# RESEARCH



# Inpatient preferences among patients with multiple chronic conditions in China: A discrete choice experiment



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# Abstract

**Background** Multiple chronic conditions (MCC) have become a leading cause of low vitality and high mortality among the Chinese population. Although a series of policies has been implemented to promote patients' rational access to health care, patients still prefer a higher level of inpatient service, hampering the efficient utilization of resources in county hospitals, which are the first point of contact for inpatient care. Thus, this study aimed to identify the factors that affect MCC patients' inpatient preferences and the extent to which these factors influence their decisions, thereby guiding inpatient service utilization among MCC patients.

**Methods** Five attributes (institution scale, waiting time for hospital admission, presence of acquaintances, travel time from residence to hospital, and out-of-pocket expenses per visit) were identified to estimate inpatient choice for MCC patients through a discrete choice experiment. A partial factor analysis was performed to generate selection sets. Data were collected from MCC patients aged between 35 and 75 years, in Fuqing City, China. A mixed logit model was used to analyse MCC patients' preferences for each attribute. Willingness to pay was estimated by regression coefficients, and interaction terms were included in the model to estimate the heterogeneity of inpatient preferences among MCC patients.

**Results** A total of 504 valid questionnaires were included in the analysis. The most important attribute of patients when choosing inpatient care is out-of-pocket expenses per visit, followed by travel time from residence to hospital, waiting time for hospital admission, institution scale, and presence of acquaintances. In addition, patients were willing to pay ¥1253, ¥434, and ¥323 for shorter times from the residence to the hospital, larger institutional scale, and beds available on the day, respectively. The findings of the interaction analysis indicated that age and gender also influence MCC patients' inpatient preferences.

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**Conclusion** This study provides evidence of the inpatient preferences of MCC patients. Increasing inpatient insurance reimbursement rates, bolstering the leading role of district and county hospitals in the area, and strengthening information systems will empower district and county hospitals to effectively serve as the first point of contact for inpatient care.

Keywords Inpatient preferences, Multiple chronic conditions (MCC), Discrete choice experiment (DCE)

### Introduction

Chronic diseases have become a major public health challenge facing the international community [1], accounting for 30% of global deaths and almost 80% of all deaths in Chinese people aged 60 years and older [2]. According to the World Health Organization's document "China's Assessment Report on Aging and Health", chronic diseases have emerged as the leading cause of mortality in China, with changes in the disease spectrum of the population, and their prevalence is expected to increase by at least 40% by 2030 [3]. In this severe context, it is increasingly common for residents to suffer from multiple chronic conditions (MCC) at the same time. MCC refers to the presence of two or more chronic diseases in a patient that persist for at least one year or more [4]. This can impair patients' ability to perform activities of daily living, resulting in decreased quality of life, increased psychological stress, increased treatment costs, and aggravated adverse effects of treatments or interventions [5].

To strengthen the management of chronic diseases and guide patients' health care-seeking behavior, China has issued a series of supportive policies. In 2009, China launched nationwide health care reform, clarifying community and township health centers are responsible for providing treatment of common and frequent diseases as well as public health services rather than inpatient care [6]. District and county hospitals play the leading role in primary care, serving as the first point of contact for inpatient care. However, given the absence of a well-developed referral system in China, patients can seek inpatient care at any hospital level [7]. In 2015, a hierarchical diagnosis and treatment system (HDTS) that focuses mainly on the management of chronic diseases, such as hypertension and diabetes, was proposed. HDTS refers to different levels of medical institutions undertaking therapy tasks according to disease severity [8]. In 2017, the functional positioning of the member institutions of medical alliances was required to be clarified, and the urban tertiary hospitals were required to gradually reduce the proportion of patients with chronic disease in stable condition [9]. In 2018, family doctor contract services were steadily implemented by district and county hospitals, giving priority to key groups, such as patients with chronic diseases [10]. However, despite these policies, the proportion of inpatient care in district and county hospitals accounted for only 24.9% in 2023,

which was significantly less than the 49.1% in urban tertiary hospitals [11]. This indicates that patients still prefer higher levels of inpatient care, which runs counter to HDTS and is not conducive to the efficient utilization of health resources for MCC patients.

To increase access to the first point of contact for inpatient care and effectively implement HDTS, an investigation of MCC patients' inpatient preferences is urgently needed. Extensive studies have examined the flow of medical treatment for patients with chronic diseases, and the overall finding is that the factors affecting their selection of medical institutions include patient personal factors and external environmental factors, such sociodemographic characteristics, out-of-pocket as expenses, convenience of services, and level of medical institution. However, most scholars pay attention to specific chronic diseases, such as hypertension [12], Parkinson's disease [13], chronic obstructive pulmonary disease [14], etc. Moreover, most research has focused on patient care preferences [15, 16], and there is a dearth of evidence on MCC patients and their inpatient preferences. Furthermore, in the research that has examined patients' inpatient preferences, the analysis methods routinely used include multivariate analysis [17], logistic regression analysis [18], cross-analysis [19], etc., which do not consider that patients' inpatient preferences are the result of combinations of multiple factors and that the importance of different factors varies. In recent years, discrete choice experiment (DCE) has been used in research on patient preferences [13, 20]. The DCE is based on random utility theory, assuming that respondents always prefer the alternative that offers the greatest utility, and its overall utility is decomposed by its attributes [21]. It can quantitatively analyse the impact of the determinants of patients' preference for seeking health care to better understand their health demands.

Therefore, to bridge the knowledge gap of inpatient preferences among MCC patients, as well as to overcome the limitations of previous analytical methods, this study aimed to investigate MCC patients' inpatient preferences and identify the key influencing factors of their choices through a DCE.

### Methods

### Determination of attributes and levels

This study employed the Anderson Healthcare Services Behavior Utilization model as a basis to determine the attributes of a DCE. This model is the most classic and influential theoretical framework in health services research [22]. We hypothesized that MCC patients' inpatient preferences are based on five factors related to patient satisfaction, including convenience, availability, financing, provider characteristics, and quality factors. The attributes were selected on the basis of three criteria: confirmed associations with patients' health care-seeking behavior [16, 23, 24], conformity to the theoretical model, and consultation with health care management experts.

Six relevant experts in different fields (i.e., health technology assessment, health management, health services administration, preventive medicine, and clinical medicine) were invited for consultation via one-on-one online interviews during June and July 2021. Their feedback was then compiled and summarized, which led to adjustments in the attributes and their respective levels. The details of the consultation course and experts' information can be found in Additional File 1. Table 1 shows the final attributes and levels. First, given the nature of the Chinese nepotistic society in which people want to use 'relationships' to gain convenience in normal procedures [25, 26], the convenience factor was measured by the presence of acquaintances in hospitals. Second, the accessibility factor is reflected by the travel time from residences to hospitals rather than travel distance, which can be more intuitively understood by patients [27]. On the basis of the geographical distribution of health care institutions in Fuqing, this study identified two levels of travel time: less than one hour and more than three hours. Third, the financing factor refers to the out-ofpocket expenses per visit. After combining open online data on per capita hospitalization expenditure [28], the final cost range was identified to be 800-5000 Chinese yuan (CNY). Fourth, because the provider characteristic factor refers to the hospital's qualifications, this study used the institution scale to reflect the provider characteristic factor. The scale was categorized into district/ county hospitals and urban tertiary hospitals. Finally, given that the waiting time for hospital admission serves as a performance indicator of service quality [29], this study employed the waiting time for hospital admission to reflect the quality factor.

#### Experiment design and questionnaire development

Because of various inpatient facility choice tasks, the number of attributes and levels  $(2^4 \times 3^1 = 48)$  was considered impractical for a full factorial design. To improve the acceptance of the questionnaire and the cooperation of the respondents, a partial factorial design was used to maximize the D efficiency using SAS. Furthermore, 12 representative pairs of choice sets were obtained, which were set up using the unmarked-choice format with two medical facility options. This study assigned all the selection sets into three different versions of the questionnaire, each containing four choice sets. The main purpose was to avoid cognitive fatigue among respondents and improve questionnaire quality. Previously, Friedel JE [30] reported that the number of selection sets should not exceed 10 unless the option content is very simple. Bech M's research [31] revealed that the choices of patients who completed 17 selection sets were guided by one attribute. Other studies [32, 33] have involved the completion of 4 selection sets. Ultimately, opt-out options were not set in DCE because although they avoid forcing patients to make difficult choices between options, they do not generate the highest utility and provide the most adequate preference information [34]. Thus, optout options were not set in this study. Ultimately, the questionnaire consisted of three parts: demographic characteristics, health status, and DCE tasks (the formal questionnaire is provided in Additional file 2).

#### Sample size

This study followed the DCE sample size estimation principle proposed by Orme [35]. The following formula was used to calculate the minimum sample size:  $N \ge (500^*C) / (T^*A)$ ,

Dimensions	Attributes	Levels	Explanation of attributes
Provider characteristics factor	Institutional scale	District and county hospitals; Urban tertiary hospitals	The rank of medical institution reflects hospital qualifica- tions such as hospital functions, facilities, and sizes.
Quality factor	Waiting time for hospital admission	Bed available on the day; Wait three days for beds	The waiting time to obtain inpatient care provided by medical institutions.
Convenience factor	Presence of acquaintances in hospitals	Acquaintance; No acquaintance	Whether the patient has an acquaintance in medical institutions.
Availability factor	Travel time from residence to hospital	Less than one hour; More than three hours	The time it takes patients to travel from home to the medi- cal institution. It was varied by two levels, based on the geographical distribution of medical institutions in Fuqing.
Financing factor	Out-of-pocket expenses per visit (CNY)	¥800; ¥2000; ¥5000	The average expense that patients need to pay all by themselves per visit and the three levels were calculated based on the average cost per inpatient visit in Fuqing.

Table 1 List of attributes and levels among MCC patients in the discrete choice experiment

Notes: CNY Chinese yuan; MCC multiple chronic conditions

where N represents the number of respondents, T represents the number of choice sets that the respondents need to complete, A represents the number of options that the respondents need to complete in a single choice set, and C represents the maximum level of any attribute. According to this formula, the sample size of this study needed to be greater than 188 respondents.

#### DCE implementation and data collection

To improve the reliability and validity of the questionnaire, a small-scale pilot survey was conducted before the formal investigation. This small-scale pilot survey involved 21 participants. According to the feedback obtained in the pilot survey, the wording of the questionnaire items was adjusted, especially for the DCE items. For quality assurance, a survey training manual was compiled to train the interviewers before the formal investigation.

This cross-sectional study was conducted as part of the Fuqing Cohort Study. The Fuqing cohort is an ongoing project in Fuqing City, China, with a baseline survey initiated in 2019. More details about the Fuqing cohort can be found in our published work [36]. The data used in this study were from the Fuqing cohort questionnaire survey administered between November 2021 and January 2022. The inclusion criteria were as follows: [1] participants aged between 35 and 75 years and [2] participants who self-reported being diagnosed with two or more chronic diseases by doctors at community hospitals and above. The exclusion criteria included [1] participants with no chronic disease or only one chronic disease and [2] participants who were unaware of DCE choices (those who could not understand the purpose of the survey after receiving a detailed explanation by the investigators and were unable to make a balanced choice). After these exclusions, 504 participants were ultimately included in this study (the flow chart of inclusion of the study population can be found in Additional file 3). The interviewers were trained to ensure that the formal questionnaire survey was conducted smoothly.

#### Statistical analysis

Descriptive analysis was used to present the demographic characteristics of the respondents. In this study, the DCE data analysis used a mixed logit model and a conditional logit model, and the most suitable model was determined on the basis of the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). The smaller the values of AIC and BIC are, the better the model fit [37]. Best-worst attribute scaling (BWAS) estimates the relative impacts of each attribute, placing them on a common scale [38].

The "out-of-pocket expenses per visit" attribute was used to calculate the willingness to pay (WTP). WTP is the negative ratio of the noneconomic attribute coefficient to the economic attribute coefficient, which reflects the monetary value of the noneconomic attribute that affects the preference of inpatient institutions. In addition, interaction terms were included in the model to estimate the heterogeneity of inpatient preferences among MCC patients. To create a more parsimonious model, the interaction terms of the individual characteristic variables were gradually reduced on the basis of the inclusion of all the interaction terms of the individual charaction effects one at a time with a *P* value > 0.10. All statistical analyses were performed via SAS 9.3 and Stata 16. A *P* value  $\leq$  0.05 indicated statistical significance.

#### Results

#### Respondents' demographic characteristics

A sample of 504 patients was included. Table 2 shows that there were 341 females, 230 patients less than age 60 years, and 455 (90.3%) subjects who were married. More than half of the patients had received formal education, and 83 (16.5%) were farmers. Approximately 60% of patients had one to three family members. Nearly 70% of the subjects had a total household income of less than ¥60,000 last year, and more than 50% of the patients had a self-perceived disease severity score of less than two points.

#### Model estimation of preferences

According to the results presented in Tables 3 and 4, the AIC of the mixed logit model was 2058.564, and the BIC was 2115.282. The AIC of the conditional logit model was 2149.713, and the BIC was 2181.223. A comparison of the AIC and BIC of the two models revealed that the mixed logit model was more effective in analysing the inpatient preferences of MCC patients. Thus, the analysis of the DCE is mainly based on the results of the mixed logit model.

Table 3 reveals that all attributes are statistically significant except for "presence of acquaintances". Taking "district and county hospitals" as the reference, the degree of influence  $\beta$  (95% CI) of "urban tertiary hospitals" on patients' inpatient preferences was 0.2635 (0.1156 to 0.4113). Taking "waiting 3 days for beds" as a reference, the degree of influence  $\beta$  (95% CI) of "having beds available on the day of hospitalization" on the patients' inpatient care utilization was 0.1962 (0.0214 to 0.3709). Compared with the travel time from the residence to the hospital for "more than 3 hours", the degree of influence  $\beta$  (95% CI) of "the travel time from the residence to the hospital within 1 hour" on the patients' inpatient preferences was 0.7602 (0.5526 to 0.9679). The degree of influence  $\beta$  (95% CI) of "the out-of-pocket expenses per visit" on patients' inpatient preference was - 0.0006 (-0.0007 to

Table 2	Demographic	characteristics o	of the study	participants
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Variable	Number	Percentage (%)
Gender		
Male	163	32.3
Female	341	67.7
Age		
< 60 years old	230	45.6
≥60 years old	274	54.4
Marital status		
Married	455	90.3
Other	49	9.7
Education		
No formal education	235	46.6
Formal education	269	53.4
Profession		
Farmer	83	16.5
Worker	38	7.5
Housework	276	54.8
Unemployed/laid off	29	5.8
Other	78	15.5
Number of family member		
1–3 people	305	60.5
4–13 people	199	39.5
Total household income last year (CNY)		
< 10,000	82	16.3
10,000–29,999	142	28.2
30,000–59,999	122	24.2
60,000–99,999	52	10.3
100,000–149,999	65	12.9
150,000–299,999	27	5.4
≥ 300,000	14	2.8
Self-perceived disease severity*		
<2	258	51.2
≥2	246	48.8

Notes: Other marital statuses include single, widowed, separated/divorced; CNY Chinese yuan; \*Calculated by dividing the total score for self-perceived severity of each chronic disease (rated as 1 for mild, 2 for average, and 3 for severe) by the total number of chronic diseases

-0.0005). According to the relative impact results given in Table 5, the most important attribute of patients when choosing inpatient care is out-of-pocket expenses per visit (64.35%), followed by travel time from residence to hospital (16.17%), waiting time for hospital admission (11.49%), institution scale (5.28%), and presence of acquaintances (2.72%).

#### **Marginal WTP**

Table 6 shows that the WTP for other attributes is statistically significant except for "presence of acquaintances". Compared with district and county hospitals, patients' WTP for urban tertiary hospitals was \$434(95% CI: 188 to 680). Compared with waiting for beds for 3 days, the patients' WTP for beds available on the day was \$323 (95% CI: 32 to 614). Compared with the travel time from the residence to the hospital of more than 3 h, the patients' WTP within 1 h was ¥1253 (95% CI: 927 to 1580). The WTP for attributes from high to low is as follows: "short time from residence to hospital", "large hospitals", and "beds available on the day of hospitalization".

#### Model estimation results of interaction terms

Table 7 shows that age and gender had heterogeneity with respect to patients' preference for inpatient care (P < 0.05). Specifically, age had an effect on "having beds available on the day of hospitalization" ( $\beta$ =-0.5896, P < 0.05) and "hospitals with acquaintances" ( $\beta$ =-0.3404, P < 0.05), implying that younger patients preferred "having beds available on the day of hospitalization" and "hospitals with acquaintances". Gender had an effect on "having beds available on the day of hospitalization" ( $\beta$ =-0.5859, P < 0.05) and "out-of-pocket expenses per visit" ( $\beta$ =-0.0002, P < 0.05), indicating that compared with female patients, male patients preferred "having beds available on the day of hospitalization" and "low out-ofpocket expenses per visit".

#### Discussion

To the best of our knowledge, there is a dearth of research on the inpatient preferences of MCC patients. This study identified the influencing factors and assessed their relative importance with respect to the inpatient preferences of MCC patients. The results revealed that the ideal inpatient institutions preferred by MCC patients may include the following four conditions: "low out-of-pocket expenses per visit", "short time from residence to hospital", "short waiting time for beds" and "urban tertiary hospitals". Gaining insight into the inpatient preferences of MCC patients is crucial for efficient medical service utilization and optimal allocation of health care resources.

The out-of-pocket expense per visit was the most important attribute of patients' preferences for inpatient care; it was also a negative predictor, indicating that patient preferences decreased as out-of-pocket expenses per visit increased. Patients preferred to visit medical institutions with lower out-of-pocket expenses, regardless of whether they perceived themselves as having a mild or severe disease. Given the common health inequalities caused by income disparities [39], low-income groups face greater barriers to obtaining adequate health care services [40]. In particular, MCC patients face more complications and incur greater medical expenses, even if they have health insurance as a backup, which does not alleviate the financial burden on those who are already poor. Thus, their preference for inpatient institutions with low out-of-pocket expenses per visit made perfect sense. District and county hospitals can further decrease the deductible line and increase the reimbursement rates of medical care expenses.

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Sample size

Table 3 Estimates of the mixed logit mo	del			
Attributes	Coefficient	S.E.	<i>p</i> value	95% CI
Institutional scale				
(Ref: District and county hospitals)				
Urban tertiary hospitals	0.2635	0.0754	< 0.001	(0.1156 to 0.4113)
Waiting time for hospital admission				
(Ref: Wait three days for beds)				
Bed available on the day	0.1962	0.0892	0.028	(0.0214 to 0.3709)
Presence of acquaintances in hospitals				
(Ref: No acquaintances)				
Acquaintances	0.1429	0.0780	0.067	(-0.0099 to 0.2958)
Travel time from residence to hospital				
(Ref: More than three hours)				
Less than one hour	0.7602	0.1060	< 0.001	(0.5526 to 0.9679)
Out-of-pocket expenses per visit	-0.0006	0.00005	< 0.001	(-0.0007 to -0.0005)
Log likelihood	-1020.282			
AIC	2058.564			
BIC	2115.282			
Observations	4032			

504

Table 4         Estimates of the conditional logit model				
Attributes	Coefficient	S.E.	p value	95% CI
Institutional scale (Ref: District and county hospitals)				
Urban tertiary hospitals	0.1974	0.04810	< 0.001	(0.1032 to 0.2916)
Waiting time for hospital admission (Ref: Wait three days for beds)				
Bed available on the day	0.1933	0.06190	0.002	(0.0720 to 0.3145)
Presence of acquaintances in hospitals (Ref: No acquaintances)				
Acquaintances	0.0968	0.05180	0.061	(-0.0047 to 0.1983)
Travel time from residence to hospital (Ref: More than three hours)				
Less than one hour	0.5220	0.06720	< 0.001	(0.3902 to 0.6537)
Out-of-pocket expenses per visit	-0.0004	0.00002	< 0.001	(-0.0004 to -0.0003)
Log likelihood	-1020.282			
AIC	2149.713			
BIC	2181.223			
Observations	4032			
Sample size	504			

Travel time from residence to hospital played another important role in inpatient care among MCC patients, and they were willing to pay much more for this attribute than for other attributes. These findings are similar to those of previous studies [41], in which patients generally preferred medical institutions located short distances or those that could be reached by their private car or public transport [42]. The plausible reason for this phenomenon may be that chronic diseases have a long course and require long-term monitoring and management [43], so patients' demands for the convenience and accessibility of inpatient care are much greater. In addition, short distances to medical institutions benefit patients' health consequences, and it is understandable that MCC patients are more willing to pay extra fees to obtain medical care at facilities that are only a short distance away [44]. Thus, district and county hospitals should ensure that most residents can reach the nearest institution within 15 min.

With respect to the waiting time for hospital admission, MCC patients clearly preferred medical institutions with beds available on the date of admission. This finding is consistent with those of previous studies that have demonstrated that the time spent on waiting lists and in waiting rooms [45, 46] had a negative effect on patients' preference for treatment. Reducing waiting time was important to most patients [47] and can allow for timely hospitalization. In further interaction analysis,

#### Table 5 Results of the relative impact of attribute

Attributes	Coefficient	Relative Impact	Order
Institutional scale		0.0528	4
District and county hospitals (Reference)	-0.1529		
Urban tertiary hospitals	0.1529		
Waiting time for hospital admission		0.1149	3
Wait three days for beds (Reference)	-0.3328		
Bed available on the day	0.3328		
Presence of acquaintances in hospitals		0.0272	5
No acquaintances (Reference)	-0.0787		
Acquaintances	0.0787		
Travel time from residence to hospital		0.1617	2
More than three hours (Reference)	-0.4685		
Less than one hour	0.4685		
Out-of-pocket expenses per visit (CNY)		0.6435	1
800 (Reference)	1.7987		
2000	0.1317		
5000	-1.9304		
Observations	4032		
Sample size	504		

Reference group level coefficient = -1 \* (the sum of other level coefficients in the attribute); CNY Chinese yuan

Ta	ble 6	Willingness to	pay	for non-economic work attributes

Attributes	WTP (95%CI)
Institutional scale (Ref: District and county hospitals)	
Urban tertiary hospitals	434 (188 to 680)
Waiting time for hospital admission (Ref: Wait three days for beds)	
Bed available on the day	323 (32 to 614)
Presence of acquaintances in hospitals (Ref: No acquaintances)	
Acquaintances	236 (-17 to 488)
Travel time from residence to hospital (Ref: More than three hours)	
Less than one hour	1253 (927 to 1580)

male patients and nonelderly patients were more likely to choose medical institutions with beds available on the date of admission. These results are consistent with those of previous studies showing that some male patients are reluctant to wait when seeking medical help [48] and that young patient groups place more value on the personal experience of the entire medical service process, especially the waiting time [20].

Institution scale was the fourth important indicator related to patients' choices of inpatient care. Because many urban tertiary hospitals in China are medical institutions with better technical capability and efficiency [49], it is not difficult to understand that MCC patients are more willing to visit them to obtain high-quality medical services. The qualifications or expertise of medical service providers are important determinants of patients' medical institution choice [42, 50]. This suggests that patients' bypassing of district and county hospitals to seek inpatient care in urban tertiary hospitals may be attributed to distrust in the technical capacity of district and county hospitals. Hence, it is necessary to strengthen the capacity of district and county hospitals and improve their functions.

Notably, the attribute "presence of acquaintances in hospitals" was found to have a small effect on patients' inpatient care, which was inconsistent with the research hypothesis. The reason for this may be that patients' trust in doctors has been greatly enhanced by a more transparent diagnosis and treatment process. With sufficient information resources, patients do not pay much attention to their acquaintances when seeking inpatient care [51]. Conversely, the interaction analysis results revealed that patients in the nonelderly group tended to choose hospitals where acquaintances were present. Because these patient groups are more concerned about the experience of seeking medical care and are reluctant to spend much of their time in queues [20, 52], they may be more inclined to obtain more prompt and effective medical services through their acquaintances.

The results of the DCE showed that the most significant attributes influencing patients' options for inpatient care were out-of-pocket expenses per visit, followed by travel time, waiting time, and institution scale. Given

#### Table 7 Model estimation results of interaction terms

Variable	Coefficient	S.E.	<i>p</i> value
Institutional scale			
(Ref: District and county hospitals)			
Urban tertiary hospitals	0.3108	0.3924	0.428
Waiting time for hospital admission			
(Ref: Wait three days for beds)			
Bed available on the day	2.0828	0.4962	< 0.001
Presence of acquaintances in hospitals			
(Ref: No acquaintances)			
Acquaintances	1.2030	0.4107	0.003
Travel time from residence to hospital			
(Ref: More than three hours)			
Less than one hour	0.4644	0.5244	0.376
Out-of-pocket expenses per visit	-0.0003	0.0002	0.112
Institutional scale			
(Ref: District and county hospitals)			
Urban tertiary hospitals *Age	-0.1361	0.1560	0.383
Urban tertiary hospitals *Gender	0.0955	0.1584	0.547
Waiting time for hospital admission			
(Ref: Wait three days for beds)			
Bed available on the day*Age	-0.5896	0.1973	0.003
Bed available on the day*Gender	-0.5859	0.1977	0.003
Presence of acquaintances in hospitals			
(Ref: No acquaintances)			
Acquaintances*Age	-0.3404	0.1652	0.039
Acquaintances*Gender	-0.3199	0.1689	0.058
Travel time from residence to hospital			
(Ref: More than three hours)			
Less than one hour*Age	-0.0594	0.2273	0.794
Less than one hour*Gender	0.2496	0.2071	0.228
Out-of-pocket expenses per visit			
Out-of-pocket expenses per visit*Age	-0.00007	0.00006	0.247
Out-of-pocket expenses per visit*Gender	-0.00015	0.00007	0.034
Observations	4032		
Sample size	504		

that institution scale was not a primary influencing factor, district and county hospitals should concentrate their efforts on the first three factors to meet patients' preferences. This will not only regulate excessive increases in medical expenses and strengthen service capacity but also prevent the emergence of so-called "medical deserts". Despite the disparity in inpatient reimbursement rates between urban tertiary hospitals and district/county hospitals, there was no significant effect on promoting patient access to the first point of contact for inpatient care. Thus, it is recommended that district and county hospitals further increase reimbursement rates. In addition, to save travel time, district and county hospitals should assume a leading role in the area. Community and township health centers can assist in referring patients, and district and county hospitals can provide pick-up services. Furthermore, it is imperative that district and county hospitals strengthen their information systems to streamline processes and reduce waiting time.

This study was strengthened by several distinguished features. First, unlike previous studies, which have focused mostly on the factors that influence the outpatient preferences of patients with chronic diseases, this study enriches the empirical research in related fields by providing valuable information regarding inpatient preferences among MCC patients. Second, a DCE was applied to better understand the relative importance of various attributes in the process of medical care, with a mixed logit model adopted to further analyse unobservable utility and take individual differences scrupulously into account, making it a more appropriate approach to examining behavior selection problems. Third, the WTP of noneconomic attributes preferences was assessed, and interaction analyses were conducted to understand the heterogeneity of patients' preferences, offering insight into the patterns of inpatient care among MCC patients with different demographic characteristics.

There are a few limitations to this study. First, the participants were only from Fuqing City, Fujian Province, China, which may limit generalization of the research results. In addition, the study excluded 106 participants who were unaware of DCE choices, which may have some bias in the representativeness of the sample. Future research could include more participants from different regions to increase representativeness. Second, considering that the factors influencing MCC patients to choose inpatient institutions are complex and diverse, it is also recommended that more representative and targeted attributes and levels be included in future research to meet certain research objectives and realistic situations. Third, to ensure compliance with questionnaire completion, this study determined that each patient answered 4 selection sets by drawing lessons from previous research designs, which may raise concerns that the data collected would be limited by only 4 selection sets in each questionnaire.

### Conclusion

This study performed a DCE to investigate MCC patients' inpatient preferences and identify the key factors influencing their choices, which is essential for improving service capacity in primary care settings and developing a more rational HDTS. The most important attributes considered by patients seeking inpatient care are out-of-pocket expenses per visit, followed by travel time from residence to hospital, waiting time for hospital admission, institution scale, and the presence of acquaintances. To increase access to district and county hospitals for MCC patients and effectively implement HDTS, it is recommended that district and county hospitals proactively increase the inpatient insurance reimbursement rates, assume the leading role in the area, and strengthen their information systems.

#### Abbreviations

MCC	Multiple chronic conditions
DCE	Discrete choice experiment
WTP	Willingness to pay
CI	Confidence interval
AIC	Akaike information criterion
BIC	Bayesian information criterion
HDTS	Hierarchical diagnosis and treatment system

## **Supplementary Information**

The online version contains supplementary material available at https://doi.or g/10.1186/s12875-025-02731-2 .

Supplementary Material 1

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#### Author contributions

Liu WB: Conceptualization, Funding acquisition, Resources, Writing -review &editing. Ye WM: Conceptualization, Funding acquisition, Resources. Wang YQ: Formal analysis, Investigation, Writing -original draft, Writing -review &editing. Wu SY: Formal analysis, Interpretation of data, Writing -revise, Writing -review &editing. Chen YH and Li WX: Writing-review &editing. Du SS, Huang XY and Xiao L: Investigation. Su QL and Wang WK: Formal analysis.

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#### Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

#### Declarations

#### Ethics approval and consent to participate

This research was approved by the Biomedical Research Ethics Review Committee of Fujian Medical University (No. 2021 – 154) and (No. 2021 – 109). This study was conducted under the Declaration of Helsinki. Informed consent was obtained from all individual participants included in the study. All participants were informed about the study purpose, participation in the study was voluntary, and all responses were anonymous.

#### **Consent for publication**

Not applicable.

#### **Competing interests**

The authors declare no competing interests.

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