THREE STUDIES ON EXPLORING MOBILE HEALTH SERVICES IN CHINA

FEI LIU

PhD

This programme is jointly offered by
The Hong Kong Polytechnic University and
Harbin Institute of Technology

2019

The Hong Kong Polytechnic University

Department of Management and Marketing

Harbin Institute of Technology

School of Management

Three Studies on Exploring Mobile Health Services in China

Fei Liu

A thesis submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy

January, 2019

CERTIFICATE OF ORIGINALITY

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it reproduces no material previously published or written, nor material that has been accepted for the award of any other degree or diploma, except where due acknowledgement has been made in the text.

Fei Liu

ABSTRACT

Mobile health (mHealth), is renowned as a new healthcare paradigm providing ubiquitous and pervasive health information and services through mobile communication devices. In an endeavour to expand the technology adoption research domains, this thesis presents three studies to investigate individuals' different use intentions of mHealth services.

Study Ⅰ is designed to explore the relationships among health promotion expectancy, disease prevention expectancy, regulatory focus, and routine use intention of mobile health services based on expectancy and regulatory focus theories. In view of the increasing importance of mobile technologies applied in the healthcare industry to promote healthy behaviours and prevent illnesses, examining the factors that influence individuals' routine use of those emerging technologies is imperative. Findings reveal that health promotion expectancy has a stronger effect on individuals' routine use intention than disease prevention expectancy. In addition, promotion focus exerts a moderating effect on the relationship between health promotion expectancy and routine use intention.

Study Ⅱ theorizes two information systems (IS) use behaviors associated with individuals' usage intention of mobile health services. Emergency use refers to individuals' use of IS in emergency situations. Routine use refers to individuals' use of IS on a daily basis. We adopt motivation theory 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. Based on data collected from 241 participants, we find that perceived usefulness enhances people's emergency and routine use intentions of mHealth services, and 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.

Moreover, the increasing number of studies have been conducted to investigate individuals' adoption behaviour of mHealth service, but how service characteristics influence people's use intention has not been drawn much attentions. In addition, individuals with different personal traits can also affect their behavioural decisions. Therefore, using data collected from 350 participants, Study III aims to investigate the effects of perceived service relevance and perceived information accuracy on individuals' use intention of mHealth services. Moreover, individuals' innovativeness and privacy concern are also introduced as two moderators influencing the relationships between services characteristics and use intentions of mHealth services. This study provides a new insights of perspective influencing individuals' usage behavior of

mHealth services that can shed light on the further understanding of how individuals' adopt new information service or technologies, which contribute both information system and health care research area in a very promising way.

Key words: mHealth, regulatory focus theory, motivation theory, use behaviour, service characteristics, personal characteristics

Acknowledgements

I would like to take this opportunity to express my sincere gratitude to people who give me support, help and love during my doctoral study.

First, I would like to thank Prof. Eric Ngai and Prof. Xitong Guo for their guidance and support throughout my whole doctoral study. Their diligent and rigorous academic attitude deeply inspire and stimulate me. I feel super lucky to be supervised by them.

I also would like to thank the staff who help me to coordinate and communicate a lot of administrative and research work. Really appreciated their kind help.

Finally, I would like to thank my family for their selfless and unlimited support. Without them, I could not finish my doctoral study without distractions.

Table of Contents

Cover Page..... I
Title Page..... II
CERTIFICATE OF ORIGINALITY III
ABSTRACT IV
Acknowledgements VII
Table of Contents VIII
List of Tables XI
List of Figures XII
Chapter 1 Introduction 1
1.1 Research Background 1
1.2 Research Objective 3
Chapter 2 Literature Review of mHealth 7
2.1 mHealth Services Conception 7
2.2 mHealth Research Areas 9
Chapter 3 13
3.1 Introduction of Study 13
3.2 Theoretical Background 15
3.2.2 Routine Use Intention 15
3.2.3 Performance Expectancy 16
3.2.4 Regulatory Focus Theory 18
3.3 Research Model and Hypotheses 19
3.4 Methodology 23
3.4.1 Measurement Development 23
3.4.2 Data Collection 24
3.5 Analysis and Results 25
3.5.1 Common Method Bias 26
3.5.2 Measurement Model 26
3.5.3 Structural Model 27
3.6 Discussion and Implications 29

3.6.1 Key Findings 29
3.6.2 Theoretical Implications 31
3.6.3 Practical Implications 32
3.6.4 Limitations and Future Research 33
3.7 Summary of Study Ⅰ 33
Appendix A The Leaflet of Introduction to mHealth Services 34
Appendix B Measurement Items of Study Ⅰ 35
References 37
Chapter 4 44
4.1 Introduction of Study Ⅱ 44
4.2 Theoretical Background 46
4.2.2 Routine and Emergency Uses 46
4.2.3 Motivation Theory 50
4.3 Research Model and Hypotheses 53
4.4 Method 61
4.4.1 Measurement Development 61
4.4.2 Data Collection 62
4.5 Results 63
4.5.1 Measurement Evaluation 63
4.5.2 Common Method Bias Testing 66
4.5.3 Hypothesis Testing 66
4.6 Discussion 69
4.6.1 Theoretical Implications 69
4.6.2 Practical Implications 71
4.6.3 Limitations and Future Research 73
4.7 Summary of Study Ⅱ 73
References 75
Appendix Measurement Items of Study Ⅱ 87
Chapter 5 91
5.1 Introduction of Study Ⅲ 91
5.2 Theoretical Background 93

5.2.1 Service Characteristics 93
5.2.2 Innovativeness 95
5.2.3 Privacy Concerns 96
5.3 Research Model 98
5.3.1 Effects of Service Characteristics on Use Intentions 99
5.3.2 Effects of Innovativeness 101
5.3.3 Effects of Privacy Concern 102
5.4 Methodology 103
5.4.1 Data Collection 103
5.4.2 Measurement Model 105
5.4.3 Common Method Bias Testing 107
5.4.4 Structural Model 107
5.5 Discussion of Study Ⅲ 109
5.5.1 Key Findings 110
5.5.2 Theoretical Implications 111
5.5.3 Practical Implications 112
5.5.4 Limitations and future research 113
5.6 Conclusion of Study Ⅲ 113
Appendix Measurement Items of Study Ⅲ 115
References 117
Chapter 6 Conclusion 124
References 126

List of Tables

Table 2-1 Definitions of mHealth……8

Table 2-2 Research on mHealth Adoption Behaviors……..11

Table 3-1 Research Constructs of Study 1 ……23

Table 3-2 Demographic Profile of the Respondents of Study 1……25

Table 3-3 Correlations and Discriminant Validity of Study 1……26

Table 3-4 Cross Loadings of Constructs of Study 1……27

Table 3-5 The Structural Equation Model Results of Study 1……28

Table 3-6 Hypothesis Testing Results of Study 1……29

Table 4-1 Item Loadings and Cross-Loadings of Study 2……62

Table 4-2 Descriptive Statistics and Correlation Matrix of Study 2……..64

Table 4-3 Results of Hypothesis Testing of Study 2……67

Table 5-1 Research Constructs of Study 3……104

Table 5-2 Respondents' Demographics of Study 3……..105

Table 5-3 Descriptive Statistics and Correlation Matrix of Study 3……106

Table 5-4 Loadings and Cross Loadings of Constructs of Study 3……106

Table 5-5 The Structural Equation Model Results of Study 3……109

List of Figures

Figure 1-1 Linkage of Three Studies……..5

Figure 3-1 Research Model of Study 1……20

Figure 3-2 PLS Results of Model Testing of Study 1……28

Figure 3-3 The Moderating Effect of Promotion Focus on the Relationship Between Health Promotion and Routine Use Intention of Study 1……30

Figure 4-1 Research Model and Hypotheses of Study 2……59

Figure 4-2 PLS Results of Model Testing of Study 2……67

Figure 5-1 Research Model of Study 3……98

Figure 5-2 PLS Results of the Structural Model of Study 3……108

Chapter 1 Introduction

1.1 Research Background

Among the national issues that encountered, people's health and well-being is one of the most vital matters, and also consumes considerable national resources (Agarwal et al. 2010). As the increasing demand of healthcare services, healthcare source shortage, and uneven medical resources distribution, these issues that have become urgent demand to be resolved (Liu et al. 2016). In addition, the dramatic growth of healthcare cost has enforced stakeholders to exploit new ways to reduce costs in the meaning time of improving efficiency (Jun et al. 1999). Further, aging population and increasing chronic disease burden lead to stretched healthcare resources in order to satisfy the booming healthcare needs (Alagöz et al. 2010), of which attract health providers or other practitioners find solutions that are different from traditional healthcare and more innovative and cost-effective to address this demanding problems (Sultan 2014).

Under such healthcare environment, the promotion of new pattern of healthcare is promising (Lustria et al. 2011). As the emerging of mobile information communication technology, it generates a novel way of healthcare --- mobile health（mHealth）(Bakshi et al. 2012). 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 making 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 is an effective way to assist in changing behaviour and improving health outcomes under limited resource conditions (Thirumurthy and Lester 2012). mHealth changes the spectrum of healthcare services from crisis intervention to health promotion, prevention, and self-management (Akter et al. 2013; Dehzad et al. 2014).

The integration of information technology and healthcare is a big opportunity for the evolution of healthcare industry, in the meanwhile, this new technology also encounters many realistic problems. The number of mHealth services recipients account for 90 million. Thereinto, the majority of the recipients are young people. However, the elderly people, has highly healthcare service demand, with the population of 220 million (Consulting 2014). The statistic shows that elderly people with relatively high healthcare demand are not the primary population of using mHealth services, which imposing the low adoption rate issues of mHealth services. In addition, using frequency and continuous use remain in a low level after the adoption of mHealth services. Although the advancement of mHealth services bring into the industry of healthcare

and has been acknowledged by doctors and practitioners, the realization of extensive use of the service has been far to achieved (Standing and Standing 2008). Investigating the use behaviour of mHealth services not only contributes to broaden the horizon of information system research, but also impose significance influence into the healthcare industry (Standing and Standing 2008).

1.2 Research Objective

This thesis, contains three studies on investigating individuals' different use intentions of mobile health (mHealth) services, expands along three different dimensions, namely, health performance, user motivation and service characteristics. Each dimension is elaborated into three independent studies. Study 1 explores the routine use of mHealth services from the perspective of health performance. This study is designed to explore the relationships among health promotion expectancy, disease prevention expectancy, regulatory focus, and routine use intention of mobile health (mHealth) services based on expectancy and regulatory focus theories. Findings reveal that health promotion expectancy has a stronger effect on individuals' routine use intention than disease prevention expectancy. In addition, promotion focus exerts a moderating effect on the relationship between health promotion expectancy and routine use intention.

Study 2, investigates two different use of mHealth services from the perspective of user motivation, and also examine the effects of technological and psychological antecedents. This study primarily theorizes two information systems (IS) use behaviors

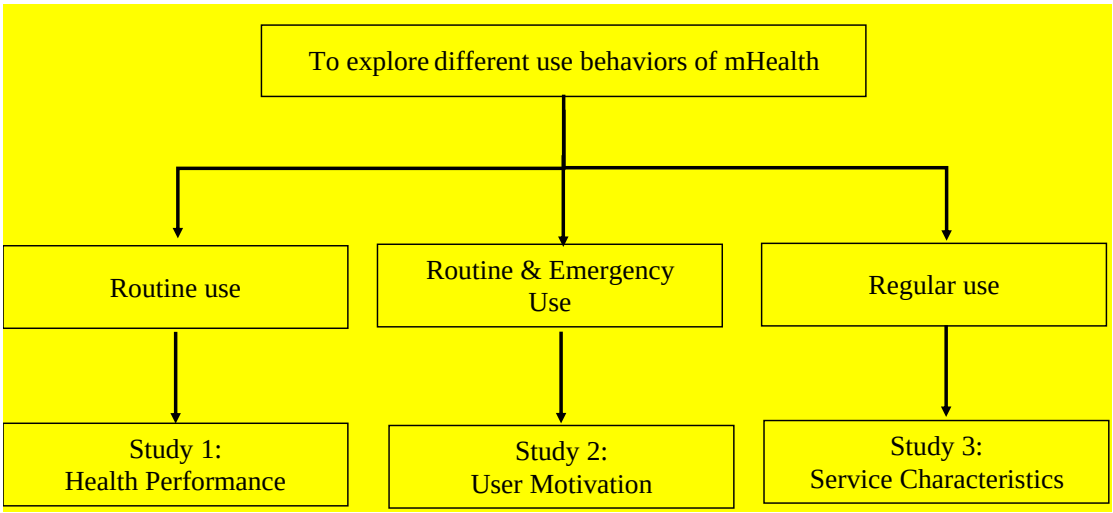
associated with individuals' behavioral intention of mHealth services. Motivation theory is adopted as the overarching theoretical lens to investigate the influence of individuals' different motivation incentives on individuals' emergency and routine use intentions of mHealth services. The influences of technological and psychological antecedents on extrinsic and intrinsic motivations are also investigated. Based on data collected from 241 participants, this study finds that perceived usefulness enhances people's emergency and routine use intentions of mHealth services, and perceived enjoyment positively influences routine use intention. In addition, perceived source credibility, perceived service availability, and perceived diagnosticity are found to 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.

Study 3 focuses on the effects of service characteristics on use of mHealth services, and also examines the moderating role of personal traits of innovativeness and privacy concern. This study aims to investigate the effects of service characteristics, perceived service relevance and perceived information accuracy, on individuals' use intention of mHealth services. In addition, individuals' innovativeness and privacy concern are also introduced as two moderators influencing the relationships between services characteristics and use intentions of mHealth services. This study provides a new insights of perspective influencing individuals' usage behavior of mHealth services that

can shed light on the further understanding of how individuals' adopt new information service or technologies.

These three studies complement each other in the following aspects. First, all of the three studies are conducted to investigate different use behaviours of mHealth services. Study 1 discusses the routine use of mHealth services; Study 2 comparatively evaluates routine and emergency uses of mHealth services; Study 3 examines the regular use of mHealth services. Second, each study is elaborated along different dimensions in discovering the influencing factors on uses of mHealth services. In study 1, it investigates the routine use of mHealth services from the perspective of health performance; Study 2 examines routine and emergency use of mHealth services from the perspective of user motivation; Study 3 investigates the use of mHealth services from the perspective of service characteristics. Figure 1-1 shows the linkage of three studies.

Figure 1-1 Linkage of Three Studies



This thesis establishes and empirically tests three theory-based behavioural models with a set of hypotheses and provides new perspective for future research in discovering individuals' use behaviours of mHealth services. As extant research rarely discovers different uses of mHealth services. Additionally, current information technology acceptance studies primarily focus on the instrumental beliefs as the main drivers. Therefore, the current thesis is designed to contribute both information system and health care research area in a very promising way.

Chapter 2 Literature Review of mHealth

2.1 mHealth Services

mHealth refers to the burgeoning mobile communication and network technologies employed in the healthcare industry (Istepanian et al. 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 et al. 2013b). mHealth has transformed the traditional means of managing health and making health decisions by delivering services highly affordable and accessible to service recipients (Akter et al. 2010a; Varshney 2014; Sadegh et al. 2018). 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). Marcolino et al. (2018) advocated the contributions of mHealth in chronic disease management, survival rate enhancement, disease prevention and health promotion. mHealth changes the spectrum of healthcare services from crisis intervention to health promotion, prevention, and self-management (Akter et al. 2013a; Dehzad et al. 2014). In sum, mHealth services can be described as the use of portable and wireless communication equipment (e.g., mobile phones, tablet, and wearable

devices) to help individuals realize health promotion and disease prevention and simplify the healthcare services.

The WHO initiated and developed the concept of mHealth in 2011. mHealth is depicted as capitalizing advanced mobile technologies to assist medicine and public healthcare (Dahdah et al. 2015; Kay et al. 2011; Consulting 2014). mHealth involves the application of portable and wireless communication equipment, such as mobile phones, tablets, and wearable devices, to deliver health services (Dahdah et al. 2015). By virtue of the ubiquitous traits, mHealth devices can potentially render the services provided increasingly available, accessible, and affordable health management instruments worldwide (Akter et al. 2013). The different definitions of mHealth is shown in Table 2-1. The present study defines mHealth as one type of healthcare service that can provide mobile device users with ubiquitous and pervasive access to medical advice and information (Akter et al. 2010). mHealth can be regarded as an advanced technology applied to healthcare, health promotion, and public health purposes (Lupton 2015). mHealth changes the spectrum of healthcare services from crisis intervention to health promotion, prevention, and self-management (Dehzad et al. 2014; Akter et al. 2013).

Table 2-1 Definitions of mHealth

Definition	Source
mHealth is obtaining health information and medical services by using network and other technology	Gustafson & Wyatt (2004)
mHealth, is one subset of eHealth, deliver medical services by using mobile devices.	Mechael & Patricia (2009)

mHealth can track physical data by embedding in applications of Wireless devices	Bardramet al. (2006)
mHealth provides ubiquitous and pervasive medical advices and services through mobile platform.	Akter et al. (2014)
mHealth refers to using mobile information technology (i.e. personal digital devices and mobile phone) to obtain required medical information and services.	UN foundation & Vodafone foundation (2014)
mHealth refers to emerging mobile communication and network technology that can provide services to medical industry.	Istepanian et al.(2006)

Akter and Ray (2010) summarize different definitions of mHealth and listed some key attributes regarding to mHealth, including affordability, availability, consciousness and acceptability. Varshney (2014) compares the different of mHealth services research between developed country and developing country, and the results show that the development of mHealth in developed and developing country still encounter many hinders, but with tremendous development space. Motamarri et.al. (2014) categorized different types of mHealth services in developing countries, including health education and consciousness improvement services, medical information system appointment services, diagnose and treatment assistant services, data collection and disease monitoring services, and emergency medical services.

2.2 mHealth Research Areas

mHealth research has been drawing incremental attention by researchers and healthcare practitioners (Miah et al. 2017). Research topics associated with mHealth services have extensive discussions, oriented along the areas of commentary on new technologies (Lupton 2012, 2015; Kay et al. 2011); technology adoption (Dehzad et al. 2014; Chib

et al. 2015; Hoque 2016); security issues (Martínez-Pérez et al. 2015; Sunyaev et al. 2014); technology interaction between patients and healthcare professionals (Free et al. 2013); and design, development, and testing of mHealth application (Cole-Lewis and Kershaw 2010; Evans et al. 2012). The current study mainly focuses on the mHealth adoption, which has scarcely been discussed in IT literature (Zhang et al. 2014).

According to Varshney (2014), the extant literature on mHealth can be divided into three dimensions: health informatics, biomedical informatics, and IS. Varshney (2014) categorized mHealth studies into different types based on the aspects of technology adoption; security issues; technology interaction among patients and healthcare professionals; IT designed to address healthcare challenges; and the design, development, and testing of mHealth application. In addition, Sadegh et al. (2018) confirmed evaluated dimensions and measures of mHealth services by developing frameworks regarding key stakeholders of mHealth. Akter et al. (2010b) developed a 3D measure of service quality from the perspective of mHealth adoption. Although abundant research topics have emerged that contribute to the development of mHealth, the precondition for realizing the promised benefits of a new technology is to use it (Venkatesh, Morris, Davis, and Davis 2003). As advanced technology has been rapidly infused into the healthcare industry, studies on the adoption behavior of health IT services are promising (Cocosila and Archer 2010). Table 2-1 shows the relevant research on mHealth adoption behaviors.

Table 2-2 Research on mHealth adoption behaviors

Research Topic	Research Object	Independent Variables	Dependent Variables	Theory	Sources
mHealth Computing	MHealth Adopter	Adaptability, Self-efficacy, Technique Support, Training, Perceived Usefulness, Perceived Ease of Use	Use Intention	TAM, Innovation Diffusion Theory	Wu, Wang, Lin (2007)
mHealth Services	Elderly	Perceived Usefulness, Perceived Ease of Use, Technology Anxiety, Resistance to Change	Adoption Intention	Two-factor Model for Technology Adoption	Guo et.al. (2013)
mHealth Services	Potential Users	Privacy Concern, Perceived Personalization, Trust, Competence, Integrity, Benevolence	Adoption Intention	Privacy-personalization Paradox	Guo et. al. (2016)
mHealth System	Users of mHealth Services	Management and Technology Support, Computer Self-efficacy, Compatibility	Use Intention	TAM, Innovation Diffusion Theory	Wu et.al. (2005)
MHealth Technology	Users of mHealth Services	System Quality, Service Quality,	Mobile Technology Use,	IS-successful Model	Chatterjee et. al. (2009)

		Content Quality	Mobile Technology User Satisfaction		
mHealth Services	Medical Professional	Perceived Usefulness, Perceived Ease of Use, Personal Information Technology Innovativeness, Perceived service availability Subjective Norm, Perceived Behavioral Control, Attitude	Use Intention	TAM, Theory of Planned Behavior	Wu et al. (2011)
mHealth Services	Potential Users	Service Matching, Health Consciousness, Information Source, Reliability	Routine Use Intention	Elaboration Likelihood Model	Meng et. al. (2016)
Medical Application	Pharmacist	Social Norms, Perceived Usefulness, Resistance to Change, Safety, Convenience, Results Provability	Behavioral Intention	TAM, Theory of Reasoned Action	Ng et.al. (2015)
mHealth Services	Users of mHealth	Attitude, Perceived Behavioral Control, Social Norm	Use Intention	Theory of Reasoned Action	Zhang et. al. (2014)
mHealth Information System	Users of mHealth	Consumer Trust, Credibility	Trust	Theory of Reasoned Action	Akter et.al. (2013)

Chapter 3

Study Ⅰ: Exploring Routine Use of Mobile Health Services: Promotion or Prevention

3.1 Introduction of Study Ⅰ

With the dramatic advancement of mobile technologies, the rapidly increasing mobile devices are infused into the healthcare industry. The introduction of mobile technologies results in more accessible and affordable healthcare, which has profoundly transformed healthcare delivery (Akter et al. 2010; Howell et al. 2005; Ivatury et al. 2009). Mobile health (mHealth) has been regarded as an effective approach to manage health as acknowledged by the UN World Health Organization (Consulting 2014). The burgeoning field of mHealth perfectly penetrates mobile technologies into the healthcare sector, aids in the reduction of healthcare costs, and extensively improves health condition (Kumar et al. 2013). Understanding the behavior of individual's acceptance of mHealth can pose significant influence of information technology (IT) research, which encouragingly benefits the healthcare industry (Standing and Standing 2008). By contrast, the value of IT services can be realized through routine use rather than first-time use (Bhattacherjee 2001). The daily use of health information technology (HIT) can enhance the effectiveness of healthcare and might perform a predominant role in the pursuit of the "meaningful use" of HIT (Ritu Agarwal et al. 2010). In the information system field, extant literature tends to focus heavily on instrumental beliefs; an example would be the perceived ease of use and perceived usefulness as prime drivers of use intentions of IT (Lu et al. 2005), which has limited the extension in the area of mHealth research. Knowledge with respect to other drivers of usage intentions of mHealth must be researched further.

The present study seeks to investigate the following research questions: 1) Which performance expectancies affect individuals' adoption intention of mHealth; 2) Are individuals influenced by the nurturing routine use intention of mHealth by promotion or prevention foci? Our study aims to explore an unfamiliar antecedent of healthcare behavior by introducing health performance expectancies (health promotion and disease prevention) to contribute to the knowledge of behavioral intentions. The moderating effects of regulatory focus, which has been rarely examined in previous studies, can provide insights into the healthcare information system studies.

To address these research questions, we draw upon theory of reasoned action that people would like to use new technologies when they expect positive outcomes by using such technologies (Compeau and Higgins 1995; Ajzen and Fishbein 1975). From the context of healthcare, reasoned action would inspire individuals to select one technology when they anticipate good health performance after using it. Previous broad discussions in psychological and IT studies have regarded "performance expectancy" as a driver to users' adoption behavior of IT (Venkatesh et al. 2003; D. Compeau et al. 1999; Yu 2012; Seethamraju et al. 2017). Based on hedonic principle (Higgins 1997), people consistently tend to pursue positive outcomes (health promotion) and attempt to avoid negative outcomes (disease prevention). Consequently, the current study attempts to probe the influence of performance expectancies on the routine use intention of mHealth services from two perspectives, namely, health promotion and disease prevention. Moreover, psychology research has demonstrated that people constantly have different regulatory foci, which are prone to appear in different levels of sensitivity to the same stimuli (Higgins 1998). Regulatory focus theory proposes that these two different regulatory foci can be classified as promotion and prevention foci. Hence, we integrate promotion and prevention foci into our research model to examine the

moderation effects on the relationship between health performance expectancies and routine ues intention.

This study makes several key research contributions. First, it adds health performance expectancy to the existing HIT literature. Extant research has rarely examined this concept as the major factors that determine individuals' use intention of IT. Second, it addresses IT routine use intention instead of IT use intention. This attempt can potentially enhance our understanding of people's use behavior in IT research. Third, this study uses regulatory focus as its overarching theoretical foundation and introduces promotion and prevention foci to exert moderating effects on the relationship between individuals' performance expectancy and routine use intention, which promotes the development of motivational mechanisms in HIT research.

The next section expounds prior studies related to mHealth, performance expectancies, and regulatory focus theory. Then, we develop our research hypotheses and establish research model regarding the effects of health performance expectancies on mHealth routine use intention and the moderating role of regulatory focus, followed by an overview of the proposed methodology and data analysis results. A conclusion of our results and implications for research and practice are also illustrated.

3.2 Theoretical Background

3.2.2 Routine Use Intention

Users actually utilizing new technologies is the precondition of realizing their promised benefits (Venkatesh et al. 2003). Extensive studies have been conducted to testify the importance of adopting IT in an organizational context or in an individual level (Liang et al. 2013; D. Compeau et al. 1999; Yu 2012). However, acceptance of technologies only reveals the commitment to information system use; nonetheless, routine use of

such technologies can reflect the integration of technology into people's daily work processes, which implies that the routine use of technology has a strong effect on people's performance (Saga and Zmud 1993). In an organizational set, routine use can be defined as the standardized and routinized use of information systems by accepters to support their daily work (Li et al. 2013). In HIT context, routine use refers to recipients integrating HIT into their regular life to promote the enhancement of health management.

Bhattacherjee (2001) asserted that successful application of new information communication technology depends on continuous use rather than first-time use. In other words, the extent of the effectiveness of a technology can only be measured when stakeholders integrate such technology into their daily lives. Ritu Agarwal et al. (2010) posited that routine use of HIT assists in achieving "meaningful use" of the technology, which in turn contributes to performance improvement. Incorporating routine use intention into the mHealth service context, interest is now focused on probing the mechanisms that psychological characteristics affect service recipients' routine use intention.

3.2.3 Performance Expectancy

Performance expectancy is defined as the extent to which one believes that utilizing technologies or systems can lead to positive outcomes (Venkatesh et al. 2003). This conception has found many uses in different technology acceptance contexts. Compeau et al. (1999) asserted that performance expectations are highly related to satisfactory job performance when using computer technology. In addition, driven from outcome expectancy, performance expectancy can play a dominant role in influencing individuals' use intention of mobile technology (Yu 2012). In theory of reasoned action,

people would choose to use new technologies in the case of their possible expectation on the positive outcomes of such use (Compeau and Higgins 1995; Ajzen and Fishbein 1975).

The effect of performance expectancy on health behavior or technology use behavior has been supported in powerful human behavior theories and technology acceptance theories. In social cognitive theory (SCT) (Bandura 1989), performance expectancy has reciprocal interactions with self-efficacy and is viewed as an antecedent to technology use. D. Compeau et al. (1999) further extended the SCT and applied it to the context of computer adoption in organizations. They stated that performance-related outcome expectations refer to the perceived job performance associated with utilizing computer technology. Five different constructs adopted in unified theory of acceptance and use of technology to depict performance expectations are perceived usefulness, extrinsic motivation, job fit, relative advantage, and outcome expectations (Davis et al. 1992; Thompson et al. 1991; Davis et al. 1989; Porter 1963). Venkatesh et al. (2003) stated that all of the performance-expectancy-centered constructs have the strongest prediction power of use intention of technology. In the health care area, health expectancies can also encourage individuals to enact health behavior or use health-related technologies, which in turn lead stakeholders toward better well-being. Furthermore, expectancy theory provides a basic paradigm of individuals' attitudes and behavior stimulated by the cognitively oriented assumptions (Lawler and Suttle 1973). Expectancy theory has been regarded as a theoretical foundation that assists researchers in exploring users' adoption behavior of new information system (De Sanctis 1983; Robey 1979). Moreover, performance expectancy is one of the factors that has been depicted in expectancy theory (Fudge and Schlacter 1999). The present study therefore

examines performance expectancy of mHealth services from two perspectives, namely, health promotion expectancy and disease prevention expectancy.

People who lack awareness of their health have few incentives to engage in health behavior. By contrast, the predictors of intention to engage in a health behavior amount to various outcome expectancies (Bandura 1998). In this regard, physical performance expectancy tends to be the important determinant that triggers the use intention of mHealth services. Therefore, aiming to gain a comprehensive understanding of the mHealth adoption behavior inspires the present study to adapt health promotion expectancy and disease prevention expectancy.

3.2.4 Regulatory Focus Theory

Based on the hedonic principle, people are specified to have constant intentions to pursue happiness originating from positive outcomes; by contrast, they avoid pain originating from negative outcomes (Higgins 1997). The hedonic principle can be regarded as the radical assumption applied in long-standing motivational studies (Higgins 2006) and has been utilized to explain the avoidance behavior of IT threat (Liang and Xue 2009). Regulatory focus theory has extended the hedonic principle by explaining the motivation behavior that satisfies two fundamentally different survival needs, namely, nurturance and security (Higgins 1998, 1997). This theory leads to two types of regulatory foci, namely, promotion and prevention foci (Liang et al. 2013).

Promotion focus is constantly motivated by the desire for growth and development. Conversely, prevention focus is motivated by the need for safety (Johnson and Yang 2010). In an endeavor to achieve “ideal self,” promotion-focused population requires fulfilling their accomplishments, aspirations, and hopes. They also tend to notice positive outcomes, including gain, success, and reward. By contrast, to become “ought

self," prevention-focused population must assume duties, obligations, and responsibilities. This group of people constantly focuses on the negative outcomes, including punishment, failure, and loss (Higgins 1998).

The previous literature has demonstrated that perceptions, emotions, engagement, and behavior can be affected by the regulatory focus to different contexts (Brockner and Higgins 2001). Despite its role as an important approach to explore users' IT behavior, the application of regulatory focus theory has seldom emerged in information system studies (Liang et al. 2013). Therefore, regulatory focus theory is employed to conduct an empirical investigation on the moderator functions of different regulatory foci affecting mHealth adoption intention.

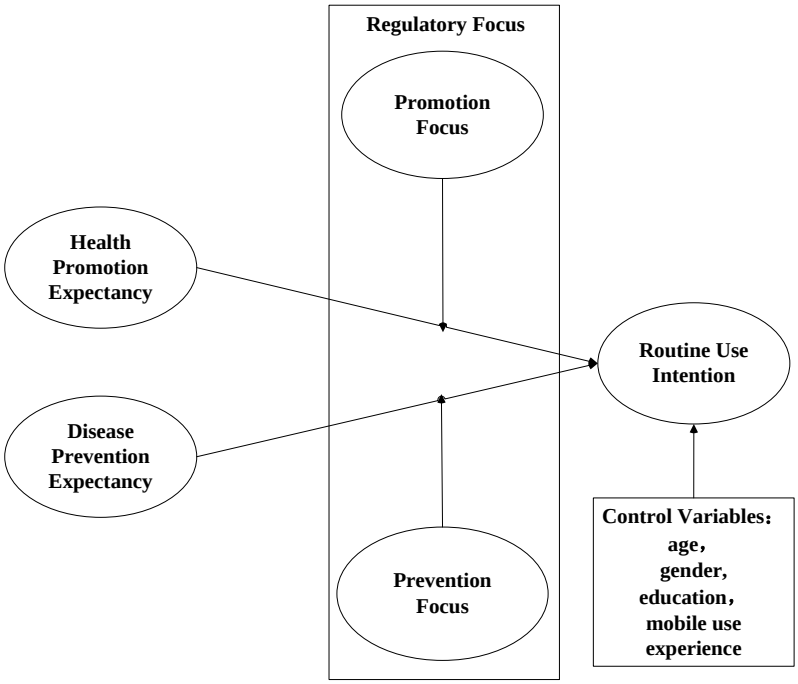
3.3 Research Model and Hypotheses

Figure 3-1 shows our research model. Based on SCT and regulatory focus theory, we hypothesize that health promotion expectancy promotes mHealth routine use intention. Moreover, promotion focus strengthens the relationship between health promotion and mHealth routine use intention. Similarly, disease prevention promotes mHealth routine use intention; prevention focus strengthens the relationship between disease prevention and mHealth routine use intention. In addition, to avert the influences of demographic characteristics on mHealth routine use intention, I included age, gender, education, and mobile use experience as control variables. Table 3-1 displays the adopted constructs and their operational definitions.

Health promotion and disease prevention are commonly encountered and discussed in the healthcare research area (Breslow 1999). Based on SCT and theory of reasoned action, physical performance expectancy can be the predictors of health behavior (Bandura 1998). The present study categorizes the adoption of HIT into health behavior.

Accordingly, when individuals perceive that anticipated performance will result from

Figure 3-1. Research Model



the technology use, they may partake in routine use to enhance their health conditions. Given that many researchers have awareness of the positive functionality of mobile technology in the aspects of health promotion and illness prevention (Lupton 2012), the expectancy of health promotion and disease prevention might empower individuals to participate in routine health-promoting behavior (adoption of mHealth).

Promotion is a motivational expression that interprets people's desire to pursue positive outcomes (Lockwood et al. 2002). Health promotion is defined as "it seeks the development of community and individual measures which can help people to develop lifestyle that maintain and enhance the state of well-being" (Official US Public Health Services Document 1979). We define health promotion expectancy as the expectation that using mHealth services can promote one's health condition. Individuals are prone to discover the consequences caused by performing certain behaviors, and their future

behaviors will be guided if repeated behaviors can lead to positive outcomes (Komaki 2003; Skinner 1953). If the imaginary incentives—using mHealth can promote the state of well-being—can guide individuals' own behavior, then they tend to have the intention to use it on a daily basis. Therefore, we propose the following:

Hypothesis 1: Health promotion expectancy positively influences mHealth routine use intention.

Prevention is a motivational expression that explains individuals' avoidance behavior on negative outcomes (Lockwood et al. 2002). Disease prevention focuses on preventive perspective to reduce the risk of developing the underlying disease (Breslow 1999). Meanwhile, disease prevention expectancy is defined as the expectation that one's disease can be prevented effectively using mHealth services. Individuals refer to the behaviors that can cause negative consequences and are prone to perform their future behavior to avoid them (Komaki 2003; Skinner 1953). In the mHealth adoption context, if people believe that using mHealth services can help them to be more aware of how to prevent them from contracting certain disease, then they might develop the intention to use the service. Given the above statements, we propose the following:

Hypothesis 2: Disease prevention expectancy positively influences mHealth routine use intention.

Based on regulatory focus theory, individuals have different strategic propensities to conduct behavior that moves toward their goals. Such regulatory focuses can affect the motivational significance of difference stimuli (Higgins 1998, 1997). In the context of HIT use, we propose that individuals' regulatory focus can moderate the relationships between the performance expectancy and routine use intention of mHealth services, given that individuals can perceive their desired goals to fit their regulatory focus. This framing can be explained by regulatory fit proposed by Higgins (2000). Regulatory fit

occurs when individuals use goal pursuit means that fit their regulatory focus (Higgins 2000). People with promotion foci constantly focus on the positive outcomes, such as success, happiness, and promotion. Promotion-centered incentive will be more influential on a person with promotion focus (Liang et al. 2013). Promotion focus is stimulated by the requirement of growth and development (Johnson and Yang 2010). Individuals with promotion focus are eager to attain achievement and success of their pursued goals (Higgins et al. 2001). Thus, we hypothesize the following:

Hypothesis 3: Promotion focus positively moderates the relationship between health promotion expectancy and mHealth routine use intention.

Prevention focus frames the attention of loss. Prevention-focused individuals are motivated to avoid pain, loss, and other negative outcomes (Higgins 1998). Moreover, disease susceptibility indicates the negative physical outcome expectancy (Becker 1974). Shah et al. (1998) argued that individuals with prevention focus are inclined to be influenced by prevention-framed incentives. In the healthcare area, disease prevention can be described as prevention situations in which individuals perceive avoiding disease as the desired goal, which fits the prevention focus tendency. Under this framing, we predict that prevention focus will strengthen the relationship between disease prevention expectancy and mHealth routine use intention. Therefore, we propose the following:

Hypothesis 4: Prevention focus positively moderates the relationship between disease prevention expectancy and mHealth routine use intention.

Table 3-1. Research Constructs

Construct	Operational definition	Source
Routine use intention (RUI)	An individual's intention to use mobile health services as a routine and in a standardized manner in their daily life.	(Sundaram et al. 2007)
Health promotion expectancy (HPE)	Expectancy seeks the development of individual measures which can help people to develop lifestyles that can maintain and enhance the state of well-being.	(Compeau and Higgins 1995)
Disease prevention expectancy (DPE)	Expectancy that bad health condition can be prevented. The negative physical outcomes expectancy.	(Gulmans et al. 2011a)
Promotion focus (PMF)	It is driven by the need for growth and development.	(Johnson et al, 2010)
Prevention focus (PVF)	It is driven by the need for safety.	

3.4 Methodology

3.4.1 Measurement Development

We developed the measures of the constructs based on the previous studies to promote content validity. Multiple items were adopted to evaluate the theoretical constructs. We reworded each construct to accommodate the context of mHealth adoption. Measures for routine use intention, health promotion expectancy, disease prevention expectancy, and promotion and prevention foci were adapted from Sundaram et al. (2007), Compeau and Higgins (1995), Gulmans et al. (2011a), and Lockwood et al. (2002),

respectively (See Appendix B). We conducted a pretest before assigning the questionnaires to participants. We received feedback from two IT professors and 20 doctoral students. We made minor changes to some items to enhance coherence. We evaluated all the measurement items using a seven-point Likert scale (1 = “strongly disagree” and 7 = “strongly agree”).

3.4.2 Data Collection

We conducted a survey to collect quantitative data in an “intelligent” community delivering mHealth services to residents in Shanghai, China. We invited 180 participants across different age groups in the community to fill out the questionnaires. Each participant was given 20 RMB cash as a reward for their participation. From the 180 distributed questionnaires, 154 questionnaires were acceptable. Before participants filled out the questionnaires, we distributed leaflets to each of them to establish the definition, functions, and benefits of mHealth services (See Appendix A). The questionnaire consisted of two main parts. The first part required the respondents to answer questions regarding their demographic information. The second part asked questions related to their perceptions and opinions of mHealth services. All of the measures of constructs were developed from extant literature and evaluated using a seven- point Likert scale.

Among the 154 applicable respondents, the majority of them (61.04%) were female. More than half of them (51.30%) were older than 30 years old. Most of them (65.58%) had no university education. The median of years of mobile phone usage were 6 to 8 years. The detailed demographic information is shown in Table 3-2.

Table 3-2. Demographic Profile of the Respondents

Characteristic	**Statistic**	
	N	**%**
Gender		
Male	60	38.96
Female	94	61.04
Age		
Less than 30 years old	75	48.70
More than 30 years old	79	51.30
Level of education		
Primary school	2	1.30
Secondary school	55	35.71
Pre-university	44	28.57
University	36	23.38
Postgraduate	17	11.04
Years of mobile phones usage		
Less than 2 years	9	5.84
2~4 years	11	7.14
4~6 years	21	13.64
6~8 years	36	23.38
8~10 years	32	20.78
More than 10 years	45	29.22

3.5 Analysis and Results

Structural equation modeling was utilized to analyze the proposed research model because of its appropriate and comprehensive method in hypotheses testing in terms of verifying the relationship between observed and latent constructs (Hoyle 1995). We selected SmartPLS 2.0 software as our main statistic tool for data analysis. First, we examined the measurement model to test the reliability, validity, and multicollinearity of the variables. Next, we assessed the structural model and tested the proposed hypotheses.

3.5.1 Common Method Bias

The possibility of common method bias might occur due to the use of self-reported data (Podsakoff and Organ 1986). To reduce common method bias, we conducted Harman's one-factor test (Podsakoff et al. 2003) to examine the five latent variables in our theoretical model. Results have shown that five factors are present, and the covariance explained by largest factor accounts for 29.16%. Therefore, common method bias is not a concern in the present study.

3.5.2 Measurement Model

Reliability, convergent, and discriminant validity of the measurement model indicate its goodness. The values of composite reliability and Cronbach's alpha were all higher than the recommended value of 0.707 (Nunnally 1967), indicating good reliability (Table 3-3). In addition, the values of AVE were all above the threshold value of 0.50 (Fornell and Larcker 1981); thus, the result supports convergent validity. Discriminant validity was assessed by evaluating the item loadings of expected constructs higher than the cross loadings on any other constructs(Table 3-4), and the square root of the AVE value of each indicator was greater than any other constructs (Fornell and Larcker 1981). The results show that discriminant validity was also supported.

Table 3-3. Correlations and Discriminant Validity

	CR	Cronbach's Alpha	AVE	RUI	DPE	HPE	PMF	PVF
RUI	0.932	0.891	0.821	**0.906**				
DPE	0.897	0.841	0.744	0.262	**0.863**			
HPE	0.877	0.813	0.641	0.458	0.387	**0.801**		
PMF	0.907	0.866	0.710	0.236	0.130	0.161	**0.843**	

PVF	0.853	0.896	0.749	-0.043	0.132	0.163	0.354	**0.865**
Note: RUI=Routine Use Intention, DPE=Disease prevention expectancy, HPE= Health promotion expectancy, PMF=Promotion focus, PVF=Prevention focus, Square roots of AVE are shown in bold on diagonal.								

Table 3-4. Cross Loadings of Constructs

	RUI	DPE	HPE	PMF	PVF
RUI1	**0.896**	0.227	0.429	0.197	-0.075
RUI2	**0.929**	0.281	0.436	0.227	-0.018
RUI3	**0.893**	0.200	0.376	0.218	-0.023
DPE1	0.093	**0.786**	0.318	-0.031	0.069
DPE2	0.246	**0.898**	0.317	0.150	0.104
DPE3	0.266	**0.900**	0.372	0.132	0.146
HPE1	0.414	0.342	**0.865**	0.155	0.180
HPE2	0.291	0.282	**0.735**	0.015	0.150
HPE3	0.344	0.277	**0.792**	0.190	0.217
HPE4	0.400	0.331	**0.804**	0.136	-0.006
PMF1	0.235	0.178	0.159	**0.858**	0.265
PMF2	0.196	0.119	0.112	**0.871**	0.268
PMF3	0.127	0.113	0.026	**0.816**	0.350
PMF4	0.206	0.020	0.202	**0.824**	0.334
PVF1	0.07	0.178	0.111	0.440	**0.719**
PVF2	-0.035	0.148	0.160	0.388	**0.990**

3.5.3 Structural Model

We used SmartPLS statistic tool to evaluate the significance of path coefficients (β) and moderating effects. All the results are presented in Figure 3-2 and Table 3-5.

Figure 3-2. PLS Results of Model Testing

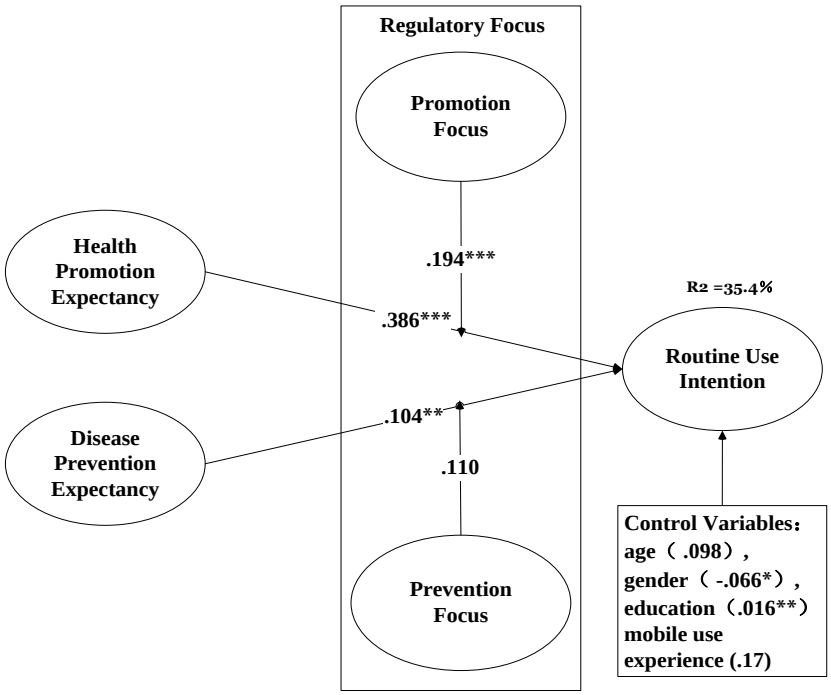


Table 3-5. The Structural Equation Model Results

	Path	β	T	Sig.
Control variables	GEN->RUI	0.098	0.437	NS
	EDU->RUI	-0.066	1.886	*
	AGE->RUI	0.016	2.484	**
Main effects	HPE -> RUI	0.386	7.714	***
	DPE -> RUI	0.104	2.083	**
Moderating effects	HPE*PMF-> RUI	0.194	3.472	***
	DPE*PVF -> RUI	0.110	0.856	NS
Note1: when |t value| > 2.610, P < 0.01; when |t value| > 1.977, P < 0.05, when |t value| > 1.656, P < 0.1. Note2: ***p < 0.01, **p < 0.05; *p < 0.1; NS: not significant.				

The main results show that the proposed model has a strong explanatory power, yielding a total explained variance of 35.4% (R2 = 0.354). Health promotion expectancy (β = 0.386, T = 7.714) acts as one of the most significant predictors in the present study (Table 6). Together with disease prevention expectancy (β = 0.104, T = 2.083), it positively affects routine use intention; thus, H1 and H2 are supported.

For the testing results of the moderating effect, promotion focus (β = 0.194, T = 3.472) has a strong positive moderating effect on the relationship between health promotion expectancy and routine use intention, thereby supporting H3. Hypothesis 4 posited that prevention focus (β = 0.110, T = 0.856) positively moderates the relationship between disease prevention expectancy and mHealth routine use intention. Therefore, Hypothesis 4 is not supported. Summarized results for hypothesis testing are shown in Table 3-6.

Table 3-6. Hypothesis Testing Results

Hypothesis Description	Result
Hypothesis 1 (H1): Health promotion expectancy positively influences mHealth routine use intention.	Support
Hypothesis 2 (H2): Disease prevention expectancy positively influences mHealth routine use intention.	Support
Hypothesis 3 (H3): Promotion focus positively moderates the relationship between health promotion expectancy and mHealth routine use intention.	Support
Hypothesis 4 (H4): Prevention focus positively moderates the relationship between disease prevention expectancy and mHealth routine use intention.	Not Support

3.6 Discussion and Implications

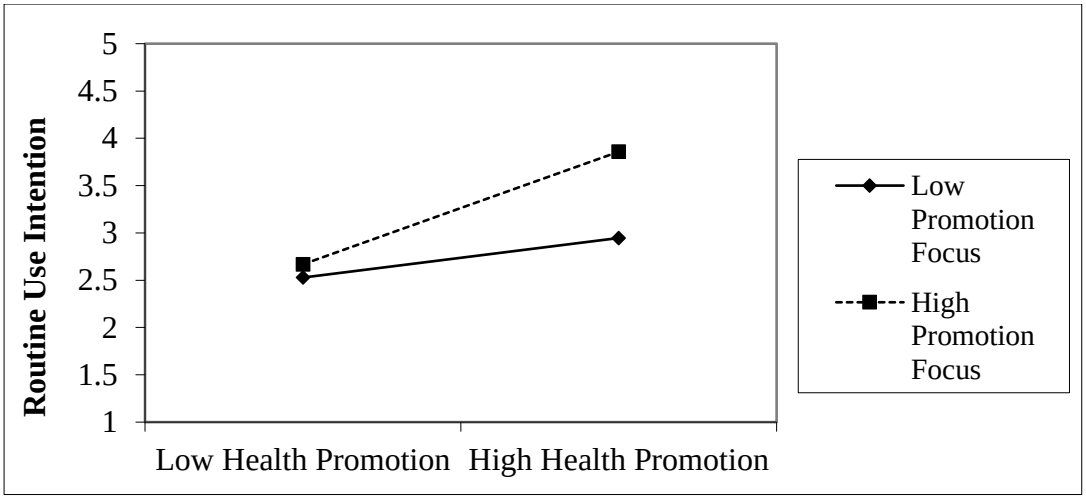
3.6.1 Key Findings

Three main findings are determined in the present study. First, the results have empirically verified that performance expectancies, health promotion expectancy, and disease prevention expectancy are key elements contributing to individuals' attitude change toward routinized use intention of mHealth services. This finding is consistent with the basic tenets of expectancy theory (Fudge and Schlacter 1999), which indicates

that individuals' cognitive assumptions or expectations influence their attitude and behaviors toward pursuing a goal. Our results also show that health promotion expectancy has a significantly stronger effect on routine use intention than disease prevention expectancy, which suggests that the influences of health promotion and disease prevention differ based on the types of behavior they intend to choose. A plausible explanation of this finding is that individuals tend to choose HIT that can positively promote their health conditions.

The second finding agrees with our hypothesis, that is, promotion focus strengthens the relationship between health promotion expectancy and mHealth routine use intention. Figure 3-3 shows the moderating effect of promotion focus in H3. Individuals' regulatory focus can moderate the relationship between performance expectancy and routine use intention of mHealth services, given that individuals can perceive their desired goals to fit their regulatory focus. This framing can be explained by regulatory fit, which occurs when individuals use goal pursuit means that fit their regulatory focus (Higgins 2000). Based on regulatory focus theory, individuals with a promotion focus involve sensitivity to approach positive outcomes and they are frequently eager to pursue gains, advancement, and success. (Higgins 1997; Higgins et al. 2001). Health promotion expectancy frames a promotion situation where the desired end states can be obtained, which is compatible with the inclination with promotion focus. Therefore, with the increase of promotion focus, health promotion expectancy tends to be motivating and to cause a strong effect on routine use behavior.

Figure 3-3. The Moderating Effect of Promotion Focus on the Relationship Between Health Promotion and Routine Use Intention



The third finding is incompatible with our hypothesis, that is, prevention focus has no effect on the relationship between disease prevention and routine use intention. The possible explanation regarding this result is that regulatory fit can increase the intensity of the value experience of a goal; thus, repulsiveness of goals will increase in intensity (Cesario et al. 2004; Higgins 2006). R Agarwal et al. (2011) indicated that health conditions and well-being can be endangered if individuals use inappropriate healthcare services. Prevention-focused individuals consistently tend to be skeptical, prudent, and self-cautious. Therefore, although prevention-focused individuals might perceive the benefits of mHealth services in terms of disease prevention, they are not easily convinced to accept it.

3.6.2 Theoretical Implications

The present study provides three contributions to the information system and healthcare research. First, performance expectancy is adapted to the context of HIT research. We propose that health promotion and disease prevention expectancies can effectively influence individuals' attitude change toward mHealth services. Extant literature has rarely examined performance expectancies as the dominant factors that trigger individuals' use intention of IT.

Second, this research addresses IT routine use intention rather than IT use intention. Abundant studies have investigated IT use intention; however, few studies have explored routine use intention of IT. The present work explores individuals' routine use intention of mHealth services, which enhances our understanding of people's routine use behavior in IT research.

Third, this study uses regulatory focus as its overarching theoretical foundation and introduces the conceptions of promotion and prevention foci, which have moderating effects on the relationship between individuals' performance expectancy and routine use intention. Promotion-focused individuals are motivated by health promotion expectancy to conduct certain health behavior. In addition, the notion of regulatory focus has rarely been explored in IT research, especially in the HIT context. Our findings illustrate the moderating role of promotion focus, which contributes to the development of motivational mechanisms in HIT research.

3.6.3 Practical Implications

The current study has two implications to practice. First, compared with disease prevention, health promotion is more influential on mHealth service acceptance. Therefore, health service providers should deliver personalized services, such that they design and develop their products with the aim to help individuals develop a healthy lifestyle that promotes and enhances the state of well-being. Second, given the different regulatory foci of people, promotional-focused potential service adopters are sensitive to success, improvement, and some other positive outcomes. Healthcare product producers should notice their customers' eagerness in making progress and aspirations to achieve their goals. Therefore, for promotion-focused customers, their customized healthcare products should also be promotion-oriented.

3.6.4 Limitations and Future Research

This study has several limitations. First, data collection was only conducted in China and may limit the generalizability of our findings. Thus, the applicability of this study in other countries should be examined. Second, despite our random recruitment of participants to reduce selection bias, the limited sample size is a limitation of this study. Third, the definition of mHealth services is discussed unilaterally in this study. We only explored the customization and interaction of mHealth services. Akter et al. (2013) described the attributes of mHealth services to include mobility, ubiquity, accessibility, and immediacy. Our future research aims to develop a suitable model to examine the actual use behavior of mHealth services.

3.7 Summary of Study 1

The present study examines the effects of performance expectancy, health promotion, and disease prevention on individuals' routine use intention of mHealth services by integrating expectancy and regulatory focus theories. Data were collected from 154 participants, demonstrating that health promotion and disease prevention expectancies have an effective influence on routine use intention. However, health promotion expectancy has a considerably stronger effect than disease prevention expectancy. In addition, health promotion expectancy has a significant effect on routine use intention of mHealth services only for those individuals with a high level of promotion focus. Furthermore, contrary to our research hypothesis, prevention focus exerts no effect on the relationship between disease prevention and routine use intention. The findings of this study can enrich the relevant theories and expand the research areas in mHealth adoption and diffusion.

Appendix A The Leaflet of Introduction to mHealth Services

mHealth Introduction

Mobile Health (mHealth) can be depicted as portable and wireless communication equipment such as mobile phones, tablet, wearable devices. By virtue of the ubiquitous traits, mHealth devices have the potential to render them an increasingly indispensable health management instruments around the world.

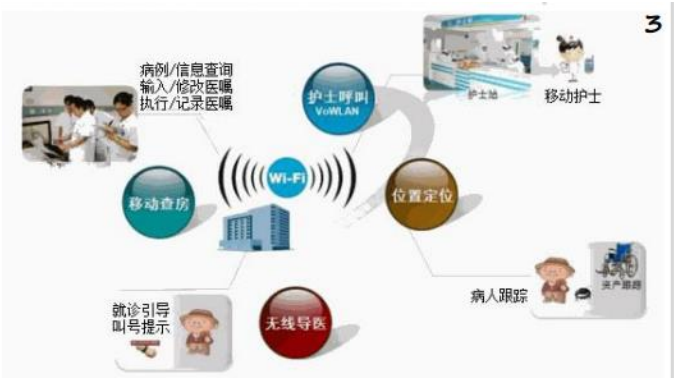
What mHealth can bring to us?

- ✧ Health promotion
  mHealth can help you to better understand your health condition, and formulate personal diet and exercise plan for you, etc.
- ✧ Health prevention
  mHealth can monitor health indicators, such as blood pressure, blood glucose, and also provide intelligence analysis to you.
- ✧ Process simplification
  mHealth can help you to consult physicians online at anytime anywhere, also can register online.

What can mHealth do?

1

2



3

1. Health monitor & remote diagnosis :
   - ✧ *Individual Self-monitor.*
   - ✧ *Physicians can conduct remote diagnosis through analyzing data gathered by mHealth.*
2. Health information search and consult :
   - ✧ *Communicate with physicians*
   - ✧ *Search health information through health app*
3. Medical treatment assistant :
   - ✧ *Search physicians' information*
   - ✧ *Appointment register*

Appendix B Measurement Items of Study I

Routine Use Intention: (Sundaram et al,2007)

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

RUI2: 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

Health promotion expectancy: (Compeau and Higgins, 1995)

HPE1: If I use mHealth services, I will increase my effectiveness on promoting my health.

HPE2: If I use mHealth services, I will spend less time on routine health services.

HPE3: If I use mHealth services, I will increase the quantity of output for the same amount of effort in promoting my health.

HPE4: If I use mHealth services, I will increase the quality of output of promoting my health.

Disease prevention expectancy: (Gulmans et al. 2011b; Gulmans et al. 2011a)

DPE1: I expect that I will be able to prevent disease more easily through use of mHealth services.

DPE2: I expect that I will be able to reserve time for preventing disease in my daily life through use of mHealth services.

DPE3: I expect that as a result of using mHealth services more consistent and useful disease prevention information can be given to us.

Promotion focus: (Lockwood et al. 2002)

PMF1：In general, I am focused on achieving positive outcomes in my life

PMF2： I typically focus on the successes I hope to achieve in the future

PMF3：I often think about how I will achieve my work goals

PMF4：Overall, I am more orientated towards achieving success than preventing failure

Prevention focus: (Lockwood et al. 2002)

PVF1：I often worry that I will fail to accomplish my work goals

PVF2：I am anxious that I will fall short of my responsibilities and obligations

References

Agarwal, R., Gao, G., DesRoches, C., and Jha, A.K. 2010. "Research Commentary—the Digital Transformation of Healthcare: Current Status and the Road Ahead," Information Systems Research (21:4), pp. 796-809.

Ajzen, I., and Fishbein, M. 1975. "Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research." Reading, MA: Addison-Wesley.

Akter, S., D'Ambra, J., and Ray, P. 2010. "User Perceived Service Quality of M-Health Services in Developing Countries," 18th European Conference on Information Systems, pp. 1-12.

Akter, S., D'Ambra, J., and Ray, P. 2013. "Development and Validation of an Instrument to Measure User Perceived Service Quality of Mhealth," Information & Management (50:4), pp. 181-195.

Alagöz, F., Valdez, A.C., Wilkowska, W., Ziefle, M., Dorner, S., and Holzinger, A. 2010. "From Cloud Computing to Mobile Internet, from User Focus to Culture and Hedonism: The Crucible of Mobile Health Care and Wellness Applications," Pervasive Computing and Applications (ICPCA), 2010 5th International Conference on: IEEE, pp. 38-45.

Bandura, A. 1989. "Human Agency in Social Cognitive Theory," American Psychologist (44:9), p. 1175.

Bandura, A. 1998. "Health Promotion from the Perspective of Social Cognitive Theory," Psychology and Health (13:4), pp. 623-649.

Becker, M.H. 1974. The Health Belief Model and Personal Health Behavior. Slack.

Bhattacherjee, A. 2001. "Understanding Information Systems Continuance: An Expectation-Confirmation Model," MIS Quarterly, pp. 351-370.

Breslow, L. 1999. "From Disease Prevention to Health Promotion," Jama (281:11), pp. 1030-1033.

Brockner, J., and Higgins, E.T. 2001. "Regulatory Focus Theory: Implications for the Study of Emotions at Work," Organizational Behavior and Human Decision Processes (86:1), pp. 35-66.

Compeau, D., Higgins, C.A., and Huff, S. 1999. "Social Cognitive Theory and Individual Reactions to Computing Technology: A Longitudinal Study," MIS Quarterly, pp. 145-158.

Compeau, D.R., and Higgins, C.A. 1995. "Computer Self-Efficacy: Development of a Measure and Initial Test," MIS Quarterly, pp. 189-211.

Consulting, V. 2014. "Mhealth for Development: The Opportunity of Mobile Technology for Healthcare in the Developing World. Washington, Dc and Berkshire, Uk: Un Foundation-Vodafone Foundation Partnership. "

Davis, F.D., Bagozzi, R.P., and Warshaw, P.R. 1989. "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models," Management Science (35:8), pp. 982-1003.

Davis, F.D., Bagozzi, R.P., and Warshaw, P.R. 1992. "Extrinsic and Intrinsic Motivation to Use Computers in the Workplace," Journal of Applied Social Psychology (22:14), pp. 1111-1132.

De Sanctis, G. 1983. "Expectancy Theory as an Explanation of Voluntary Use of a Decision-Support System," Psychological Reports (52:1), pp. 247-260.

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

Fudge, R.S., and Schlacter, J.L. 1999. "Motivating Employees to Act Ethically: An Expectancy Theory Approach," Journal of Business Ethics (18:3), pp. 295-304.

Gulmans, J., Vollenbroek-Hutten, M.M., van Gemert-Pijnen, L.J., and van Harten, W.H. 2011a. "Determinants of Use and Non-Use of a Web-Based Communication System in Cerebral Palsy Care: Evaluating the Association between Professionals' System Use and Their a Priori Expectancies and Background," BMC Medical Informatics and Decision Making (11:1), p. 43.

Gulmans, J., Vollenbroek-Hutten, M.M.R., van Gemert-Pijnen, L.J.E.W.C., and van Harten, W.H. 2011b. "Determinants of Use and Non-Use of a Web-Based Communication System in Cerebral Palsy Care: Evaluating the Association between Professionals' System Use and Their a Priori Expectancies and Background," BMC Medical Informatics & Decision Making (11:1), pp. 43-50.

Higgins, E.T. 1997. "Beyond Pleasure and Pain," American Psychologist (52:12), p. 1280.

Higgins, E.T. 1998. "Promotion and Prevention: Regulatory Focus as a Motivational Principle," Advances in Experimental Social Psychology (30), pp. 1-46.

Higgins, E.T. 2000. "Making a Good Decision: Value from Fit," American Psychologist (55:11), p. 1217.

Higgins, E.T. 2006. "Value from Hedonic Experience and Engagement," Psychological Review (113:3), p. 439.

Higgins, E.T., Friedman, R.S., Harlow, R.E., Idson, L.C., Ayduk, O.N., and Taylor, A. 2001. "Achievement Orientations from Subjective Histories of Success: Promotion Pride Versus Prevention Pride," European Journal of Social Psychology (31:1), pp. 3-23.

Howell, J.M., Shea, C.M., and Higgins, C.A. 2005. "Champions of Product Innovations: Defining, Developing, and Validating a Measure of Champion Behavior," Journal of Business Venturing (20:5), pp. 641-661.

Ivatury, G., Moore, J., and Bloch, A. 2009. "A Doctor in Your Pocket: Health Hotlines in Developing Countries," Innovations (4:1), pp. 119-153.

Johnson, R.E., and Yang, L.-Q. 2010. "Commitment and Motivation at Work: The Relevance of Employee Identity and Regulatory Focus," Academy of Management Review (35:2), pp. 226-245.

Jun, J., Jacobson, S.H., and Swisher, J.R. 1999. "Application of Discrete-Event Simulation in Health Care Clinics: A Survey," Journal of the Operational Research Society), pp. 109-123.

Komaki, J. 2003. "Reinforcement Theory at Work: Enhancing and Explaining What Employees Do," Motivation and Work Behavior), pp. 95-113.

Kumar, S., Nilsen, W.J., Abernethy, A., Atienza, A., Patrick, K., Pavel, M., Riley, W.T., Shar, A., Spring, B., and Spruijt-Metz, D. 2013. "Mobile Health Technology Evaluation: The Mhealth Evidence Workshop," American Journal of Preventive Medicine (45:2), pp. 228-236.

Lawler, E.E., and Suttle, J.L. 1973. "Expectancy Theory and Job Behavior," Organizational Behavior and Human Performance (9:3), pp. 482-503.

Li, X., Hsieh, J.P.-A., and 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), pp. 659-682.

Liang, H., and Xue, Y. 2009. "Avoidance of Information Technology Threats: A Theoretical Perspective," MIS Quarterly), pp. 71-90.

Liang, H., Xue, Y., and Wu, L. 2013. "Ensuring Employees' It Compliance: Carrot or Stick?," Information Systems Research (24:2), pp. 279-294.

Liu, X., Guo, X., Wu, H., and Wu, T. 2016. "The Impact of Individual and Organizational Reputation on Physicians' Appointments Online," International Journal of Electronic Commerce (20:4), pp. 551-577.

Lockwood, P., Jordan, C.H., and Kunda, Z. 2002. "Motivation by Positive or Negative Role Models: Regulatory Focus Determines Who Will Best Inspire Us," Journal of Personality and Social Psychology (83:4), p. 854.

Lu, J., Yao, J.E., and Yu, C.-S. 2005. "Personal Innovativeness, Social Influences and Adoption of Wireless Internet Services Via Mobile Technology," The Journal of Strategic Information Systems (14:3), pp. 245-268.

Lupton, D. 2012. "M-Health and Health Promotion: The Digital Cyborg and Surveillance Society," Social Theory & Health (10:3), pp. 229-244.

Lupton, D. 2015. "Health Promotion in the Digital Era: A Critical Commentary," Health promotion international (30:1), pp. 174-183.

Organization, W.H. 2014. "Mhealth: New Horizons for Health through Mobile Technologies: Second Global Survey on Ehealth. 2011," Geneva: WHO Google Scholar).

Porter, L. 1963. "Job Attitudes in Management: Perceived Importance of Needs as a Function of Size of Company," Journal of Applied Psychology (47), pp. 386-397.

Robey, D. 1979. "User Attitudes and Management Information System Use," Academy of Management Journal (22:3), pp. 527-538.

Saga, V.L., and Zmud, R.W. 1993. "The Nature and Determinants of It Acceptance, Routinization, and Infusion," Proceedings of the IFIP TC8 working conference on diffusion, transfer and implementation of information technology: Elsevier Science Inc., pp. 67-86.

Shah, J., Higgins, T., and Friedman, R.S. 1998. "Performance Incentives and Means: How Regulatory Focus Influences Goal Attainment," Journal of Personality and Social Psychology (74:2), p. 285-293.

Skinner, B.F. 1953. Science and Human Behavior. Simon and Schuster.

Standing, S., and Standing, C. 2008. "Mobile Technology and Healthcare: The Adoption Issues and Systemic Problems," International Journal of Electronic Healthcare (4:3-4), pp. 221-235.

Sundaram, S., Schwarz, A., Jones, E., and 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), pp. 101-112.

Thompson, R.L., Higgins, C.A., and Howell, J.M. 1991. "Personal Computing: Toward a Conceptual Model of Utilization," MIS Quarterly), pp. 125-143.

Venkatesh, V., Morris, M.G., Davis, G.B., and Davis, F.D. 2003. "User Acceptance of Information Technology: Toward a Unified View," MIS Quarterly), pp. 425-478.

Yu, C.-S. 2012. "Factors Affecting Individuals to Adopt Mobile Banking: Empirical Evidence from the Utaut Model," Journal of Electronic Commerce Research (13:2), p. 104-121.

Chapter 4

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

4.1 Introduction of Study II

Health information technology (HIT) has the potential to augment individuals' health conditions and enhance the quality of healthcare, thereby ensuring improved self-management of health (Buntin et al. 2011). Mobile health (mHealth) is commonly treated as an important component of HIT (Bauer et al. 2014) and plays an important role in incidence detection, patient personal information collection, and provision of medical care (Varshney 2014). mHealth can provide individuals with different healthcare services that accommodate their different medical requirements (Free et al. 2013). The current study investigates individuals' routine and emergency uses of mHealth that contribute to the understanding of individuals' different usage behaviors of mHealth. The aim is to provide service providers and researchers with a comprehensive understanding of the specific requirements for mHealth services, which they can use to improve the design and development of these healthcare services.

Routine use, which has been articulated and tested empirically in extant IS literature (Li et al. 2013; Saga and Zmud 1993; Sundaram et al. 2007), refers to the integration of 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 and is likened to 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 the different usage behaviors of service recipients and contributes to individuals' realization of the benefits that each usage behavior provides.

Comprehending the drivers of people's use intention of mobile services and adapting the services to fulfill people's motives for using them is important (Nysveen et al. 2005). Therefore, exploring the motivators that trigger the routine and emergency usage behaviors of mHealth services is a worthwhile endeavor. 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 different use behaviors and propose that emergency and routine use might be stimulated by extrinsic and intrinsic motivations.

Deci and Ryan (2002) illustrated 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 (Deci and Ryan 2002). Given that perceived usefulness is a representative extrinsic motivator and perceived enjoyment is an important intrinsic motivator (Brown and Venkatesh 2005; Davis et al. 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. 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); and (3) examine the antecedents of perceived usefulness and perceived enjoyment from the two characterized predictors.

The remainder of the paper is organized as follows. In Section 4.2, we provide the theoretical background. In Section 4.3, we propose the research model and hypotheses. In Section 4.4, we describe the methodology. In Section 4.5, we present the analysis results. Finally, we discuss the findings, implications, limitations, and future research in Section 4.6.

4.2 Theoretical Background

4.2.2 Routine and Emergency Uses

Routine and Emergency in Healthcare Context

Routine and emergency have often emerged as two comparative conceptions in the healthcare research area. The common topics include utilizing health facilities to provide patients with routine and emergency care (Gabrysch et al. 2012), providing routine and emergency treatment on different diseases (Elnekave et al. 2013), and evaluating the effectiveness of medicines by adopting routine and emergency analysis

methods (Segatti et al. 1991). Specifically, whereas routine emphasizes the characteristics of repeatability, standardization, and regularization, emergency reflects primarily urgent and unexpected traits. The essential difference between these two aspects lies in how people use technology under different situations to achieve better health outcomes. Accordingly, we propose that the routine and emergency uses of mHealth can be contrasted based on the different requirements of individuals. In this study, we conceptualize the differences between individual's routine and emergency uses of mHealth services by drawing upon their different healthcare needs.

Routine Use and Emergency Use of mHealth

Prior studies refer to routine use as the use of IS in a standardized manner by individuals to support their daily work (Li et al. 2013; Saga and Zmud 1993; Sundaram et al. 2007). We define routine use as the individual use of mHealth services on a daily basis to manage their health and achieve better health outcomes. The success of the application using new IT depends on continuous use rather than first-time use (Bhattacherjee 2001), and thus routine use is highlighted by its repetitive and standardized characteristics (Saga and Zmud 1993), which have been discussed broadly in IS contexts (Meng et al. 2016; Wang and Hsieh 2006). By contrast, emergency use refers to the use of mHealth services in situations requiring urgent medical care. Topics related to the design and applications of emergency management systems have been examined widely in extant IS literature (Annelli 2006; Blandford and Wong 2004; Yang et al. 2012). However, the emergency use of IT has attracted limited attention. Prior studies have asserted that

the implementation of appropriate measures in response to acute diseases (e.g., cardiac disease) can lead to a significant improvement in patient outcomes and the reduction of mortality rates (Canto et al. 1997; Schrading et al. 1993). mHealth has played a critical role in providing proper healthcare in emergencies (Miah et al. 2017). We believe the exploration of emergency use of mHealth services can contribute significantly to individuals' health and wellbeing. Accordingly, we extend the study of emergency use into the domain of mHealth and emphasize individuals' healthcare requirement under urgent circumstances.

Routine Use and Emergency Use: Healthcare Requirements

Routine and emergency uses describe two distinct use behaviors performed by individuals to achieve the same goals: better health outcomes. Routine and emergency uses are expected to vary among individuals because people have different healthcare requirements and needs for the usage of mHealth services. Whereas routine use focuses on the standardized use of mHealth that lead individuals to gain a better understanding of their health conditions and perform healthier behaviors (e.g., diet and exercise), emergency use aims to help patients obtain appropriate disruptive care in urgent situations and improve the efficiency of treatment in response to acute diseases.

The services of mHealth include utilizing mobile devices, such as mobile phones, personal digital assistants, patient monitoring devices, and other wireless devices (Nisha et al. 2015). 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, and other mHealth applications have been developed to remind elderly to take medicine regularly (Goyal et al. 2016). mHealth also plays an important role in managing chronic disease such as cancer, diabetes, and heart disease by monitoring patients' daily diet, exercise, and medications and providing regular mobile-enabled interventions (Varshney 2014). Such services require users, particularly diagnosed patients, to regularly input their physical signs to mobile devices to monitor their health status (Nisha et al. 2015), thereby leading service recipients to participate in the routine use of mHealth services. mHealth can provide services including healthcare information to patients, physicians, and other stakeholders, enabling real-time monitoring of physical signs, health data collection, and mobile telemedicine (Yadav et al. 2016). Thus, 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.

mHealth can also provide appropriate treatment under urgent situations (Miah et al. 2017; Varshney 2014). Studies have asserted that the implementation of pre-hospital measures in response to acute diseases (e.g., cardiac disease) leads to a significant improvement in patient outcomes and a reduced mortality rate (Canto et al. 1997; Schrading et al. 1993). Mobile technology can faster deliver healthcare services and information to patients, which assists patients in making faster decisions in emergency situations (Michalowski et al. 2003). Individuals can also receive appropriate medical assistance during an emergency by using mHealth services, such as mobile application,

wearable devices, and telemedicine services. 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, transport to healthcare facilities, acquisition of patient information, and provision of suitable medical care. Therefore, a patient with an acute disease or one who encounters urgent incidents can choose the emergency use of mHealth services to acquire appropriate medical assistance and improve treatment efficiency.

Given the above statements, we draw from two qualitatively different orientations to theorize on the differences between individuals' routine and emergency uses of mHealth services. Routine use focuses on the standardized and regular use of mHealth, while emergency use pertains to the 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 for examining the variations in individuals' different use behaviors of mHealth services.

4.2.3 Motivation Theory

Individuals partake in activities or perform behaviors ascribed to intrinsic and extrinsic motivations (Deci and Ryan 2002). Intrinsically motivated behavior is associated with people's perceived pleasure, enjoyment, and satisfaction, while extrinsically motivated behavior is associated with individuals' desire to gain external benefits, such as money,

rewards, and promotion (Deci and Ryan 2002). Accordingly, intrinsically motivated people focus on the process of activity engagement, while extrinsically motivated people focus on the consequences or results of the activity engagement (Vallerand et al. 1997). Intrinsic and extrinsic motivations are vital determinants that trigger individuals' technology use intention (Ajzen 1991; Taylor and 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 and 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 individuals' use behavior of IS (Brown and Venkatesh 2005; Davis et al. 1992; Venkatesh and Davis 2000). In an organizational setting, perceived usefulness is defined as the degree to which individuals perceive that using an IS system can enhance their work performance (Davis 1989; Davis et al. 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 et al. 1999). In this light, individuals who have utilitarian considerations would use mHealth services to help them attain anticipated health outcomes (Dwivedi et al. 2016). Accordingly, perceived usefulness, is adopted as a

surrogate construct of extrinsic motivation 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 and 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 are dominated by their preferences related to cognitive, affective, and behavioral components of beliefs (Hong and Tam 2006; Kim et al. 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.

4.3 Research Model and Hypotheses

Figure 4-1 depicts our research model. As extrinsic and intrinsic motivations can be the determinants of IT use (Venkatesh et al. 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; Davis et al. 1992). From the utilitarian perspective, people can be motivated for good performance by material or physical rewards (Hu et al. 1999; Saga and 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. mHealth services can provide appropriate healthcare in emergency situations and assist people in receiving suitable emergency care (Miah et al. 2017). 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 in emergency situations. Additionally, utilitarian benefit is deemed as a 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 the following:

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

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

Perceived enjoyment is a representative intrinsic motivator to facilitate IS use (Davis 1989). From the hedonic perspective, individuals perceive that pleasant feelings of IS use effectively trigger users' interest and cultivate positive perceptions toward IS, thereby generating intentions of IS use. Dwivedi et al. (2016) also demonstrated that the occurrence of a new alternative healthcare service (mHealth) stimulates patients to

generate affective fun or pleasure, indicating that perceived enjoyment has a positive impact on individuals' behavioral intention for mHealth adoption. In addition, Li et al. (2013) contended 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 and Speier 1999), thus making users' routine use less vapid and tedious. Specifically, patients with chronic diseases are required to execute long-term disease management to attain positive health outcomes, and incentive strategies play a dominant role in promoting patients' self-management regularly (Miller et al. 2016). The enjoyable features of gamification in mHealth services can exert an influence on facilitating patients' self-management and encourage them to routinely perform healthier behaviors. Therefore, intrinsically motivated individuals might be activated to engage in the routine use of mHealth. The above discussion leads us to propose the following hypothesis:

Hypothesis 2: Perceived enjoyment is positively associated with individuals' 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 unique factors on the mHealth use context.

Technological characteristics are critical in affecting the adoption of mobile IS (Hsiao et al. 2008; Lian et al. 2014; Lin et al. 2012). Perceived source credibility, perceived service availability, and perceived diagnosticity are chosen as three typical technological antecedents for perceived usefulness because they reflect three aspects of mHealth. mHealth services enable anyone to gain access to healthcare services anytime and anywhere, without locational and temporal constraints (Varshney 2009), thus facilitating service availability. 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 et al. (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 users believe that the information source is reliable, competent, and trustworthy (Bhattacherjee and Sanford 2006; Sussman and Siegal 2003). Perceived source credibility, which has been found to be an important influencing factor of individuals' perceived usefulness (Bhattacherjee and Sanford 2006), is defined in the current study as mHealth service receivers' perceptions of the credibility of the services. 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 and 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, which has been widely discussed in information searching, web-based information sharing, electronic shopping, and online review literature (Hernandez et al. 2014; Jiang and Benbasat 2004; Jiang and Benbasat 2007; Mudambi and Schuff 2010; Wang and Chang 2013; Yi et al. 2017), 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 and Schuff 2010). People with high levels of perceived diagnosticity have an improved ability to appraise products and thus make appropriate use decisions (Jiang and 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 and Smith 1998). If the level of diagnosticity of the current information is low, consumers have a low degree of confidence in evaluating the product (Maheswaran et al. 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 the following hypotheses:

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 their competence or efficacy (White 1959); this fact strengthens the argument that individuals' needs for competence and self-determination promote their intrinsically motivated behaviors (Deci 1975). Self-determination theory advocates that autonomy, competence, and relatedness are representative innate psychological characteristics that facilitate the understanding of human motivation behaviors (Deci and Ryan 2000). Therefore, we choose perceived autonomy, perceived competence, and perceived relatedness as three salient psychological antecedents for perceived enjoyment in exploring the motivational behaviors of individuals to use mHealth. Autonomy, competence, and relatedness are three psychological needs for people's psychological growth, integrity, and well-being (Deci and Ryan 2000; Vlachopoulos and Michailidou 2006). The need for autonomy refers to individuals' performance of self-endorsed behavior that is not influenced by other factors (Deci and Ryan 1985; Ryan and La Guardia 2000); the need for competence reflects people's inclination to be effectively involved in the environment to practice and show their capacities (Deci and Ryan 2000); and 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 and La Guardia 2000). Autonomy, competence, and relatedness play a role in influencing intrinsic motivation (Deci and Ryan 2000) and may indirectly lead to different types of outcomes (e.g., enjoyment) (Cox et al. 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 need for accomplishment, curiosity, and learning (Venkatesh and Speier 1999). The unique features of a new technology can arouse users' curiosity and interest, thereby making interaction with mHealth services enjoyable. A high degree of curiosity on the novel features of mHealth means a high degree of perceived enjoyment. Thus, we propose that curiosity is a psychological predictor of perceived enjoyment. Specifically, we posit the following:

Hypothesis 4a: Curiosity is positively associated with perceived enjoyment.

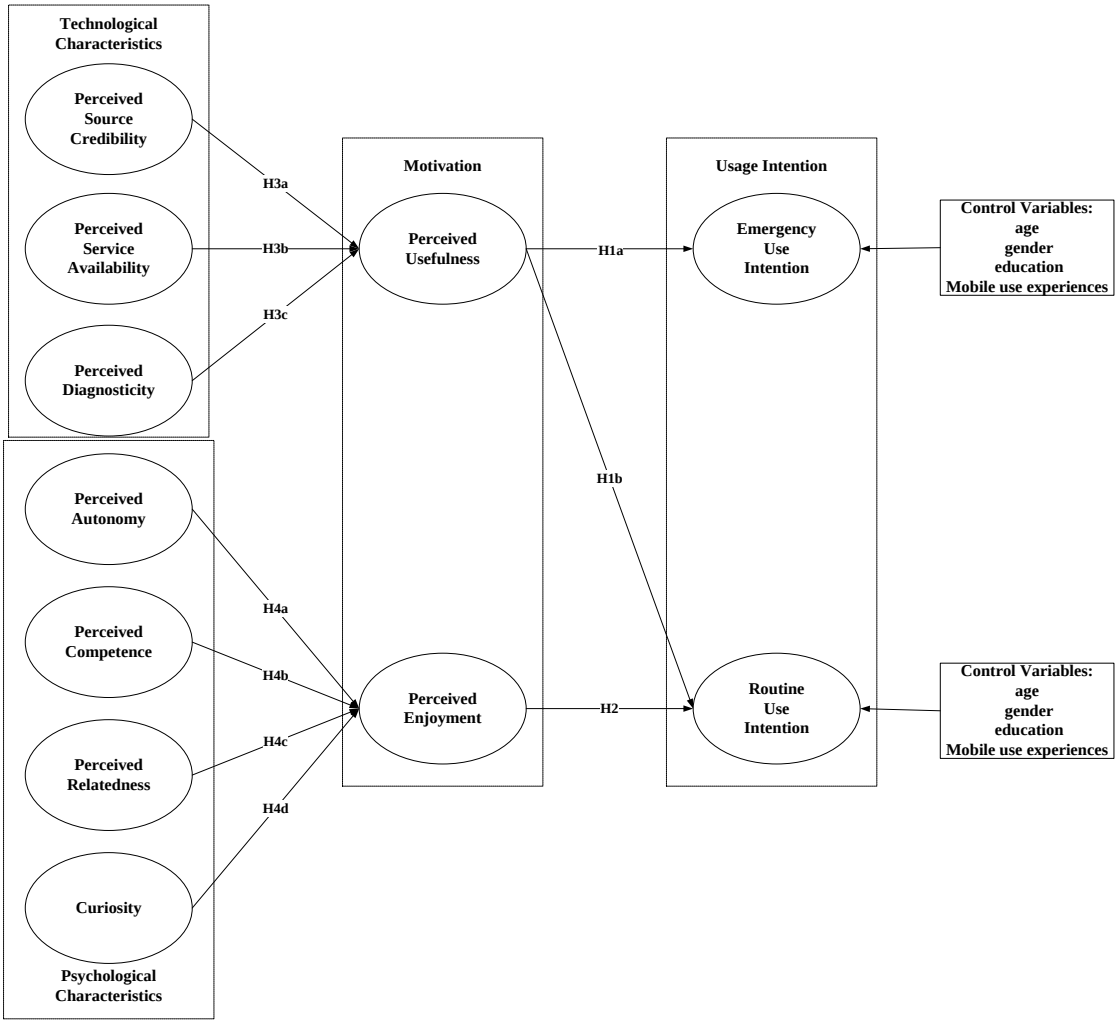
Hypothesis 4b: Autonomy is positively associated with perceived enjoyment.

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.

Figure 4-1. Research Model and Hypotheses



4.4 Method

4.4.1 Measurement Development

Most of the measures of the constructs were developed based on prior literature. For the constructs that could not be found in existing relevant literature, we self-developed the items. We adapted each 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), and measures for perceived diagnosticity were adapted from Jiang and Benbasat (2007). We adapted the items for curiosity from Reeve (1989), and 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), and the measures for routine use intention derived from Sundaram et al. (2007). We self-developed the measures of emergency use intention to accommodate our research context. As numerous literature has focused on routine use of technology (e.g., Li et al. 2013; Wang and Hsieh 2006), few studies have explored emergency use, which is an important counterpart of routine use to disclose individuals' use behavior of IT. We therefore 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 the Appendix "Measurement Items of Study Ⅱ". To test the content validity of the measures, we conducted a pretest before administering the questionnaires to the participants. We received feedback from 20

research students and three professionals with medical backgrounds. We made a few minor changes to some items to enhance the expressions. All measurement items used a seven-point Likert scale (1 = “strongly disagree” to 7 = “strongly agree”).

4.4.2 Data Collection

We conducted a survey to collect data in a residential community in China. With the aim of becoming an “Intelligent Health Community,” the community has been authorized by the local government and has collaborated with community hospitals to provide local residents with appropriate health education and consultation services, track their physical data regularly through mobile healthcare services, and utilize GPS technology to obtain residents’ locational information when they have urgent medical requirements. We thus believe that residents in this community are an applicable target for the data collection. Of the 260 completed questionnaires, 241 were deemed valid, giving a response rate of 93%. Each respondent received 20 RMB in cash as a token of our appreciation for their participation. Before distributing the questionnaires, we introduced the conceptions, functions, and benefits of mHealth services to all participants to assist them in fully understanding the new healthcare services. The questionnaire contained two main parts. The first part was designed to collect respondents’ demographic information. The second part asked questions to obtain participants’ opinions and determine their 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 level or above education, and nearly half of them (48%) had mobile use experience over eight years. We conducted a t-test to test the means between users who had mobile use experience over eight years (A) and users who had mobile use experience less than eight years (B). The results of T_A = - 27.56, T_B= 26.99, and $p < .05$ indicate a significant difference between these two populations.

4.5 Results

4.5.1 Measurement Evaluation

We used partial least squares (PLS) to conduct the data analysis because PLS is regarded as a component-based structural equation modeling technique that is suitable for maximizing explained variance (Gefen et al. 2011). We used SmartPLS 2.0 software as our main statistical tool to evaluate and test the research model.

Table 4-1. 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 4-1, each item loading on their own construct was above 0.7; therefore, convergent validity was supported (Peng and 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 et al. 1998). Table 4-2 shows the values of the average variance extracted (AVE), composite reliability, and Cronbach's alpha for all constructs in the proposed model. The AVE scores were all above the recommended cutoff value of 0.50 (Fornell and Larcker 1981), and the composite reliability and Cronbach's alpha values were all higher than the threshold of 0.707 (Nunnally 1967). These findings indicate 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 4-2. 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.

4.5.2 Common Method Bias Testing

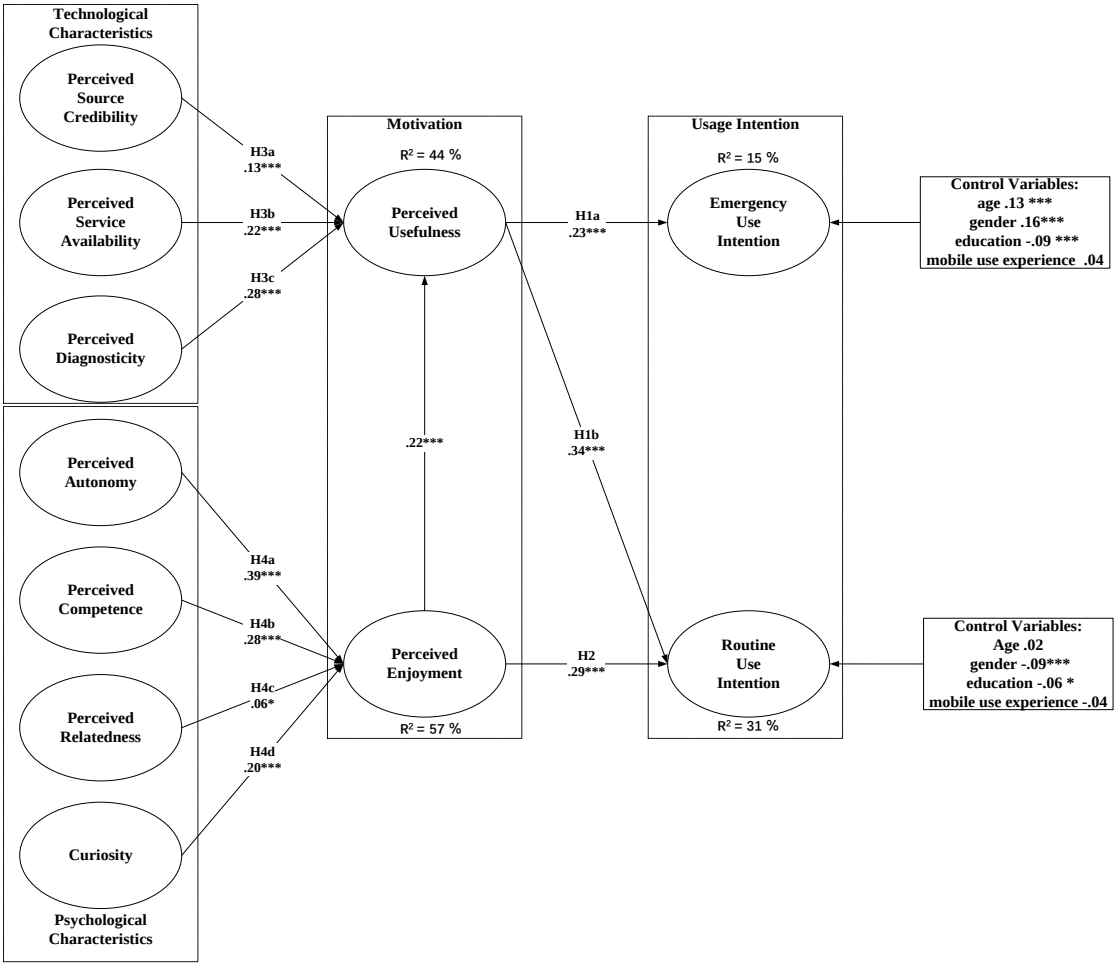
Because the data were collected from participants' self-reports, common method bias (CMB) might exist (Podsakoff and Organ 1986). Thus, following Podsakoff et al. (2003), we first conducted Harmon's one factor test to examine the latent constructs in our theoretical model. The results showed that the first factor of the un-rotated solution explained 30.09% of the total variance, indicating no existence of CMB. We then 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: perceived usefulness, perceived enjoyment, emergency use intention, and routine use intention. The results revealed that the correlations and significance remained unchanged, indicating negligible CMB in the current study.

4.5.3 Hypothesis Testing

Figure 4-2 presents the model's testing results. The main results show 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. All the main effects were significant. Specifically, perceived usefulness positively affected emergency use intention (β=0.23, p < .01) and routine use intention (β=0.34, p < .01), thus supporting H1a and H1b. Perceived enjoyment (β=0.29, p < .01) was positively related to routine use intention; thus, H2

was supported. Perceived source credibility (β=0.13, p < .01), perceived service availability (β=0.22, p < .01), and perceived diagnosticity (β=0.28, p < .01) positively affected perceived usefulness, thereby supporting H3a, H3b, and H3c. Perceived autonomy (β=0.39, p < .01), perceived competence (β=0.28, p < .01), perceived relatedness (β=0.06, p < .01), and curiosity (β=0.20, p < .01) positively affected perceived enjoyment. Therefore, H4a, H4b, H4c, and H4d were also supported. Table 4-3 shows the results of the research hypothesis testing. Three possible reasons may explain why low R-squared values are acceptable in this kind of social science research. First, having such low values in social science where human behavior (use of eHealth service) is being predicted is not uncommon. Rather, the relatively low values are common in the extant technology adoption literature (Agarwal and Prasad 1999) because user behavior is difficult to predict. Second, this novel research combines the constructs of routine and emergency use and attempts to use it to predict the usage of eHealth services. We believe having such low R-squared values reflects similar novel research models. Finally, a substantial amount of variance is present in the usage of mHealth service intentions that is not accounted for by perceived usefulness and enjoyment. We believe that other factors should be added to the research model to improve the ability to predict the usage of eHealth service intentions.

Figure 4-2. 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 4-3. Results of Hypothesis Testing

Hypothesis Descriptions	**Result**
Hypothesis 1a: Perceived usefulness positively influences emergency use intention of mHealth.	Support
Hypothesis 1b: Perceived usefulness positively influences routine use intention of mHealth.	Support
Hypothesis 2: Perceived enjoyment positively influences routine use intention of mHealth.	Support
Hypothesis 3a: Perceived diagnosticity positively affect perceived usefulness.	Support

Hypothesis 3b: Perceived source credibility positively affect perceived usefulness.	Support
Hypothesis 3d: Perceived service availability positively affect perceived usefulness.	Support
Hypothesis 4a: Curiosity positively affect perceived enjoyment.	Support
Hypothesis 4b: Autonomy positively affect perceived enjoyment.	Support
Hypothesis 4c: Competence positively affect perceived enjoyment.	Support
Hypothesis 4d: Relatedness positively affect perceived enjoyment.	Support

4.6 Discussion

4.6.1 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, IS use is deemed to be a broad behavioral category in extant IS literature and has frequently been examined in forms of duration or frequency (Li et al. 2013). Therefore, exploring the specific use behaviors of IS can contribute to the development of extant 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, our findings reveal that perceived usefulness acts as an extrinsic motivator that effectively affects people's emergency and routine use intentions of mHealth services. Notably, 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 a stronger influence on routine use intention than on emergency use intention. In addition, perceived enjoyment is closely associated with routine use intention, indicating that 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 a positive impact on extrinsic and intrinsic motivations on people's use intention of mHealth services. Specifically, this research presents how intrinsic and extrinsic motivators can affect two distinct use intentions based on the perceptions of technological and psychological characteristics. The findings reveal a possible theoretical perspective through which motivational factors can be generated and the application of motivation theory can be broadened.

4.6.2 Practical Implications

The current study has practical implications in both IS and healthcare domains. mHealth service providers and researchers should recognize that individuals can exhibit both emergency and routine usage behaviors, thereby offering unique opportunities for mHealth service design and development. Specifically, service providers and researchers should recognize that individuals are more likely to engage in routine use of mHealth services when they have chronic diseases, improve health management, and live independently (especially the elderly). Such individuals can integrate mHealth services into their daily lives to manage chronic diseases, monitor their health status, and perform healthy behaviors. Health monitor and remote diagnosis features can be developed in the mHealth devices and applications. Services users can conduct daily self-monitoring their physical signs, sleep cycle, and diet. In addition, physicians can conduct real-time remote diagnosis through analyzing data gathered by mHealth applications and provide feedback to their patients. Further, individuals are more likely to perform emergency use behavior when they require emergency care under urgent situations, such as acute diseases and unexpected incidence. Typically, when an emergency happens, the crisis management process includes detecting the incidence, transporting the patient to a healthcare facility, getting the patient's information, making decisions, and providing care (Varshney 2014). Under urgent circumstances, the priority is to find an approximate method to minimize the immediate risks and speed up the treatment process for the patients. In this regard, mHealth services providers are

encouraged to develop application features that facilitate urgent calls to physicians or hospitals (seeking professional healthcare assistance), a positioning system (position patients' geographic location), and treatment guidance (healthcare information searching).

Our results have shown that perceived enjoyment affects routine use intentions of mHealth services. The enjoyable feelings generated from interactions with IS can promote users to create pleasant reactions to IS, making the use of healthcare services less tedious and vapid (Venkatesh and Speier 1999). Service providers are therefore encouraged to stimulate individuals' intrinsic motivation (perceived enjoyment) by developing features of the 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. This finding indicates that the mHealth usage behaviors of individuals are more likely to be driven by utilitarian outcomes. People are more likely to perform routine and emergency use behaviors when they perceive that using mHealth services can achieve good health outcomes and satisfy their different healthcare requirements. We also investigated several relevant technological antecedents for extrinsic motivation. The results indicate source credibility, service availability, and diagnosticity are the three salient predictors for perceived usefulness. Therefore, service providers should ensure the information source is reliable, competent, and trustworthy, provide timely healthcare services, and assist individuals in understanding the mHealth services comprehensively. Our data

analysis also shows that females and highly educated participants exhibit considerable interest in mHealth services. Service providers should thus target these populations as major potential users.

4.6.3 Limitations and Future Research

This study has some limitations that can be explored further. As the data were collected in China, this may affect the generalizability of this study. Future studies should thus select a research sample from other demographic groups. This study is conducted in the context of mHealth services. However, as mHealth services possess different features, we only discuss its general characteristics. Future research should therefore explore the mHealth services' use behavior targeting its specific features. This study utilized perceived usefulness and perceived enjoyment as two surrogates for extrinsic and intrinsic motivations. Future studies can examine other forms of extrinsic and intrinsic motivations to explore the effectiveness on IS use behavior. This study also examined the effects of emergency and routine uses separately. Whether a correlation exists between the two use behaviors needs to be discovered in future research.

4.7 Summary of Study II

This study explored different IS use behaviors by theorizing two use behaviors, namely, emergency and routine uses, which lie in the situational difference of urgent and rationalized orientations. We find that emergency and routine use intentions effectively exert an influence on people's behavioral use intention of IS. Drawing upon motivation

theory, we evaluated the relative influence of extrinsic motivation (perceived usefulness) and intrinsic motivation (perceived enjoyment) on people's emergency and routine use intentions of mHealth. We also examined the theoretical and psychological antecedents of extrinsic and intrinsic motivations, thereby contributing to advancing the understanding of IS use motivations. This study provides instrumental insights for practitioners to fully understand different IS use behaviors and to improve the quality of services, thus satisfying users' actual requirements.

References

Agarwal, R., and Prasad, J. 1999. "Are individual differences germane to the acceptance of new information technologies?," *Decision Sciences 30*(2), 361-391.

Ajzen, I. (1991). *The theory of planned behavior. Organizational behavior and human decision processes*. Massachusetts: Academic Press. Inc.

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.

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), 223-231.

Bauer, A. M., Thielke, S. M., Katon, W., Untzer, J. & Aren, P. (2014). Aligning health information technologies with effective service delivery models to improve chronic disease care. *Preventive Medicine,* 66**,** 167-172.

Bhattacherjee, A. (2001). Understanding information systems continuance: an expectation-confirmation model. *MIS Quarterly*, *25*(3),351-370.

Bhattacherjee, A., & Sanford, C. (2006). Influence processes for information technology acceptance: An elaboration likelihood model. *MIS Quarterly, 30*(4),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*. New York: Wiley

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*, *29*(3),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.

Chapman, S., & Schofield, W. (1998). Lifesavers and Samaritans: emergency use of cellular (mobile) phones in Australia. *Accident Analysis & Prevention, 30*(6), 815-819.

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*, *13*(3), 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). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.

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.

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

Dehzad, F., Hilhorst, C., de Bie, C., & Claassen, E. (2014). Adopting Health Apps, What's Hindering Doctors and Patients? *Health, 6*,2204-2217.

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), 1153-1166.

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*, 18(1) 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.

Goyal, S., Morita, P., Lewis, G. F., Yu, C., Seto, E. & Cafazzo, J. A. (2016). The systematic design of a behavioural mobile health application for the self-management of type 2 diabetes. *Canadian Journal of Diabetes*, 40, 95-104.

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.

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.

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, 35*(3), 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.

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. *ICIS Proceedings 2016*. http://aisel.aisnet.org/icis2016/ISHealthcare/Presentations/7/.

Miah, S. J., Gammack, J. & Hasan, N. (2017). Extending the framework for mobile health information systems Research: A content analysis. *Information Systems,* 69**,** 1-24.

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. *MIS Quarterly*, *34*(1), 185-200

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). *McGraw-Hill series in psychology. Psychometric theory*. New York: McGraw-Hill.

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), 330-346.

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.

Podsakoff, P. M., & Organ, D. W. (1986). Self-reports in organizational research: Problems and prospects. *Journal of Management, 12*(4), 531-544.

Podsakoff, P. M., Mackenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common mehtod biases in behavioral resaerch: A critical review of the literautre and recommendated remedies. *Journal of Applied Psychology, 88*(5), 879-903.

Rönkkö, M., & Ylitalo, J. (2011). PLS marker variable approach to diagnosing and controlling for method variance. *ICIS 2011 Proceedings*. 8.

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. In S. H. Qualls & N. Abeles (Eds.), *Psychology and the aging revolution: How we adapt to longer life* (pp. 145-172). Washington, DC, US: American Psychological Association.

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, 28*(4), 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, 27*(3), 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. ICIS 2006 Proceedings. 48. http://aisel.aisnet.org/icis2006/48.

White, R. W. (1959). Motivation reconsidered: The concept of competence. *Psychological Review, 66*(5), 297-333.

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*, 28(2) ,413-429.

Zajonc, R. B. (1980). Feeling and thinking: Preferences need no inferences. *American psychologist*, *35*(2), 151-175.

Appendix Measurement Items of Study II

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 and 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 and 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 and 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 and 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 and 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 and 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)

CUR 1: 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.

Chapter 5

Study Ⅲ: Exploring the Influences of Service Characteristics on Individuals' Use Intention of Mobile Health Services

5.1 Introduction of StudyⅢ

Mobile health (mHealth) emerges as a new paradigm of health information technology, transforms the traditional way of delivering healthcare services globally by providing more accessible, pervasive and affordable healthcare services (Akter et al. 2013). Extant technology acceptance literature has heavily focused on these instrumental beliefs such as perceived enjoyment and perceived usefulness as the primary drivers of individuals' use intentions of technology (Lu et al. 2005). Service characteristic factors are verified as the determinants in influencing people's use intention of mHealth (Wang et al. 2018). Exploring interactions among service characteristics that promote the understanding of the influences of the services on users plays an important role in improving service adoption rate (Blut et al. 2014; Wang et al. 2018). In this present study, we mainly investigate the impacts of service characteristics including service relevance and service accuracy on individuals' use intention of mHealth services. Service relevance, refers to the extent to service (information) provided meet people's need, is regarded as one of the distinct dimension measuring service quality and influence individuals' technology adoption behavior (Ho and Ho 2006). While, service accuracy refers to the extent to individuals' perception that the service (information) provided is correct (Wixom and Todd 2005). Service accuracy is found to be an

important factor influencing use intention of technology (Wixom and Todd 2005). The objective of this current study is to explore how service characteristics (service relevance and service accuracy) interact to influence individuals' use intention of mHealth services. In addition, behavioral and psychological literature reveal that people with different personal traits tend to have different reactions toward technology. People's innovativeness positively affects their decision making and determines their technology adoption behavior (Lu et al. 2005). Further, mHealth service appears to be an emerging new technology and also a new pattern of healthcare service, users have concern about their personal information might be disclosed and their personal data can be used without permission, in turn, hinders people's adoption behavior of mHealth services (Guo et al. 2016). Therefore, we adopted innovativeness and privacy concern as two moderators exert opposite influence between service characteristics and use intention of mHealth services. Based on precede reasoning, we propose two research questions: (1) How service relevance and service accuracy affect individuals' use intention of mHealth service? (2) How innovativeness and privacy concern moderate the relationship between services characteristics and use intention of mHealth services. To address the preceding research questions, we develop an integrative model based on two service characteristics, as well as personal trait innovativeness and privacy concern. Thereafter, the proposed research model was empirically tested by analyzing survey data. This current research provides both theoretical and practical implications. It broadens the horizons of technology acceptance research by investigating technology

adoption behavior from the service characteristics perspective and focuses on individuals' perceptions of service attributes. Additionally, this research also assists in explaining how personal traits exert moderating effects during the process. Therefore, this can enhance our understanding of mHealth service use behavior. Furthermore, this research can also provide practical suggestions for service providers regarding to product design and feature development.

5.2 Theoretical Background

5.2.1 Service Characteristics

Understanding service characteristics assist people in understanding the effects of the services on them. Service characteristic is a key element for evaluating the service (Wang et al. 2018). Accuracy and relevance, are deemed as two vital elements in influencing people's online purchasing behaviors (Cheung et al. 2008), and have been investigated broadly in the extant e-commerce studies (Delone and McLean 2003). In addition, relevance and accuracy are also two important measures of information quality. mHealth service is also regarded as one kind of information service, and the features of information quality is also applicable to mHealth service (Wang et al. 2018). Therefore, we adopted service relevance and service accuracy as two distinct service characteristics, and primarily investigated their effects on individuals' use intention of mHealth services.

Relevance is deemed as one of the most effective factor in the process of decision making (Dunk 2004). Delone and McLean (2003) discussed that relevance is one important dimension measuring information quality, and affects use intention of technology. Service relevance positively influences online customers' perception of usefulness of the service, in turn, determining their information adoption decision (Cheung et al. 2008). Hussein et al. (2015) described service relevance as it is associated with users' requirements, preferences, interaction history, trusted services, authorization restrictions, and services ratings. There are certain studies have demonstrated service relevance is a key indicator when building social service framework and interaction mechanism (Hussein et al. 2015; Musa et al. 2010).

Accuracy has been widely discussed in different research area. In the healthcare context, scholars attempted to probe the effects of diagnostic accuracy (Whiting et al. 2011), drug accuracy (Gaikwad et al. 2007), treatment accuracy (Ahmad et al. 2011) and informatics accuracy (Miner et al. 2014) on patients' life and health performance. According to Cheung et al. (2008), accuracy involves in the assessment of reliability of the service. It also indicates the extent to people's perception of the service (information) is accurate (Wixom and Todd 2005).

However, scant studies have been conducted to investigate how service relevance and service accuracy influence people's use behaviors of mHealth services. Additionally, few scholars have concentrated on the moderating effects of innovativeness and privacy concern on the relationship between service characteristics and use intentions of

mHealth services in existing literature. To narrow these research gaps, the extant study thus attempts to explore the effects of service relevance and service accuracy on people's use intention of mHealth services. Further, we also investigate the moderating effects of innovativeness and privacy.

5.2.2 Innovativeness

Prior innovation diffusion studies have found that individuals with highly innovative awareness are active information seekers about new ideas. These people are capable of dealing with uncertainty and have more positive acceptance intentions of new technologies (Rogers 1995). Rogers (1981) conceptualized personal innovativeness from an operational perspective as individuals can be classified as innovative if they are early to adopt innovations. Midgley and Dowling (1978) defined innovativeness as the degree to people make innovation decisions independently of communicated experience of others. People with highly innovativeness always have highly confidence towards new technology (Lu et al. 2005). Agarwal and Prasad (1998) categorized this personal characteristic on technology adoption behavior as Personal Innovativeness in Information Technology (PIIT), which is defined as individual's willingness to try out new information technology.

Personal innovativeness has been discussed broadly in innovation diffusion research (Rogers 1995), the domain of marketing (Flynn and Goldsmith 1999), and social and psychology studies, and played differing roles in extant theoretical framework (Lu et

al. 2005). Agarwal and Prasad (1998) investigated the moderating effects of personal innovativeness on the relationship between people's perceptions (including perceived relative advantage, ease of use and compatibility) and use intentions of new technology. In addition, Agarwal and Karahanna (2000) proposed that personal innovativeness is one of the dominant indicators of cognitive absorption, which is labeled as an antecedent of two instrumental beliefs: perceived usefulness and perceived ease of use. Further, Lewis et al. (2003) extended the technology acceptance model (TAM) by introducing the effects of personal innovativeness in information technology on perceived usefulness and perceived ease of use. Although personal innovativeness has been explored widely in different research scenario, rarely studies have been conducted to integrate this personal traits into technology acceptance research, and even fewer into use intentions of information technology innovations (Lu et al. 2005).

In the present study, we mainly investigate the moderating role of personal innovativeness on service characteristics and use intention of mHealth services. This attempt can further our understanding of the process by expounding the role of personal traits in the process of technology adoption.

5.2.3 Privacy Concerns

Extant privacy research primarily focus on the motive and inhibitive characteristics regarding to the information disclosure (Xu and Gupta 2009). Privacy concern has been discussed broadly in information system studies. Smith et al. (1996) introduced the

notion of Concern for Information Privacy (CFIP). This instrument categorizes information privacy concern into four dimensions: collection, unauthorized secondary use, errors and improper access. These dimensions have been deemed as representative measurements towards privacy concerns. Additionally, Malhotra et al. (2004) integrated the instrument of Concern for Information Privacy into the internet context and developed the notion of Internet Users Information Privacy Concerns (IUIPC).

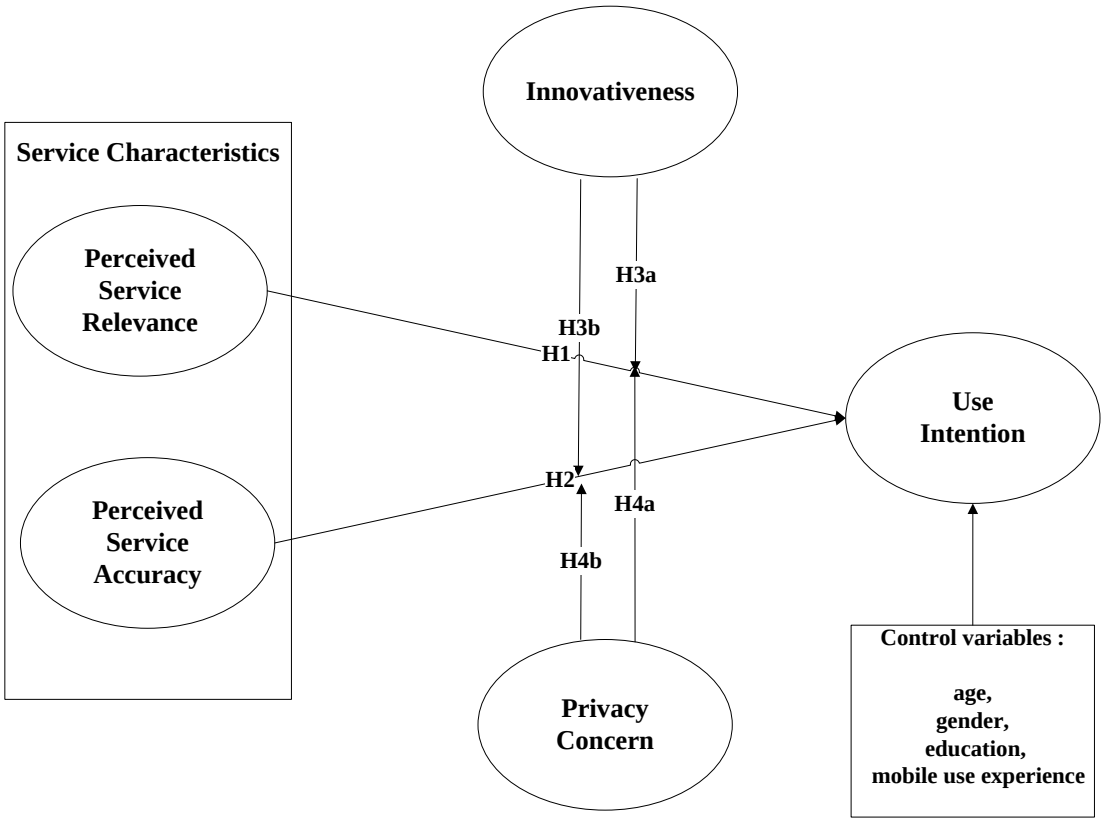
Privacy refers to people have rights to prevent their personal information from leaking to third parties (Varshney 2014). Scholars have attempted to redefine privacy from different perspectives to enrich extant privacy research (Guo et al. 2016). In recent literature, service and information privacy concerns draw increasingly attentions. Privacy concerns have been widely discussed in the social network literature. Li et al. (2011) argued that information privacy concerns refer to individuals' concern about information privacy, are not targeted to a specific website or company. Stieger et al. (2013) concluded that privacy concern is a prime reason for users' abandon of their social network accounts. It reports that 69％ of adults express their concerns originated from the fact that their activity records maintained by the social media sites leading to private and secure issues (Madden and Rainie 2015). In the e-commerce research context, privacy concerns has been deemed as one facet of risk that people worry about disclosing private information online to third parties (Cocosila and Archer 2010; Shareef et al. 2008). In the mHealth scenario, as mHealth is an emerging development, users uncertain about providers' operations and might be fear of their health data

disclosing. Thus, privacy concern is a nonnegligible element in the process of mHealth diffusion (Guo et al. 2016).

5.3 Research Model

This study is designed to investigate the effects of service relevance and service accuracy on individuals' use intention of mHealth services. Additionally, we also test the moderating effects of innovativeness and privacy concern on the relationship between service characteristics and use intentions of mHealth services. The proposed research model is illustrated in Fig. 5-1.

Figure 5-1. Research Model



5.3.1 Effects of Service Characteristics on Use Intentions

Effects of service relevance

Individuals tend to perceive outcomes when they get in touch with new services. External information might influence people's decision to adopt required technology or service (Wang et al. 2018). Drawing upon the elaboration likelihood model, it illustrates that external information primarily affects people's attitudes, and then determining their behaviors. (Ho and Bodoff 2014). The elaboration likelihood model suggests that the relevance of information contents is significantly influence information users. It implies that information receiver will show positive attitudes if the information content is highly relevant to them (Haimerl and Fries 2010). Olshavsky (1985) discussed that individuals have intentions to appraise a product or service by virtue of their purchase decision criteria when they perceive that the information provided satisfy their needs. This implies that individuals' perception of service relevance is a significant indicator for their future use behavior (purchase).

Moreover, relevance is an essential element consisting of information quality (Cheung et al. 2008). mHealth service can be attributed to one kind of information service, thus the features of information service are also applicable in the mHealth service (Wang et al. 2018). According to DeLone and McLean's updated information system success model (2003), relevance is regarded as one important component of information quality, is positively associated with use intention of technology. Wang et al. (2018) also

expresses that the relevance of mHealth service to individuals indicating more tendentious use intention of the service. Therefore, we propose that:

Hypothesis 1: Service relevance positively influence individuals' use intention of mHealth service.

Effects of service accuracy

Accuracy is deemed as one distinct dimension of traditional service quality (Yang et al. 2003). In D & M IS Success Model, accuracy is attributed to one of the measurement of information quality (Delone and McLean 2003). Accuracy of service's information indicates the reliability, also represents people's perception about the information is correct (Wixom and Todd 2005). The updated D & M IS Model indicates that both information quality and service quality are positively associated with intention to use of technology. According to Gu et al. (2009), the accuracy of mobile banking service can stimulate people's usefulness perception, in turn, triggers the use intention of the service. In this light of discussing, if individuals perceive the service provided by mHealth is accurate and reliable, they might have the use intention of mHealth service. Therefore, based on the above reasoning, we hypothesize:

Hypothesis 2: Service accuracy positively influence individuals' use intention of mHealth service.

5.3.2 Effects of Innovativeness

Prior literature demonstrates that innovation is always related to uncertainty, imprecision and risk (Thiesse 2007). Personal innovativeness, has been described as certain people's particular personal traits, symbolizes the risk-taking propensity (Agarwal and Prasad 1998). According to the theory of the diffusion of innovations, people develop their beliefs about new technologies by collecting information originated from various media. If individuals have high level of innovativeness, they have highly tendency to be more interested in the target technology when they expose to different sources of media (Agarwal and Prasad 1998). Individuals' technology adoption decisions are affected by the innovativeness, and this personal trait differs among people (Xu and Gupta 2009). Innovators always perform certain characteristics behaviors (Rogers 1995). They are always sensitive to new things, seeking active information, and are more open minded to accept different features of technology. In the mHealth context, when individuals perceive the service meet their requirements and is relevant to them, the ones with higher level of innovativeness traits are more likely to have use intention than those with lower level of innovativeness. Similarly, when individuals perceive the service/ information provided by mHealth is accurate and reliable, the more innovative ones have more propensity to have use intention of mHealth service. Therefore, we propose:

Hypothesis 3a: Personal innovativeness positively moderate the relationship between service relevance and use intention of mHealth service.

Hypothesis 3b: Personal innovativeness positively moderate the relationship between service accuracy and use intention of mHealth service.

5.3.3 Effects of Privacy Concern

Service/information privacy concerns refers to individuals worry about the disclosure of personal information (Li et al. 2011). Privacy disclosure is seemed as one facet of risk that individuals might encounter when they using mobile information and communication technology as a health promotion intervention (Cocosila and Archer 2010). mHealth is an emerging healthcare service, individuals still remain in the phase of exploring the new service. They are diffident in service providers' operations and regulations, and have concerns about their privacy information especially their personal health information might be accessed by third parties and used in unknown purposes. According to Guo et al. (2016), privacy concerns exerts negative effects on influencing consumers' adoption intention of mHealth services. Applied within the present context, we propose that privacy concerns plays a negative role in influencing the relationship between service characteristics and use intention of mHealth services.

Based on above reasoning, we hypothesize:

Hypothesis 4a: Privacy concern negatively moderate the relationship between service relevance and use intention of mHealth service.

Hypothesis 4b: Privacy concern negatively moderate the relationship between service accuracy and use intention of mHealth service.

5.4 Methodology

5.4.1 Data Collection

A survey was conducted to test our hypotheses. We distributed questionnaires in a local company producing healthcare products in China. Our respondents were targeted to the customers of the company in China. This study is designed to investigate individuals' perceptions of services characteristics and use intentions of mHealth services. The customers of healthcare company might pay more attention on their health and eager to change their health conditions. Therefore, we believe that the customers of the healthcare company are appropriate for data collection. Each of them was given 20 RMB as a reward for their participations. We initially provided a brief introduction of mHealth services to the participants and then distributed the questionnaires to them. The questionnaires contain two main parts. The first part was designed to collect respondents' demographic information. The second part was asked about respondents' perceptions regarding to mHealth services.

All the measures of constructs were adapted from previous literature (see Appendix Measurement Items of Study Ⅲ), and were evaluated by a seven-point Likert scale with anchors ranging from strongly disagree (1) to strongly agree (7). The measures for service relevance were adapted based on Cheung et al. (2008). We adapted the measures for service accuracy from Wixom and Todd (2005). The measures for innovativeness were adapted from Lee (2013). In addition, we adapted privacy concern from Cocosila and Archer (2010). The measures for the use intention were followed Johnston and

Warkentin (2010). We also included demographic characteristics, such as age, gender, education and mobile use experience as control variables. The adopted constructs and the operational definitions are displayed in Table 5-1.

Table 5-1. Research Constructs

Constructs	Operational definition	Source
Service relevance (RLVN)	The service provide by mHealth is relevance to personnel need	(Cheung et al. 2008)
Service accuracy (PMSA)	The users' perception that the mHealth service is correct.	(Wixom and Todd 2005)
Innovativeness (INOV)	People willing to try out the new information technology.	(Lee 2013)
Privacy concern (PRCO)	The extent to individuals are disturbed about the information collection practices of others and how the acquired information will be used.	(Cocosila and Archer 2010)

The questionnaires were firstly constructed in English, and then were translated in parallel into Chinese. We removed unqualified samples to improve the validity of the questionnaires. We totally distributed 400 questionnaires, and 350 of them were recognized as valid responses, indicating the response rate of 87.5%. The demographic information is displayed in Table 3-2. Among the 350 respondents, 141 of them were male (40%) and 209 were female (60%). 175 of them were more than 30 years old (50%). 121 of them went to university or above, nearly 35 % in total. About 68% of participants have more than 6 years mobile use experience.

Table 5-2 Respondents' Demographics

Characteristic	Statistic	
	N	%
Gender		
Male	141	40.29
Female	209	59.71
Age		
Less than 30 years old	175	50.00
More than 30 years old	175	50.00
Level of education		
Primary school	4	1.00
Secondary school	112	32.00
Pre-university	113	32.29
University	85	24.29
Postgraduate	36	10.29
Years of mobile phones usage		
Less than 2 years	20	5.71
2~4 years	28	8.00
4~6 years	59	18.43
6~8 years	64	18.28
8~10 years	69	19.71
More than 10 years	110	31.14

5.4.2 Measurement Model

In our study, Smart PLS was used to examine the measurement and structural model. We first tested the reliability of each construct by checking the value of composite reliability (CR), Cronbach's alpha and average variance extracted (AVE). The results showed that the values of composite reliability and Cronbach's alpha were all above the threshold value of 0.70 (Nunnally 1967) and the values of AVE were all higher than

0.5 (Fornell and Larcker 1981), thus indicating reliability was supported. In addition, the loadings of each item were greater than 0.70, showing convergent validity was sufficient. Moreover, discriminant validity was assessed by valuing the factor loadings of expected constructs higher than the cross loadings on any other constructs and the correlations between constructs were smaller than the square root of the AVE value of each indicator (Fornell and Larcker 1981). The results showed that discriminant validity was acceptable. The results are shown in Tables 5-3 and 5-4.

Table 5-3. Descriptive Statistics and Correlation Matrix

	CR	Cronbach's Alpha	AVE	RLVN	PMSA	INOV	PRCO	UI
RLVN	0.893	0.821	0.737	**0.860**				
PMSA	0.929	0.886	0.813	0.490	**0.902**			
INOV	0.916	0.863	0.785	0.265	0.244	**0.886**		
PRCO	0.916	0.862	0.785	-0.158	-0.07	-0.08	**0.886**	
BI	0.939	0.903	0.838	0.385	0.387	0.342	-0.153	**0.915**
Note1: RLVN =Service relevance, PMSA =Service accuracy, INOV = Innovativeness, PRCO =Privacy concern, UI=Usage intention. 2. The diagonal value in bold print represents the square roots of the AVEs.								

Table 5-4. Loadings and Cross Loadings of Constructs

	RLVN	PMSA	INOV	PRCO	BI
RLVN 1	**0.837**	0.401	0.242	-0.098	0.322
RLVN 2	**0.903**	0.439	0.193	-0.149	0.346
RLVN 3	**0.835**	0.421	0.249	-0.157	0.322
PMSA 1	0.418	**0.921**	0.197	-0.064	0.392
PMSA 2	0.468	**0.912**	0.217	-0.071	0.335
PMSA 3	0.447	**0.871**	0.255	-0.046	0.311

INOV 1	0.235	0.218	**0.879**	-0.090	0.295
INOV 2	0.232	0.196	**0.907**	-0.089	0.334
INOV 3	0.201	0.238	**0.871**	-0.030	0.275
PRCO 1	-0.096	-0.013	-0.080	**0.854**	-0.129
PRCO 2	-0.167	-0.086	-0.079	**0.927**	-0.145
PRCO 3	-0.152	-0.076	-0.055	**0.873**	-0.131
UI 1	0.315	0.344	0.331	-0.157	**0.902**
UI 2	0.376	0.346	0.280	-0.097	**0.910**
UI 3	0.365	0.371	0.327	-0.165	**0.933**

5.4.3 Common Method Bias Testing

As we use respondents' self-report data, common method bias might occur to weaken the validity of the results (Podsakoff et al. 2003). In order to test this problem, we used marker variable analysis followed the procedures proposed by Rönkkö and Ylitalo (2011). We used three factors in our data set with low correlations with the factors in our research model as marker variables. Next, we included these variables in our model to test their influences on use intention of mHealth services. The results have shown that these three marker variables have no impacts on the endogenous latent variable, indicating that common method bias is not concern in our study.

5.4.4 Structural Model

The results showed that the main effects are significant. Both perceived service relevance ($\beta = 0.390$, $T = 5.460$) and perceived service accuracy ($\beta = 0.101$, $T = 1.756$) positively influence use intentions of mHealth, and yields a total explained variance of =42.6% (R^2), thereby supporting hypotheses H1 and H2 Additionally, we also tested

the moderating role of innovativeness and privacy concern. innovativeness positively influences the relationship between perceived service accuracy and use intention (β = 0.188, T = 2.458), while having no effect on the relationship between perceived service relevance and use intention (β = -0.127, T =1.540). This indicates that hypotheses H3a is supported, but H3b is not. Further, the results indicated that privacy concern has a negative effect on the relationship between perceived service relevance and use intention (β = -0.125, T = 1.732), but having a positive effect on the relationship between perceived service accuracy and use intention (β = 0.187, T = 2.440). Thus, hypotheses H4a is supported and H4b is not supported. The results of the structural model are presented in Fig. 5-2 and Table 5-5.

Fig.5-2. PLS Results of the Structural Model

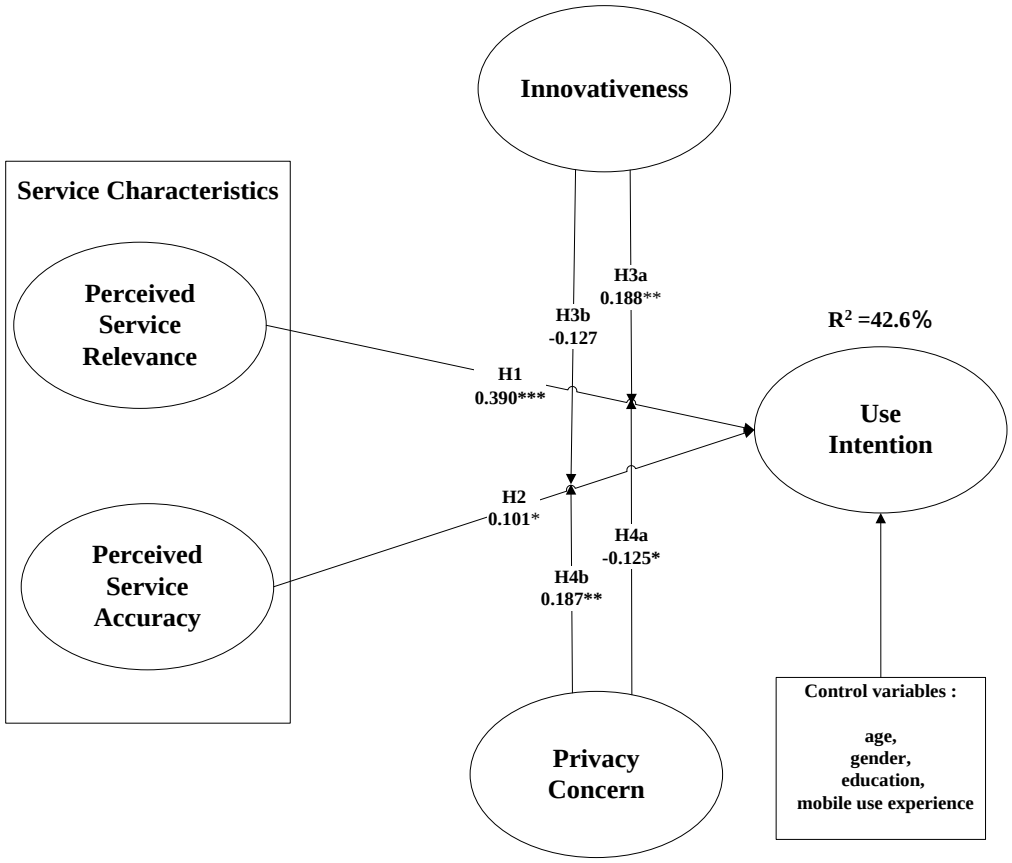


Table 5-5. The Structural Equation Model Results

	Path	β	T	Sig.
Main effects	RLVN → UI	0.390	5.460	***
	PMSA →UI	0.101	1.756	*
Moderating effects	RLVN* INOV →UI	0.188	2.458	**
	PMSA* INOV →UI	-0.127	1.540	NS
	RLVN* PRCO →UI	-0.125	1.732	*
	PMSA* PRCO →UI	0.187	2.440	**
Note1: when |t value| > 2.610, P < 0.01; when |t value| > 1.977, P < 0.05, when |t value| > 1.656, P < 0.1. Note2: ***p < 0.01, **p < 0.05; *p < 0.1; NS: not significant.				

5.5 Discussion of Study III

The purpose of this present study was to investigate the roles of service characteristics exerted in the process of mHealth service acceptance. A theoretical research model was developed to explore individuals' use intention of mHealth services and also examine the moderating effects of innovativeness and privacy concern. Service relevance significantly have positive influence in individuals' use intention of mHealth servcies, and service accuracy also positively influence individuals' use intention of mHealth services. Innovativeness exert positive moderating effects on the relationship between service relevance and use intention of mHealth, but has no moderating effects on the relationship between service accuracy and use intention of mHealth. Moreover, privacy concern negatively influence the relationship between service relevance and use intention, but positively moderating the relationship between service accuracy and use intention of mHealth. Based on the research results, we concluded three key findings.

5.5.1 Key Findings

First, this research integrated service characteristics into mHealth research context. service relevance and service accuracy are regarded as two representative elements of service characteristics. Service relevance refers to the extent to service provide by mHealth can meet individuals' need. Service accuracy reflects the degree to which the service/information provided by mHealth is accurate and reliable. We found that both service relevance and service accuracy positively influence individuals' use intention of mHealth services. The findings indicate that when individuals perceive the mHealth services can meet their healthcare requirement, and the services provided are accurate and reliable, they might be interested in using the service.

Second, the results show that innovativeness exerts positive moderating effects on the relationship between service relevance and use intention of mHealth services. This finding suggests that if potential users of mHealth services are innovators and always willing to try out new technologies or services, they tend to be pay more attention on the relevance of the service and care about whether mHealth service can satisfy their personal needs. This implies that individuals with innovativeness are more influenced by service relevance towards mHealth use.

Third, the study also explores the moderating role of privacy concern. Privacy concern is found to negatively moderate service relevance, but positively moderate service accuracy. The finding indicates that individuals seek reliable service when they worry about their personal information disclosure. It interprets that individuals will choose to

use mHealth services when they perceive the services provided are dependable and trustworthy even bearing with privacy concerns. Simultaneously, the finding also suggests that individuals with privacy concern are less willing to use mHealth services no matter how the service meet their requirements.

5.5.2 Theoretical Implications

This study provides several theoretical contributions. First, this research extends the previous understanding of the technology acceptance research that only considers the instrument beliefs such as perceived usefulness, perceived enjoyment and perceived ease of use as the antecedents of adoption intention of technology and fails to discover other silent influencing factors (Lee et al. 2017). In the current study, we investigate individuals' use behaviors in the mHealth research context, and expound individuals' use intentions by introducing the perspectives of service characteristics. This study has investigated the effects of service relevance and service accuracy, two representative service characteristics, on use intention of mHealth service, and provides a new insight into individuals' acceptance behavior of mHealth.

Second, this study also contributes to mHealth research by investigating individuals' different personal traits. Potential users of mHealth service might react differently when they have different personal attributes (Guo et al. 2016). In this current study, we incorporated innovativeness as one of the moderator to influence the relationship between service characteristics and use intention of mHealth. In this interaction process,

it shows that innovativeness has impact on service relevance and cannot influence service accuracy. The adoption of innovativeness augments our understanding of the technology adoption process by explaining the role of personal traits.

Moreover, we also examine the influence of privacy concern. Privacy concern is deemed as one the primary concerns in health services (Zhang et al. 2017). We adopted privacy concern to examine its moderating role in the mHealth research. Privacy concern can negatively moderate service relevance and positively moderate service accuracy. Therefore, this attempt provides fresh insights for researchers to explore the impacts of personal traits in the technology and health domain.

5.5.3 Practical Implications

In addition, this study also has new insights for practitioners and assist them in developing better mHealth services. Service relevance and service accuracy positively affect individuals' use intention of mHealth services. It implies that individuals' perceptions about the services are very important for influencing their future use of mHealth. Therefore, service providers need to guarantee the service is reliable, accurate and can satisfy their personal needs. Further, providers should aware that people with different personal traits might be sensitive to different service characteristics. For people who have privacy concerns, they pay more attention on accurate and trustworthy services. In addition, innovative individuals care about the relevant services, which can meet their personal needs.

5.5.4 Limitations and future research

This study still has several limitations should be concerned. Firstly, the data of this study was collected in Harbin, China. This might influence the depth of general applicability of this research. Therefore, researchers are suggested to gather data from random sample from different companies that related to mHealth services. Moreover, we only investigate service characteristics of service relevance and service accuracy as two representative antecedents of use intention of mHealth services. Other dimensions of service characteristics, such as service matching (Tam and Ho 2005), service expertise (Wallin and Lindestad 1998) also worth to explore in the future research. Furthermore, we only adopt innovativeness and privacy concern as two personal traits into our research, and we recommend researchers to explore other human attributes in future research.

5.6 Conclusion of Study III

The increasing number of studies have been conducted to investigate individuals' adoption behavior of mHealth service, but how service characteristics influence people's use intention has not been drawn much attentions. We confirm that service relevance and service accuracy positively and directly influence individuals' use intention of mHealth services. Additionally, this research also explores the moderating role of different personal traits. We confirm that innovativeness positively affects the relationship between service relevance and use intention. Privacy concern negatively

influence the relationship between service relevance and use intention, but positively influence the relationship between service accuracy and use intention. The present study aims to provide a new insights of perspective influencing individuals' usage behavior of mHealth services that can shed light on the further understanding of how individuals' adopt new information service or technologies, which contribute both information system and health care research area in a very promising way.

Appendix Measurement Items of Study Ⅲ

Perceived Service relevance (Cheung et al. 2008)

RLVN 1 The health service provided by mHealth services would be relevant

RLVN2 The health service provided by mHealth services would be appropriate

RLVN3 The health service provided by mHealth services would be applicable

Perceived Service accuracy (Wixom and Todd 2005)

PMSA1 The health service provided by mHealth will be accurate.

PMSA2 The health service provided by mHealth will be correct.

PMSA3 The health service provided by mHealth will be reliable.

Innovativeness (Lee 2013)

INOV1 I am willing to take new information technologies

INOV2 I think it is very interesting to try new information technologies

INOV3 I enjoy trying on new information technologies

Privacy concern (Cocosila and Archer 2010)

PRCO1 My use of mHealth services would cause me to lose control over the privacy of my personal health outcomes.

PRCO2 Using mHealth services would lead to a loss of privacy for me because my personal health information and health outcomes could be used without my knowledge.

PRCO3 Others might take control of my health information and health outcomes if I used mHealth.

Usage intention (Johnston and Warkentin 2010)

BI1 I intend to use mHealth services in the next 3 months

BI2 I predict I will use mHealth services software in the next 3 months

BI3 I plan to use mHealth services in the next 3 months

References

Agarwal, R., and Karahanna, E. 2000. "Time Flies When You're Having Fun: Cognitive Absorption and Beliefs About Information Technology Usage," *MIS Quarterly*, pp. 665-694.

Agarwal, R., and Prasad, J. 1998. "A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology," *Information Systems Research* (9:2), pp. 204-215.

Ahmad, R., Hoogeman, M. S., Bondar, M., Dhawtal, V., Quint, S., De Pree, I., Mens, J. W., and Heijmen, B. J. 2011. "Increasing Treatment Accuracy for Cervical Cancer Patients Using Correlations between Bladder-Filling Change and Cervix–Uterus Displacements: Proof of Principle," *Radiotherapy and Oncology* (98:3), pp. 340-346.

Akter, S., D'Ambra, J., and Ray, P. 2013. "Development and Validation of an Instrument to Measure User Perceived Service Quality of Mhealth," *Information & Management* (50:4), pp. 181-195.

Blut, M., Beatty, S. E., Evanschitzky, H., and Brock, C. 2014. "The Impact of Service Characteristics on the Switching Costs–Customer Loyalty Link," *Journal of Retailing* (90:2), pp. 275-290.

Cheung, C. M., Lee, M. K., and Rabjohn, N. 2008. "The Impact of Electronic Word-of-Mouth: The Adoption of Online Opinions in Online Customer Communities," *Internet Research* (18:3), pp. 229-247.

Cocosila, M., and Archer, N. 2010. "Adoption of Mobile Ict for Health Promotion: An Empirical Investigation," *Electronic Markets* (20:3-4), pp. 241-250.

Delone, W. H., and McLean, E. R. 2003. "The Delone and Mclean Model of Information Systems Success: A Ten-Year Update," *Journal of management information Systems* (19:4), pp. 9-30.

Dunk, A. S. 2004. "Product Life Cycle Cost Analysis: The Impact of Customer Profiling, Competitive Advantage, and Quality of Is Information," *Management Accounting Research* (15:4), pp. 401-414.

Flynn, L. R., and Goldsmith, R. E. 1999. "A Short, Reliable Measure of Subjective Knowledge," *Journal of Business Research* (46:1), pp. 57-66.

Fornell, C., and Larcker, D. F. 1981. "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error," *Journal of Marketing Research*), pp. 39-50.

Gaikwad, R., Sketris, I., Shepherd, M., and Duffy, J. 2007. "Evaluation of Accuracy of Drug Interaction Alerts Triggered by Two Electronic Medical Record Systems in Primary Healthcare," *Health Informatics Journal* (13:3), pp. 163-177.

Gu, J.-C., Lee, S.-C., and Suh, Y.-H. 2009. "Determinants of Behavioral Intention to Mobile Banking," *Expert Systems with Applications* (36:9), pp. 11605-11616.

Guo, X., Zhang, X., and Sun, Y. 2016. "The Privacy–Personalization Paradox in Mhealth Services Acceptance of Different Age Groups," *Electronic Commerce Research and Applications* (16), pp. 55-65.

Haimerl, C., and Fries, S. 2010. "Self-Fulfilling Prophecies in Media-Based Learning: Content Relevance Moderates Quality Expectation Effects on Academic Achievement," *Learning and Instruction* (20:6), pp. 498-510.

Ho, S. Y., and Bodoff, D. 2014. "The Effects of Web Personalization on User Attitude and Behavior: An Integration of the Elaboration Likelihood Model and Consumer Search Theory," *MIS Quarterly* (38:2).

Ho, S. Y., and Ho, K. K. 2006. "Success of Electronic Government Information Portal: Technological Issues or Managerial Issues?," *Journal of E-Government* (3:2), pp. 53-74.

Hussein, D., Park, S., Han, S. N., and Crespi, N. 2015. "Dynamic Social Structure of Things: A Contextual Approach in Cpss," *IEEE Internet Computing* (19:3), pp. 12-20.

Johnston, A. C., and Warkentin, M. 2010. "Fear Appeals and Information Security Behaviors: An Empirical Study," *MIS Quarterly*, pp. 549-566.

Lee, E., Han, S., and Jo, S. H. 2017. "Consumer Choice of on-Demand Mhealth App Services: Context and Contents Values Using Structural Equation Modeling," *International journal of medical informatics* (97), pp. 229-238.

Lee, S. 2013. "An Integrated Adoption Model for E-Books in a Mobile Environment: Evidence from South Korea," *Telematics and Informatics* (30:2), pp. 165-176.

Lewis, W., Agarwal, R., and Sambamurthy, V. 2003. "Sources of Influence on Beliefs About Information Technology Use: An Empirical Study of Knowledge Workers," *MIS Quarterly*, pp. 657-678.

Li, H., Sarathy, R., and Xu, H. 2011. "The Role of Affect and Cognition on Online Consumers' Decision to Disclose Personal Information to Unfamiliar Online Vendors," *Decision Support Systems* (51:3), pp. 434-445.

Lu, J., Yao, J. E., and Yu, C.-S. 2005. "Personal Innovativeness, Social Influences and Adoption of Wireless Internet Services Via Mobile Technology," *The Journal of Strategic Information Systems* (14:3), pp. 245-268.

Madden, M., and Rainie, L. 2015. *Americans' Attitudes About Privacy, Security and Surveillance*. Pew Research Center.

Malhotra, N. K., Kim, S. S., and Agarwal, J. 2004. "Internet Users' Information Privacy Concerns (Iuipc): The Construct, the Scale, and a Causal Model," *Information Systems Research* (15:4), pp. 336-355.

Midgley, D. F., and Dowling, G. R. 1978. "Innovativeness: The Concept and Its Measurement," *Journal of Consumer Research* (4:4), pp. 229-242.

Miner, L., Bolding, P., Hilbe, J., Goldstein, M., Hill, T., Nisbet, R., Walton, N., and Miner, G. 2014. *Practical Predictive Analytics and Decisioning Systems for Medicine: Informatics Accuracy and Cost-Effectiveness for Healthcare Administration and Delivery Including Medical Research*. Academic Press.

Musa, M. W., Mokhtari, M., Ali, B. M., Rasid, M. F. A., and Ghorbel, M. 2010. "Seamless Semantic Service Provisioning Mechanism for Ambient Assisted Living," *Proceedings of the 8th International Conference on Advances in Mobile Computing and Multimedia*: ACM, pp. 119-125.

Nunnally, J. C. 1967. "Psychometric Theory," McGraw-Hill New York.

Olshavsky, R. W. 1985. "Perceived Quality in Consumer Decision Making: An Integrated Theoretical Perspective," *Perceived Quality* (4:1), pp. 3-29.

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., and Podsakoff, N. P. 2003. "Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies," *Journal of Applied Psychology* (88:5), p. 879.

Rönkkö, M., and Ylitalo, J. 2011. "Pls Marker Variable Approach to Diagnosing and Controlling for Method Variance,". *Proceedings of the 32nd International Conference on Information System*.https://aisel.aisnet.org/icis2011/proceedings/researchmethods/8.

Rogers, E. M. 1981. "With Shoemaker, Ff (1971). Communication of Innovations: A Cross Cultural Approach." New York: The Free Press.

Rogers, E. M. 1995. "Diffusion of Innovation. 4th," *New York: The Free*.

Shareef, M. A., Kumar, U., and Kumar, V. 2008. "Role of Different Electronic-Commerce Quality Factors on Purchase Decision: A Developing Country Perspective," *Journal of Electronic Commerce Research* (9:2), p. 92.

Smith, H. J., Milberg, S. J., and Burke, S. J. 1996. "Information Privacy: Measuring Individuals' Concerns About Organizational Practices," *MIS Quarterly*, pp. 167-196.

Stieger, S., Burger, C., Bohn, M., and Voracek, M. 2013. "Who Commits Virtual Identity Suicide? Differences in Privacy Concerns, Internet Addiction, and Personality between Facebook Users and Quitters," *Cyberpsychology, Behavior, and Social Networking* (16:9), pp. 629-634.

Tam, K. Y., and Ho, S. Y. 2005. "Web Personalization as a Persuasion Strategy: An Elaboration Likelihood Model Perspective," *Information Systems Research* (16:3), pp. 271-291.

Thiesse, F. 2007. "Rfid, Privacy and the Perception of Risk: A Strategic Framework," *The Journal of Strategic Information Systems* (16:2), pp. 214-232.

Varshney, U. 2014. "Mobile Health: Four Emerging Themes of Research," *Decision Support Systems* (66), pp. 20-35.

Wallin Andreassen, T., and Lindestad, B. 1998. "Customer Loyalty and Complex Services: The Impact of Corporate Image on Quality, Customer Satisfaction and Loyalty for Customers with Varying Degrees of Service Expertise," *International Journal of Service Industry Management* (9:1), pp. 7-23.

Wang, L., Wu, T., Guo, X., Zhang, X., Li, Y., and Wang, W. 2018. "Exploring Mhealth Monitoring Service Acceptance from a Service Characteristics Perspective," *Electronic Commerce Research and Applications*(30).pp 159-168.

Whiting, P. F., Rutjes, A. W., Westwood, M. E., Mallett, S., Deeks, J. J., Reitsma, J. B., Leeflang, M. M., Sterne, J. A., and Bossuyt, P. M. 2011. "Quadas-2: A Revised Tool for the Quality Assessment of Diagnostic Accuracy Studies," *Annals of Internal Medicine* (155:8), pp. 529-536.

Wixom, B. H., and Todd, P. A. 2005. "A Theoretical Integration of User Satisfaction and Technology Acceptance," *Information Systems Research* (16:1), pp. 85-102.

Xu, H., and Gupta, S. 2009. "The Effects of Privacy Concerns and Personal Innovativeness on Potential and Experienced Customers' Adoption of Location-Based Services," *Electronic Markets* (19:2-3), pp. 137-149.

Yang, Z., Peterson, R. T., and Cai, S. 2003. "Services Quality Dimensions of Internet Retailing: An Exploratory Analysis," *Journal of Services Marketing* (17:7), pp. 685-700.

Zhang, X., Guo, X., Wu, Y., Lai, K.-h., and Vogel, D. 2017. "Exploring the Inhibitors of Online Health Service Use Intention: A Status Quo Bias Perspective," *Information & Management* (54:8), pp. 987-997.

Chapter 6 Conclusion

mHealth service, is an emerging medical pattern that applies information technology to the healthcare industry, has received extensive attention from experts, scholars and practitioners in the field of information systems and healthcare. As an emerging medical service, it has real problems in the current market with low adoption rate and low acceptance. The current research regarding to mHealth services is relatively fragmented and lack a systematic and comprehensive research system. Therefore, this dissertation, consists of three empirical studies, attempts to understand the different use behaviors of mHealth services and also investigate the influencing factors that trigger individuals' use of mHealth services.

Specifically, in study Ⅰ, it draws Regulatory Focus theory to examine how health performance expectancies affect routine use intentions of mHealth services, and also examine the moderating role of regulatory focus. The results suggest that health promotion expectancy has more effects than that of disease prevention expectancy on routine use intention of mHealth services. In addition, promotion focus exerts a positive role in promoting the routine use intention of mHealth services. Study Ⅰ articulates the effects of health performance expectancy on use intention of mHealth services, broaden the relevant research boundary, enhance the dimensions of mHealth use behavior, and also enrich the applicability of Regulatory Focus Theory in different research arena.

In study Ⅱ, it theoretically examines the effects of motivational attributes on different use intentions of mHealth services, and also categorized the antecedent elements of

extrinsic and intrinsic motivations. The results show that perceived usefulness and perceived enjoyment as the surrogates of extrinsic and intrinsic motivations have positive influence on routine and emergency use intentions of mHealth services. Besides, this study also finds 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.

In study III, it mainly investigates the effects of service characteristics on regular use intention of mHealth services, and examine the moderating role of personal innovativeness and privacy concern. The results suggest that individuals' use intention of mHealth services are influenced by service characteristics, perceived service relevance and perceived service accuracy. In addition, personal innovativeness strengthens the relationship between perceived service relevancy and use intention of mHealth services. Privacy concern negatively moderate the relationship between perceived service relevancy and use intention of mHealth services, but have positive moderating effects on the relationship between perceived service accuracy and use intention of mHealth services.

Extensive studies have been conducted to discuss mHealth use behaviors in both IS and healthcare research area. This dissertation attempts to build a multi-dimensional

theoretical model that probe into the different use behaviors of mHealth services and examine their influencing factors. This study contributes to the knowledge of mHealth in both theoretical and practical aspects, and provides a new perspective to understand the use behaviors of mHealth services.

In the future study, researchers are suggested to further explore the research of mHealth services in the following aspects. Akter et. al. (2013) describe the attributes of mHealth include mobility, ubiquitous, availability and promptness. Researchers can investigate how these attributes influence people's work and health performance. In addition, the current study only examines the different use intention of mHealth services. Future study can develop an appropriate research model to investigate the actual use and continuous use behaviors of mHealth.

References

Agarwal, R., Gao, G., DesRoches, C., and Jha, A.K. 2010. "Research Commentary—the Digital Transformation of Healthcare: Current Status and the Road Ahead," Information Systems Research (21:4), pp. 796-809.

Akter, S., D'Ambra, J., and Ray, P. 2010. "User Perceived Service Quality of M-Health Services in Developing Countries," 18th European Conference on Information Systems, pp. 1-12.

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), pp.29-47.

Akter S, RAY P. 2010. Mhealth-an Ultimate Platform to Serve the Unserved. Yearb Med Inform. pp.94-100.

Alagöz, F., Valdez, A.C., Wilkowska, W., Ziefle, M., Dorner, S., and Holzinger, A. 2010. "From Cloud Computing to Mobile Internet, from User Focus to Culture and Hedonism: The Crucible of Mobile Health Care and Wellness Applications," 5th International Conference on Pervasive Computing and Applications: IEEE, pp. 38-45.

Bakshi, A., Li, J., Ray, P., Narasimhan, P., and Bakshi, K. 2012. "Delivery of Multilingual Mhealth Service for Control of Tb/Hiv in Developing Countries," System Science (HICSS), 2012 45th Hawaii International Conference on: IEEE, pp. 925-931.

Chatterjee, S., Chakraborty, S., Sarker, S., Sarker, S., and Lau, F.Y. 2009. "Examining the Success Factors for Mobile Work in Healthcare: A Deductive Study," Decision Support Systems (46:3), pp. 620-633.

Chib, A., van Velthoven, M.H., and Car, J. 2015. "mhealth Adoption in Low-Resource Environments: A Review of the Use of Mobile Healthcare in Developing Countries," Journal of Health Communication (20:1), pp. 4-34.

Consulting, V. 2014. "Mhealth for Development: The Opportunity of Mobile Technology for Healthcare in the Developing World. Washington, Dc and Berkshire, Uk: Un Foundation-Vodafone Foundation Partnership. "

Cole-Lewis, H., and Kershaw, T. 2010. "Text Messaging as a Tool for Behavior Change in Disease Prevention and Management," Epidemiologic Reviews), p. mxq004.

Cocosila, M., & Archer, N. (2010). Adoption of mobile ICT for health promotion: an empirical investigation. *Electronic Markets, 20*(3-4), 241-250.

Dahdah, M., Du Loû, A.D., and Méadel, C. 2015. "Mobile Health and Maternal Care: A Winning Combination for Healthcare in the Developing World?," Health Policy and Technology (4:3), pp. 225-231.

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

Evans, W.D., Wallace, J.L., and Snider, J. 2012. "Pilot Evaluation of the Text4baby Mobile Health Program," BMC Public Health (12:1), p. 1031.

Free, C., Phillips, G., Galli, L., Watson, L., Felix, L., Edwards, P., Patel, V., and 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), p. e1001362.

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

Guo, X., Zhang, X., and Sun, Y. 2016. "The Privacy–Personalization Paradox in Mhealth Services Acceptance of Different Age Groups," *Electronic Commerce Research and Applications* (16), pp. 55-65.

Guo, X., Sun, Y., Wang, N., Peng, Z., and Yan, Z. 2013. "The Dark Side of Elderly Acceptance of Preventive Mobile Health Services in China," Electronic Markets (23:1), pp. 49-61.

Gustafson, D.H., and Wyatt, J.C. 2004. "Evaluation of Ehealth Systems and Services: We Need to Move Beyond Hits and Testimonials," BMJ: British Medical Journal (328:7449), p. 1150.

Hoque, M.R. 2016. "An Empirical Study of Mhealth Adoption in a Developing Country: The Moderating Effect of Gender Concern," BMC Medical Informatics & Decision Making (16:1), p. 51.

Istepanian, R., Laxminarayan, S., & Pattichis, C. S. 2006. “Ubiquitous m-Health Systems and the Convergence Towards 4G Mobile Technologies”. In R.S.H. Istepanian, S. Laxminarayan& C.S. Pattichis (Eds.), M-health: Emerging Mobile Health Systems (pp. 3-14). Boston, MA: Springer US.

Jun, J., Jacobson, S.H., and Swisher, J.R. 1999. "Application of Discrete-Event Simulation in Health Care Clinics: A Survey," Journal of the Operational Research Society), pp. 109-123.

Kay, M., Santos, J., and Takane, M. 2011. "Mhealth: New Horizons for Health through Mobile Technologies," World Health Organization (64:7), pp. 66-71.

Liu, X., Guo, X., Wu, H., and Wu, T. 2016. "The Impact of Individual and Organizational Reputation on Physicians' Appointments Online," International Journal of Electronic Commerce (20:4), pp. 551-577.

Lupton, D. 2015. "Health Promotion in the Digital Era: A Critical Commentary," Health promotion international (30:1), pp. 174-183.

Lustria, M.L.A., Smith, S.A., and Hinnant, C.C. 2011. "Exploring Digital Divides: An Examination of Ehealth Technology Use in Health Information Seeking, Communication and Personal Health Information Management in the USA," Health Informatics Journal (17:3), pp. 224-243.

Martínez-Pérez, B., De La Torre-Díez, I., and López-Coronado, M. 2015. "Privacy and Security in Mobile Health Apps: A Review and Recommendations," Journal of Medical Systems (39:1), p. 181.

Marcolino, M. S., Oliveira, J. A. Q., D'agostino, M., Ribeiro, A. L., Alkmim, M. B. M. & Novillo-ortiz, D. 2018. "The Impact of mHealth Interventions: Systematic Review of Systematic Reviews". *JMIR mHealth and uHealth,* （6）**,** e23.

Meng, F., Guo, X., Peng, Z., Lai, K.-h., & Vogel, D. 2016. "Routine Use of Mobile Health Services in the Presence of Health Consciousness". ICIS Proceedings 2016. http://aisel.aisnet.org/icis2016/ISHealthcare/Presentations/7/.

Mechael, P.N. 2009. "The Case for Mhealth in Developing Countries," innovations (4:1), pp. 103-118.

Miah, S. J., Gammack, J. & Hasan, N. 2017.“ Extending the framework for mobile health information systems Research: A content analysis”. *Information Systems,* （69）**,** 1-24.

Motamarri S, Akter S, Ray P, et al. 2014. “Distinguishing “Mhealth” from Other Healthcare Services in a Developing Country: A Study from the Service Quality Perspective”. Communications of the Association for Information Systems （34:1）, pp.669-692.

Ng S N, Matanjun D, D’souza U, Alfred R. 2015. “Understanding Pharmacists’ Intention to Use Medical Apps”. Electronic Journal of Health Informatics (9:1).

Sadegh, S. S., Khakshour, P. S., Sepehri, M. M. & Assadi, V. 2018. “A framework for m-health service development and success evaluation”. International Journal of Medical Informatics (112)**,** pp.123-130.

Standing, S., and Standing, C. 2008. "Mobile Technology and Healthcare: The Adoption Issues and Systemic Problems," International Journal of Electronic Healthcare (4:3-4), pp. 221-235.

Sultan, N. 2014. "Making Use of Cloud Computing for Healthcare Provision: Opportunities and Challenges," International Journal of Information Management (34:2), pp. 177-184.

Sunyaev, A., Dehling, T., Taylor, P.L., and Mandl, K.D. 2014. "Availability and Quality of Mobile Health App Privacy Policies," Journal of the American Medical Informatics Association (22:e1), pp. e28-e33.

Thirumurthy, H., and Lester, R.T. 2012. "M-Health for Health Behaviour Change in Resource-Limited Settings: Applications to Hiv Care and Beyond," Bulletin of the World Health Organization (90:5), pp. 390-392.

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

Venkatesh, V., Morris, M.G., Davis, G.B., and Davis, F.D. 2003. "User Acceptance of Information Technology: Toward a Unified View," MIS Quarterly, pp. 425-478.

Wu, J.-H., Wang, S.-C., and Lin, L.-M. 2005. "What Drives Mobile Health Care? An Empirical Evaluation of Technology Acceptance," System Sciences, 2005. HICSS'05. Proceedings of the 38th Annual Hawaii International Conference on: IEEE, pp. 150a-150a.

Wu, J.H., Wang, S.C., and Lin, L.-M. 2007. "Mobile Computing Acceptance Factors in the Healthcare Industry: A Structural Equation Model," International Journal of Medical Informatics (76:1), pp. 66-77.

Wu, L., Li, J.Y., and Fu, C.Y. 2011. “The Adoption of Mobile Healthcare by Hospital's Professionals: An Integrative Perspective,” Decision Support Systems, (51:3), pp. 587-596.

Zhang, X., Guo, X., Lai, K.-h., Guo, F., and Li, C. 2014. "Understanding Gender Differences in M-Health Adoption: A Modified Theory of Reasoned Action Model," Telemedicine and e-Health (20:1), pp. 39-46.