Identification and Analysis of Key Influencing Factors of Knowledge Contribution Behavior in Online Medical Communities - Postprint

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Abstract

[Purpose/Significance] To identify and analyze the key influencing factors of knowledge contribution behavior in online health communities, thereby providing a theoretical foundation for promoting such behavior and enhancing community activity. [Method/Process] An influencing factor system for knowledge contribution behavior in online health communities is constructed from an information ecology perspective, and the DEMATEL method is employed to analyze the interrelationships among these factors. [Results/Conclusion] By ranking the centrality and causality of all influencing factors, the key factors affecting knowledge contribution behavior in online health communities are identified. The primary causal factors include patient self-efficacy, national policies and regulations concerning online healthcare, and platform usability; the primary centrality factors include physicians' needs to improve medical efficiency and patients' perceived consistency with the community. Corresponding recommendations and strategies for promoting knowledge contribution behavior are proposed accordingly.

Full Text

Abstract

[**Purpose/Significance**] This study identifies and analyzes the critical influencing factors of knowledge contribution behavior in online health communities, providing a theoretical foundation for promoting such behavior and enhancing community activity. [**Method/Process**] From an information ecology perspective, we constructed an influencing factor system for knowledge contribution behavior in online health communities and applied the DEMATEL method to analyze the relationships among these factors. [**Result/Conclusion**] By ranking the centrality and causality of all influencing factors, we identified the key

factors affecting knowledge contribution behavior. The primary causal factors include patients' self-efficacy, national policies and regulations on online healthcare, and platform ease of use. The main centrality factors include doctors' needs to improve medical efficiency and patients' perceived consistency with the community. Based on these findings, we propose recommendations for promoting knowledge contribution behavior.

1. Introduction

As China enters an aging society and people become increasingly health-conscious, problems such as uneven distribution of medical resources, poor information sharing, and suboptimal user experiences have become more prominent. In 2014, entrepreneurial enterprises and capital jointly ignited the "Internet + healthcare" era, with the rapid development of the industry offering potential solutions to these challenges. According to the 39th "China Internet Development Statistics Report" released by CNNIC, by December 2016, China's online healthcare user base reached 195 million, accounting for 26.6% of all internet users. Medical information queries, online appointment registration, and online consultations were the most frequently used services. Online healthcare (eHealth) refers to the provision of medical services through the internet or mobile internet, encompassing any healthcare service 环节 that employs these technologies. This includes online health and wellness services for the general public or patients, online diagnosis and treatment services, and related pharmaceutical and medical device businesses, as well as social networking, professional knowledge, and online consultation platforms for physicians.

Online health communities provide an excellent platform for knowledge sharing between doctors and patients. Platforms such as Haodf.com, Dxy.cn, Chunyu Doctor, and Ping An Good Doctor have assembled hundreds of thousands of doctors from public hospitals, completing over 500,000 daily patient consultations. Research by Einav and Neil demonstrates that online health websites not only provide learning and exchange platforms for participants but also serve "lurkers" who browse without actively participating. Kraut et al. conducted qualitative evaluations of diabetes patients' use and sharing of medical information on Facebook, studying physicians' information sharing behavior in detail. Faraj analyzed the value of online health communities, noting that they provide collaborative platforms for doctors and patients to exchange and share medical knowledge, enabling doctors to achieve self-actualization while patients receive emotional support. Oh examined user motivations for sharing medical knowledge on Yahoo Answers, proposing ten incentive factors including learning, efficacy, personal gain, community benefit, altruism, reciprocity, and reputation.

Domestic scholars have also contributed to this field. Deng Chaohua et al. constructed and validated a knowledge sharing behavior model for online health communities using Dxy.cn users, finding that altruism, interaction centrality, sense of belonging, perceived interactivity, and equivalence significantly influ-

ence knowledge sharing intention. Wu Jiang et al. studied user interaction behaviors in online health communities using social network analysis, concluding that core members' behaviors significantly influence other users and that maintaining such members enhances community activity. Hou Guisheng et al. developed an evolutionary game model for knowledge transformation and sharing among online health community users, analyzing dynamic evolution processes and stable strategies. Liu Guoqi analyzed factors influencing knowledge sharing on the "Chunyu Doctor" app from a uses and gratifications perspective, while Li Yuguang studied information sharing willingness from the patient perspective, validating that patients' willingness depends on their attitude toward the behavior, perceived behavioral control, and perceived social returns from the community.

Overall, international research has focused on the value of online health communities to users and motivations for knowledge sharing, while domestic studies have primarily examined influencing factors from the patient perspective and user interaction behaviors. However, research on knowledge contribution behavior in doctor-patient communities remains relatively scarce, particularly regarding identification of critical influencing factors. The concept of knowledge contribution behavior remains ambiguous, lacking a systematic theoretical framework and comprehensive analysis. This study addresses this gap by investigating the critical influencing factors of knowledge contribution behavior in online health communities, providing insights for community operators and regulators.

2. Theoretical Review

2.1 Concept and Classification of Online Health Communities

Online health communities (OHCs) emerge from the convergence of online social networks and growing public health awareness. Based on Web 2.0 technologies, these communities enable users to share treatment experiences, disease-related knowledge, consult experts, and interact with other members. Users can consult experts, learn from other patients, and share experiences to obtain beneficial health information.

Online health communities can be categorized by service targets and communication modes into: doctor-doctor communities, doctor-patient communities, and patient-patient communities. Doctor-doctor communities, represented by Dxy.cn, facilitate academic, professional, and personal exchanges among physicians. Doctor-patient communities, including Haodf.com, Chunyu Doctor, and Dxy Doctor, primarily provide consultation services, health information queries, appointment registration, family doctor services, and convenient outpatient services. Patient-patient communities are spontaneous online social networks where patients share experiences, treatment plans, and emotional support. Notable examples include the internationally influential PatientsLikeMe and DailyStrength, and domestic platforms such as the Baidu Hemophilia Forum and

Sweet Home. This study focuses on doctor-patient communities, which represent the most dynamic segment of online health communities in China.

2.2 Defining Knowledge Contribution Behavior

Knowledge contribution is a specialized term in knowledge management research, yet few scholars have provided a precise definition. It refers to the effort expended to achieve a particular outcome. Knowledge sharing comprises two activities: knowledge contribution and knowledge seeking. Successful knowledge sharing depends on seekers accessing, commenting on, and disseminating knowledge, while contributors provide new and valuable resources. These behaviors are inseparable: knowledge seeking often triggers contribution intentions through reciprocity motives, while continuous knowledge contribution ensures community growth and attracts further seeking behavior. Virtual communities rely on members' continuous contribution of ideas and knowledge for vitality, making sustained knowledge sharing essential for community success.

2.3 Knowledge Contribution Behavior in Online Health Communities

As a type of virtual community, online health communities maximize value through knowledge sharing and exchange. The key participants include doctors, patients, family members, health-conscious individuals, and community managers. In doctor-patient communities, physicians contribute by writing medical articles, browsing patient inquiries, answering questions, and interacting with patients. These activities constitute knowledge contribution behavior. Patients contribute by searching for knowledge, consulting doctors, acquiring information, and interacting with physicians. When patients formulate inquiries, they must describe symptoms, medical history, allergies, and treatment history, often uploading medical reports—this process itself represents information sharing and knowledge contribution. Once answered, these doctor-patient dialogues become explicit knowledge resources for other patients with similar conditions.

3. Constructing the Key Influencing Factor System

3.1 Information Attributes

Online health communities bring together doctors, patients, and health-conscious individuals, with information flowing constantly. Users' fundamental purpose in browsing, searching, adopting, interacting, and contributing is to acquire knowledge, making information attributes a basic influencing factor. Through literature and questionnaire surveys, we identified three key information attributes: usefulness, credibility, and timeliness of community knowledge. Usefulness refers to recipients' perception of value in applying the knowledge to enhance health understanding. Credibility indicates users' trust in community knowledge, with higher trust strengthening contribution willingness. Timeliness reflects knowledge's value for decision-making within a specific timeframe, particularly important given rapid advances in medical

technology, pharmaceutical updates, and evolving treatment protocols. These three attributes significantly influence knowledge contribution behavior across all user types.

3.2 Information Agent Attributes

Community users include doctors, patients, and health-conscious individuals. Since patients and health-conscious individuals exhibit similar behaviors, we analyze them collectively as "patients."

Doctor-related factors include altruistic intention, reputation enhancement needs, economic benefit needs, and medical efficiency improvement needs. Motivation theory distinguishes between internal motivation (behavior's inherent value) and external motivation (pursuit of rewards like money or status). In virtual communities, internal motivation manifests as altruism, while external motivation appears as prestige or image enhancement. Chinese physicians typically contribute medical knowledge during spare time, driven primarily by altruistic "benevolent heart" principles. However, they also receive income from paid consultations, gain reputation through patient votes and testimonials, and improve offline practice efficiency through pre-diagnosis consultations and post-treatment management.

Patient-related factors include perceived community consistency, consistent trust, self-efficacy, and cost-benefit ratio judgment. Perceived consistency occurs when knowledge sharing aligns with users' values and experiences, promoting contribution behavior. Consistent trust emerges from comparing community reputation with actual experience. Self-efficacy refers to patients' ability to encode their symptoms and implicit knowledge into communicable content. Cost-benefit judgment is unique to online health communities, as patients pay for doctor interactions with uncertain outcomes regarding response quality, waiting time, and consultation effectiveness.

3.3 Information Environment Attributes

Environmental attributes include national policies and regulations, key population influence, platform ease of use, technological security and advancement, and fair management systems. National policies directly shape community development—for instance, the 2016 joint regulation by China's National Health and Family Planning Commission and eight other ministries eliminated manual appointment-adding functions, while 2017's "Internet Diagnosis and Treatment Management Measures" imposed stricter requirements on access, practice rules, and supervision.

In social networks, key groups—early adopters who influence others' participation—play crucial roles. When colleagues or friends join communities, social and conformity needs drive others to follow. Platform characteristics like user-friendly interfaces, low learning costs, security, and privacy protection significantly affect usage. Fair management systems ensure

objective supervision of patient evaluations, preventing online medical disputes from affecting doctors, while also ensuring reasonable interaction controls from the patient perspective.

4. Identifying Key Influencing Factors

4.1 DEMATEL Factor Identification Method

The DEMATEL method, developed by the Geneva-based Battelle Association in 1971, effectively analyzes complex real-world problems by simplifying causal relationships and identifying critical factors. It determines variable interdependencies and constraints based on expert opinions, making it suitable for multi-attribute decision problems like this study. The method involves: (1) analyzing direct relationships and their strength among system elements; (2) constructing a direct influence matrix; (3) normalizing the matrix; (4) calculating the comprehensive influence matrix; and (5) computing each element's influence degree, influenced degree, centrality, and causality. Causal factors (causality $>$ 0) significantly influence others, while result factors are more influenced by others. Centrality (sum of influence and influenced degrees) indicates an element's overall importance in the system.

4.2 Key Factor Identification

Our research focused on the Haodf.com platform. We invited ten experts—online health community researchers, product managers, registered doctors (active at least three times weekly), and frequent patients (weekly visitors)—to score factor relationships using the evaluation criteria in Table 2 . Experts generated ten direct influence matrices by comparing each factor pair asymmetrically (e.g., F1's usefulness might not influence F10's self-efficacy, but F10 could strongly influence F1). We averaged and rounded these scores to produce the final direct influence matrix Xa (Table 3).

Using MATLAB, we calculated the comprehensive influence matrix P (Table 4) and computed each factor's influence degree, influenced degree, centrality, and causality (Table 5). We visualized these results in a causality diagram (Figure 2 [Figure 2: see original paper]).

4.3 Analysis of Key Influencing Factors

The factor system forms an organic whole where information agents, knowledge, and environmental factors interact complexly. Analysis reveals:

(1) Causal factor analysis: Factors with positive causality (strongly influencing others) include: patients' self-efficacy (F10), national policies and regulations (F12), platform ease of use (F14), technological security and advancement (F15), fair management systems (F16), and knowledge usefulness (F1). Patients' self-efficacy shows the highest causality, decisively affecting all communication.

Since doctor-patient interactions rely entirely on text and images, patients' ability to encode implicit knowledge into explicit, transmissible content determines contribution effectiveness. Communities should provide guided processes to help patients accurately describe conditions, medical history, and needs.

Notably, F12, F14, and F16 are environmental factors, indicating that information environment profoundly impacts knowledge contribution. Appropriate regulations, secure and user-friendly technology, and standardized management effectively promote knowledge exchange.

Result factors (negative causality), ordered by influenced degree, include: patients' perceived community consistency (F8), cost-benefit judgment (F11), doctors' medical efficiency improvement needs (F7), patients' consistent trust (F9), doctors' reputation needs (F5), doctors' economic benefit needs (F6), doctors' altruistic intention (F4), knowledge timeliness (F3), platform ease of use (F14), and knowledge credibility (F2). Patients' perceived consistency is most susceptible to influence from knowledge usefulness (F1), platform ease of use (F14), and fair management systems (F16). Enhancing these aspects can improve patients' consistency perception, for example, through big data-driven personalized content recommendations, simplified interfaces, and improved doctor-patient interaction mechanisms.

(2) Centrality analysis: Centrality rankings reveal the most critical factors: doctors' medical efficiency improvement needs (F7), patients' perceived community consistency (F8), doctors' reputation needs (F5), doctors' altruistic intention (F4), and patients' cost-benefit judgment (F11).

Doctors' medical efficiency improvement needs (F7) ranks highest in centrality, playing a pivotal role while being most influenced by other factors. As China ages, chronic disease management burdens increase, and doctors expect online communities to handle pre-diagnosis and post-treatment management, reducing unnecessary face-to-face visits. Platforms like PatientsLikeMe demonstrate how dynamic health data tracking supports clinical decisions. However, F7 is highly susceptible to patients' self-efficacy (F10), fair management systems (F16), national policies (F12), and platform ease of use (F14), requiring comprehensive, multi-faceted support.

Patients' perceived community consistency (F8) ranks second in centrality, strongly influencing knowledge contribution from the patient perspective. When patients' experiences align with their values, they engage in deeper knowledge sharing. For patients transitioning from "lurkers" to "contributors," cost-benefit judgment is crucial—communities must demonstrate that "paid consultation is worthwhile" through satisfactory management rules, reasonable interaction controls, and rapid response mechanisms to cultivate user stickiness and sustained contribution.

5. Recommendations for Promoting Knowledge Contribution

Under the "Internet + Healthcare" initiative, online health communities continue gaining attention, with knowledge contribution behavior influenced by multiple interacting factors. Based on our investigation and analysis, particularly regarding doctors' medical efficiency improvement needs (the key factor) and patients' self-efficacy (the primary causal factor), we propose the following recommendations:

5.1 Optimize Knowledge Access Processes to Enhance User Experience

Patients' perceived community consistency (F8), the second most central factor, is heavily influenced by platform ease of use (F14) and technological security/advancement (F15). These factors directly determine whether patients can smoothly access knowledge. Only when users experience seamless knowledge acquisition will they share their own implicit knowledge. Therefore, sustained patient contribution requires simplified usage processes, friendly interfaces, strengthened privacy protection, improved doctor-patient interaction workflows, and enhanced perceived consistency.

5.2 Continuously Improve Community Management Systems to Cultivate User Identification

Fair management systems (F16) are crucial causal factors that significantly influence doctors' reputation needs (F5), altruistic intention (F4), and patients' cost-benefit judgment (F11). Communities must objectively supervise patient evaluations to prevent online medical disputes from unfairly affecting doctors, while also ensuring reasonable interaction controls. By fairly reflecting doctors' labor value, communities can foster doctors' sense of identification and belonging. For patients, demonstrating consultation value through satisfactory management rules and rapid response mechanisms is essential for cultivating loyalty and sustained contribution.

5.3 Establish Patient Sharing Platforms to Aggregate Precision Medical Big Data

Our quantitative analysis of Haodf.com revealed patients' self-efficacy (F10) as the most influential causal factor. Beyond improving patients' descriptive abilities, communities should provide friendly guided processes and similar case examples to help patients articulate their conditions. For post-treatment chronic disease management, communities could offer nearly "foolproof" forms or options for sharing health data, directly satisfying doctors' medical efficiency improvement needs (F7). Adding patient-patient sharing platforms would allow patients to find others with similar conditions, exchange emotional support and

treatment experiences, and share daily health data—benefiting both patient emotional needs and doctor monitoring capabilities.

5.4 Establish Medical Knowledge Recommendation Systems for Precise Contribution

Knowledge usefulness (F1) is an important causal factor with high centrality. By collecting and analyzing patients' personalized behaviors, attention patterns, and search behaviors, communities can provide precisely targeted medical knowledge. This significantly improves patients' perceived consistency (F8) and trust (F9). When patients' cost-benefit judgment (F11) satisfaction increases, it positively influences their knowledge contribution behavior, creating a virtuous knowledge circulation cycle that supports community health.

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Author Contributions

Sun Yue: Paper writing and data analysis;
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An Analysis on the Critical Influencing Factors of the Knowledge-Contributing Behavior of Online Health Communities

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Abstract: [Purpose/significance] This paper identifies and analyzes the critical influencing factors of knowledge-contributing behavior in online health communities, providing a theoretical basis for promoting community activity. [Method/process] From an information ecology perspective, we constructed an influencing factor system and applied the DEMATEL method for incidence analysis. [Result/conclusion] By ranking causality and centrality, we recognized key factors: patients' self-efficacy, national policies/regulations, and platform ease of use (causal factors); and doctors' needs to improve medical efficiency and patients' perceived community consistency (centrality factors). Recommendations for promoting knowledge-contributing behavior are proposed.

Keywords: online health communities; knowledge-contributing behavior; doctors; patients; influencing factors

Note: Figure translations are in progress. See original paper for figures.