitals.

Limitations

This study also has several limitations. First, the connotation of disease severity is ambiguous, so in most previous studies, disease severity has been referred to by descriptive ratings. Although the methodology is not yet perfect, this paper has attempted to quantify the concept of disease severity and tried to optimise it by integrating actual treatment situations, clinical experts' opinions and government guidelines. Second, only 10 diseases were selected 5 text for scenario tests in this study. Each disease severity was represented by one disease, which was susceptible to be impacted by patients' preference for a con-disease. Third, this study estimated the capacity of a for DUC seconding to its achievable treatment combinations from government guidelines, but the guidelines may not be objective and comprehensive enough, which may also give rise to some deviation.

Conclusions

, AI training, TDSP can be a good indicator of residents' willingness towards first-contact with PHC under uncertainty and freedom of choice in healthcare based on residents' decision-making process. Residents' overall TDSP was relatively low with low willingness towards PHC, and a small percentage of residents had high TDSP with high willingness to visit PHC. Age, education, economics, substitute medical decision-maker, level of risk aversion and experience of visiting PHC in the last 6 months were the predictors of low TDSP level. Those results may intervene in future improvement for modifying residents' medical decisions and rationally promoting their willingness towards PHC.

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Patient consent for publication Consent obtained directly from patient(s).

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