

# The mechanism of word-of-mouth learning on chronic disease patients' physician choice in online health communities: Latent Dirichlet allocation analyses and cross-sectional study

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## Abstract

**Background:** Word-of-mouth learning (WOML) plays a substantial role in patients' physician choice behavior. However, there is still a research gap in analyzing the mechanism of WOML on chronic disease patients' physician choice in online health communities (OHCs) considering individual differences.

**Objective:** This study aims to develop a physician choice mechanism research model to reveal the influence of WOML on chronic disease patients' physician choice decision process from external interaction to internal cognition and emotion in OHCs based on social learning theory (SLT). The moderating effects of reasons for consultation and patients' demographic characteristics on the model's relationships were also explored.

**Methods:** Guided by SLT, this study identified the external interaction factors and internal cognitive and emotional factors by analyzing 72,123 patients' online reviews based on a Latent Dirichlet Allocation model and developed the physician choice mechanism research model. The model was validated using structural equation modeling based on an online questionnaire survey of 526 valid Chinese patients with chronic disease. The moderating effect of reasons for medical consultation and demographic characteristics was examined using multi-group analysis.

**Results:** Status capital (SC), decisional capital (DC), and price value (PV)) were the main external interaction factors to initiating chronic disease patients' internal cognition and emotion (perceived convenience (PC), perceived health benefits (PH), and patients' physician choice intention (CI)). PH and PC significantly mediated the relationship between SC, DC, PV, and CI. Reasons for medical consultation, district, and sex significantly moderated the relationships in the model.

**Conclusions:** Considering individual differences, the results of this study advance a comprehensive understanding of how chronic disease patients interact with the environment through WOML to make physician choice decisions. OHCs can recommend suitable physician information to chronic disease patients considering individual differences to match patients' demands and improve service quality.

## Keywords

Online consultations, physician choice, social learning theory, latent Dirichlet allocation, chronic disease patients, individual differences, structural equation modeling

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## Introduction

### Background

Online health communities (OHCs) connect patients, physicians, hospitals, and other entities involved in the medical ecosystem through the Internet.<sup>1</sup> Online consultations through OHCs are not only cost-effective and time-saving, but also provide better patient care.<sup>2</sup> Patients with chronic disease require frequent diagnosis and treatment communication due to the long disease duration, high mortality rate, long treatment time, and high service demand.<sup>3</sup> As a result, both patients and society bear heavy economic burdens.<sup>4</sup>

Chronic diseases cause more than 70% of China's overall disease burden.<sup>5,6</sup> As of 2019, nearly 180 million Chinese citizens suffered from chronic diseases, many of whom with multimorbidity.<sup>7,8</sup> Patients with chronic diseases must regularly consult with their physicians during treatment. China's medical resources are unevenly distributed.<sup>9,10</sup> While medical resources are relatively abundant in Eastern China, they remain scarce in Midwestern China. Consequently, this makes it difficult for Midwestern China to meet the growing demand for medical services.<sup>11</sup>

Through OHCs, patients with chronic diseases can consult with qualified physicians across the country for medical advice, examinations, and prescription refills, contributing to the optimization of medical resource allocation.<sup>12,13</sup> In 2021, 73.8% of Chinese patients underwent online medical consultations for chronic diseases.<sup>3</sup> Recently, a clear upward trend was observed. Chronic disease management has become an important engine for the future development of OHCs.<sup>3</sup> Unlike traditional medical settings, physicians and patients cannot communicate face-to-face in OHCs.

Scholars have extensively examined patients' physician-choice behavior from the perspectives of physicians' pro-social behavior, activity levels, free knowledge sharing, personal image and reputation on social platforms in OHCs<sup>14–18</sup> based on physicians' personal information (e.g., physician's academic background, number of patients, consultation price, and online image)<sup>19–23</sup> and patients' evaluation information (e.g., service evaluation and emotional expression reflected in online reviews).<sup>14–17</sup> There are two main approaches to studying the factors influencing patients' physician choice in OHCs. The first is regression analysis which examines the influence factors on physician choice in OHCs.<sup>16,19</sup> The second is natural language processing, which is used to analyze patient-generated online reviews<sup>14,15</sup> to identify the key factors influencing patient attitudes regarding physician consultation and patients' adoption of OHCs. Word-of-mouth (WOM) quantity and quality can significantly induce or reduce patients' physician choice behavior in OHCs.<sup>24</sup> WOML is the primary form of social learning that has proven can enhance motivation and significantly influence

consumers' online behavior in the field of marketing and e-commerce.<sup>25,26</sup>

Despite considerable research on the influence of WOM on patients' physician choices in OHCs, there is still an analytical gap in developing the physician choice mechanism to examine the influence of WOML on chronic disease patients' physician choice process. Studies have shown that differences in patient satisfaction with physician services are impacted primarily by reasons for medical consultation and patient characteristics.<sup>27</sup> However, a research gap exists on patients' physician choice behavior considering individual differences. Therefore, identifying the mechanism of WOML on chronic disease patients' physician choice in OHCs and analyzing the influence of individual differences of chronic disease patients' reasons for medical consultation and demographic characteristics on physician choice behavior is imperative. By doing so, OHCs can improve their services and enhance their ability to prevent, control, and treat chronic diseases by meeting patient needs.

The objectives of this study were to generate a mechanisms model by which WOML influences chronic disease patients' physician choice and analyze the moderating effects of reasons for the consultation and patients' demographic characteristics on the model relationships.

### Theoretical background

According to social learning theory (SLT), individuals can learn new behaviors through observation, which involves perceiving, interacting, and reproducing observed behaviors during the interaction.<sup>28,29</sup> In the Internet era, SLT plays a significant role in influencing online behavior.<sup>30</sup> Individuals prefer to make online purchase decisions through the social learning process, which can be described as a two-interaction process (external and internal interaction).<sup>31</sup> In the external interaction process, individuals interact with the external environment through the social dimension. In the internal interaction process, individuals form internal cognition and emotion. Internal cognition is based on individuals' knowledge and beliefs. Emotion determines whether to imitate others' actions.<sup>31</sup> Therefore, SLT is highly suitable for our research and provides the basis for our analysis.

WOML is the main social learning method that conveys opinions on products or sellers which help individuals form cognitive frameworks and make purchase decisions.<sup>25</sup> Individuals communicate with the external environment through WOM. They can be influenced by the opinions of others by reading online reviews that transmit information about brands, sellers or products to individuals.<sup>25</sup> In the context of online shopping, individuals decide whether to imitate the behavior of others by observing consumer evaluations of a product, such as its description and service quality, which are important factors when making

purchasing decisions.<sup>32,33</sup> Previous studies have confirmed that positive WOM can promote consumer purchase decision-making, whereas negative WOM has a greater impact on consumer adoption decisions.<sup>26</sup>

Scholars have applied social learning theory (SLT) to explain individuals' decision-making behavior in various economic and social phenomena.<sup>25,34–36</sup> However, there is a gap in the analysis of patients' physician choice behavior in OHCs utilizing SLT. Accordingly, this research analyzed chronic disease patients' physician choice behavior from external interaction to internal cognition and emotion in OHCs during the WOML process based on the SLT framework.

### Study overview

To present theoretical and empirical support, drawing upon SLT, a latent Dirichlet allocation (LDA) model was used to analyze chronic disease patients' online reviews to identify the external interaction, internal cognitive and emotional factors during the process of WOML and develop the physician choice mechanism research model.

To estimate how these factors affect chronic disease patients' physician choice behavior, and investigate the moderating effects of reasons for the consultation and patients' demographic characteristics on the relationships in the research model, we conducted a cross-sectional online survey to examine the research model based on structural equation modeling (SEM) and tested the moderating effect of reasons for medical consultations and demographic characteristics based on a multi-group analysis (MGA). Figure 1 illustrates the research framework.

## Research model and hypotheses

### External and internal interaction in WOML

WOML helps individuals form cognitive frameworks and make purchase decisions by discovering their peers' attitudes toward products or sellers in online reviews.<sup>25</sup> Patient reviews include the evaluations of physicians' medical consultation, such as physicians' communication skills, medical knowledge, bedside manners, personal ethical practices, internal cognitive and internal emotion. These factors are important to patients when selecting a physician.<sup>14,37</sup> Scholars have employed natural language processing to analyze online reviews in OHCs and identify patient attitudes and experiences regarding physician consultation.<sup>14,15</sup> Online reviews are an important subjective information resource for patients when choosing physicians.<sup>38,39</sup> This study used the LDA model to identify external interaction, internal cognitive and internal emotional factors influencing patients' physician choices.

**Data collection and preprocessing.** The online review data was obtained from WeDoctor, a leading OHCs platform in China, which provides patients' comments on physicians according to disease type. We wrote a crawler program to gather online reviews in WeDoctor from chronic disease patients in six disease categories: heart disease, diabetes, chronic obstructive pulmonary disease, chronic kidney disease, asthma, and arthritis. Online review data included patient identifiers, physician names, review content, and review dates. As the number of online reviews for some physicians was small, 379 physicians treating chronic diseases were selected. The following steps were executed for preprocessing procedures (Figure 1). Firstly, we filter patients' online reviews. Duplicate reviews for the same physician and reviews that did not involve specific subjective information were removed. Emoticons were replaced with their corresponding Chinese expressions. Since Wedoctor only allows patients who have made consultations to leave online reviews. There were no fake online reviews that influenced patients' physician choice decisions. We also delete shorter online reviews of no more than five words which rarely include evaluations of the medical consultation experience. Finally, we obtained 72,123 online reviews involving 379 physicians from June 2015 to June 2024. Secondly, 'Jieba' package was employed to carry out tokenisation. Thirdly, stop words, punctuation and numbers were removed. Lastly, we removed the low-frequency words.

**Topic modeling.** LDA is a generative probabilistic model commonly used for uncovering topics from a corpus of documents.<sup>40,41</sup> The process begins with assigning topics at random, followed by the computation of word distributions for each topic, as well as topic distribution within a document. Through the process of document allocation, it became possible to determine the leading topic for each online review included in the dataset. Figure 2 illustrates the process of document generation of LDA. Where  $\alpha$  is Dirichlet parameter.  $\theta_d$  is per-document topic proportions.  $Z_{d,n}$  is the per-word topic assignment.  $\beta$  is the topic hyper-parameter.  $\varphi_{d,n}$  denotes word distribution for topic  $k$ .  $w_{d,n}$  is the observed word.

In this research, the corpus is a collection of all patients' online reviews. For every online review  $i$  in the corpus, an estimate  $\theta_{ik}$  representing the probability of topic  $k$  within that online review. Gensim toolkit was used to extract hidden topics. The training of the model was conducted utilizing TF-IDF features generated from the dataset. According to the document-topic probability of online reviews, the topic with the highest probability was labeled as the document's topic.

We determined the number of topics based on coherence score cross-validation which conducts an iterative process of running the LDA topic model by incrementally raising

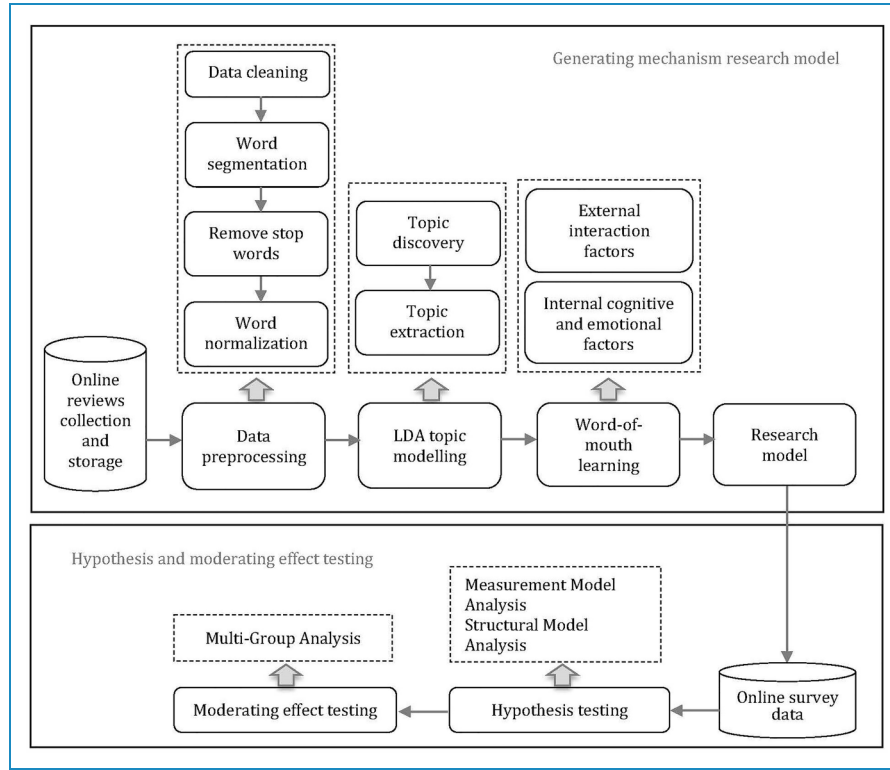


Figure 1. Research framework.

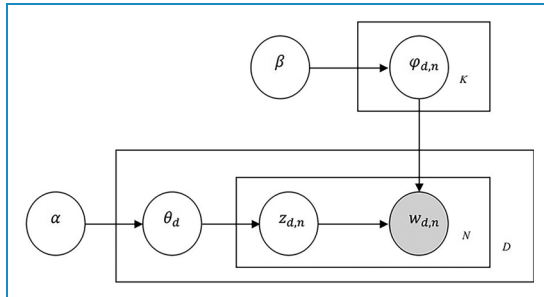


Figure 2. Graphical model representation of LDA.

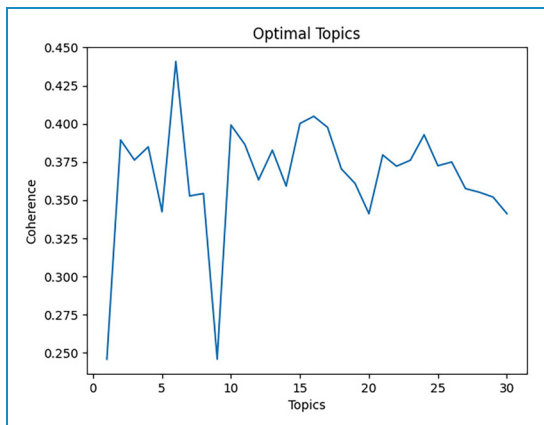


Figure 3. Coherence score plot for LDA model.

the number of topics.<sup>42,43</sup> For every analysis conducted, a coherence score is generated. The coherence score measures how interpretable the topics are to humans and is suggested as an indicator for identifying the optimal number of topics.<sup>42</sup> We compared the coherence score of the LDA topic number  $k$  from 1 to 30. According to the coherence score and manual examination, the best model with 6 topics was selected and the coherence score was 0.441 (Figure 3).

**Topic labeling.** We can define the meaning of various topics through the assignment of appropriate descriptive words or phrases.<sup>44</sup> In this research, topic labeling was manually done by evaluating the top words of each topic.<sup>45</sup> According to studies on physician choice in OHCs,<sup>14,15</sup> three expert opinions of OHCs, and high-frequency feature words in each topic, final definitions were determined for the six topics. Ten words were chosen as high-frequency feature words. Table 1 shows each topic's names, high-probability words, and examples.

The results of the WOML analysis suggest that physician status capital (SC), decisional capital (DC), and price value (PV) are external interaction factors patients learned through environmental interaction during the WOML process. Perceived convenience (PC), perceived health benefits (PH), and patients' physician choice intention (CI) are internal cognition and emotional factors patients learned

**Table 1.** Topics in LDA model.

Topic number	Topic name	High-frequency feature words	Example
1	Status capital	Professional, experienced, chief, responsible, prescription, clear, explanation, excellent, provide, accurate answers	The chief physician is very professional and experienced. Provided practical treatment plan with very authoritative knowledge. Gave very clear and effective advice to solve the patient's pain.
2	Decisional capital	Patient, good advising, satisfied, earnest, assured, cordial, answer all questions, friendly, fast, practical	The physician was patient and answered all questions in detail, with clear answers, very friendly and helpful, thanks.
3	Price value	Enthusiasm, really, dedicated, comparative, worth, service, comprehensive, possible, trustworthy, effective	Very enthusiastic and quick to reply. The price is very worth it. Provided very effective service.
4	Perceived convenience	Careful work, attentive, feeling, patience, clinical skills, convenience, consultation, easy-to-use, praised, good experience	It is convenient and easy to consult online. The physician provided careful work and the same quality consultation as the hospital. It is a good experience.
5	Perceived health benefits	Suggestion, helpful, recover, clear, solve the problem, meticulous, fast, accurate, quick, awesome	The doctor gave me very targeted and accurate suggestions, which not only solved the problem but also helped me eliminate the tension. It was an awesome experience.
6	Physician choice Intention	Advice, illness, great, give, hope, peace of mind, wise, kind-hearted, kindness, recommend	I like to consult with her. She is always kind-hearted and provides great advice to me. I will consult with her in the future. Recommend.

Note. The high-frequency feature words have been translated from Chinese and listed from the highest to the lowest document-topic probability.

through the psychological acquisition process through WOML.

### Hypotheses and modeling

**Status capital and perceived convenience.** In online consultations, patients evaluate physicians' SC through their academic titles, clinical titles, hospital level to which the physician belonged, and hospital location.<sup>45</sup> Typically, high SC reflects physicians can provide high-quality medical treatment.<sup>46,47</sup> Although SC does not reflect a physician's online behavior, patients with chronic diseases especially patients who are not in the same geographic area as the physicians will perceive the convenience of choosing a physician with high SC in OHCs, given the scarcity of physicians with high SC and the difficulty of consultation with physicians with high SC offline. Thus, the following hypothesis is:

H1a: SC positively affects chronic disease patients' PC in OHCs.

**Decisional capital and perceived convenience.** DC refers to physicians' quality of interaction with patients and their

ability to provide effective diagnosis and treatment.<sup>37,47,48</sup> Physicians must show their DC to earn more trust from patients.<sup>49</sup> Physician's DC has been proven a key factor influencing patients' physician choices in OHCs.<sup>50–52</sup> In online consultations, patients cannot communicate with physicians in person. This absence of direct interaction elevates the importance of physicians' DC. Physicians with high DC can develop adequate communication with their patients, enabling patients with chronic diseases to receive a consultation experience akin to that of face-to-face interactions,<sup>47</sup> and then perceive the convenience of online consultation. Thus, the following hypothesis is:

H2a: DC positively affects chronic disease patients' PC in OHCs.

**Price value and perceived convenience.** PV is the subjective judgment of a customer concerning the value of a company's product or service. Customers prefer to assess the utility of a product after weighing its perceived benefits to cost.<sup>53</sup> They like to acquire products or services when they can obtain more value for their money.<sup>54,55</sup> In the context of OHCs, studies show that PV can positively affect patients' physician choices.<sup>50</sup> Compared to traditional hospital consultation, the most distinguishing advantage of



online consultation is convenience.<sup>2</sup> When the PV of online consultation is greater than or equal to the PV of traditional hospital consultation, chronic disease patients will perceive the convenience of online consultation. Thus, the following hypothesis is:

H3a: PV positively affects chronic disease patients' PC in OHCs.

**Status capital and perceived health benefits.** SC refers to physicians' social status (e.g., job title, affiliations, etc.). Physicians with high SC means they have a high title and come from a hospital with a high level, which stands for their advantages in academic research and clinical experience, and their ability to dispatch and use more advanced medical resources during diagnosis.<sup>46,52,56</sup> The purpose of online consultation for patients with chronic diseases is to address health issues, particularly for those living in regions where medical resources are scarce. Consulting with a physician with a high SC in OHCs will allow patients to perceive health benefits. Thus, the following hypothesis is:

H1b: SC positively affects chronic disease patients' PH in OHCs.

**Decisional capital and perceived health benefits.** DC reflects physicians' ability to accurately express, insight and diagnose patients' conditions, and willingness to communicate with patients online, which is the foundation for patients' physician choices.<sup>46,57</sup> Physicians with high DC can provide accurate diagnoses and adequate treatment services, enabling patients with chronic diseases to perceive health benefits. Thus, the following hypothesis is:

H2b: DC positively affects chronic disease patients' PH in OHCs.

**Price value and perceived health benefits.** The core function of OHCs is to be able to address the diagnostic and treatment needs of chronic disease patients, thereby enhancing their physical health.<sup>12</sup> Chronic disease patients need to regularly consult with physicians for medical advice, examinations, and prescription refills. In particular, given the geospatial and time constraints of offline consultations,<sup>49</sup> chronic disease patients will perceive the health benefits of online consultations when the PV of online consultations are greater than offline. Thus, the following hypothesis is:

H3b: PV positively affects chronic disease patients' PH in OHCs.

**Perceived convenience and physician choice intention.** PC refers to the time and effort consumers save during the purchasing process, which includes allowing them to contact sellers quickly, find the products they need, and conveniently complete their purchases.<sup>58</sup> In this study, PC indicates patients can conveniently obtain medical consultations

through OHCs. Chronic disease patients require frequent medical consultation.<sup>3</sup> Once chronic disease patients assess that the physician they wish to consult matches the services they expect and achieve the same results as offline consultations, they perceive the convenience of online consultation. Moreover, their intention to consult the physician increases.

Thus, the following hypothesis is:

H4: PC positively affects chronic disease patients' CI in OHCs.

**Perceived health benefits and physician choice intention.** Generally, chronic disease patients seek medical advice when they believe the physician can benefit their health.<sup>50</sup> Through WOML, patients can assess whether the physician can provide them with the desired perceived health benefits. When chronic disease patients require physicians to treat high-risk diseases, they prefer to select physicians with high SC and DC even though the consultation cost is higher.<sup>59</sup> However, when such patients seek online consultation for prescription refills, they may choose a physician with a lower consultation cost. Once the physician matches chronic disease patients' desires, they perceive health benefits, and their intention to choose the physician increases. Thus, the following hypothesis is:

H5: PH positively affects chronic disease patients' CI in OHCs.

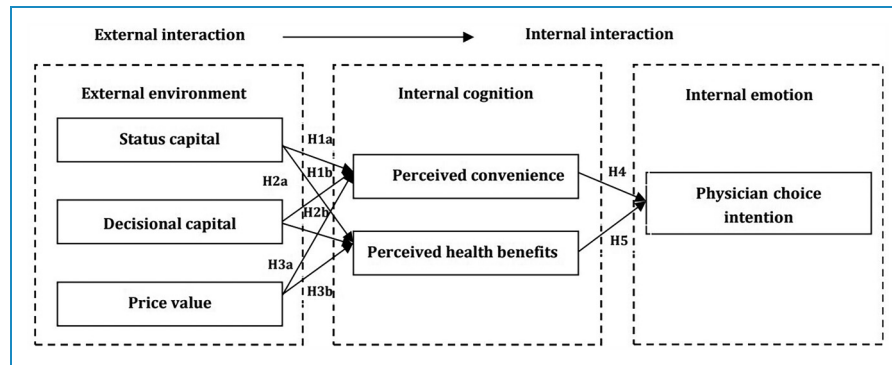
Based on these eight hypotheses, we summarize our conceptual model (Figure 4).

## Methods

### Participants and data collection

An anonymous online survey was conducted in 31 provinces of China between January and June 2024 using Credamo, a leading survey company that provides one-stop data collection solutions. The platform has a database of over three million respondents and can deliver surveys to targeted respondents based on demographic characteristics. Based on previous studies, A survey scale was developed to measure 20 items related to 6 variables associated with chronic disease patients' physician choice in OHCs. SC and DC measurements were adapted from Huang et al.,<sup>47</sup> PC and PH were evaluated based on Li et al.,<sup>60</sup> PV was adapted from Zhang et al.,<sup>15</sup> CI was measured based on Chen et al.,<sup>61</sup> Lee and Kozar,<sup>62</sup> and Zhang et al.<sup>63</sup> (Table 2). A 7-point Likert scale ranging from strongly disagree to strongly agree was used to measure the items.

Since all our participants were from China, we employed a forward-backward translation method to translate our questionnaire in accordance with previous studies.<sup>64,65</sup> First, two independent translators and one translator proficient in both English and Chinese translated the



**Figure 4.** Conceptual model.

questionnaire into Chinese. Next, two professionals with medical translation capabilities compiled the two Chinese versions of the questionnaire and translated them into English. As a result, we selected 65 chronic disease patients who had consultation experiences in OHCs for a preliminary survey and refined the questionnaire to determine the final version. Chronic disease patients' reasons for medical consultation and demographic items were collected for moderating effect analysis. To ensure that all respondents had online consultation experience, we asked two initial questions: "Do you have online consultation experience in OHCs?" and "What was your reason for the previous online consultation?" The final sample consisted only of respondents who had experience with online consultations. We estimated that a reasonable time to complete the questionnaire should not be less than 60 s; thus, questionnaires with a response time shorter than 60 s were considered invalid. Finally, 526 valid questionnaires were obtained.

### Demographic characteristics

Regarding demographic data, among the 526 participants (184 males and 342 females), the participant pool consisted of approximately 65% females, and the sex distribution is close to the data of China's online medical and health services consumption white paper report by iResearch 2022, a leading Chinese consulting firm which proved that the sex ratio for the overall actual and potential population is approximately 66.67 males to 100 females. Undergraduate and higher education participants accounted for 94.6%. A total of 34.8% of the participants came from East China, and 65.2% from Midwest of China. Of these participants, 57.6% had no more than 8000 monthly income. Moreover, 84.8% of the participants were aged < 41 years (Table 3).

### Ethical considerations

All participants submitted written informed consent online before attending the survey. This research was approved by the Scientific Research Ethics Committee of Alibaba

Business School at Hangzhou Normal University (approval number: 20240001). All participants were anonymous. Participants who completed the survey were awarded a cash reward.

## Results

### Measurement model analysis

This study investigates the reliability, convergent validity, and discriminate validity of the measurement model. SPSS 27.0 was used to test data reliability. Table 4 illustrates that all of the variables had Cronbach's alpha coefficients and CR values greater than 0.8, exceeding the recommended threshold of 0.7, which indicates a high level of reliability.<sup>66–68</sup> Table 4 shows that the standardized factor loadings and AVE values exceeded the threshold of 0.5, which indicates sufficient convergent validity.<sup>69,70</sup> AMOS 24.0 was used to conduct the CFA to examine the validity of the model. Based on the fitness indices ( $\chi^2_{df} = 1.701$ , RMSEA = 0.037, GFI = 0.953, CFI = 0.980, TLI = 0.975), it was evident that the model was well-fitted.<sup>71</sup> Furthermore, the square root of the AVE and the correlations between the constructs were compared. Table 5 shows that the square root AVE of each construct exceeds its correlation with the other constructs.<sup>67</sup> Consequently, the model had a high degree of discriminate validity.

### Structural model analysis

We employed AMOS 24.0 to evaluate the structural model. The fit indices ( $\chi^2_{df} = 1.853$ , RMSEA = 0.040, GFI = 0.947, CFI = 0.975, TLI = 0.970) showed that the model had a good fit.<sup>71</sup> Table 6 and Figure 5 illustrate that all hypotheses are supported. SC ( $\beta = 0.239$ ,  $P < 0.01$ ), DC ( $\beta = 0.440$ ,  $P < 0.001$ ), and PV ( $\beta = 0.125$ ,  $P < 0.05$ ) positively affected PC. As a result, H1a–3a was supported. Moreover, SC ( $\beta = 0.369$ ,  $P < 0.001$ ), DC ( $\beta = 0.288$ ,  $P < 0.001$ ), and PV ( $\beta = 0.308$ ,  $P < 0.001$ ) positively affected PH. Thus, H1b–3b was supported. Lastly, PC ( $\beta = 0.165$ ,  $P < 0.001$ ) and PH ( $\beta = 0.724$ ,  $P < 0.001$ ) positively affect chronic

**Table 2.** Scale items of variables.

Variable	Items	Source
Status capital	SC1: The physician I prefer to consult occupies a higher level than most other physicians.	Huang et al. <sup>47</sup>
	SC2: I think the physician I prefer to consult would get a high position; therefore he can access more resources for my health.	
	SC3: If necessary, this physician may be able to utilize his medical resources to assist the patient in recovering faster and more effectively.	
	SC4: I think the physician I prefer to consult can take advantage of his highly qualified professional background to inform an accurate diagnosis.	
Decisional capital	DC1: The physician I prefer to consult is very passionate and dedicated to his patients, and enjoys the dynamic interaction with them.	Huang et al. <sup>47</sup>
	DC2: The physician I prefer to consult has extensive experience in clinical judgment.	
	DC3: The physician I prefer to consult relies on the evidence and clinical experience to make clinical judgments.	
	DC4: The physician I prefer to consult makes informed medical judgments based on his profession's commitment.	
Price value	PV1: The consultation price of the physician is reasonable.	Zhang et al. <sup>15</sup>
	PV2: The consultation price of the physician is valuable.	
	PV3: The consultation price of the physician is worth the money.	
Perceived convenience	PC1: I can consult with physicians from all over the country without having to travel to the hospital in OHCs.	Li et al. <sup>60</sup>
	PC2: Online consultation saves me a lot of time and transportation costs.	
	PC3: I can easily and quickly identify a physician to consult in OHCs.	
Perceived health benefits	PH1: With the assistance of the physician I wish to consult in OHCs, I can receive an accurate understanding of the condition.	Li et al. <sup>60</sup>
	PH2: With the assistance of the physician I wish to consult in OHCs, I can receive effective treatment recommendations.	
	PH3: With the assistance of the physician I wish to consult in OHCs, I can receive effective medication guidance.	
Physician choice intention	CI1: I consider the physician as my first choice in OHCs.	Chen et al. <sup>61</sup> , Lee and Kozar <sup>62</sup> , and Zhang et al. <sup>63</sup>
	CI2: I expect to consult with the physician in OHCs.	
	CI3: I intend to consult with the physician in OHCs.	

disease patients CI. Consequently, H4 and H5 were supported. The  $R^2$  results of PC, PH, and CI were 0.508, 0.697, and 0.690, respectively. The mediating effects of SC, DC, and PV on chronic patients' CI through PC and PH were examined using bootstrapping procedures with

5000 samples and a confidence interval of 95%. Table 7 demonstrates that the indirect effects of SC, DC, and PV on chronic patients' CI through PC are 0.039, 0.073, and 0.021, respectively. There are no zeros contained in confidence intervals. Similarly, the indirect effects of SC, DC,



**Table 3.** Demographic statistics of respondents (N = 526).

Category		Participants, n (%)
Sex		
	Male	184 (35)
	Female	342 (65)
Age		
	18–30	237 (45.1)
	31–40	209 (39.7)
	41–55	58 (11)
	56 above	22 (4.2)
Education		
	High school and below	28 (5.3)
	Undergraduate	412 (78.3)
	Graduate and above	86 (16.4)
Monthly Income (RMB)		
	Less than 4600	133 (25.3)
	4601–8000	170 (32.3)
	8001–17,000	186 (35.4)
	17,001 above	37 (7)
District		
	East	183 (34.8)
	Midwest	343 (65.2)

and PV on chronic patients' CI through PH were 0.267, 0.209, and 0.223, respectively. There are no zeros contained in confidence intervals.

### Multi-group analysis

Using pairwise comparisons of each relationship between the unconstrained and constrained models, differences between reasons for medical consultation, districts, and sex groups were identified. We impose an equal constraint on each path in the constrained model. A moderating effect exists if the change of chi-square values in the two models is significant.<sup>66</sup> We employed AMOS 24.0 to conduct MGA.

Regarding the comparison of reasons for medical consultation (Table 8), the path coefficients between PV and PC ( $\chi^2 = 4.810$ ,  $p < 0.05$ ) and those between PH and CI ( $\chi^2 = 16.977$ ,  $p < 0.001$ ), show significant differences between the prescription refills and medical advice groups. The effect of PH on CI for medical advice ( $\beta = 0.884$ ,  $P < 0.001$ ) was greater than for prescription refills ( $\beta = 0.562$ ,  $P < 0.001$ ). Furthermore, the coefficient of PV on PC for prescription refills was significant ( $\beta = 0.243$ ,  $P < 0.01$ ); however, the coefficient of PV on PC for medical advice was not significant ( $\beta = -0.011$ , n.s.). The  $R^2$  values for CI in prescription refills and medical advice groups were 0.485 and 0.780, respectively.

Based on a comparison of the districts (Table 9), there are two significant path differences between the Eastern and Midwestern China groups. The effect of PV on PH ( $\chi^2 = 4.981$ ,  $p < 0.05$ ) in the Eastern group ( $\beta = 0.406$ ,  $P < 0.001$ ) was larger than that in the Midwestern group ( $\beta = 0.215$ ,  $P < 0.01$ ). The coefficient of DC on PH for the Midwestern group was significant ( $\beta = 0.410$ ,  $P < 0.001$ ); however, the coefficient of DC on PH for the Eastern group was not ( $\beta = 0.092$ , n.s.). Overall,  $R^2$  for CI in the Eastern and Midwestern groups were 0.662 and 0.721, respectively.

Table 10 shows that sex had a significant moderating effect on the relationship between PH and CI ( $\chi^2 = 4.496$ ,  $p < 0.05$ ). The effect of PH on CI in the male group ( $\beta = 0.937$ ,  $P < 0.001$ ) was larger than that in the female group ( $\beta = 0.640$ ,  $P < 0.001$ ). The  $R^2$  for CI in the male and female groups were 0.900 and 0.588, respectively.

## Discussion

### Principal findings

This study developed a physician choice mechanism model to examine the influence of WOML on chronic disease patients' physician choice process in OHCs. The three principal findings are as follows:

First, according to the LDA topic analysis of online reviews, SC, DC, and PV were identified as the main antecedents affecting physician choice during the external interaction process. This was consistent with previous research on the factors influencing patients' physician choice.<sup>22,35,52</sup> Furthermore, PC and PH were the main internal cognitions that patients with chronic disease learned from their internal cognition, which is rarely discussed in existing research. Since chronic disease patients require frequent diagnosis and treatment communication, patients will balance PH and PC according to physicians' SC, DC, and PV, and finally make physician choice decisions based on their needs.

Second, based on the results of the LDA topic analysis, we developed a physician choice mechanism model to examine the influence of WOML on chronic

**Table 4.** Results of reliability and validity analysis.

Variable	Items	Loading	CR	AVE	Cronbach's alpha
Status capital	SC1	0.728	0.832	0.553	0.831
	SC2	0.731			
	SC3	0.748			
	SC4	0.767			
Decisional capital	DC1	0.667	0.830	0.550	0.828
	DC2	0.761			
	DC3	0.751			
	DC4	0.783			
Price value	PV1	0.733	0.829	0.619	0.828
	PV2	0.836			
	PV3	0.787			
Perceived convenience	PC1	0.862	0.835	0.628	0.830
	PC2	0.732			
	PC3	0.778			
Perceived health benefits	PH1	0.756	0.832	0.624	0.832
	PH2	0.821			
	PH3	0.791			
Physician choice intention	CI1	0.790	0.823	0.608	0.823
	CI2	0.768			
	CI3	0.781			

Note. CR: composite reliability; AVE: average variance extracted; SC: status capital; DC: decisional capital; PV: price value; PC: perceived convenience; PH: perceived health benefits; CI: physician choice intention.

disease patients' physician choices. SC, DC, and PV were confirmed as all having positive correlations with PH and PC, and both PH and PC were positively correlated with CI. The mediating role of PC and PH in the relationships among SC, DC, PV, and CI were verified. This suggests that physicians' SC, DC, and PV play a vital role in chronic disease patients' physician choices. This is consistent with existing studies highlighting the importance of SC, DC, and PV on physician choice.<sup>15,47</sup>

Third, it was proven that reasons for medical consultation, district, and sex significantly moderated the relationships in the model. In existing research, it is rarely

discussed. Based on these results, we found that the impact of PH on CI was stronger for patients seeking medical advice consultations (male patients) than for those seeking prescription refills (female patients). A possible explanation is that the purpose of patients seeking medical advice consultations (male patients) pays more attention to PH than those seeking prescription refills (female patients) in online medical consultations. We also identified that PV (DC) has a significant positive effect on PC (PH) for patients seeking prescription refills (patients from Midwest China). However, the influence of PV (DC) on PC (PH) is not significant for patients seeking medical advice (patients from East China). This

**Table 5.** Discriminate validity.

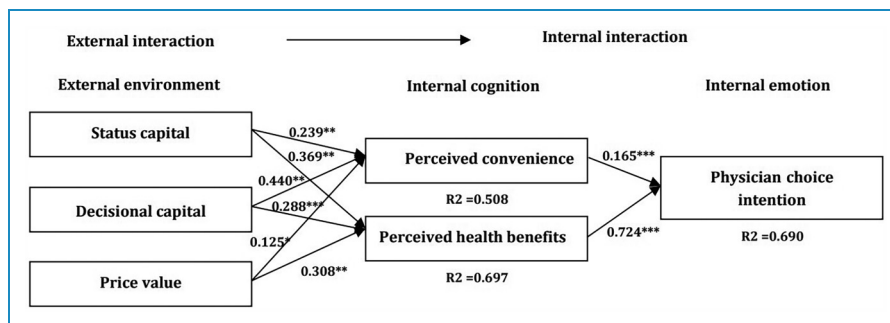
Constructs	CI	PC	PH	PV	DC	SC
CI	<b>0.780</b>					
PC	0.577	<b>0.793</b>				
PH	0.777	0.591	<b>0.790</b>			
PV	0.669	0.489	0.645	<b>0.786</b>		
DC	0.668	0.667	0.682	0.511	<b>0.742</b>	
SC	0.711	0.621	0.736	0.617	0.71	<b>0.744</b>

Note. SC: status capital; DC: decisional capital; PV: price value; PC: perceived convenience; PH: perceived health benefits; CI: physician choice intention; The square root AVE of each construct is bolded on a diagonal.

**Table 6.** Results of hypotheses test.

Hypotheses	Path	Ustd.	S.E.	T-value	P	$\beta$	Results
H1a	SC→PC	0.272	0.087	3.113	0.002**	0.239	Supported
H2a	DC→PC	0.565	0.092	6.154	0.000***	0.440	Supported
H3a	PV→PC	0.13	0.06	2.18	0.029*	0.125	Supported
H4	PC→CI	0.166	0.05	3.297	0.000***	0.165	Supported
H1b	SC→PH	0.403	0.075	5.364	0.000***	0.369	Supported
H2b	DC→PH	0.354	0.075	4.745	0.000***	0.288	Supported
H3b	PV→PH	0.308	0.052	5.923	0.000***	0.308	Supported
H5	PH→CI	0.758	0.064	11.814	0.000***	0.724	Supported

Note. SC: status capital; DC: decisional capital; PV: price value; PC: perceived convenience; PH: perceived health benefits; CI: physician choice intention.

**Figure 5.** Results of the structural model.

could be explained that online consultations for prescription refills are more convenient than offline, so PV makes it easier for them to perceive the convenience of online consultations. The main purpose of patients from Midwest China is to seek better medical resources

through online medical consultations. Physicians with high DC enable patients from Midwest China to perceive health benefits. Additionally, this study also identified the impact of PV on PH was smaller in patients with chronic disease from the Midwest than in those from

**Table 7.** Results of mediation effects analysis (standardized coefficients).

Paths	Effect	SE	Bias-Corrected 95% CI		
			Boot LLCI	Boot ULCI	P-value
SC→PC→CI	0.039	0.024	0.005	0.106	0.018
DC→PC→CI	0.073	0.034	0.014	0.148	0.017
PV→PC→CI	0.021	0.014	0.002	0.062	0.028
SC→PH→CI	0.267	0.062	0.151	0.395	0.000
DC→PH→CI	0.209	0.055	0.107	0.326	0.000
PV→PH→CI	0.223	0.054	0.118	0.331	0.001

Note. SC: status capital; DC: decisional capital; PV: price value; PC: perceived convenience; PH: perceived health benefits; CI: physician choice intention.

**Table 8.** Results of MGA by reasons for medical consultation.

Path	Reasons for medical consultation				Path difference $\Delta\chi^2$ (df = 1)
	Prescription refills (N = 243)		Medical advice (N = 283)		
	$\beta$	t	$\beta$	t	
SC→PC	0.187	1.860	0.143	1.160	0.418
DC→PC	0.326	4.158***	0.673	4.868***	2.817
PV→PC	0.243	2.631**	−0.011	−0.155	4.810*
PC→CI	0.237	3.393***	0.056	0.781	1.445
SC→PH	0.245	2.415*	0.415	4.093***	0.104
DC→PH	0.260	3.370***	0.312	3.033**	0.003
PV→PH	0.347	3.669***	0.291	4.692***	0.528
PH→CI	0.562	6.663***	0.884	9.249***	16.977***
R <sup>2</sup> for CI	0.485		0.780		

Note. SC: status capital; DC: decisional capital; PV: price value; PC: perceived convenience; PH: perceived health benefits; CI: physician choice intention.

the East. There is a possible explanation that qualified physicians are scarce in Midwestern China which led to the consultation price having less impact on perceived health benefits for patients from the Midwest than for patients from East China.

### Theoretical contributions

The study contributes three theoretical insights to the literature. First, we applied SLT to analyze the mechanisms of chronic disease patients' physician choice in OHCs during the process of WOML which revealed the

physician choice process from external interaction (SC, DC, and PV) to internal cognitions (PC and PH) and, finally to internal emotion (CI), expanding the application of SLT theory to the OHCs field. Although previous studies have verified the factors influencing patients' physician choices,<sup>22,35,52</sup> there is still a research gap regarding patients' psychological processes that stimulate chronic disease patients' physician choices. This study opens the black box of the physician choice mechanism for patients with chronic diseases and contributes new insights to the existing literature on patients' physician choice in OHCs.

**Table 9.** Results of MGA by district.

Path	District				Path difference $\Delta\chi^2$ (df = 1)
	East (N = 183)		Midwest (N = 343)		
	$\beta$	t	$\beta$	t	
SC→PC	0.044	0.329	0.312	3.342***	2.938
DC→PC	0.622	4.943***	0.349	4.017***	2.222
PV→PC	0.207	2.301*	0.110	1.438	0.903
PC→CI	0.154	1.819	0.163	2.680**	0.074
SC→PH	0.526	4.709***	0.295	3.426***	2.371
DC→PH	0.092	1.032	0.410	4.905***	7.743**
PV→PH	0.406	5.297***	0.215	3.026**	4.981*
PH→CI	0.705	7.128***	0.750	9.592***	1.603
R <sup>2</sup> for CI	0.662		0.721		

Note. SC: status capital; DC: decisional capital; PV: price value; PC: perceived convenience; PH: perceived health benefits; CI: physician choice intention.

**Table 10.** Results of MGA by sex.

Path	Sex				Path difference $\Delta\chi^2$ (df = 1)
	Male (N = 184)		Female (N = 342)		
	$\beta$	t	$\beta$	t	
SC→PC	0.438	3.313***	0.139	1.450	2.720
DC→PC	0.387	3.635***	0.481	5.078***	1.628
PV→PC	0.043	0.422	0.149	2.159*	1.036
PC→CI	0.017	0.184	0.206	3.396***	2.790
SC→PH	0.425	3.801***	0.337	3.860***	0.029
DC→PH	0.358	3.985***	0.254	3.181**	0.051
PV→PH	0.229	2.671**	0.340	5.232***	2.773
PH→CI	0.937	7.711***	0.640	8.902***	4.496*
R <sup>2</sup> for CI	0.900		0.588		

Note. SC: status capital; DC: decisional capital; PV: price value; PC: perceived convenience; PH: perceived health benefits; CI: physician choice intention.

Second, according to the WOML based on the SLT, by introducing PC and PH as mediating variables, the resulting findings provide insight into patients' cognition of physician choices in OHCs. Although previous studies have

verified that WOM is a key factor influencing patients' physician choice behavior in OHCs,<sup>19,21</sup> there is still a research gap regarding how WOML affects patients' psychological processes that stimulate chronic disease patients'



physician choices. We demonstrated that both PC and PH can positively impact chronic disease patients' CI. Guided by SLT, experience and guidance about chronic disease patients' cognition and behavioral responses in physician choice are provided to help inform future research on this subject.

Finally, by examining the moderating effects of reasons for medical consultation and demographic characteristics, we developed a better understanding of the individual differences among patients' physician choice mechanisms. Despite previous studies examining the mediating role of disease risk in service choices in OHCs,<sup>50</sup> little is known about the moderating effects of reasons for the consultation and patients' demographic characteristics on patients' physician choice behavior. The results provide valuable supplementation concerning the moderation effect of reasons for medical consultation, district, and sex on the chronic disease patients' physician choice behavior.

### Practical contributions

Specifically, our research has practical implications for physicians and OHCs to improve consultation quality for patients with chronic diseases.

First, results show that SC, DC, and PV are key antecedents of chronic disease patients' physician choices, which initiate the internal cognitive process. PC and PH are internal cognitive factors which determine chronic diseases patients' physician choice in OHCs. For physicians, in addition to clinical titles, emphasizing their skills and abilities in personal information in OHCs, setting reasonable consultation prices,<sup>15</sup> and improving their DC can increase the possibility of patients' choices.<sup>12,49</sup> For OHCs service providers, optimizing platform functions, improving the convenience of consultation, and strengthening the qualification review of physicians can stimulate patients' behavioral intentions based on analyzing chronic disease patients' needs for medical consultation in OHCs. For example, the introduction of artificial intelligence-assisted diagnosis and treatment provides patients with an initial diagnosis based on their own conditions and treatment needs and matches them automatically with the appropriate physician.

In addition, the results showed that reasons for medical consultation had a significant moderating effect on the relationship between PV and PC as well as PH and CI. District had a significant moderating effect on the relationship between DC and PH as well as PV and PH. The relationship between PH and CI is significantly moderated by sex. Therefore, for physicians, suitable consultation prices should be formulated for patients from different districts and increase the PV of patient consultations. Physicians should improve their diagnosis and treatment services quality to enhance male patients and patients requiring medical advice' PH. For online health consultation service

providers, artificial intelligence technology could be applied to recommend suitable physicians to patients based on their reasons for medical consultation and demographic characteristics. For example, for patients requiring medical advice (prescription refills), OHCs should recommend physicians with high SC and high DC (high PV) to improve patients' PH (PC), which is more likely to help patients' decision-making. For patients from Midwest China (East China), OHCs should recommend physicians with high DC (high PV) to improve their PH. For male patients, OHCs should recommend physicians with high SC, DC, and PV to improve their PH, which helps patients' decision-making.

### Limitations

This study has some limitations. First, the data used were derived only from China. The physician's choice behavior for patients with chronic diseases can be influenced by the degree of OHCs development and cultural differences in different countries. Future research could be expanded to other countries to enhance the applicability of our research model. Second, this study did not consider differences in physician choice behavior in OHCs among patients with different types of chronic diseases. In OHCs, different chronic diseases have different treatment options, which influence the patients' physician choice behavior. The behavior of patients with severe chronic diseases differs from that of patients with common chronic diseases. Therefore, further research is needed to examine the differences in physician choice behaviors among chronic patients with different diseases. Third, the distribution of patients' demographic characteristics varies in diverse online health communities. The moderating effect of patients' demographic characteristics on the mechanism research model relationships may be different. Online health communities should develop operational strategies based on the distribution of patients' demographic characteristics of their platform. Finally, owing to the privacy policy of OHCs, we were unable to obtain patients' personal information. In the future, it may be possible to obtain patients' personal information and combine it with their consultation behavior data from OHCs to conduct more accurate research.

### Conclusions

Based on SLT, this study identified external interaction factors, internal cognitive factors, and internal emotional factors influencing chronic disease patients' physician choices during the WOML process and developed a physician choice mechanism model. Our findings indicate that SC, DC, and PV are key antecedents to initiating internal cognition in patients with chronic diseases. Internal cognitive, such as PC and PH, determine physician choices


behavior for chronic disease patients. Furthermore, reasons for medical consultation, district, and sex significantly moderated the relationships in the model. This study extends SLT to the study of OHCs, reveals chronic disease patients' physician choice mechanisms, provides new insights about patients' physician choice in OHCs, and offers empirical evidence for physicians and OHCs to improve diagnosis and treatment services for chronic disease patients considering individual differences.

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## Statements and declarations

### Ethics approval

This study was approved by the Scientific Research Ethics Committee of Alibaba Business School at Hangzhou Normal University (approval number: 20240001). Informed consent was obtained from all participants. Consent can be obtained from the corresponding author. To protect participants' privacy, these consents are not accessible to the public.

### Contributorship

Linlin Han and Narongsak (Tek) Thongpapanl were key contributors to formulating the conceptual framework of this study, data collection, data analysis, and manuscript writing. Ou Li performed data collection, data analysis, and manuscript preparation.

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### Conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Guarantor

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