

WHAT TRIGGER PEOPLE USE PHYSICIAN-PATIENT INTERACTIVE OHCS? AN EMPIRICAL RESEARCH BASED INTEGRATION MODEL

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Abstract:

Online health community (OHC) has become a hot research topic in the IS filed. A lot of previous studies have focused on online patient support groups or peer-to-peer (P2P) communities, but another kind of OHC, i.e., patient-to-doctor (P2D) communities, is still with less attention. P2D communities link patients and physicians, which have sprung up and developed exponentially all over the world. This research tries to explore users' intention of P2D communities and the benefits brought by the use. Based on three theory lenses: D&M IS success model, social support theory and social presence theory, we build an integrated model to deeply understand: what factors trigger users' information seeking and participation intention. A survey is used to collect data from potential young users of two main P2D online health communities (Hao Daifu and Xunyi Wenyao) in China. PLS technique is used to analyse the data and test the hypotheses. We find that the use of P2D communities could bring positive perceived patient-doctor relationship from patients' perspective; social presence could positively influence users' information seeking and participation intention both; emotional support is positively related to social presence; and social presence plays a mediated effect between information quality and use intention. Then potential implications and limitations are discussed.

Keywords: Patient-to-doctor (P2D) Communities, Healthcare, Use Intention, IS Success Model, Social Support, Social Presence

1. INTRODUCTION

Online Health Community (OHC) is a fast-moving virtual approach providing patients and physicians a better and more convenient way to communicate and interact with each other. The virtual communities can connect people with common interests and provide a scaffolding for support, solidarity, information share and social capital (Maloney-Krichmar & Preece 2002), and OHC is a particular platform which provides health information and discussion, self-help, social support and empathy for people with health concerns (Finn 1999; Gustafson et al. 1994), and also provides a channel for both patient and physician to communicate easily and effectively. As a medium for conveying information, OHC is gradually penetrating into people's lives with a broad scope of influence (Cotten & Gupta 2004).

According to a report from Allied Health World¹, 42% of users choose social media to look up reviews for health providers, treatments, and products. At the same time, almost 20% of users would like to join an online health community. As an increasing number of people choose to gain healthcare-related knowledge and advice from the Internet, E-health has become growingly popular in diversified domains, especially in information systems. These research topics are cross-disciplinary with theories and methodologies from medical informatics, information systems, marketing, and public policy and so on (Eysenbach 2001; Tong et al. forthcoming). For example, Research on online health communities has explored how they are used and how they can benefit patients (Brodie et al. 2000; Eysenbach et al. 2002; Nambisan 2011; Sussman & Siegal 2003). Such topics mainly focus on online health communities that allow patients communicate and share experience with each other. These online health communities, also known as online patient support groups or peer-to-peer (P2P) communities (Vennik et al. 2014), have been found to be effective tools for patients to obtain information and emotion support (Ballantine & Stephenson 2011; Nambisan 2011), eliminate negative health disparities (Israel et al. 2010) and find peer patients (Ziebland & Wyke 2012).

Besides P2P online health communities, there is another kind of OHC that link patients and physicians, namely patient-to-doctor (P2D) communities (van der Eijk et al 2013; Vennik et al. 2014), which are relatively studied less than P2P communities, though such physician-patient communities have sprung up and developed exponentially all over the world. HealthTap, one of the most famous interactive OHCs in United States, holds a social network of 63,125 top physicians ready to give advices to patients on it, and secures \$24 million from capital market. In China, there are also plenty of OHCs such as Hao Daifu, and Xunyi Wenyao attracting numerous visits every day. In these communities, patients and physicians are able to communicate with each other in spite of geographical locations or the professional's institutional affiliation (Vennik et al. 2014). Without the limit of space and time, communication and information transferring between physicians and patients become more convenient and efficient, which helps to improve physician and patient relationship (Anderson et al. 2003).

Though knowledge exists on the consequences of using P2D communities (Umefjord et al. 2003; Vennik et al., 2014), they mainly focus on patients' feelings of experience, rather than the concrete factors triggering patients' use intention and deeply indirect benefits (e.g., improving physician and patient relationship) through the usage. In this research, we set our research context in China, since China has experienced a surge in medical disputes in recent years (Liebman 2013), P2D communities have been realized as a potential way to help to form harmonious physician and patient relationship.

By integrating several theoretical lenses, this paper aims to uncover the in-depth knowledge about what affect patients' usage intention of P2D communities and benefits introduced by the usage. The specified research questions are:

- How quality and social features of interactive P2D communities influence users' usage intentions?
- What individual benefits will be brought by using interactive P2D communities?

¹ A Tweet a Day Keeps the Doctors Away. Retrieved November 11, 2014, from <http://www.alliedhealthworld.com/visuals/tweet-day-keeps-doctors-away.html>

- Do interactive P2D communities could improve the physician-patient relationship from patients' perspective?

To answer these research questions, an empirical study for two famous physician-patient P2D communities, Xuyi Wenyao and Hao Daifu, is done. This paper is organized as followed. In section2, we present the theoretical background. The research model and hypotheses are proposed in section 3. Section 5 discusses the research methodology and design, followed the analysis and results in section 6. In the last section, we discuss our conclusions, contributions, limitations and future works.

2. THEORETICAL BACKGROUND

We develop our research model based on three theoretical lenses: D&M IS success model, social support theory and social presence theory.

2.1 IS Success Model

IS success model, initially developed in 1992 (DeLone & McLean 1992), explains six major dimensions of information systems success, including IS quality (system quality and information quality), user satisfaction, usage, individual impact and organization impact. In the updated version of the IS success model (DeLone & McLean 2003), net benefit is used to capture various impacts, like individual, organizational and societal. A new dimension of IS quality, service quality, is added to reflect the effectiveness of the service provider. In previous studies, D&M IS success model has been assessed empirically and theoretically in diverse IS use contexts (Rai et al. 2002), such as E-government (Wang & Liao 2008), E-commerce websites (Cao et al. 2005), virtual community (Zheng et al. 2013). Besides, it has also been extended by adding other concepts to measure the success of specified IT products or services (Kulkarni et al. 2006; Seddon 1997; Wu & Wang 2006) .

2.2 Social Support

From a psychology perspective, social support is perceived care, love and comfort that help to assist, support seekers to solve or eliminate problems causing distress (Cobb 1976).A positive association has been verified between social support and well-being , since it helps to protect persons from potentially adverse effects of stressful events (Cohen & Wills 1985). For people with diseases, social support could bring buffering effect to reduce distress and burden (Baek et al. 2014; Robinson et al. 2014). In the early days of IS research, the utility of social support has been validated for information systems managers to reduce symptoms of work strain (Weiss 1983). Recently social support is increasingly investigated in electronic environments, including different patient online communities and social ecommerce in SNSs (Braithwaite et al. 1999; Coursaris & Liu 2009; Hajli 2014).

2.3 Social presence

Social presence refers to the degree to which a medium allows an individual to closely connect with others (Short et al. 1976). The social presence of a website evaluates the extent to which a “psychological” connection is formed between a website and its visitors (Kumar & Benbasat 2006). Social presence is identified as an essential element in various virtual environments, such as online learning (Hayashi et al. 2004; Phang & Kankanhalli 2009) and online shopping (Animesh et al. 2011; Gefen & Straub 2004; Kumar & Benbasat 2006; Ou et al. 2014). The degree of social presence is determined by both media characteristics and user perceptions (Tu & McIsaac 2002).The importance of social presence in information systems has been proven by some studies from the system design perspective(Cyr et al. 2009; Saunders et al. 2011). Some researchers characterize the social presence of a medium as its capacity to transmit information about facial expressions and non-verbal cues (Short et al. 1976). Others argue that social presence has close relationship with information richness because of the interactivity of the media (Straub & Karahanna 1998; Straub 1994). Moreover, others stress the psychological connection, which social presence is concerned about “warmth” that it conveys a feeling of human contact, sociability, and sensitivity (Kim & Shyam Sundar 2014; Yoo & Alavi 2001). In this perspective, social presence is considered as a necessary condition for the

development of trust and elimination of perceived risk (Gefen & Straub 2003; Gefen & Straub 2004; Hassanein & Head 2007).

2.4 The integration of D&M IS success model with social support and social presence

In this research, we integrate social support and social presence with D&M IS success model to build a patient usage of online healthcare community model. The main purpose for integrating the three theoretical lenses is to deepen our understanding of the role of quality and affective characteristics of the system (social presence) in the online healthcare community. DeLone and McLean emphasized that IS success model is process model in which the linkages among success dimensions are not a causal sense, and the causal relationships between success dimensions should be contingent on the specified context of the empirical investigations (DeLone & McLean 2003). The research context of this study is P2D online health community, which focus on the interaction process of different users, including patients and physicians. This process transfers inputs (such as health information, emotional caring in this research) into output (perceptions, such as social presence) (Burke & Chidambaram 1999), which finally brings positive effects (see Figure 1). In P2D online healthcare community, there are generally three actors: website provider, physicians and patients, and they are the sources of input for interaction process. Website provider contributes an interaction system or platform for physicians and patients to communicate, and then physicians provide health information and comforts to their patients. And patients choose to receive them according to their needs. Moreover, there is also a reciprocal support mechanism between patients since they have similar experiences.

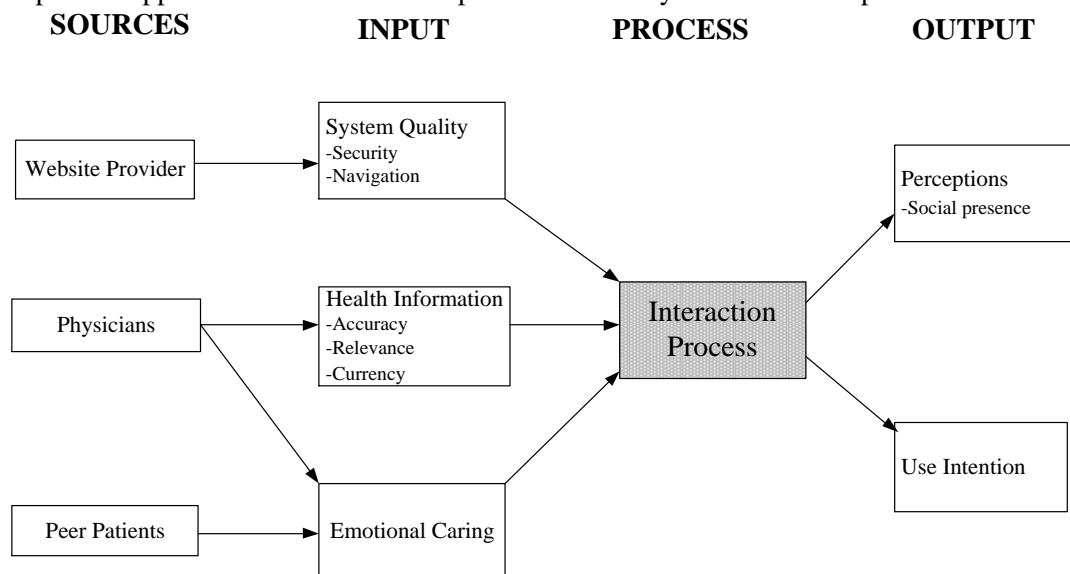


Figure 1. Interaction Process in Online Healthcare Community

Although D&M IS success model can provide us a guideline to measure system success from a quality perspective, it doesn't consider about the social exchange effects during interactions. Hence, in order to comprehensively measure the success of P2D online healthcare community, we integrate two concepts, social support and social presence, into IS success model (see Figure 2). The dotted lines are hypotheses from IS success model. The brief definitions of the constructs in the research model are shown in table 1 below.

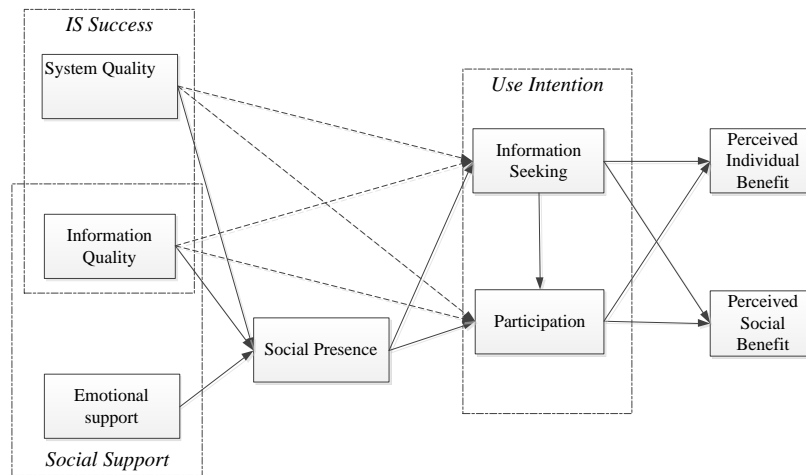


Figure 2. Research model

Variables	Definitions	References
System Quality		
Security	The extent to which users' information is protected in P2D communities.	(Zheng et al. 2013)
Navigation	The extent to which users can easily go back and forth, and find what they want in P2D communities.	(Lee et al. 2009)
Information Quality		
Accuracy	The extent of the health information is regarded as true, precise, significant and reliable.	(Lee et al. 2002; Nelson et al. 2005)
Relevance	The extent of the health information is fit to users' needs.	(Lee et al. 2002; Zheng et al. 2013)
Currency	The extent of the timeliness of available health information.	(Lee et al. 2009; Lee et al. 2002)
Emotion Support	Providing messages involving emotional concerns such as caring, understanding, or empathy.	(Cobb 1976; Uchino 2006)
Social Presence	The feeling of the warmth, sociability, and feeling of human contact that can be conveyed through a website.	(Kumar & Benbasat 2006; Short et al. 1976)
Use Intention		
Information Seeking	Users' tendency to find and browse health information online.	(Park et al. 2010; Zheng et al. 2013)
Participation	Users' tendency to participate into and contribute to P2D communities.	
Net benefit		
Perceived Individual Benefits	Personal related benefits introduced by using P2D communities, such as time saving, self-health management.	(DeLone & McLean 2003)
Perceived Social Benefits	Possible social level benefits introduced using P2D communities, like physician-patient relationship improvement.	

Table 1. Definitions of Constructs in the Research Model

3. HYPOTHESES DEVELOPMENT

3.1 Use intention

Patient-to-doctor (P2D) community is a typical information exchange virtual platform that user can either purely browse information or participate in a discussion with others (Ahuja & Galvin 2003; Park et al. 2010; Zheng et al. 2013). Hence, use intention can be divided into two ways: information

seek and participate. Information seeking intention means users' tendency to find and browse health information online (Zheng et al. 2013), while participation intention in our research context could be defined from three aspects: 1) post question to ask help from specified or non-specified physicians; 2) make a review for specified physicians; 3) participate into discussion under certain post. According to social exchange theory (Emerson, 1976), usage of P2D community is a reciprocal process. Patients can firstly obtain useful information and support by others' messages on the websites, and they may be motivated to provide comments or help others as a return of what they have received. Hence, there may be a positive relationship between the two-stage usage intentions of online healthcare community. We hypothesize that:

H1: Users' information seeking intention is positively related to their participation intention.

Social presence refers to the feeling of being close to others (Short et al. 1976). Social presence has more recently been conceptualized as the warmth, sociability, and feeling of human contact that can be conveyed through a website (Gefen & Straub 2004; Kumar & Benbasat 2006). Research has indicated that social presence of the website is a key factor for developing users' initial trust (Hess, Fuller & Campbell 2009) and motivating their usage intention (Hayashi et al. 2004). For P2D community website, social presence may be more important, since people try to obtain knowledge and support for their health. Therefore, we hypothesize that:

H2a: The social presence of website is positively related to their information seeking intention.

H2b: The social presence of website is positively related to their participation intention.

3.2 The mediated role of social presence

According to D&M IS success model (DeLone & McLean 2003), there are three main kinds of IS features that will influence users' satisfaction and usage intention. For online community, system quality and information quality are more related features (Zheng et al. 2013). Hence we include information quality and system quality into our model. However, Wixom and Todd (2005) indicate that system quality and information quality are object-based beliefs, which don't determine use intention directly. Their relationships to use intention are found to be moderate both by meta-analysis (Stacie Petter & McLean 2009) and qualitative literature review (Petter et al. 2008). Online health communities are formed based on the central premise of exchanging support that social presence is very critical to motivate patients' use intention (Goonawardene & Tan 2013, 2014). Hence, we introduce social presence, and expect it has mediating influence to the relationships between system quality, information quality and use intention.

Information quality is an individual's evaluation of the content provided on the website (DeLone & McLean 2003; Nelson et al. 2005). It denotes users' assessment of whether the physician generated information on the website is accurate, related and timely (Teo et al. 2008). Social presence is an important perceived characteristic of media. Fulk, Steinfield, Schmitz, and Power (1987) propose that perceived media characteristics would be a function of objective media characteristics and social information, in the form of attitudes, statements, and behaviours of salient co-workers regarding the media. In online healthcare community, patients can ask questions related to the health issues, and physicians are important co-workers who give suitable the remedy to them. Moreover, they can also find useful information according to the interactions between other patients and physicians. If they can find useful solutions or improvement for their health problems via online physicians' suggestions or other patients' experience sharing, they will feel a sense of supporting and caring from the community. In addition, perceived information quality can increase users' trusting belief and feeling of self-belonging, and also reduce their perceived risk (Nicolaou & McKnight 2006). In this case, patients' perceived social presence will increase, which later transfer to use intention of the P2D communities. According to above discussion, we hypothesize that social presence could be a mediated factor for information quality and use intention.

H3: Social presence of website is expected to mediate the effect of information quality on users' (a) information seeking and (b) participation intention in P2D communities.

While information quality denotes users' perception of the quality of health information generated by physicians, system quality is the extent that an individual's evaluation of the system features (DeLone & McLean 2003; Nelson et al. 2005; Teo et al. 2008). These system features relate to the organization and design of the website, which are supported by system provider. Considering our research context – P2D community, we mainly concern two kinds of system quality: navigation and security. The main purpose of online health community for users is to find useful health information through browsing the webpages or interact with other users. Navigation denotes users' perception of the technical performance of the website in information retrieval (Lee et al. 2009; Teo et al. 2008). Previous research has indicated that whether an online community is easy to use could influence the sense of belonging to the community (Lin 2007). Meanwhile, since the main users of P2D communities are patients, it is crucial to protect their individual privacy and make users feel safe and comfortable when participating in community. Therefore, security is a significant dimension of system quality in P2D communities (Zheng et al. 2013). These characteristics of system users feel when seeking information or participating in P2D communities is related to users' perception of comfort, safe, self-belonging, warm and sensitivity, which then transfer to use intention. Hence, we hypothesize that:

H4: Social presence of website is expected to mediate the effect of system quality on users' (a) information seeking intention and (b) participation intention in P2D communities.

3.3 The role of social support

Social support is widely investigated in the context of both online and offline healthcare. Social support is an important element for P2D communities (Ballantine & Stephenson 2011; Chuang & Yang 2010; Donovan et al. 2014). There are mainly two kinds of social support in P2D communities: informational support and emotional support (Chuang & Yang 2010; Ridings & Gefen 2004). And the combination of these two typical social support is relatively more effectively for P2D communities (Donovan et al. 2014). Informational support is given to help patients solve or eliminate health problems by providing effective health suggestions support (Chuang & Yang 2010; Ridings & Gefen 2004). Since P2D communities involve question-answer (QA) function, patients can obtain information supports from physicians directly through post their questions or read other patients' post. Physicians generated information quality is highly related to the quality of information support in the P2D communities. Therefore, after information quality is presented, we pay more attention on emotional support. Emotional support is similar to socio-emotional support (Finn 1999). It is derived from the communication with physicians or other patients, which can comfort and console patients indirectly. In web environment, emotional support has been verified as a positive factor to users' satisfaction of websites (Liang & Turban 2011). Some researcher also finds that social support could facilitate patients' uncertainty management goals. Social support could help them overcome multiple types of uncertainty, like medical, personal and social uncertainty, through communicate with physicians and peer patients (Donovan et al. 2014). Furthermore, researchers find that the sociability or interaction features could improve the sense of social presence of website (Animesh et al. 2011). Hence, when users obtain emotional support via browsing information or social interact with others in P2D communities, they may also feel the website is warmth and sensitive to their health needs. Hence, we hypothesize that:

H5: Emotional support is positively related to users' social presence of the website.

3.4 Net benefits

According to D&M IS success model (DeLone & McLean 2003), usage of certain information system will bring final net benefits. Net benefit is multi-dimensional, including individual, organizational and society perspectives. In our study, we mainly focus on individual and society perspectives. Firstly, we propose that though using P2D communities may lead to users' individual perceived benefits, such as time saving and health management. In addition, patients' feeling to physicians may also be improved by harmonious interaction on online communities. Hence, we also hypothesize that use intention of P2D communities may also bring better physicians patients relationships from patients' perceived perspective.

H6: Users' information seeking intention is positively related to (a) possible perceived individual net benefits and (b) possible perceived improved physicians and patients relationship.

H7: Users' participation intention is positively related to (a) possible perceived individual net benefits and (b) possible perceived improved physicians and patients relationship.

4. RESEARCH METHODOLOGY

4.1 Research Design

To test the research model, an online survey of two famous Chinese online health communities (*haodf.com* and *xywy.com*) is conducted respectively. This research mainly tries to find out the factors that influence users' use intention of those P2D communities, therefore our survey directs to potential young users with little experience using P2D. These young people may have relative health body conditions with less experience of P2D. For these young respondents that never use online health community, a set of simple tasks is designed to ask them to complete in the P2D community before answering survey. The tasks include: finding contents (the interaction records between patients and doctors) related to certain illness; finding a doctor related to the illness in respondent' hometown and living city respectively, and so on.

4.2 Measures

Most of the measures are adapted from existing instruments in previous literatures. For example, measures for social presence are from Kumar & Benbasat's (2006) and Phang & Kankanhalli's (2009) studies; measures for emotion support are from Liang et al.'s (2011), Hajli's (2014), Ballantine & Stephenson's (2011) researches. Measures for the two kinds of net benefits are self-developed according to our research context and motivations. Special attention is paid on the content validity of the instrumentation. In order to guarantee rationality and understandability of our questionnaire, a pilot test is done. A total of 34 questionnaires are collected. During the pilot test, we also ask respondents to give their thoughts about the survey. According to the results of pilot test, we modify the contents and structures of our questionnaire slightly, thus make it more readable and understandable.

Eventually, we have 13 latent constructs, and 40 items in our questionnaire. According to the four criteria for deciding whether a construct is formative or reflective proposed by Jarvis, MacKenzie, and Podsakoff (2003) : (1) causal direction from construct to indicators, (2) interchangeability of indicators, (3) covariation among the indicators, and (4) nomological net of the construct indicators, there are four formative constructs, including information quality, system quality, participation intention, perceived individual net benefit, in our research model (see in Table 2).

Latent Construct	Order	Type	Sub-construct		Num. of Items
			First-order Constructs	Types	
System Quality	2	Formative	Security	Reflective	3
			Navigation	Reflective	4
Information Quality	2	Formative	Accuracy	Reflective	4
			Relevance	Reflective	4
			Currency	Reflective	3
Participation Intention	1	Formative			3
Perceived Individual Net Benefit	1	Formative			3
Note: Others are 1-order reflective constructs					

Table 2 Formative Constructs

4.3 Data Collection and Administration

We mainly invite young people to participate our survey. Demographics information such as gender, age, and education, are introduced as the control variable of this study. All the measures will be measured with 7-point Likert scales, ranging from “strongly disagree” to “strongly agree”.

The respondents will take about 25 minutes to complete the whole survey, including tasks and filling questionnaire. All the collected questionnaires will be filtered according to four criteria: 1) All the questions are completed without missing; 2) Data should have certain difference; 3) No obvious inconsistency; 4) Answering time should be no less than 5 minutes. Finally, we obtain 108 valid responses. Table 3 shows the summary of demographic information of the final samples. Over 90% of respondents are young people, which is consistent with our expectation.

Variables		Count	Column N %	Mean	Std. Deviation
Gender	male	49	45.4%	1.55	.500
	female	59	54.6%		
age	<20	12	11.1%	2.16	.822
	21-25	80	74.1%		
	26-30	7	6.5%		
	31-35	5	4.6%		
	>36	4	3.7%		
occupation	student	74	68.5%	1.68	1.151
	teacher	11	10.2%		
	employee	11	10.2%		
	civil servant	8	7.4%		
	others	4	3.7%		
degree	high school	5	4.6%	3.75	.996
	vocational/technical school	4	3.7%		
	bachelor	28	25.9%		
	master	47	43.5%		
	PhD	24	22.2%		
health status	very good	25	23.1%	2.204	.8940
	good	44	40.7%		
	ordinary	32	29.6%		
	bad	6	5.6%		
	very bad	1	0.9%		

Table 3 Demographic Characteristics of the Sample

5. DATA ANALYSIS AND RESULTS

5.1 Exploratory Factorial Analysis

Firstly, we use SPSS to conduct principal components analysis with Varimax rotation to examine the data (reflective constructs). In the results, a total of 9 reflective factors with eigenvalue greater than 1.0, which is the same with the number of reflective constructs we propose. However, the 9 factors only explain 79.163 percent of the total variance, and there are four items (Navi1, Accu4, EP4 and SP1) dispersed over factors. Hence, we drop the four items from further analysis, and the final EFA results are shown in table 4. The eigenvalues for the 9 factors are still greater than 1.0, and they explain 80.846% of total variance.

Reflective Construct	Items	Component								
		1	2	3	4	5	6	7	8	9
Security	Secu1	0.06	0.101	-0.001	0.145	0.115	0.873	0.089	0.041	0.067
	Secu2	0.178	0.121	0.182	0.095	0.143	0.808	0.1	0.086	0.071
	Secu3	0.119	0.158	0.244	0.056	0.021	0.796	0.123	0.223	0.038

Navigation	Navi2	0.076	0.205	0.194	-0.043	0.164	0.164	0.826	0.113	0.034
	Navi3	0.128	0.13	0.103	0.186	0.088	0.127	0.794	0.237	0.088
	Navi4	0.088	0.298	0.306	-0.079	0.168	0.038	0.704	-0.114	0.069
Accuracy	Accu1	0.109	0.155	0.121	0.196	0.737	0.054	0.163	0.214	0.285
	Accu2	0.103	0.074	0.171	0.149	0.852	0.135	0.065	0.137	0.075
	Accu3	0.192	0.026	0.066	0.123	0.745	0.131	0.268	0.333	0.086
Relevance	Rel1	0.153	0.162	0.706	0.178	0.205	0.196	0.232	0.123	0.194
	Rel2	0.095	0.076	0.845	0.111	0.131	0.182	0.166	0.161	0.144
	Rel3	0.227	0.316	0.794	0.005	0.044	0.075	0.172	0.101	0.03
	Rel4	0.159	0.345	0.718	0.272	0.094	0.078	0.111	0.006	0.186
Currency	Curr1	0.218	0.021	0.188	0.200	0.363	0.172	0.053	0.717	-0.03
	Curr2	0.130	0.145	0.175	0.226	0.185	0.146	0.056	0.724	0.281
	Curr3	0.191	0.234	0.023	0.201	0.247	0.137	0.167	0.678	0.125
Emotional Support	ES1	0.225	0.296	0.167	0.154	0.251	0.155	0.196	0.122	0.707
	ES2	0.248	0.154	0.224	0.190	0.146	0.086	-0.007	0.097	0.800
	ES3	0.410	-0.133	0.126	0.184	0.07	-0.028	0.174	0.398	0.561
Social Presence	SP2	0.652	0.242	0.184	0.092	0.298	0.086	-0.059	0.023	0.392
	SP3	0.783	0.111	0.054	0.054	0.161	0.090	0.006	0.213	0.280
	SP4	0.837	0.086	0.098	0.038	0.014	0.095	0.039	0.278	0.165
	SP5	0.697	0.288	0.281	0.236	0.093	0.082	0.178	0.144	-0.08
	SP6	0.668	0.092	0.163	0.211	0.079	0.212	0.320	-0.107	0.083
Information Seeking Intention	InfS1	0.087	0.801	0.183	0.087	0.079	0.139	0.279	0.131	0.191
	InfS2	0.074	0.825	0.244	0.084	-0.007	0.053	0.194	0.171	0.201
	InfS3	0.161	0.814	0.135	0.237	0.116	0.142	0.099	0.032	0.057
	InfS4	0.314	0.702	0.237	0.255	0.114	0.183	0.118	0.02	-0.100
Doctor-Patients Relationship	PPR1	0.101	0.177	0.148	0.861	0.180	0.070	-0.035	0.156	0.156
	PPR2	0.149	0.102	0.098	0.883	0.148	0.16	0.082	0.178	0.118
	PPR3	0.148	0.250	0.141	0.821	0.109	0.106	0.038	0.178	0.114
Eigenvalue		12.241	2.685	1.967	1.938	1.665	1.389	1.151	1.024	1.003
Extraction Method: Principal Component Analysis.										
Rotation Method: Varimax with Kaiser Normalization.										
a. Rotation converged in 8 iterations.										

Table 4 EFA for Reflective Constructs

5.2 Measurement model

Partial least square (PLS) is utilized to examine the research model. PLS is more robust to handle reflective and formative factors and avoid the problem of identification of such factors (Chin 1998; Petter et al. 2007). Meanwhile, Wetzels, Odekerken-Schroder, and Van Oppen (2009) also clarify that PLS is suitable for hierarchical model with high order formative. In our research, there are 2 two-order formative constructs and 2 one-order formative constructs. Moreover, considering our sample is relative small, PLS therefore is a better method to test our model.

The reliability, convergent validity and discriminant validity of the instrument (reflective constructs) are examined through confirmatory factorial analysis (CFA) by using WarpPLS 4.0 (Kock 2011, 2013). Bootstrapping analysis was performed to test the structural model. Table 5 is the CFA results for 9 reflective constructs. ALL the indexes are greater than thresholds: loading>0.707; CR>0.7; Cronbach's alpha>0.7; AVE>0.5.

Constructs	items	Loading	CR	Cronbach's alpha	AVE
Accuracy	Accu1	0.883	0.922	0.874	0.798
	Accu2	0.89			
	Accu3	0.907			
Relevance	Rel1	0.866	0.933	0.905	0.778
	Rel2	0.905			
	Rel3	0.886			
	Rel4	0.871			

Currency	Curr1	0.877	0.904	0.841	0.759
	Curr2	0.886			
	Curr3	0.85			
Security	Secu1	0.873	0.916	0.862	0.783
	Secu2	0.891			
	Secu3	0.891			
Navigation	Navi2	0.914	0.902	0.836	0.754
	Navi3	0.844			
	Navi4	0.845			
Emotional support	ES1	0.879	0.901	0.834	0.752
	ES2	0.907			
	ES3	0.812			
Social presence	SP2	0.839	0.915	0.884	0.684
	SP3	0.868			
	SP4	0.863			
	SP5	0.81			
	SP6	0.751			
Information seek intention	InfS1	0.908	0.938	0.911	0.791
	InfS2	0.912			
	InfS3	0.897			
	InfS4	0.839			
Doctor-patient relationship	PPR1	0.94	0.96	0.938	0.89
	PPR2	0.955			
	PPR3	0.935			

Table 5 CFA Results

5.3 Structural Model

We use the weights of the formative indicators as the beta coefficients for formative constructs according to Cenfetelli and Bassellier (2009). The related indicators for structure model are shown in table 6, and we can find that there are no problems for these indicators. For formative constructs, variance inflation factor (VIF) statistics should be lower than 3.3 (Diamantopoulos & Winklhofer 2001). The VIF values of the measures for system quality are both 1.140; for information quality the VIF values range from 1.298 to 1.740; for participation intention, VIF values are 1.742, 1.840, 1.519; and VIF values for perceived individual benefit are 1.709, 1.805, 1.730. Moreover, all the model fit indices, such as Gof, SPR, PSCR, SSR and NLBCDR, are in acceptable range.

	Square Roots of AVEs and Correlations								CR	AVE	VIFs
	1	2	3	4	5	6	7	8			
SystQ	0.822								0.806	0.675	1.994
InfQ	0.611	0.816							0.856	0.665	2.715
ES	0.408	0.642	0.867						0.901	0.752	2.196
SP	0.451	0.591	0.626	0.827					0.915	0.684	2.091
InfS	0.545	0.535	0.423	0.482	0.889				0.938	0.791	2.384
Parti	0.46	0.548	0.575	0.606	0.592	0.840			0.878	0.705	2.304
PB	0.622	0.626	0.562	0.57	0.731	0.621	0.849		0.886	0.721	3.287
PPR	0.334	0.568	0.462	0.423	0.45	0.559	0.578	0.943	0.96	0.89	1.87

Table 6 Correlations, CR, AVE and VIFs of First-Order Constructs

The results of the structural model are presented in Table 7. The results have no difference between different respondents, since most control variables are not significant at the 0.05 level. We find that, most hypotheses are supported by our sample, except:

- The positive relationships between information quality, system quality and participation intention are not significant. The difference between information seeking intention and participation intention may explain the non-significant results. Participation is a kind of intention during post use stage of IT. Compared with information seeking, participation is more complicated and time-

consuming. For information seeking, users just need to click their mouses and keyboards, while users should consider a lot about participation, such as their time, the severity of their health condition, returns, and whether their doctors are active on the communities and so on. Hence, information quality and system quality could influence users' information seeking intention, but they seem to be leaner to motivate their participation intention.

- The relation between system quality and social presence is not supported. We think the main reason may be that the increasing development of information technology makes users' perceived system quality change. Nowadays, fast speed of Internet, reasonable layout of websites, and security are the basic and common elements of an attractive IT product for users. Thus these characteristics are hard to bring warmth, feeling of self-belonging for them, while the contents are more attractive. This may be the reason why information quality is positively related to social presence but system quality is not.

DVs	IVs		Control variables				
a. Perceived Individual Net Benefit	R ² = 0.67		Gender	Age	Occupation	Education	Health
	Information Seeking	0.515***	-0.096	0.134	-0.253*	-0.012	-0.012
	Participation	0.328***					
b. Perceived Physician-patients Relationship	R ² = 0.42						
	Information Seeking	0.218**	-0.035	0.11	0.227	-0.077	-0.077
	Participation	0.389***					
c. Information Seeking	R ² = 0.47						
	Social Presence	0.237*					
	System Quality	0.259*	-0.087	0.039	0.12	0.211	0.074
	Information Quality	0.252*					
d. Participation	R ² = 0.59						
	Information Seeking	0.368***					
	Social Presence (SP)	0.310**	-0.058	-0.06	0.124	-0.207*	-0.011
	System Quality	0.041 (p=0.35)					
	Information Quality	0.115 (p=0.09)					
e. Social Presence (SP)	R ² = 0.51						
	System Quality	0.166 (p=0.06)					
	Information Quality	0.214*	-0.023	-0.008	-0.063	-0.026	-0.054
	Emotional Support	0.431***					

Notes: *** p-value < 0.001; ** p-value < 0.01; * p-value < 0.05

Table 7 Results of the structural models

5.5 Mediating Effect of Social Presence

In order to uncover the deep knowledge about how the factors influence users' intention, we also analyse the mediating effect of social presence. Since the relation between system quality and social presence is not significant (H4), we only test the H3 based on Baron and Kenny steps (1986). And the results are shown in table 8. We can find that social presence has a partial mediating effect for Information Quality and Information Seeking Intention and a full mediating effect between Information Quality and Participation. Hence H3 is supported by our data.

Step 1	Step 2: Without SP	Step 3: With SP	Mediating
InfQ → SP:	InfQ → InfSeek: 0.503***	InfQ → InfSeek: 0.428**	Partial

0.309***	InfQ→Parti: 0.305***	InfQ→Parti: 0.071 (p=0.207)	Full
Notes: *** p-value < 0.001; ** p-value < 0.01; * p-value < 0.05			

Table 8 Mediating effect analysis of SP

6. DISCUSSION

6.1 Key Findings

In this study we conduct an empirical study of P2D community usage intention based the integrated model combining D&M IS success theory with social support theory and social presence theory. We collect survey data from potential users of P2D communities to examine the model and test the hypotheses by PLS method. The empirical results demonstrate that the information quality and system quality is positively related to users' information seeking intention, while not relation users' participation intention. The social presence of the website has positive influence on both the users' information seeking and participation intention of, and social presence is found to be mediated factor for the effect of information quality on use intention. Rather than the perceived system quality, the information quality and emotional support, they are all positively related with the users' social presence. Moreover, the users' information seeking intention and the users' participation intention are positively related with the possible perceived individual net benefits and have good effects on the improving the relationships between physicians and patients.

6.2 Contributions and Implications

Theoretically, this research discusses the interaction process of patients and doctors on patient-to-doctor (P2D) health communities. According the discussion, this research integrates social presence and social support into D&M IS success model creatively, and applies it into E-health research stream. This gives another theoretical basis for E-health researchers, especially for whom focusing on online health community research. We imply this integration model to investigate P2D communities, which are less studied in IS field. Moreover, the data analysis results theoretically confirm that these physician-patients interactive health communities could help to improve physician-patient relationship and eliminate medical dispute to some degree.

Generally there are three practical contributions. Firstly, this study uncovers the inner mechanism of the adoption of P2D communities, which could be referred as a design, managerial guidance for occupiers of P2D communities. Secondly, the results identify the importance and necessity of the corporation between hospitals and P2D communities, since it helps to form harmonious doctor-patient relationship. Hence hospitals should collaborate with those P2D communities, which could not only provide another channel for doctors and patients to communicate, but also an opportunity to improve the degree of patients' and their families' satisfaction. As a result, the image and the social position of the hospitals will be promoted. Lastly, for physicians and peer patients who want to provide supports or helps to other people, this research also provides a positive evidence of the importance and value of their helps.

6.3 Limitations and Future Work

The sample itself offers some important limitations. We only have 108 valid questionnaire respondents. The sample is small. In future work, more questionnaires from experienced users, such as old people in real world communities, will be collected to deepen our understanding of their use intention. Additionally, we integrate IS success model, social support and social presence, but don't consider other important factors, such as satisfaction, perceived usefulness, which may also influence our results. Moreover, in EFA, the third item for emotional support still disperses across factors slightly. Finally, there are two self-developed instruments, and only pilot test is used to test their content validity. In future, more valid method, such as Q sorting, will be used to improve the self-developed items.

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