

Building Trust in Mobile Medical Consultations: The Roles of Privacy Concerns, Personality Traits, and Social Cues

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Abstract. It is increasingly popular to access health professionals through mobile medical consultations (MMCs). However, few studies on trust building during MMCs were found. To fill this gap, this study conducted an online survey study with 108 users of MMCs in China. We investigated the predictors of two types of trust (i.e., trust in physicians and trust in MMCs) by examining the influences of privacy concerns, personality traits, social presence of interaction, and social validation. The results indicated that intellect, privacy concerns, social presence of interaction, and social validation are the predictors of trust in physicians, while neuroticism, privacy concerns, and social presence of interaction are the predictors of trust in applications. The findings provided suggestions about how to build trust by considering privacy concerns and personality traits and highlighted the effects of social presence of interaction and social validation, which are interface features, on trust. Practically, this study also implied that practitioners and designers can apply different strategies to enhance trust in physicians and trust in applications in relation to MMCs.

Keywords: Mobile Medical Consultations, Trust, Privacy Concerns, Personality Traits, Social Cues

1 Introduction

Professional medical consultations are vital to patients' health and wellbeing. With advances in technology, online medical consultation services increasingly help people reach professionals and receive health advice [1]. Various types of online medical services, such as website consultations, online forums, and mobile health applications, help patients manage their health and make treatment decisions [1]–[4]. Among them, mobile medical consultations (MMCs) could be the most promising method for providing online medical services. MMCs, which allow for immediate communication between patients and physicians through various interaction methods, such as text-, figure-, audio-, and video-based chats, represent one of the functions provided by mobile health applications. MMCs not only provide more accessible health consultations and diagnoses compared with traditional medical services requiring in-person visits [1], [5], but they also allow for the possibility of tracking patients' combined physical or mental data by wearable devices for diagnoses [4].

While mobile medical services offer opportunities to reach health professionals without geographical constraints, their adoption is facing challenges of trust during consultations [4], [6]. Regarding trust in the adoption of MMCs can involve two aspects: trust in physicians and trust in applications. Trust in physicians plays a fundamental role in medical consultations [7]. It can influence users' willingness to seek mobile medical services, disclose personal information, and follow physicians' advice about treatment [7]. Unlike traditional medical consultations, in which trust is built through face-to-face communications and prior experience with the physicians, MMCs users are more likely to access unknown physicians in a virtual environment. Therefore, building trust between users and physicians in MMCs can be critical to the users' decisions and behaviors in relation to medical treatments. While trust in physicians focuses on the relationship between users and physicians, trust in applications

emphasizes users' attitudes towards the service providers. Trust in applications has been widely studied as a vital predictor of technology adoption [5], [8], [9]. In MMCs, users can disclose sensitive information and conduct payment transactions through the applications. Therefore, users' trustworthiness toward the applications can influence their decisions on using MMCs platforms [8].

Although many studies have been conducted to understand the determinants of trust in mobile services [5], [8], [10], there is little knowledge about how to build trust in MMCs. Building trust in MMCs can be quite different from other services because MMCs emphasize immediate communications between patients and physicians. The interaction features involved in the communications can be vital determinants of trust. Previous studies indicated the role that social cues (e.g., social presence and social validation) play in enhancing trust in the healthcare context [2], [11]. In addition, patients' privacy concerns and personality traits can influence relationships between individuals in interactions that specifically involve the transmission of sensitive information [12], [13]. Presently, there is still a lack of evidence to support the effect of social cues, privacy concerns, and personality traits on two types of trust (trust in physicians and trust in applications) in MMCs. Therefore, this study aimed to investigate the relationships associated with privacy concerns, personality traits, social cues, and trust in physicians and trust in applications in MMCs by proposing the following research question: How do privacy concerns, personality traits, and social cues affect patients' trust in mobile medical consultations (MMCs)? To address the research question, this research conducted a survey study to collect empirical data regarding users' privacy concerns, personality traits, attitudes toward the social presence of interaction with physicians, attitudes toward the functions of social validation in MMCs, trust in physicians, and trust in applications. The findings reveal the effects of individual differences related to privacy concerns and personality traits on trust and provide insights into the application of social cues in facilitating trust in MMCs.

2 Literature Review and Hypotheses Development

In this study, we investigated the predictors of two types of trust in relation to MMCs: trust in physicians and trust in applications. Trust is essential to maintain the relationships between different parties [14]. Trust describes the degree to which an individual or a group is willing to rely on or to be vulnerable to other parties [7], [14]. In this study, we define trust in physicians as users' expectations and beliefs in the reliability of physicians' services and advice in MMCs. Trust in applications reflects users' expectations and beliefs in the reliability of the applications providing MMCs. Given the limitation of previous research in identifying the effects of privacy concerns, personality traits, and social cues on trust in physicians and trust in applications, this study attempted to explore these relationships.

Privacy concerns refer to a patient's concerns about disclosing personal information without authority [5], [15]. Specifically, it is an "individual's subjective views of fairness within the context of information privacy" [16 p.337]. In MMCs, users could be anxious about the unauthorized access or collection of their personal information while sharing their health information with physicians for online diagnoses [17], [18]. Both physicians and applications could present potential risks for privacy disclosures in MMCs; therefore, we propose:

H1. Privacy concerns have a negative effect on trust in physicians and trust in applications in MMCs.

Comprising a set of specific characteristics, an individual's personality can influence differences in thoughts and behaviors toward an information system [19]. Prior work has employed five dimensions to describe an individual's personality traits, including extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience/intellect [19]–[21]. Extraversion refers to the level of sociability and optimism; agreeableness represents the willingness to be cooperative, sympathetic, and helpful; conscientiousness describes a tendency toward dutifulness and organization; neuroticism indicates a tendency to be anxious, nervous, and emotional; and openness to experience/intellect refers to an individual who is innovative, creative, and curious [19]–[21]. Trust reflects a disposition to believe in and rely on others [22]. It can be deduced that some personality traits can be positively related toward a disposition to trust, while others can be negatively associated with the disposition to trust. Since few studies have explored the effects of personality traits on trust in MMCs, we propose:

H2. Personality traits have an influence on trust in physicians and trust in applications in MMCs.

Since MMCs involve communication between users and physicians, social cues are critical to the interactions. Social presence is a social cue found to be positively associated with trust in health contexts [2]. Social presence represents the “feeling of being with another” [23 p.456], usually being measured with perceived warmth, a sense of human contact, and sociality in the interactions. Rather than studying the feeling of social presence, Lu, Fan, and Zhou [24] proposed investigating how interaction methods, such as the use of chat tools, wording styles, figures, or emotional icons, convey the sense of social presence. They defined it as the social presence of interaction, which they found has a positive effect on trust in sellers in online commerce [24]. Although communications in MMCs would be conducted in a more rigorous manner than those in online commerce, it also employs various interaction methods, such as text-, figure-, audio-, or video-based communications [5]. The interaction methods between users and physicians should be able to convey a sense of human warmth and contact, which could influence users’ trust in physicians. Also, social presence of interaction would be a possible predictor of trust in applications, as users can rely more on applications that support communications with various interaction methods. Therefore, we hypothesize that:

H3. Social presence of interaction has a positive effect on trust in physicians and trust in applications.

Social validation, defined as the opinions and verifications towards the services provided by other users, is another social cue that influences trust in the online health context [11]. Currently, mobile health applications enable users to share and receive information regarding unknown physicians from other users with the functions and interface features embedded in the interfaces. The recommendations, ratings, and forums in the applications generate a word of mouth of a physician and help to build trust in MMC [25]. Thus, we hypothesize that the users require functions of social validation to build trust in physicians:

H4. Social validation has a positive effect on trust in physicians and trust in applications.

3 Method

3.1 Instrument Development

To test the hypotheses and investigate the relationships among privacy concerns, personality traits, social presence of interaction, social validation, and two types of trust in MMCs, this study applied a survey to collected empirical data, and a questionnaire was designed with three parts. The first part aimed to collect participants’ demographic information, including age, gender, city of residence, and education level. The second part measured the participants’ personality traits and asked them to report on their usage experience with MMCs, such as applications used, year of use, frequency of use, the registered department, and the interaction methods. Finally, we asked participants to recall their most recent experience with MMCs and to respond to items regarding their attitudes toward privacy concerns (PC), social presence of interaction (SPI) and social validation (SV), trust in physicians (TP), and trust in applications (TA).

Personality traits of extraversion (E), conscientiousness (C), neuroticism (N), and intellect (I) were measured by the adapted Mini-IPIP for the Chinese context. N was constructed by three items; E, C, and I was measured by two items with a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) [20]. The measurement items PC, SPI, SV, TP, and TA were adapted from previous studies. To be specific, PC is measured with four items adapted from Li [5]; SPI is measured with four items adapted from Lu, Fan, and Zhou [24], Gefen and Straub [26], Verhagen, van Nes, Feldberg [27]; three items for SV were generated based on the definition of social validation and dimensions of word of mouth Jucks and Thon [11], Hajli, Lin, Featherman, and Wang [25]; and TP and TA were measured with four items adapted separately from Li [5]. A seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) was used to measure each item regarding participants’ attitudes toward MMCs. To improve the data quality, we inserted an attention filter to detect careless responses. Participants were required to select the designated option in the attention filter. If they failed to do so, the responses were deemed invalid. Table 1 lists the items and constructs utilized in this survey.

Table 1. The measurement scale.

| Constructs | Items | Questions | References |
|--------------------------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Extraversion | E1 | I don't talk a lot. (R) | [20] |
| | E2 | I keep in the background. (R) | |
| Conscientiousness | C1 | I often forget to put things back in their proper place. (R) | |
| | C2 | I make a mess of things. (R) | |
| Neuroticism (N) | N1 | I have frequent mood swings. | |
| | N2 | I get upset easily. | |
| | N3 | I seldom feel blue. (R) | |
| Intellect (I) | I1 | I am not interested in abstract ideas. (R) | |
| | I2 | I have difficulty understanding abstract ideas. (R) | |
| Privacy concerns | PC1 | Using MMC services would make me lose control over the privacy of my information. | [5] |
| | PC2 | Using MMC services would not cause any privacy problems. | |
| | PC3 | Signing up for and using MMC services would lead to a loss of privacy for me because my personal information could be used without my knowledge. | |
| | PC4 | Others might take control of my information if I use MMC services. | |
| Social presence of interaction | SPI1 | I can make sense of the attitude of physicians by interacting with them in MMC. | [24], [26], [27] |
| | SPI2 | I can imagine how physicians may look like by interacting with them in MMC. | |
| | SPI3 | There is a sense of human touch to communicate with physicians in MMC. | |
| | SPI4 | Communication in MMC was warm. | |
| Social validation | SV1 | I need to know the reputation of the physician when I use this MMC services. | [11], [25] |
| | SV2 | I need to know the ratings of the physician from others when I use this MMC service. | |
| | SV3 | I need to know the official information about the physician when I use this MMC service. | |
| Trust in physicians | TP1 | This MMC service is trustworthy. | [5] |
| | TP2 | This MMC service provider provides reliable information. | |
| | TP3 | The physicians in this MMC service keeps promises and commitments. | |
| | TP4 | The physicians' behaviors in this MMC service meets my expectations | |
| Trust in applications | TA1 | This MMT service provider is trustworthy. | [5] |
| | TA2 | This MMT service provider provides reliable information. | |
| | TA3 | This MMT service provider keeps promises and commitments. | |
| | TA4 | This MMT service provider's behavior meets my expectations | |

3.2 Recruitment and Data Collection

We collected empirical data through Wenjuanxing (<https://www.wjx.cn>), an online Chinese survey platform. Users experienced in using MMCs were selected to participate in this study. Additionally,

participants were required to be over 18 years old. Before filling in the questionnaire, participants were asked if they had experienced in consulting physicians about their diseases, their family members' diseases, or their friends' diseases in mobile applications.

The survey was conducted in December 2020. It took one week to collect a total of 182 responses. A reward was offered to our respondents on the survey platform. By examining the attention filter and reversed questions, we deleted 74 careless responses. Thus, 108 valid responses were used for data analysis.

3.3 Data Analysis

The descriptive analysis was applied to show participants' demographic features and usage experience with MMCs. Then, we conducted a Pearson's correlation test to examine the relationships among social cues, user characteristics, and trust. To further test the hypotheses, multiple regression was applied.

This study tested the reliability of all constructs using Cronbach's alpha. A value of above 0.6 is considered an acceptable reliability [28], [29]. We removed the constructs (i.e., extraversion and conscientiousness) with a value lower than 0.6 using Cronbach's alpha. Therefore, the Cronbach's alpha values for the retained constructs ranged from 0.620 to 0.897 in this study. Table 2 presents the results, suggesting that all constructs are accepted in reliability (>0.6). The constructs used in previous studies for the Chinese context suggested good convergent validity and discriminant validity [5], [20], [24]. Thus, the constructs used in this study could be considered reliable and valid.

Table 2. Results for reliability test.

| Constructs | Number (N) of items | Cronbach's alpha |
|--------------------------------------|---------------------|------------------|
| Extraversion | 2 | 0.455 |
| Conscientiousness | 2 | 0.512 |
| Neuroticism | 3 | 0.780 |
| Intellect | 2 | 0.620 |
| Privacy concerns (PC) | 4 | 0.897 |
| Social presence of Interaction (SPI) | 4 | 0.802 |
| Social validation (SV) | 3 | 0.620 |
| Trust in Physicians (TP) | 4 | 0.745 |
| Trust in Applications (TA) | 4 | 0.818 |

4 Results

4.1 Participants

Of the 108 valid respondents, 38 (35.2%) were male and 70 (64.8%) were female. The age distribution was as follows: 18 to 25 years old (32.4%), 26 to 35 years old (46.3%), 36 to 45 (20.4%), and 46 and above (0.9%). All participants had at least a high school education. Table 3 shows the demographic characteristics of the participants.

Table 3. Demographic characteristics.

| | | Frequency | Percentage (%) |
|--------|--------|-----------|----------------|
| Gender | Male | 38 | 35.2 |
| | Female | 70 | 64.8 |
| Age | 18-25 | 35 | 32.4 |

| | | | | |
|-----------------|-------------------------|--|----|------|
| | 26-35 | | 50 | 46.3 |
| | 36-45 | | 22 | 20.4 |
| | 46 and above | | 1 | 0.9 |
| Education Level | High school | | 5 | 4.6 |
| | degree/Polytechnic | | | |
| | Diploma/Bachelor degree | | 92 | 85.2 |
| | Master degree and above | | 11 | 10.2 |

Participants reported various usage experiences with MMCs. Our participants used 12 types of applications for medical consultations. Among these applications, Ping An Good Doctor had the greatest usage among respondents (63.0%), followed by Wexin Smart Hospital (54.6%), Good Doctor Online (48.1%), Chunyu Doctor (41.7%), and Yilu (Ali Health) (40.7%). Some participants had also used Jingdong Health (14.%) and WeDoctor (10.2%). Other platforms, such as Miaoshou Doctor, Health 160, Medlinker, Weimai, and Baidu Doctor, were less popular; less than 6.5% of participants had used them. Around half of participants (53.7%) had been using MMCs for less than one year, and 46.3% of respondents had been using MMCs for two years or more. Almost half (48.1%) of participants had consulted doctors through mobile applications from two to five times, followed by five times and above (29.6), and from one to two times (13.0%). Ten participants were not sure how many times they had used MMCs. These results indicate that although mobile medical services are still in the initial phase of adoption, they could have a promising future, since a considerable percentage of participants have accepted MMCs and have used them continuously for years. To be specific, respondents mostly consulted the dermatology (63.0%) and internal medicine (51.9%) departments through MMCs. E.N.T (34.4%), surgery (32.4%), and stomatology (32.4%) departments were also frequently contacted by our respondents. Although various interaction methods were provided by MMCs to support the communication between users and physicians, text messages (92.6%) and image messages (70.4) were mostly preferred by our respondents. Some respondents also used less popular interaction methods, such as voice message (29.6%), telephone call (21.3%), audio chat (21.3), video chat (12.0%), and chat groups in QQ or WeChat (14.8%) to communicate with physicians.

4.2 Hypotheses Testing

Table 4 shows the Pearson correlation (r) values among user characteristics, social cues, and trust. The correlation values revealed significant negative relationships between N and TP ($r = -0.196$, $p < 0.01$), N and TA ($r = -0.305$, $p < 0.001$), PC and TP ($r = -0.461$, $p < 0.001$), and PC and TA ($r = -0.406$, $p < 0.001$). Significant positive relationships were found between I and TP ($r = 0.281$, $p < 0.01$), SPI and TP ($r = 0.492$, $p < 0.001$), SPI and TA ($r = 0.428$, $p < 0.001$), SV and TP ($r = 0.275$, $p < 0.01$), and SV and TA ($r = 0.190$, $p < 0.01$).

Table 4. Pearson correlation (r) values among variables.

| | N | I | PC | SPI | SV | TP |
|-----|---------|--------|---------|---------|--------|---------|
| I | -0.029 | | | | | |
| PC | 0.200* | 0.000 | | | | |
| SPI | -0.139 | 0.236* | -0.282* | | | |
| SV | -0.178 | 0.138 | -0.055 | 0.162 | | |
| TP | -0.196* | 0.281* | - | 0.492** | 0.275* | |
| TA | - | 0.116 | - | 0.428** | 0.190* | 0.612** |
| | 0.305** | | 0.406** | | | |

** refer to a significant level at the 0.001 (2 tailed)

* refer to a significant level at the 0.01 (2 tailed)

To further examine the relationships among user characteristics, social cues, and trust, we applied a multiple regression analysis. Based on the correlation results, we utilized N, I, PC, SPI, and SV as the independent variables of TP, and we utilized N, PC, SPI, and SV as the independent variables of TA. The results are shown in Table 5. They show that I, PC, SPI, and SV significantly affect TP, accounting

for 42.6% of the variance. Consistent with the correlation results, PC has a negative impact on TP, and I, SPI, and SV have a positive effect on TP. The standardized coefficient Beta indicates that PC was the most important predictor of TP ($\beta=-0.354$), followed by SPI ($\beta=0.315$), I ($\beta=0.182$), and SV ($\beta=0.171$). N, PC, and SV are the predictors for TA, accounting for 32.0% of the variance. N ($\beta=-0.191$) and PC ($\beta=-0.276$) affect TA negatively, and SPI ($\beta=0.309$) influences TA positively. Therefore, H1, H2, H3, and H4 were supported.

Table 5. Standardized coefficient beta (β) of the multiple regression analysis with N, I, PC, SPI, and SV as independent variables and TP and TA as dependent variables.

| | TP | TA |
|-----|----------|---------|
| N | | -0.191* |
| I | 0.182* | |
| PC | -0.354** | -0.276* |
| SPI | 0.315** | 0.309** |
| SV | 0.171** | |
| R2 | 0.426 | 0.320 |

** refer to a significant level at the 0.001 (2 tailed)

* refer to a significant level at the 0.01 (2 tailed)

5 Discussion

With the aim of understanding the effects of privacy concerns, personality traits, social presence of interaction, and social validation on trust in MMCs, this study applied a survey method. The multiple regression analysis revealed that the predictors of trust in physicians and trust in applications are different. Regarding the user characteristics, the findings revealed that N negatively affects TA, while it has no effect on TP.

Neuroticism refers to holding a negative attitude (e.g., fear or nervous feelings) about the situation [30]; therefore, users with a higher level of neuroticism could find it more difficult to build trustworthiness with the applications. Previous research also indicated that neuroticism negatively affects trustworthiness toward the service provider in mobile commerce [31]. This research confirmed the effect of neuroticism in MMCs. Although Zhou and Lu [31] revealed a positive relationship between openness to experience and trust in service providers, our study found intellect affects TP only. Intellect describes an individual who is knowledgeable and intelligent. People with a high level of intellect might find it easier to trust people who hold professional knowledge. This might explain why intellect positively influences trust in physicians.

Privacy concerns hinder trust in both physicians and applications. Previous research suggested that privacy concerns can negatively affect trust in mobile medical treatment services [5], and this study also confirmed its effect on trust in MMCs. People have to share sensitive information when consulting physicians about their health problems. Even after the consultation has taken place, users can have concerns about whether their personal information is well protected by the physicians and platforms. Concerns about personal information disclosures hamper users' trust in physicians and applications based on their doubts about the physicians' and applications' integrity and ability to protect their information.

Both SPI and SV are the interaction features in MMCs. Previous work has highlighted the important role of social presence in online communication, particularly in the context of health [2]. Consistent with past findings, the present study also found that social presence conveyed by interaction methods in MMCs can help to build trust in physicians and applications. Respondents in this study reported that text messages (92.6%) and image messages (70.4%) were the main interaction methods used in MMCs. Various interaction methods, such as voice messages, video chats, or chat groups, might enhance media richness by increasing social presence in online communications (ref). Future studies could consider how to integrate this interaction method to increase social presence and enhance trust. Additionally, we confirmed that the functions of social validation can facilitate trust in

physicians, revealing that the ratings and comments provided by other users are needed in MMCs. The result is consistent with research about the effect of word of mouth on trust in social commerce [25]. However, we found that the effect of SPI on TA is almost twice as strong as SV in MMCs. This implies that interactions between patients and physicians with warmth and perceived human touch are more important than ratings and comments about physicians shown in MMCs when considering how to enhance trust in physicians.

6 Conclusion

People can easily reach health professionals and receive health advice through mobile medical consultations (MMCs). When using MMCs, trust is a critical issue, as it can not only affect users' behaviors in medical treatments, but also influence adoption behaviors. However, there is still insufficient knowledge about how to build trust in MMCs. This study attempted to examine the effects of privacy concerns, personality traits, social presence of interaction, and social validation on trust in physicians and trust in applications. The findings reveal that intellect, privacy concerns, social presence of interaction, and social validation are the predictors of trust in physicians and neuroticism, privacy concerns, and social presence of interaction are the predictors of trust in applications, indicating that practitioners should apply different strategies to build trust in physicians and trust in applications. Additionally, the results can assist physicians to better communicate with patients in MMCs by considering to improve the social presence of interaction during the consultation. However, this study only discusses the general effects of social presence of interaction and social validation on trust in MMCs. Also, although we found personality traits and privacy concerns related to trust in MMCs, it is possible that these two factors could moderate the influences of social presence of interaction and social validation. Future studies could attempt to examine what type of specific design features of social presence of interactions and social validation can facilitate trust and investigate the moderated effects of privacy concerns and personality traits in MMCs.

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