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Understanding Mobile Health Service Use: An Investigation of Routine and Emergency Use Intentions

Abstract

This study theorizes two information system (IS) use behaviors associated with individuals' behavioral intention of mobile health (mHealth) services. Emergency use refers to individuals' use of IS in emergency situations. Routine use refers to individuals' use of IS in a routinized manner. Motivation theory is adopted as our overarching theoretical lens to investigate the influence of individuals' different motivation incentives on individuals' emergency and routine use intentions of mHealth services. We also investigate the influences of technological and psychological antecedents on extrinsic and intrinsic motivations. On the basis of the data collected from 241 participants, we find that perceived usefulness enhances emergency and routine use intentions of mHealth services. By contrast, perceived enjoyment positively influences routine use intention. In addition, we find that perceived source credibility, perceived service availability, and perceived diagnosticity influence perceived usefulness (extrinsic motivation), whereas perceived autonomy, perceived competence, perceived relatedness, and curiosity affect perceived enjoyment (intrinsic motivation). This research offers insights for IS literature on understanding mHealth emergency and routine use behaviors.

Keywords: mobile health, routine use intention, emergency use intention, perceived usefulness, perceived enjoyment

1. Introduction

Health information technology (HIT) is an effective way to improve individuals' health conditions, enhance the quality of healthcare, and yield improved self-management of health by patients (Buntin, Burke, Hoaglin, & Blumenthal, 2011). Despite these benefits of HIT, the actual adoption rate is still very low (DesRoches et al., 2008; Jha et al., 2009), thereby preventing patients or other stakeholders from realizing the promised benefits of such advanced technology. Mobile health (mHealth) is likened as one representative technology in the HIT domain and plays an important role in incidence detection, patient personal information collection, and provision of medical care (Varshney, 2014) In addition, mHealth can provide individuals with different healthcare services that accommodate their different medical requirements (Free et al., 2013). While extant literature has primarily focused on the general "use" of technology, relatively few studies have explored different types of usage behaviors. Consequently, the current study is designed to investigate individuals' routine and emergency uses that contribute to understand individuals' different usage behaviors of mHealth. Therefore, the specific requirements for mHealth services can be comprehended by service providers and researchers, thus contributing to the

betterment of design and development of this healthcare services.

Routine use, has been articulated and empirically tested in extant information system literature (Li, Hsieh, & Rai, 2013; Saga & Zmud, 1993; Sundaram, Schwarz, Jones, & Chin, 2007), refers to integrate information technology into users' daily life (Sundaram et al., 2007). Emergency use, which is the counterpart of routine use, has rarely been investigated in current studies, is likened as the application of appropriate features of technology under urgent situations. Investigating routine and emergency uses that can coexist in mHealth service adoption is important in understanding service recipients' different use behaviors of such technology and also help individuals to realize the benefits that each usage behavior provides.

In addition, it is significant to comprehend the drivers of people's use intention of mobile services and in turn adapting the services to fulfill people's motives for using them (Nysveen, Pedersen, & Thorbjørnsen, 2005). Therefore, it is also worth exploring the motivators that trigger the routine and emergency usage behaviors of mHealth services. However, scant research has investigated why and how individuals choose emergency and routine uses of mHealth services. Toward this end, we draw upon motivation theory to explain the formation mechanisms of these two different use behaviors and propose that emergency and routine use might be stimulated by extrinsic and intrinsic motivations.

Edward Deci and Ryan (2002) illustrate that extrinsic and intrinsic motivations can stimulate individuals to partake in certain activities. People with extrinsic motivation focus on the usefulness or benefits gained by taking part in an activity or performing a behavior. By contrast, people with intrinsic motivation focus on the satisfaction or enjoyment derived from an activity (Edward Deci & Ryan, 2002). Given that perceived usefulness is a representative extrinsic motivator and perceived enjoyment is an important intrinsic motivator (Brown & Venkatesh, 2005; Davis, Bagozzi, & Warshaw, 1992; Li et al., 2013), we utilize perceived usefulness and perceived enjoyment as two representative surrogate constructs for extrinsic and intrinsic motivations in the present study. Further, this study also examines the antecedents that predict the two motivators from the perspectives of technological and psychological characteristics.

In summary, the objectives of our study are to (1) theorize two use behaviors, namely, emergency and routine uses; (2) adopt motivation theory as a strong theoretical foundation for addressing the relationship between extrinsic and intrinsic motivations and two use behaviors (emergency and routine uses); (3) examine the antecedents of perceived usefulness and perceived enjoyment from the two characterized predictors.

The rest of the paper is organized as follows. In Section 2, we provide the theoretical background. In Section 3, we propose the research model and hypotheses. In Section 4, we describe the methodology. In Section 5, we present the analysis results. Finally, the findings, implications, and limitations are discussed in Section 6.

2. Theoretical Background

2.1 Mobile Health

Mobile Health Introduction

mHealth refers to the burgeoning mobile communication and network technologies employed in the healthcare industry (Istepanian, Laxminarayan, & Pattichis, 2006). mHealth is an advanced technology used for healthcare, health promotion, and public health purposes (Lupton, 2015). It is a subset of electronic health and renowned as a new healthcare paradigm providing ubiquitous and pervasive health services and information through mobile communication devices (Akter, Ray, & D'Ambra, 2013). mhealth has transformed the traditional means of managing health, delivering healthcare services, and making health decisions by delivering services highly affordable and accessible to service recipients (Akter, D'Ambra, & Ray, 2010; Varshney, 2014). In other words, mHealth ensures that appropriate and accurate services and information are delivered to the right person at the right time, thereby improving the production process and decision making related to health and healthcare (Geissbuhler, 2008). mHealth services reduce costs and are convenient and personalized (Akter & Ray, 2010). mHealth changes the spectrum of healthcare services from crisis intervention to health promotion, prevention, and self-management (Akter, D'Ambra, & Ray, 2013; Dehzad, Hilhorst, de Bie, & Claassen, 2014). To conclude, mHealth services is summarized as using portable and wireless communication equipment (e.g. mobile phones, tablet, wearable devices, etc.) to help individuals realize health promotion, disease prevention and simplify the healthcare services.

Mobile Health Service Categorization

The services of mHealth include utilizing mobile devices, such as mobile phones, personal digital assistants, patient monitoring devices, and other wireless devices (Nisha, Iqbal, Rifat, & Idrish, 2015; Organization, 2011). Some of the services provided by mHealth require users to be involved on a daily basis. For example, mHealth services can provide healthcare services to manage the daily activities of elderly who live independently. In addition, mHealth plays an important role in managing chronic diseaes such as cancer, diabetes, and heart disease, etc, by monitoring patients'diet, exercise, and medications on a daily basis and providing regular mobile-enabled interventions (Varshney, 2014). It requires users, especially the diagnosed patients, to regularly input their physical signs to the mobile devices to monitor their health status (Nisha et al., 2015), thereby leading to participation of service recipients in the routine use of mHealth services.

Additionally, studies have asserted that the implementation of pre-hospital measures in response to acute diseases (e.g. cardiac disease) lead to significant improvement of patient outcomes and reduction of mortality rate. (Canto et al., 1997; Schrading et al., 1993). Mobile technology can faster deliver healthcare services and information to patients, which assist patients to make faster decision under emergency cases (Michalowski, Rubin, Slowinski, & Wilk, 2003). Individuals can receive appropriate medical assistance during an emergency by using mHealth services, such as mobile application, wearable devices, and telemedicine services. This case indicates the efficacy of mHealth in helping in emergencies.

Mobile Health Research Dimensions

The extant literature on mHealth has oriented toward different dimensions. Studies on mHealth are in three main areas of health informatics, biomedical informatics, and ISs (Varshney, 2014). Varshney (2014)

categorized mHealth studies into different types on the basis of the aspects of technology adoption, security issues, technology interaction among patients and healthcare professionals, IT designed to address healthcare challenges, and design, development, and testing of mHealth application. Akter, D'Ambra, and Ray (2010) developed a 3D measure of service quality from the perspective of mHealth adoption. The precondition for realizing the promised benefits of a new technology is to use it (Venkatesh, Morris, Davis, & Davis, 20 03). As the advanced technology has been rapidly infused into the healthcare industry, studies on the adoption behavior of health IT services are also very promising (Cocosila & Archer, 2010). Drawing from motivation and risk theories, Cocosila and Archer (2010) reported that the intention of individuals to use mobile technology to promote health conditions is triggered by extrinsic and intrinsic motivations and perceived risk factors. In the current study, we mainly investigate the influence of extrinsic and intrinsic motivators on individuals' different use intentions of mHealth services.

2.2 Routine and Emergency Uses

Routine and emergency often emerge as two comparative conceptions in the healthcare research area. The common topics related to them include utilizing health facilities to provide patients with routine and emergency care (Gabrysch et al., 2012); providing routine and emergency treatment on different disease (Elnekave et al., 2013); evaluating medicine effectiveness by adopting routine and emergency analysis methods (Segatti, Nisi, Grossi, Mangiarotti, & Lucarelli, 1991). Specifically, routine emphasizes the characteristics of repeatability, standardization and regularization. While, emergency primarily reflects the urgent and unexpected traits. The essential difference between these two lies in how people use technology under different situations to achieve better health outcomes. Accordingly, we propose that routine and emergency uses of mHealth can be contrasted based on the different requirements of individuals. In this study, we conceptualize the differences between individuals' routine and emergency uses of mHealth services by drawing on individuals' different needs.

Prior studies refer routine use as using ISs in a standardized and routinized manner by recipients to support their daily work (Li et al., 2013; Saga & Zmud, 1993; Sundaram et al., 2007).We define routine use as individuals use mHealth services on a daily basis to manage their own health and achieve better health outcomes. As the success of the application of new IT depends on continuous use rather than first-time use (Bhattacherjee, 2001), routine use is highlighted by its repetitious and standardized characteristics (Saga & Zmud, 1993) and has been discussed broadly in IS contexts (Meng, Guo, Peng, Lai, & Vogel, 2016; W. Wang & Hsieh, 2006). By contrast, emergency use refers to using mHealth services in situations requiring urgent medical care. Topics related to design and applications of emergency management systems have been widely examined in extant IS literature (Annelli, 2006; Blandford & Wong, 2004; Yang, Su, & Yuan, 2012). However, studies regarding to emergency use of IT attracts little attention. Prior studies have asserted that the implementation of appropriate measures in response to acute diseases (e.g. cardiac disease) lead to significant improvement of patient outcomes and reduction of mortality rate. (Canto et al., 1997; Schrading et al., 1993). We believe the exploration of emergency use of mHealth services has significance in contributing to individuals' health and wellbeing. Accordingly, we extend the study of emergency use into the domain of mHealth and emphasize on

individuals' healthcare requirement under urgent circumstances.

Routine and emergency uses describe two distinct use behaviors performed by individuals to achieve the same goals --- better health outcomes. Both routine and emergency uses are expected to vary across individuals. People always have different needs for the usage of mHealth services. The main difference of the two usage behaviors lies in the healthcare requirements of individuals. Routine use, is applicable for individuals who require long-term and regular healthcare services, and focuses on the routinize and standardized use of mHealth in turn leading individuals to better understand their health conditions and perform healthier behaviors (e.g. diet and exercise). By contrast, emergency use aims to help patients to obtain appropriate healthcare services in urgent situations and improve the efficiency of treatment in response to acute disease. Consider a chronic disease patient whose health condition is unstable is recommended to monitor their physical signs and report their health data to physicians regularly. As mHealth can provide services include provide healthcare information to patients, physicians, or other stakeholders, real-time monitoring of physical signs, health data collection, and mobile telemedicine (Yadav, Aliasgari, & Poellabauer, 2016), the patient could choose to use mHealth services on a daily basis to obtain real-time monitoring and receive efficient guidance on diet and exercise. Additionally, Varshney (2014) claimed the importance of mHealth in providing appropriate healthcare services for stakeholders in emergencies in terms of accelerating the processes of urgent medical care, such as incidence detection, transporting to healthcare facilities, obtaining patient's information, and providing suitable medical care. Therefore, a patient who has acute disease or encounter urgent incidents can choose emergency use of mHealth services to obtain appropriate medical assistance and improve the efficiency of treatment.

Given the statements above, we draw from the two qualitatively different orientations to theorize the differences between individuals' routine and emergency use of mHealth services. Routine use focuses on the standardized and regular use of mHealth. whereas, emergency use pertains to use of mHealth under urgent circumstances. The main difference between the two usage behaviors lies in individuals' different requirements for healthcare services. Toward this end, we adopt motivation theory as our theoretical lens to examine the variations in individuals' different use behaviors of mHealth services.

2.3 Motivation Theory

Individuals partake in activities or perform behaviors ascribed to intrinsic and extrinsic motivations (Edward Deci & Ryan, 2002). Intrinsically motivated behavior is associated with people's perceived pleasure, enjoyment, and satisfaction; on the contrary, extrinsically motivated behavior is associated with individuals' desire to gain external benefits, such as money, rewards, and promotion (Edward Deci & Ryan, 2002). Accordingly, intrinsically motivated people focus on the process of activity engagement. By contrast, extrinsically motivated people focus on the consequences or results of the activity engagement (Vallerand, Fortier, & Guay, 1997). Intrinsic and extrinsic motivations are vital determinants that trigger individuals' technology use intention (Ajzen, 1991; Taylor & Todd, 1995). Nevertheless, extant literature has rarely investigated the effects of intrinsic and extrinsic motivations on IS acceptance behaviors (Li et al., 2013), including HIT use behaviors of routine and emergency uses.

From the utilitarian view of human nature, people's behavior is strengthened by positive outcomes to achieve instrumental value (Eisenberger & Cameron, 1996; Van der Heijden, 2004); this deduction enhances the understanding of the influence of extrinsic motivation on certain behaviors (Li et al., 2013). Considerable literature has argued that perceived usefulness is an important extrinsic motivator influencing use behavior of IS (Brown & Venkatesh, 2005; Davis et al., 1992; Venkatesh & Davis, 2000). In an organizational setting, perceived usefulness is defined as the degree to which individuals perceive that using IS system can enhance their work performance (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989). In the HIT use context, perceived usefulness refers to the extent to which people believe that using HIT can improve patient care and management (Hu, Chau, Sheng, & Tam, 1999). In this light, individuals who have utilitarian considerations would use mHealth services to help them to attain anticipated health outcomes (Dwivedi, Shareef, Simintiras, Lal, & Weerakkody, 2016). Accordingly, perceived usefulness, is adopted as a surrogate construct of extrinsic motivator to investigate the emergency and routine uses of mhealth services.

By contrast, from a hedonic view of human nature, individuals pursue pleasure or happiness to achieve self-fulfilling value, which is verified as the true essence of intrinsic motivation (Van der Heijden, 2004). Perceived enjoyment, which plays an important role in presenting intrinsic motivation for IS use (Zajonc, 1980), refers to the extent to which people perceive that engaging in an activity by using IS is enjoyable (Van der Heijden, 2004). Individuals are more motivated by an activity that is enjoyable than by the same activity that is less enjoyable (Suki & Suki, 2011). Extant literature has empirically demonstrated the effectiveness of perceived enjoyment on predicting technology acceptance across a diverse area of research settings (Li et al., 2013). The pleasant senses and joyful experiences of using a technology can stimulate users' interest, which in turn trigger their use intention (Li et al., 2013; Van der Heijden, 2004). In the healthcare context, traditionally, patients go to hospitals to receive medical services through face-to-face interactions with physicians. As the occurrence of mHealth, patients can choose healthcare services that dominated by their preferences related to cognitive, affective and behavioral components of beliefs (Hong & Tam, 2006; Kim, Park, & Oh, 2008). Accordingly, mHealth adoption behavior can be influenced by perceived enjoyment as the affective fun or pleasure derived from the new experiences of using alternative healthcare services (Dwivedi et al., 2016). Toward this end, we focus on the influence of perceived enjoyment on routine use behaviors of mHealth services.

3. Research Model and Hypotheses

Our research model is depicted in Figure 1. As extrinsic and intrinsic motivations can be the determinants of IT use (Venkatesh, Morris, Davis, & Davis, 2003), we mainly examine the impact of perceived usefulness and perceived enjoyment on routine and emergency use intentions of mHealth services. Two sets of antecedents for extrinsic and intrinsic motivations are also identified, and they can be categorized into technological and psychological characteristics. We believe that these antecedents are typical for explaining mHealth use behaviors in the HIT research context.

Perceived usefulness, which refers to the extent to which an individual perceives a technology can lead to improved performance, is a distinct representative of extrinsic motivation for IS use (Davis et al., 1989,

1992). From the utilitarian perspective, people can be motivated for good performance by material or physical rewards (Hu et al., 1999; Saga & Zmud, 1993). Davis (1989) demonstrated that, if an IS is perceived as highly useful, then a positive use–performance relationship can be obtained. In the mHealth context, individuals perceive that using a technology can help them receive improved healthcare services or accomplish sound health management that may encourage them to use the technology.

Patients recover or even survive if they can deal with emergencies promptly and effectively (Herscovici et al., 2007). Considering the lack of professional healthcare knowledge and skills, individuals may be diffident about coping with unexpected situations. According to Hailey, Corabian, Harstall, and Schneider (2000), individuals can adopt health technology to acquire health information or advices in response to urgent health requests. When people perceive the benefits brought by using mHealth services to cope with urgent medical care, they might have the use intention of mHealth services under emergency situations. Additionally, utilitarian benefit is always deemed as one powerful motivator to facilitate routine development (Blau, 1964). When individuals perceive that using mHealth services can assist in improving health conditions and preventing diseases, they might be stimulated to partake in a routinized use behavior of mHealth services. Following the reasoning above, we propose:

Hypothesis 1a: Perceived usefulness is positively associated with emergency use intention of mHealth.

Hypothesis 1b: Perceived usefulness is positively associated with routine use intention of mHealth.

Perceived enjoyment is a representative intrinsic motivator to facilitate IS use (Davis, 1989). From the hedonic perspective, individuals perceive pleasant feelings of IS use effectively triggers users' interest and cultivates positive perceptions toward IS, thereby generating intentions of IS use. Dwivedi et al. (2016) have also demonstrated that the occurrence of new alternative of healthcare service (mHealth) stimulates patients to generate affective fun or pleasure, indicating that perceived enjoyment has positive impact on individuals' behavioral intention for mHealth adoption. In addition, Li et al. (2013) contend that intrinsic motivation can lead individuals to use IT on a daily basis. The enjoyable feelings generated from the interaction with IS can promote users to create pleasant reactions to IS (Venkatesh & Speier, 1999), making users' routine use less vapid and tedious. Specifically, patients with chronic diseases are required to involve in long term disease management to attain positive health outcomes, and incentive strategies play dominant role in promoting patients' self-management regularly (Miller, Cafazzo, & Seto, 2016). The enjoyable features of gamification in mHealth services can exert influence on facilitating patients' self-management, and encourage them to perform healthier behaviors on a routine basis. Therefore, intrinsically motivated individuals might be activated to engage in routine use of mHealth. The above discussion leads us to propose:

Hypothesis 2: Perceived enjoyment is positively associated with routine use intention of mHealth.

Drawing from prior literature, we categorize two sets of antecedents for perceived usefulness and perceived enjoyment, namely, technological and psychological characteristics. These antecedents are specialized for HIT use instead of being comprehensive. In such an endeavor, we can fully understand the effects of these factors on the mHealth use context.

Technological characteristics are critical in affecting the adoption of mobile IS (Hsiao, Li, Chen, & Ko, 2008; Lian, Yen, & Wang, 2014; Lin, Lin, Roan, & Yeh, 2012). Perceived source credibility, perceived service availability, and perceived diagnosticity are chosen as three typical technological antecedents for perceived usefulness as the three characteristics reflect three aspects of mHealth. mHealth services enable anyone to obtain healthcare services anytime and anywhere without locational and temporal constrains (Varshney, 2009); as a result, service availability is facilitated. mHealth services assist individuals in self-diagnosing by enhancing the accessibility of healthcare services, improving decision making, and facilitating chronic disease management (Varshney, 2014). Kumar, Nilsen, Pavel, and Srivastava (2013) argued that an efficient and effective mHealth service can provide trustworthy and reliable medical inferences in terms of psychological, physiological, and physical aspects; this capability validates the credibility of mHealth services. Therefore, technological characteristics, perceived diagnosticity, perceived source credibility, and perceived service availability are chosen as typical indicators for perceived usefulness.

Perceived source credibility refers to the extent to which information recipients believe that the information source is reliable, competent, and trustworthy (Bhattacherjee & Sanford, 2006; Sussman & Siegal, 2003). Perceived source credibility, which has been found to be an important influencing factor of individuals' perceived usefulness (Bhattacherjee & Sanford, 2006), is defined as mHealth service recipients' perception of the credibility of the services in the current study. Perceived service availability is defined as the extent to which an individual perceives a technology as being able to provide pervasive and timely connections (Hong & Tam, 2006). According to Hong and Tam (2006), perceived service availability is a salient antecedent for perceived usefulness. In the absence of ubiquitous and pervasive traits, the usefulness of mHealth services will be significantly weakened. Perceived diagnosticity has been widely discussed in information searching, web-based information sharing, electronic shopping, and online review literature (Hernandez, Han, & Kardes, 2014; Jiang & Benbasat, 2004, 2007; Mudambi & Schuff, 2010; J.-C. Wang & Chang, 2013; Yi, Jiang, & Benbasat, 2017). It is defined as the extent to which consumers believe that offered product information can assist them in fully knowing and becoming familiar with a product (Mudambi & Schuff, 2010). People with high levels of perceived diagnosticity have improved ability to appraise products and thus make appropriate use decision (Jiang & Benbasat, 2007). In the current study, we define perceived diagnosticity of mHealth services as users' perceptions that the services and information provided by mHealth can assist people in fully understanding their health condition. Service recipients can achieve confidence in using a product if the product services are perceived as diagnostic (Kempf & Smith, 1998). If the level of diagnosticity of the current information is low, then consumers have low degree of confidence in evaluating the product (Maheswaran, Mackie, & Chaiken, 1992). Accordingly, we can conclude that people with high levels of perceived diagnosticity

can realize the usefulness of services fully, comprehensively, and thoroughly.
Given the statements above, we propose

Hypothesis 3a: Perceived diagnosticity is positively associated with perceived usefulness.
Hypothesis 3b: Perceived source credibility is positively associated with perceived usefulness.
Hypothesis 3c: Perceived service availability is positively associated with perceived usefulness.

Individuals partake in activities to fulfil competence or efficacy (White, 1959); this fact strengthens the argument that individuals' needs for competent and self-determined promote their intrinsically motivated behaviors (E. L. Deci, 1975). Self-determination theory advocates that autonomy, competence, and relatedness are representative innate psychological characteristics that facilitate the understanding of human motivation behaviors (E. L. Deci & Ryan, 2000). Therefore, we choose perceived autonomy, perceived competence, and perceived relatedness as three salient psychological antecedents for perceived enjoyment in exploring individuals' motivational behaviors of mHealth. Autonomy, competence, and relatedness are three psychological needs for people's psychological growth, integrity, and well-being (E. L. Deci & Ryan, 2000; Vlachopoulos & Michailidou, 2006). The need for autonomy refers to individuals' performance of self-endorsed behavior that is not influenced by other factors (EE Deci & Ryan, 1985; Ryan & La Guardia, 2000). The need for competence reflects people's inclination to be effectively involved in the environment to practice and show their capacities (E. L. Deci & Ryan, 2000). The need for relatedness refers to one's positive feelings that are closely associated with significant others and loved ones or others in the same social environment (Ryan & La Guardia, 2000). Autonomy, competence, and relatedness play a role in influencing intrinsic motivation (E. L. Deci & Ryan, 2000) and may indirectly lead to different types of outcomes (e.g., enjoyment) (Cox, Duncheon, & McDavid, 2009). The psychological antecedents of perceived enjoyment include curiosity, autonomy, competence, and relatedness.
Reeve (1989) demonstrated that curiosity stimulates and motivates people to explore and investigate unknown or interesting matters. Individuals' attention, curiosity, and interest can be attracted by novelty and are intrinsically motivating activities (Reeve, 1989). The conception of intrinsic motivation embraces not only the hedonic perspective but also the innate needs for accomplishment, curiosity, and learning (Venkatesh & Speier, 1999). The unique features of a new technology can arouse users' curiosity and interest, thereby making interaction with mHealth services enjoyable. High degree of curiosity on the novel features of mHealth means high degree of perceived enjoyment. Thus, we propose curiosity is a psychological predictor of perceived enjoyment.
Specifically, we posit that

Hypothesis 4a: Curiosity is positively associated with perceived enjoyment.
Hypothesis 4b: Autonomy is positively associated with perceived enjoyment.
Hypothesis 4c: Competence is positively associated with perceived enjoyment.

Hypothesis 4d: Relatedness is positively associated with perceived enjoyment.

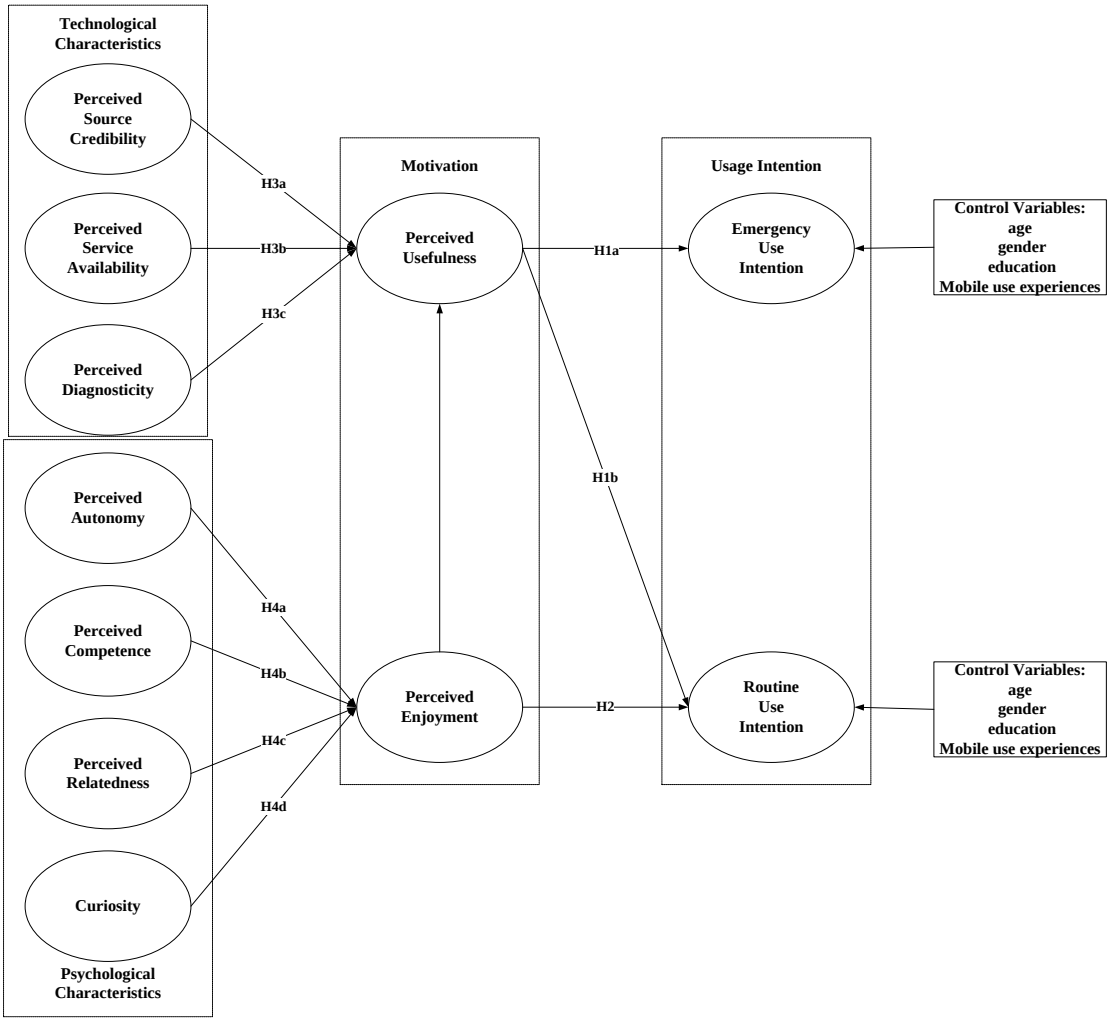
We also include four demographic characteristics as control variables to avoid covariance issues. Age, gender, education, and mobile use experience are controlled for emergency and routine use intentions.

3. Method

4.1 Measurement Development

Most of the measures of the constructs were developed on the basis of prior literature. For the constructs that could not be found in existing relevant literature, we self-developed the items. We adapted each

Figure 1. Research Model and Hypotheses



construct to fit the mHealth context. Measures for perceived source credibility were based on Bhattacherjee and Sanford (2006). We measured perceived service availability with items adapted from Hong and Tam (2006). Measures for perceived diagnosticity were adapted from Jiang and Benbasat (2007). We adapted the items for curiosity from Reeve (1989). We based the measures for autonomy, competence, and relatedness on Vlachopoulos and Michailidou (2006). We adapted the measures for

perceived usefulness and perceived enjoyment from Venkatesh et al. (2003). The measures for routine use intention were derived from Sundaram et al. (2007). We self-developed the measures of emergency use intention to accommodate our research context. As numerous literature has been focusing on routine use of technology (Li et al., 2013; W. Wang & Hsieh, 2006), barely no studies have been conducted to explore emergency use, which is an important counterpart of routine use to disclose individuals' use behavior of IT. Therefore, we self-developed the items of emergency use intention to specifically measure the urgent side of behavioral use of mHealth. All the measurement items are provided in Appendix A. To test the content validity of the measures, we conducted a pretest before assigning the questionnaires to participants. We received feedback from 20 research students and three professionals with medical background. We made a few minor changes to some items to enhance the expressions. We evaluated all the measurement items using a seven-point Likert scale (1= "strongly disagree" and 7= strongly agree").

4.2 Data Collection

We conducted a survey to collect data in a residential community in China. This community has been authorized by local government and collaborated with community hospitals, aiming to become a "Intelligent Health Community" that provides local residents appropriate health education and consultation services, track their physical data regularly through mobile healthcare services, and utilizing GPS technique to obtain residents' locational information when they have urgent medical requirement. Therefore, we believe the residents in this community are applicable target for data collection. A total of 260 participants completed the questionnaires, and 241 questionnaires were valid, with a response rate of 93 percent. Each of them received 20 RMB cash as the token of appreciation for participation. Before the distribution of questionnaires, we introduced the conceptions, functions, and benefits of mHealth services to all the participants to assist them in fully understanding the new healthcare services. The questionnaires contained two main parts. The first part was designed to collect respondents' demographic information. The second part included questions in terms of participants' opinions and use intentions of mHealth services.

Among the 241 applicable participants, 105 were male (44%) and 136 were female (56%), 141 (59%) were less than 30 years old, 173 (72%) had college or above education, and nearly half of them (48%) had mobile use experience over 8 years.

Additionally, we have also conducted a t-test to test the means between users who have mobile use experience over 8 years (A) and users who have mobile use experience less than 8 years (B). The results have shown that $T_A = -27.56$, $T_B = 26.99$, and $p < 0.05$, which indicates there is a significant difference between these two populations.

4. Results

5.1 Measurement Evaluation

We used partial least squares (PLS) to conduct data analysis because PLS is regarded as a component-based structural equation modeling technique that is suitable for maximizing explained variance (Gefen,

Straub, & Rigdon, 2011). SmartPLS 2.0 software was used as our main statistical tool to evaluate and test the research model.

Table 1. Item Loadings and Cross-Loadings

Construct	Item	EUI	PAU	PCOM	PDIA	PEN	CUR	PRE	PSC	PU	RUI	PSA
Emergency Use Intention	EUI1	**0.91**	0.37	0.25	0.13	0.26	0.11	0.25	0.27	0.22	0.15	0.24
	EUI2	**0.95**	0.40	0.29	0.20	0.29	0.11	0.25	0.27	0.28	0.18	0.27
	EUI3	**0.93**	0.40	0.29	0.17	0.24	0.08	0.24	0.28	0.23	0.14	0.25
Perceived Autonomy	PAU1	0.25	**0.80**	0.48	0.41	0.66	0.38	0.34	0.53	0.41	0.41	0.36
	PAU2	0.42	**0.77**	0.41	0.38	0.44	0.28	0.46	0.48	0.44	0.42	0.31
	PAU3	0.26	**0.63**	0.44	0.32	0.38	0.36	0.31	0.31	0.51	0.34	0.34
	PAU4	0.32	**0.66**	0.35	0.25	0.36	0.18	0.35	0.35	0.43	0.36	0.29
Perceived Competence	PCO1	0.26	0.52	**0.69**	0.42	0.49	0.33	0.26	0.47	0.65	0.37	0.35
	PCO2	0.23	0.44	**0.82**	0.52	0.52	0.37	0.29	0.58	0.47	0.42	0.44
	PCO3	0.24	0.49	**0.78**	0.43	0.42	0.42	0.25	0.48	0.44	0.46	0.49
	PCO4	0.15	0.29	**0.67**	0.28	0.40	0.25	0.20	0.36	0.23	0.32	0.30
Perceived Diagnosticity	PDIA 1	0.18	0.46	0.52	**0.87**	0.45	0.48	0.23	0.43	0.45	0.38	0.44
	PDIA 2	0.17	0.41	0.50	**0.92**	0.41	0.48	0.24	0.44	0.46	0.31	0.38
	PDIA 3	0.15	0.42	0.50	**0.91**	0.44	0.51	0.23	0.39	0.48	0.36	0.41
Perceived Enjoyment	PEN1	0.22	0.55	0.54	0.40	**0.85**	0.45	0.34	0.49	0.46	0.39	0.45
	PEN2	0.27	0.65	0.56	0.44	**0.91**	0.45	0.40	0.51	0.52	0.46	0.40
	PEN3	0.25	0.57	0.56	0.43	**0.87**	0.47	0.32	0.51	0.39	0.39	0.35
Curiostiy	CUR1	0.08	0.37	0.38	0.41	0.49	**0.86**	0.22	0.40	0.33	0.31	0.25
	CUR2	0.07	0.40	0.38	0.49	0.40	**0.85**	0.25	0.35	0.39	0.31	0.32
	CUR3	0.13	0.31	0.41	0.48	0.40	**0.80**	0.26	0.33	0.35	0.29	0.42
Perceived Relatedness	PRE1	0.21	0.34	0.26	0.17	0.25	0.15	**0.78**	0.28	0.26	0.18	0.22
	PRE2	0.26	0.39	0.30	0.20	0.33	0.23	**0.84**	0.37	0.29	0.24	0.25
	PRE3	0.10	0.34	0.20	0.25	0.25	0.26	**0.69**	0.16	0.27	0.26	0.26
	PRE4	0.25	0.47	0.30	0.22	0.41	0.25	**0.85**	0.36	0.26	0.26	0.25
Perceived Source Credibility	PSC1	0.23	0.55	0.53	0.42	0.52	0.45	0.37	**0.83**	0.37	0.38	0.28
	PSC2	0.23	0.46	0.51	0.35	0.43	0.31	0.30	**0.85**	0.34	0.34	0.25
	PSC3	0.24	0.51	0.53	0.36	0.49	0.35	0.27	**0.88**	0.40	0.32	0.26
	PSC4	0.28	0.48	0.59	0.43	0.48	0.34	0.34	**0.79**	0.39	0.30	0.34
Perceived Usefulness	PU1	0.18	0.51	0.56	0.42	0.45	0.34	0.31	0.41	**0.82**	0.42	0.47
	PU2	0.16	0.49	0.46	0.45	0.36	0.32	0.29	0.34	**0.82**	0.36	0.44
	PU3	0.23	0.49	0.50	0.40	0.45	0.36	0.28	0.35	**0.85**	0.45	0.42
	PU4	0.29	0.51	0.52	0.45	0.50	0.39	0.25	0.40	**0.83**	0.40	0.42
Routine Use Intention	RUI1	0.14	0.46	0.52	0.32	0.40	0.29	0.21	0.37	0.45	**0.86**	0.43
	RUI2	0.19	0.46	0.44	0.35	0.43	0.32	0.25	0.34	0.42	**0.88**	0.37
	RUI3	0.11	0.46	0.41	0.35	0.39	0.33	0.32	0.32	0.41	**0.85**	0.36
Perceived Service Availability	PSA1	0.33	0.42	0.43	0.37	0.37	0.29	0.28	0.30	0.41	0.41	**0.81**
	PSA2	0.13	0.32	0.40	0.33	0.37	0.41	0.22	0.22	0.45	0.30	**0.80**
	PSA3	0.20	0.34	0.45	0.40	0.35	0.21	0.25	0.28	0.38	0.38	**0.77**

As shown in Table 1, each item loading on their own construct was above 0.7; therefore, convergent validity was supported (Peng & Lai, 2012). In addition, the loading of each item was significantly higher than the cross-loadings on any other constructs; thus, discriminant validity was supported (Hair, Black, Babin, Anderson, & Tatham, 1998). Table 2 shows the values of average variance extracted (AVE), composite reliability, and Cronbach's alpha for all constructs in the proposed model. The scores of AVE were all above the recommended cutoff value of 0.50 (Fornell & Larcker, 1981), and the values of composite reliability and Cronbach's alpha were all higher than the threshold of 0.707 (Nunnally, 1967). These findings indicated that convergent validity was supported. In addition, the square root of each construct's AVE was higher than its correlations with any other constructs. Discriminant validity was examined further.

Table 2. Descriptive Statistics and Correlation Matrix

	$\bar{x}$	SD	AVE	CR	α	EUI	PAU	PCO	PDIA	PEN	CUR	PRE	PSC	PU	RUI	PSA
EUI	4.61	1.36	0.86	0.95	0.92	**0.93**										
PAU	5.05	0.84	0.51	0.81	0.69	0.42	**0.71**									
PCO	5.06	0.88	0.55	0.83	0.72	0.30	0.59	**0.74**								
PDIA	5.42	0.98	0.81	0.93	0.88	0.18	0.48	0.56	**0.90**							
PEN	5.08	1.07	0.77	0.91	0.85	0.28	0.67	0.63	0.48	**0.88**						
CUR	5.18	1.06	0.70	0.88	0.79	0.11	0.43	0.47	0.55	0.52	**0.84**					
PRE	5.21	0.86	0.62	0.87	0.80	0.27	0.50	0.34	0.26	0.41	0.29	**0.79**				
PSC	4.77	0.99	0.70	0.90	0.86	0.30	0.60	0.65	0.46	0.58	0.43	0.38	**0.84**			
PU	5.36	0.87	0.69	0.90	0.85	0.26	0.60	0.62	0.52	0.53	0.43	0.34	0.45	**0.83**		
RUI	4.97	0.96	0.74	0.90	0.83	0.17	0.53	0.53	0.39	0.47	0.36	0.30	0.40	0.49	**0.86**	
PSA	5.40	0.92	0.63	0.84	0.71	0.28	0.45	0.53	0.46	0.46	0.38	0.31	0.34	0.52	0.45	**0.79**

Note:

$\bar{x}$= Mean; SD= Standard deviation; AVE = average variance extracted; CR = composite reliability; α = Cronbach's alpha; EUI = emergency use intention; PAU = autonomy; PCO = competence; PDIA = perceived diagnosticity; PEN = perceived enjoyment; CUR = curiosity; PRE = relatedness; PSC = perceived source credibility; PU = perceived usefulness; RUI = routine use intention; PSA = perceived service availability; Square roots of AVE are shown in bold on diagonal.

4.2 Common Method Bias Testing

Considering that all the data were collected from participants' self-reports, common method bias (CMB) might exist (Podsakoff & Organ, 1986). We firstly conducted Harmon's one factor test to examine the latent constructs in our theoretical model, following Podsakoff et al. 2003. Results have shown that the first factor of the un-rotated solution explained 30.09 percent of the total variance, indicating that no existence of CMB. We also conducted the marker variable analysis to test the existence of CMB. Following the approach by Rönkkö and Ylitalo (2011), we selected the construct of prevention focus in

our data set as the marker variable, which had low correlations with items in our research model. The marker variable was tested on four endogenous latent variables, namely, perceived usefulness, perceived enjoyment, emergency use intention, and routine use intention. The results revealed that the correlations and significance remained unchanged. Therefore, the CMB in the present study was negligible.

5. 3 Hypothesis Testing

The model testing results are presented in Figure 2. The main results showed that the proposed model explained 15% variance (R^2=0.15) in emergency use intention and 31% variance (R^2=0.31) in routine use intention. This current research is an exploratory research and is designed to investigate a novel research model. The low R^2 value can also have the convincing power in explaining the latent relationship between variables.

All the main effects were significant. Specifically, perceived usefulness positively affected emergency use intention (β=0.23, P＜0.01) and routine use intention (β=0.34, P＜0.01). Therefore, H1a and H1b were supported. Perceived enjoyment (β=0.29, P＜0.01) was positively related to routine use intention. Thus, H2 was supported. Perceived source credibility (β=0.13, P＜0.01), perceived service availability (β=0.22, P ＜ 0.01), and perceived diagnosticity (β=0.28, P ＜ 0.01) positively affected perceived usefulness, thereby supporting H3a, H3b, and H3c. Perceived autonomy (β=0.39, P＜0.01), perceived competence (β=0.28, P＜0.01), perceived relatedness (β=0.06, P＜0.1), and curiosity (β=0.20, P＜0.01) positively affected perceived enjoyment. Therefore, H4a, H4b, H4c, and H4d were supported. Table 3 shows the results of the research hypothesis testing.

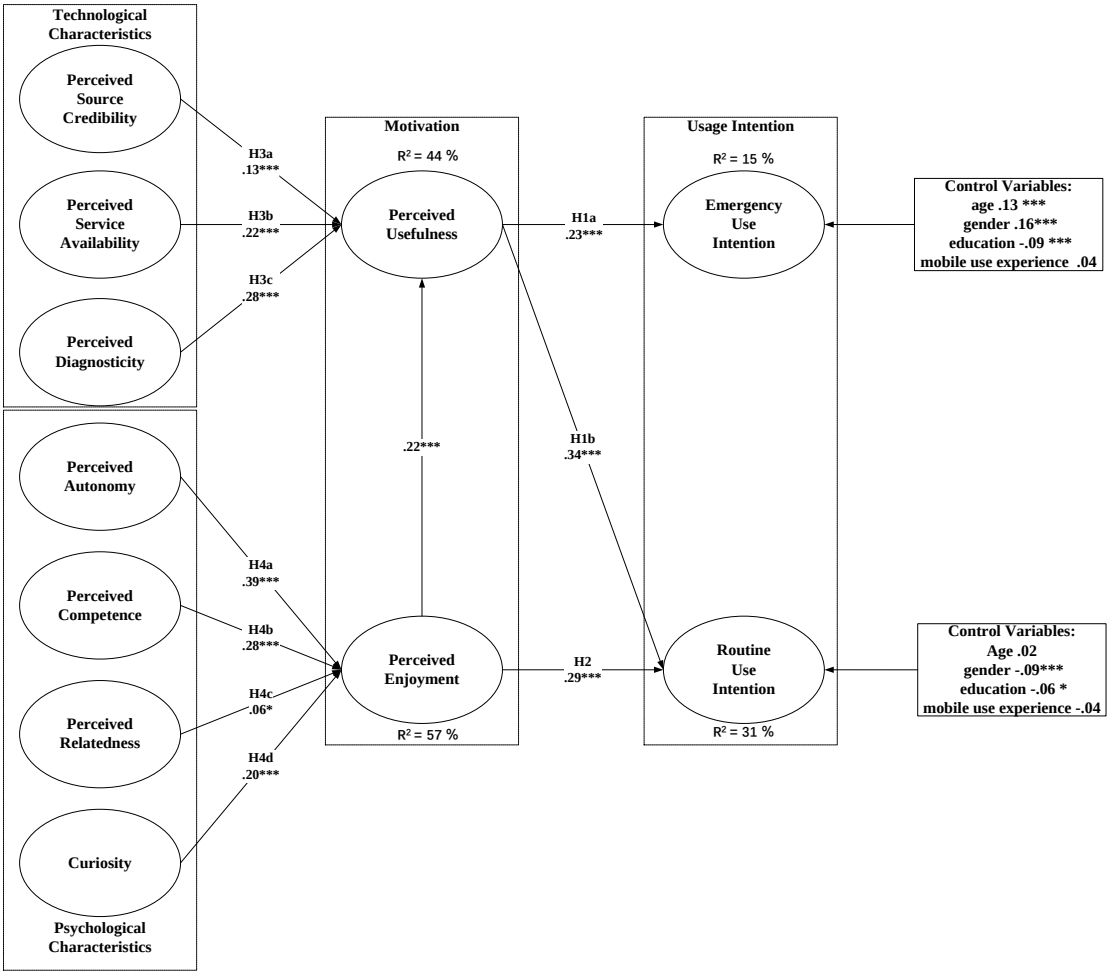


Figure 2 PLS Results of Model Testing

Note 1: when |t value| > 2.610, P < 0.01; when |t value| > 1.977, P < 0.05; when |t value| > 1.656, P < 0.1. Note 2: ***p < 0.01; **p < 0.05; *p < 0.1.

Table 3. Results of Hypothesis Testing

Hypothesis Descriptions	Result
Hypothesis 1a: Perceived usefulness positively influences emergency use intention of mHealth.	√
Hypothesis 1b: Perceived usefulness positively influences routine use intention of mHealth.	√
Hypothesis 2: Perceived enjoyment positively influences routine use intention of mHealth.	√
Hypothesis 3a: Perceived diagnosticity positively affect perceived usefulness.	√
Hypothesis 3b: Perceived source credibility positively affect perceived usefulness.	√
Hypothesis 3d: Perceived service availability positively affect perceived usefulness.	√
Hypothesis 4a: Curiosity positively affect perceived enjoyment.	√
Hypothesis 4b: Autonomy positively affect perceived enjoyment.	√
Hypothesis 4c: Competence positively affect perceived enjoyment.	√
Hypothesis 4d: Relatedness positively affect perceived enjoyment.	√

5. Discussion

6.1 Theoretical Implications

The present study provides three theoretical contributions. First, we focus on two distinct usage behaviors, emergency and routine uses. As mHealth can provide with healthcare services that satisfy individuals' requirements under different situations, it stimulates individuals to perform distinct behaviors toward mHealth use. Further, extant IS literature primarily examines the general "use" behaviors, which is always deemed as a broad behavioral category and has frequently been examined in the forms of duration or frequency (Van der Heijden, 2004). This indicates that explore the specific use behaviors of IS can fill a void in the IS literature. Accordingly, we mainly examine people's emergency and routine uses of mHealth services, which contributes to the existing IS knowledge in a promising way.

Second, this study integrates motivation theory as the theoretical foundation to develop a new perspective of shaping individuals' IS use behaviors. Our findings reveal that perceived usefulness acts as an extrinsic motivator that effectively affects emergency and routine use intentions of mHealth services. Interestingly, perceived usefulness exerts stronger influence on routine use intention than on emergency use intention. Blau (1964) asserted that external stimulus (extrinsic motivation) is an effective way to facilitate the process of routines and thus explicitly illustrated that perceived usefulness exerts stronger influence on routine use intention than on emergency use intention. In addition, perceived enjoyment is closely associated with routine use intention, indicating hedonic motivation can also play an important role in influencing individuals' behavioral intention of mHealth services (Dwivedi et al., 2016). Therefore, Perceived usefulness and perceived enjoyment are found to be the important elements that trigger individuals' routine and emergency use intentions of mHealth. This endeavor contributes to the understanding of the relationships between IS use motivations and IS use behaviors.

Third, this study enriches the understanding of motivational theory by incorporating different categorized antecedents of motivational beliefs. We find that technological and psychological perceptions exert positive impact on extrinsic and intrinsic motivations on use intention of mHealth services. Specifically, this research presents how intrinsic and extrinsic motivators can affect two distinct use intentions based on perceptions of technological and psychological characteristics. The findings reveal possible theoretical perspective through which motivational factors can be generated and the application of motivation theory can be broadening.

6.2 Practical Implications

This current study has practical implications in both IS and healthcare domains. mHealth service providers and researchers should recognize that individuals can perform emergency and routine usage behaviors, which offers unique opportunities to mHealth service design and developement. Specifically, individuals might integrate mHealth services into their daily life to manage chronic disease, monitor their health status and encourage them to perform healthy behaviors, etc. Additionally, individuals might

choose mHealth services to meet their medical requirement under urgent situations, such as acute disease and unexpected incidence. Consequently, mHealth service providers can develop more relevant medical services that satisfy individuals' different medical requirements.

Further, our results have shown that perceived enjoyment affects routine use intentions of mHealth services. As the enjoyable feelings generated from the interaction with IS can promote users to create pleasant reactions to IS , making the use of healthcare services less tedious and vapid. (Venkatesh & Speier, 1999) Therefore, service providers are encouraged to stimulate individuals' intrinsic motivation (perceived enjoyment) by developing features of product that contain entertainment and gamification elements, such as rewards, competition and achievement. By contrast, perceived usefulness influences individuals' emergency and routine use intentions of mHealth. It indicates that individuals' mHealth usage behaviors are more likely to be driven by utilitarian outcomes. Additionally, we also investigate several relevant technological antecedents for extrinsic motivation. The results show that source credibility, service availability, and diagnosticity are three salient predictors for perceived usefulness. Therefore, service providers are suggested to ensure the information source be reliable, competent and trustworthy, provide timely healthcare services, and assist individuals in understanding the mHealth services comprehensively.

Moreover, from our data analysis, we found that female and highly educated participants show great interests on mHealth services. Therefore, service providers can target these populations as major potential users.

6.3 Limitations and Future Research

This study presents some limitations that can be explored further. The data are collected in China, and this approach may affect the generalizability of this study. Research sample can be selected in other demographic group in future studies. This study is conducted in the context of mHealth services. As mHealth services possess different features, we only discuss its general characteristics. Future research is suggested to explore the mHealth services' use behavior targeting its specific features. This study utilizes perceived usefulness and perceived enjoyment as two surrogates for extrinsic and intrinsic motivations. Other forms of extrinsic and intrinsic motivations can be examined to explore the effectiveness on IS use behavior in the future research. This study examines the effects of emergency and routine uses separately. Whether a correlation exists between the two use behaviors needs to be discovered in the future research.

7 Conclusion

This study is designed to explore different IS use behaviors by conceptualizing two use behaviors, namely, emergency and routine uses. Emergency and routine uses lie in the situational difference in urgent and rationalized orientations. We find that emergency and routine use intentions effectively exert influence on behavioral use intention of IS. Drawing upon motivation theory, we evaluate the relative influence of extrinsic motivation (perceived usefulness) and intrinsic motivation (perceived enjoyment) on

emergency and routine use intentions of mHealth. This study also examines the theoretical and psychological antecedents of extrinsic and intrinsic motivations, thereby contributing to advancing the understanding of IS use motivations. This study also provides instrumental insights for practitioners to fully understand different IS use behaviors to improve the quality of services and thus satisfy users' actual requirement.

References

Ajzen, I. (1991). The Theory of Planned Behavior Prganizational Behavior and Human Decision Processes. *Taylor, S. and Todd, PA (1995) Understanding information technology Usage: A test of competing models, Information Systems Research, June, 6*(2), 144-176.

Akter, S., D'Ambra, J., & Ray, P. (2010). User perceived service quality of m-Health services in developing countries.

Akter, S., D'Ambra, J., & Ray, P. (2010). Service quality of mHealth platforms: development and validation of a hierarchical model using PLS. *Electronic Markets, 20*(3-4), 209-227.

Akter, S., D'Ambra, J., & Ray, P. (2013). Development and validation of an instrument to measure user perceived service quality of mHealth. *Information & Management, 50*(4), 181-195. doi: http://dx.doi.org/10.1016/j.im.2013.03.001

Akter, S., & Ray, P. (2010). mHealth-an ultimate platform to serve the unserved. *Yearb Med Inform, 2010*, 94-100.

Akter, S., Ray, P., & D'Ambra, J. (2013). Continuance of mHealth services at the bottom of the pyramid: the roles of service quality and trust. *Electronic Markets, 23*(1), 29-47.

Annelli, J. (2006). The national incident management system: A multi-agency approach to emergency response in the United States of America. *Revue scientifique et technique-Office international des épizooties, 25*(1), 223.

Bhattacherjee, A. (2001). Understanding information systems continuance: an expectation-confirmation model. *MIS quarterly*, 351-370.

Bhattacherjee, A., & Sanford, C. (2006). Influence processes for information technology acceptance: An elaboration likelihood model. *MIS quarterly*, 805-825.

Blandford, A., & Wong, B. W. (2004). Situation awareness in emergency medical dispatch. *International Journal of Human-Computer Studies, 61*(4), 421-452.

Blau, P. M. (1964). *Exchange and power in social life*: Transaction Publishers.

Brown, S. A., & Venkatesh, V. (2005). Model of adoption of technology in households: A baseline model test and extension incorporating household life cycle. *MIS quarterly*, 399-426.

Buntin, M. B., Burke, M. F., Hoaglin, M. C., & Blumenthal, D. (2011). The benefits of health information technology: a review of the recent literature shows predominantly positive results. *Health affairs, 30*(3), 464-471.

Canto, J. G., Rogers, W. J., Bowlby, L. J., French, W. J., Pearce, D. J., Weaver, W. D., & Investigators, N. R. o. M. I. (1997). The prehospital electrocardiogram in acute myocardial infarction: is its full potential being realized? *Journal of the American College of Cardiology, 29*(3), 498-505.

Cocosila, M., & Archer, N. (2010). Adoption of mobile ICT for health promotion: an empirical

investigation. *Electronic Markets, 20*(3-4), 241-250.

Cox, A., Duncheon, N., & McDavid, L. (2009). Peers and teachers as sources of relatedness perceptions, motivation, and affective responses in physical education. *Research quarterly for exercise and sport, 80*(4), 765-773.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly*, 319-340.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management science, 35*(8), 982-1003.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of applied social psychology, 22*(14), 1111-1132.

Deci, E., & Ryan, R. (1985). I n tri n sic M oti va tio n a n d S elf-D etermi n a tio n i n Hu m a n B e h av ior. *P le n um P ress*.

Deci, E., & Ryan, R. (2002). *Handbook of self-determination research*: University Rochester Press.

Deci, E. L. (1975). Intrinsic motivation. New York and London: Plenum Press.

Deci, E. L., & Ryan, R. M. (2000). The" what" and" why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological inquiry, 11*(4), 227-268.

Dehzad, F., Hilhorst, C., de Bie, C., & Claassen, E. (2014). Adopting Health Apps, What's Hindering Doctors and Patients? *Health, 2014*.

DesRoches, C. M., Campbell, E. G., Rao, S. R., Donelan, K., Ferris, T. G., Jha, A., . . . Shields, A. E. (2008). Electronic health records in ambulatory care—a national survey of physicians. *New England Journal of Medicine, 359*(1), 50-60.

Dwivedi, Y. K., Shareef, M. A., Simintiras, A. C., Lal, B., & Weerakkody, V. (2016). A generalised adoption model for services: A cross-country comparison of mobile health (m-health). *Government Information Quarterly, 33*(1), 174-187.

Eisenberger, R., & Cameron, J. (1996). Detrimental effects of reward: Reality or myth? *American psychologist, 51*(11), 1153.

Elnekave, E., Li, Y., Zamir, L., Even-Tov, B., Hamblin, P., Gelman, B., . . . Klement, E. (2013). The field effectiveness of routine and emergency vaccination with an inactivated vaccine against foot and mouth disease. *Vaccine, 31*(6), 879-885.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 39-50.

Free, C., Phillips, G., Galli, L., Watson, L., Felix, L., Edwards, P., . . . Haines, A. (2013). The effectiveness of mobile-health technology-based health behaviour change or disease management interventions for health care consumers: a systematic review. *PLoS med, 10*(1), e1001362.

Gabrysch, S., Civitelli, G., Edmond, K. M., Mathai, M., Ali, M., Bhutta, Z. A., & Campbell, O. M. (2012). New signal functions to measure the ability of health facilities to provide routine and emergency newborn care. *PLoS medicine, 9*(11), e1001340.

Gefen, D., Straub, D. W., & Rigdon, E. E. (2011). An update and extension to SEM guidelines for admnistrative and social science research. *Management Information Systems Quarterly, 35*(2), iii-xiv.

Geissbuhler, A. (2008). Access to health information: a key for better health in the knowledge society. *IMIA Yearbook*, 20-21.

Hailey, D., Corabian, P., Harstall, C., & Schneider, W. (2000). The use and impact of rapid health technology assessments. *International journal of technology assessment in health care,*

16(2), 651-656.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (1998). *Multivariate data analysis* (Vol. 5): Prentice hall Upper Saddle River, NJ.

Hernandez, J. M. C., Han, X., & Kardes, F. R. (2014). Effects of the perceived diagnosticity of presented attribute and brand name information on sensitivity to missing information. *Journal of Business Research, 67*(5), 874-881.

Herscovici, N., Christodoulou, C., Kyriacou, E., Pattichis, M., Pattichis, C., Panayides, A., & Pitsillides, A. (2007). m-Health e-emergency systems: current status and future directions [Wireless corner]. *IEEE Antennas and Propagation Magazine, 49*(1), 216-231.

Hong, S.-J., & Tam, K. Y. (2006). Understanding the adoption of multipurpose information appliances: The case of mobile data services. *Information systems research, 17*(2), 162-179.

Hsiao, S.-J., Li, Y.-C., Chen, Y.-L., & Ko, H.-C. (2008). Critical Factors for the Adoption of Mobile Nursing Information Systems in Taiwan: the Nursing Department Administrators' Perspective. *Journal of medical systems, 33*(5), 369. doi: 10.1007/s10916-008-9199-8

Hu, P. J., Chau, P. Y., Sheng, O. R. L., & Tam, K. Y. (1999). Examining the technology acceptance model using physician acceptance of telemedicine technology. *Journal of management information systems, 16*(2), 91-112.

Istepanian, R., Laxminarayan, S., & Pattichis, C. S. (2006). *M-health*: Springer.

Jha, A. K., DesRoches, C. M., Campbell, E. G., Donelan, K., Rao, S. R., Ferris, T. G., . . . Blumenthal, D. (2009). Use of electronic health records in US hospitals. *New England Journal of Medicine, 360*(16), 1628-1638.

Jiang, Z., & Benbasat, I. (2004). Virtual product experience: Effects of visual and functional control of products on perceived diagnosticity and flow in electronic shopping. *Journal of management information systems, 21*(3), 111-147.

Jiang, Z., & Benbasat, I. (2007). Research note—investigating the influence of the functional mechanisms of online product presentations. *Information systems research, 18*(4), 454-470.

Kempf, D. S., & Smith, R. E. (1998). Consumer processing of product trial and the influence of prior advertising: A structural modeling approach. *Journal of Marketing Research*, 325-338.

Kim, G. S., Park, S. B., & Oh, J. (2008). An examination of factors influencing consumer adoption of short message service (SMS). *Psychology & Marketing, 25*(8), 769-786.

Kumar, S., Nilsen, W., Pavel, M., & Srivastava, M. (2013). Mobile health: Revolutionizing healthcare through transdisciplinary research. *Computer, 46*(1), 28-35.

Li, X., Hsieh, J. P.-A., & Rai, A. (2013). Motivational differences across post-acceptance information system usage behaviors: An investigation in the business intelligence systems context. *Information systems research, 24*(3), 659-682.

Lian, J.-W., Yen, D. C., & Wang, Y.-T. (2014). An exploratory study to understand the critical factors affecting the decision to adopt cloud computing in Taiwan hospital. *International Journal of Information Management, 34*(1), 28-36.

Lin, C.-H., Lin, I.-C., Roan, J.-S., & Yeh, J.-S. (2012). Critical Factors Influencing Hospitals' Adoption of HL7 Version 2 Standards: An Empirical Investigation. *Journal of medical systems, 36*(3), 1183-1192. doi: 10.1007/s10916-010-9580-2

Lupton, D. (2015). Health promotion in the digital era: A critical commentary. *Health promotion*

international, 30(1), 174-183.

Maheswaran, D., Mackie, D. M., & Chaiken, S. (1992). Brand name as a heuristic cue: The effects of task importance and expectancy confirmation on consumer judgments. *Journal of consumer psychology, 1*(4), 317-336.

Meng, F., Guo, X., Peng, Z., Lai, K.-h., & Vogel, D. (2016). Routine Use of Mobile Health Services in the Presence of Health Consciousness.

Michalowski, W., Rubin, S., Slowinski, R., & Wilk, S. (2003). Mobile clinical support system for pediatric emergencies. *Decision support systems, 36*(2), 161-176.

Miller, A. S., Cafazzo, J. A., & Seto, E. (2016). A game plan: Gamification design principles in mHealth applications for chronic disease management. *Health informatics journal, 22*(2), 184-193.

Mudambi, S. M., & Schuff, D. (2010). What makes a helpful review? A study of customer reviews on Amazon. com.

Nisha, N., Iqbal, M., Rifat, A., & Idrish, S. (2015). Mobile health services: A new paradigm for health care systems. *International Journal of Asian Business and Information Management (IJABIM), 6*(1), 1-17.

Nunnally, J. C. (1967). Psychometric theory.

Nysveen, H., Pedersen, P. E., & Thorbjørnsen, H. (2005). Intentions to use mobile services: Antecedents and cross-service comparisons. *Journal of the Academy of Marketing Science, 33*(3), 330.

Organization, W. H. (2011). *Global status report on alcohol and health*: World Health Organization.

Peng, D. X., & Lai, F. (2012). Using partial least squares in operations management research: A practical guideline and summary of past research. *Journal of Operations Management, 30*(6), 467-480.

Reeve, J. (1989). The interest-enjoyment distinction in intrinsic motivation. *Motivation and Emotion, 13*(2), 83-103.

Ryan, R. M., & La Guardia, J. G. (2000). What is being optimized?: Self-determination theory and basic psychological needs.

Saga, V. L., & Zmud, R. W. (1993). *The nature and determinants of IT acceptance, routinization, and infusion.* Paper presented at the Proceedings of the IFIP TC8 working conference on diffusion, transfer and implementation of information technology.

Schrading, W. A., Stein, S., Eitel, D. R., Grove, L., Horner, L., Steckert, G., . . . Hess, D. R. (1993). An evaluation of automated defibrillation and manual defibrillation by emergency medical technicians in a rural setting. *The American journal of emergency medicine, 11*(2), 125-130.

Segatti, M. P., Nisi, G., Grossi, F., Mangiarotti, M., & Lucarelli, C. (1991). Rapid and simple high-performance liquid chromatographic determination of tricyclic antidepressants for routine and emergency serum analysis. *Journal of Chromatography A, 536*, 319-325.

Suki, N. M., & Suki, N. M. (2011). Exploring the relationship between perceived usefulness, perceived ease of use, perceived enjoyment, attitude and subscribers' intention towards using 3G mobile services. *Journal of Information Technology Management, 22*(1), 1-7.

Sundaram, S., Schwarz, A., Jones, E., & Chin, W. W. (2007). Technology use on the front line: how information technology enhances individual performance. *Journal of the Academy of Marketing Science, 35*(1), 101-112.

Sussman, S. W., & Siegal, W. S. (2003). Informational influence in organizations: An integrated approach to knowledge adoption. *Information systems research, 14*(1), 47-65.

Taylor, S., & Todd, P. A. (1995). Understanding information technology usage: A test of competing models. *Information systems research, 6*(2), 144-176.

Vallerand, R. J., Fortier, M. S., & Guay, F. (1997). Self-determination and persistence in a real-life setting: toward a motivational model of high school dropout. *Journal of personality and social psychology, 72*(5), 1161.

Van der Heijden, H. (2004). User acceptance of hedonic information systems. *MIS quarterly*, 695-704.

Varshney, U. (2009). *Pervasive healthcare computing: EMR/EHR, wireless and health monitoring*: Springer Science & Business Media.

Varshney, U. (2014). Mobile health: Four emerging themes of research. *Decision support systems, 66*, 20-35.

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management science, 46*(2), 186-204.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, 425-478.

Venkatesh, V., & Speier, C. (1999). Computer technology training in the workplace: A longitudinal investigation of the effect of mood. *Organizational behavior and human decision processes, 79*(1), 1-28.

Vlachopoulos, S. P., & Michailidou, S. (2006). Development and initial validation of a measure of autonomy, competence, and relatedness in exercise: The Basic Psychological Needs in Exercise Scale. *Measurement in physical education and exercise science, 10*(3), 179-201.

Wang, J.-C., & Chang, C.-H. (2013). How online social ties and product-related risks influence purchase intentions: A Facebook experiment. *Electronic Commerce Research and Applications, 12*(5), 337-346.

Wang, W., & Hsieh, J. (2006). Beyond routine: Symbolic adoption, extended use, and emergent use of complex information systems in the mandatory organizational context.

White, R. W. (1959). Motivation reconsidered: The concept of competence. *Psychological review, 66*(5), 297.

Yadav, N., Aliasgari, M., & Poellabauer, C. (2016). Mobile Healthcare in an Increasingly Connected Developing World. *International Journal of Privacy and Health Information Management (IJPHIM), 4*(2), 76-97.

Yang, L., Su, G., & Yuan, H. (2012). Design principles of integrated information platform for emergency responses: the case of 2008 Beijing Olympic Games. *Information systems research, 23*(3-part-1), 761-786.

Yi, C., Jiang, Z., & Benbasat, I. (2017). Designing for Diagnosticity and Serendipity: An Investigation of Social Product-Search Mechanisms. *Information systems research*.

Zajonc, R. B. (1980). Feeling and thinking: Preferences need no inferences. *American psychologist, 35*(2), 151.

Appendix Measurement Items

All measures used a seven-point Likert scale with anchors ranging from strongly disagree (1) to strongly agree (7).

Emergency Use Intention (self-developed)

EUI1: I intend to use mHealth services under urgent medical requirement.

EUI2: I predict to use mHealth services in urgent medical requirement.

EUI3: I plan to use mHealth services when I am in urgent need for medical care.

Routine Use Intention (Sundaram et al., 2007)

RUI1: I predict to incorporate mHealth services into my regular life schedule

RUI2: The mHealth services will be pretty much integrated as part of my normal life routine

RUI3: mHealth services will be a normal part of my life

Perceived Usefulness (Venkatesh et al., 2003)

PU1: Using the mHealth services would improve my health management.

PU2: Using the mHealth services will make it easier to manage my health.

PU3：Using the mHealth services would enhance my effectiveness on managing my health.

PU4：I would find the mHealth services useful in my health management.

Perceived Enjoyment (Venkatesh et al., 2003)

PEN1: I find using the mHealth services will be enjoyable.

PEN2: The actual process of using the mHealth services will be pleasant.

PEN3: I will have fun using the mHealth services.

Perceived Source Credibility (Bhattacherjee & Sanford, 2006)

PSC1：The mHealth providing the healthcare services will be knowledgeable.

PSC2：The mHealth providing the healthcare services will be trustworthy

PSC3：The mHealth providing the healthcare services are supposed to be credible.

PSC4：The mHealth providing the healthcare services should be expert on health issue.

Perceived Service Availability (Hong & Tam, 2006)

PSA1: I expect that I would be able to use mHealth services at anytime, anywhere.

PSA2: I would find mHealth services to be easily accessible and portable.

PSA3: I expect that mHealth services would be available to use whenever I need it.

Perceived Diagnosticity (Jiang & Benbasat, 2007)

PDIA 1: The mHealth service is helpful for me to evaluate my health condition.

PDIA 2: This mHealth service is helpful familiarizing me with my health condition.

PDIA 3: This mHealth service is helpful for me to understand my health condition.

Perceived Autonomy (Vlachopoulos & Michailidou, 2006)

PAU1：The mHealth services will be highly compatible with my choices and interests.

PAU2：I feel very strongly that the mHealth services will fit perfectly the way I prefer to manage my

health.
PAU3：I feel that using mHealth services to manage my health will be definitely an expression of myself.
PAU4：I feel very strongly that I will have the opportunity to make choices with respect to the way I manage my health through using mHealth services.

Perceived Competence (Vlachopoulos & Michailidou, 2006)
PCO1: I feel I will make a huge progress with respect to the health status I pursue through using mHealth services
PCO2: I feel that I could manage my health effectively through using the mHealth services.
PCO3: I feel that I will use mHealth services very well
PCO4: I feel that I will be able to manage with mHealth services I am involved.

Perceived Relatedness (Vlachopoulos & Michailidou, 2006)
PRE1: I perceive extremely comfortable with others through using mHealth services
PRE2: I feel that I will associate with others in a very friendly way through using mHealth services
PRE3: I feel there will be open channels of communication with others through using mHealth services
PRE4: I perceive very much at ease with others through using mHealth services

Curiosity (Reeve, 1989)
CUR1: The mHealth services are interesting.
CUR 2: mHealth services stimulate my curiosity at a large extent.
CUR 3: I feel curious about how mHealth work.