Review

What factors influence the mobile health service adoption? A meta-analysis and the moderating role of age

Yang Zhao[a], Qi Ni[a,*], Ruoxin Zhou[b]

[a] School of Information Management, Wuhan University, Wuhan, 430072, China
[b] Guanghua School of Management, Peking University, Beijing, 100871, China

A B S T R A C T

As an emerging field in the healthcare industry, mobile health service has been paid more and more attention in recent years. To explore the key determinants of individual attitude and behavioral intention, this study, based on 35 related empirical researches, conducted a meta-analysis to develop a comprehensive framework regarding the adoption of individual mobile health services and analyzed the moderating effect of age. Through descriptive statistics, reliability statistics, and correlation analysis, the results of meta-analysis indicate that perceived usefulness, perceived ease of use, perceived vulnerability and perceived severity all have significant impacts on individual attitude, while perceived usefulness, perceived ease of use, subjective norm, trust, perceived risk and attitude significantly influence behavioral intention. The moderator analysis confirmed that different age groups have specific moderating effects on mobile health services adoption, and results suggest that perceived ease of use, perceived vulnerability and perceived severity are more important factors for middle-aged and older users to use mobile health services.

1. Introduction

In recent years, with the improvement of people's demand for healthy living, there is increasing pressure for the traditional health industry. On the one hand, the proportion spent on health care in total fiscal expenditure is growing constantly in developed countries. For example, in the United States, health care expenditure accounted for 18.2% of GDP in 2015, and there was an increase of 5.7% compared to 2014. On the other hand, in some developing countries and less developed areas, due to the scarcity of medical resources and the unbalanced growth between the supply and demand, there is a difficulty in obtaining adequate medical services, and the cost remains high. At the same time, with the aggravation of aging problem, there is a sharp increase in morbidity and mortality of various types of chronic diseases worldwide. Facing this situation, how to reduce healthcare cost, optimize the allocation of healthcare resources, as well as improve the efficiency of patient diagnosis, treatment, and monitoring, has become the focus of the global health care industry.

Mobile health services (MHS) provide new opportunities. Healthcare Information and Management Systems Society (HIMSS) has defined mobile health services as providing health services and information through the use of mobile communication technology, such as smart phones, 3G/4G mobile networks and satellite communications.

Taking advantages of cloud computing and big data, mobile health (e.g. remote monitoring, remote consultation, personal healthcare digital services, and etc.) could track the health condition of people, evaluate the trend of its evolution and provide timely treatment. Mobile health services can save the time and cost of diagnosis. Besides, it plays a positive role in improving the quality and efficiency of medical resources, which is becoming one of the promising trends of health industry in the future.

However, the development of mobile health services, which still stays at "the first era of experimental proliferation" (Labrique, Vasudevan, Chang, & Mehl, 2013), has encountered many difficulties and challenges. As a new application of the mobile information technology and health industry, the popularization of mobile health services follows the diffusion of innovation theory, which needs to obtain common recognition and acceptance of public awareness. Moreover, the acceptance rates of mobile health services among different ages are different. Some scholars have already investigated this issue (Xue et al., 2012; Guo, Sun, Wang, Peng, & Yan, 2013; Deng, 2013). Therefore, the general factors and moderators of individual mobile health services adoption should be considered simultaneously. Besides, we could provide a more complete theoretical framework for individual mobile health services adoption research with a comprehensive quantitative analysis.

Meta-analysis refers to the statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating the findings (Glass, 1976), which provides a broader view of diverse researches by comparing different subcategories of studies rather than pure aggregation. Meta-analysis is widely used in the statistical analysis of the literature of advanced topics, and many scholars have conducted meta-analysis in the field of mobile acceptance. Deng, Zhang and Zhang (2012) conducted a meta-analysis based on 32 related empirical mobile commerce studies, aiming at analyzing the general factors which have influences on user attitude and behavioral intention. They also put forward a mobile commerce integration model. Zhang, Zhu and Liu (2012) conducted a systematic review and the meta-analysis of 53 studies regarding individual mobile commerce adoption, and the results indicate that culture does a moderating effect on mobile commerce adoption. Zhao (2016) conducted a meta-analysis to explore the impact of trust on mobile commerce acceptance, which expands the applications of meta-analysis in the field of user adoption. With the combination of mobile information communication technology and the medical services, mobile health services have the basic feature of mobile information system, which makes it suitable for meta-analysis.

However, there are some limitations in the individual mobile health services adoption proposed by previous research. First, although there are a lot of extant empirical research available on mobile health services acceptance, most of which have only investigated perceived usefulness, perceived ease of use, subjective norm and other essential technological variables from traditional information technology adoption theory like technology acceptance model (TAM), theory of planed behavior (TPB), and motivation theories (Deng, Mo, & Liu, 2014; Li et al., 2016; Cocosila & Archer, 2010). However, mobile health adoption behavior is also regarded as a health behavior. In this regard, not only the factors from traditional adoption theory, but also the factors of health-related behavior should be considered to extend research.

Second, most studies have tested essential constructs from established models such as TAM, TPB and motivation theory in the past, but due to the divergence of sample sizes, study contexts and sample characteristics, there are some contradictory conclusions. For instance, the effect of perceived usefulness on behavioral intention has been empirically tested to be significant in many studies (Xue et al., 2012; Zhang, Guo, Lai, Guo, & Li, 2014; Mohamed and Tawfik, 2011), while the findings of some other research indicate that the effect is not significant (Jen, 2010; Hsiao, Chen, & Tang, 2013; Boontarig et al., 2012), and the correlation coefficients are also different. These inconsistent conclusions not only cause confusions to researchers and medical institutions, but also bring obstacles to the development of mobile health services.

Third, with the growth of aging population in many countries, middle-aged and older users have gradually caught the attention of researchers. Compared to younger adults, middle-aged and older users have their unique physical and psychophysical characteristics. They are more likely to suffer from health problems, feel uncomfortable, as well as have lower efficacy, less mobility and less control over ICT (Guo et al., 2013; Guo et al., 2015). Also, the practical utility of ICT remains at a low level among the older generation (Guo et al., 2013). Age differences among potential consumers are associated with different behavior intention (Wang, 2014), but most previous studies have mainly focused on general user population regardless of their age. They seldom consider the differences among different age groups, which makes the applicability of the findings being subjected to certain limitations.

In conclusion, meta-analysis has been widely used in the studies of individual mobile adoption, but there is no comprehensive quantitative analysis related to mobile health services acceptance so far. To fill this gap, and to better understand the mobile health adoption and the moderating effect of age, we applied meta-analysis to conduct a statistical analysis on literature regarding the issue of users' adoption from the perspectives of traditional technology acceptance and health behavior theory, and to extract a comprehensive integrated framework of

mobile health services adoption. Specifically, age is often considered in the healthcare context. Considering the status quo and the problem of the aging population, we examined individual mobile health adoption by comparing two different age groups (i.e. the younger, and the middle-aged and older), to better understand the adoption of mobile health services.

The rest of this paper is organized as follows. Section 2 describes the research model and its key factors. Section 3 gives the methodology. Section 4 presents the data analysis, including descriptive statistics, reliability statistics, correlation analysis, and moderator analysis. Section 5 shows the discussions, section 6 shows the limitations and future research directions, and the conclusion is discussed in Section 7.

2. Research model

According to the frequency statistics of related literature and how important the construct is in mobile health adoption, we choose perceived usefulness, perceived ease of use, subjective norm, perceived behavioral control, trust, and perceived risk from traditional adoption theory, and two critical components of PMT, perceived vulnerability and perceived severity, as the variables in our proposed framework. Also, age difference (i.e. two age groups: the younger, and the middle-aged and older), which is considered as a moderator, was added in the proposed framework.

There are three reasons why other important factors influencing the adoption behavior are excluded in our research model. First, in the field of mobile health, many important factors like compatibility and perceived cost, are not appropriate to be included in the meta-analysis since they had only been investigated in a few studies. According to the frequency statistics of related literature, they are not suitable for statistics analysis in the following context. Second, other factors, like perceived service availability and personalization were excluded from the conceptual model, the main reason of which is that their roles in mobile health adoption remained unclear and confusing in previous research. Third, many factors with different names may represent similar meanings. For example, self-efficacy and facilitating conditions were closely related with perceived behavioral control, while response cost was also closely related with facilitating conditions. Thus in some papers, these constructs were uniformly viewed as perceived behavioral control. Also, response efficacy and performance expectancy were all talking about the perceived usefulness, so they can be regarded as the same factor. Therefore, factors that represent similar meanings were merged in our proposed model, and factors adopted in our model were those most used in the majority of previous research.

2.1. Technology acceptance theories

In the research field of information system (IS), technology acceptance theories focus on the factors that determine users' intentions or actual usage behaviors. Fishbein and Ajzen (1977) proposed the theory of reasoned action (TRA), which has been widely used to explain human behavior in many fields. Zhang, Guo, Lai, Guo, and Li (2014) developed a TRA model in mobile health adoption and the result suggested that attitude is a significant predictor of m-health adoption intention. The technology acceptance model (TAM) proposed by Davis (1989) is the most influential one among those technology acceptance theories, which provided a basis for tracing the influence of external factors on internal attitudes and intentions. This theory, TAM, pays attention to the impacts of two key factors, namely, perceived usefulness (PU) and perceived ease of use (PEOU), on two outcomes: attitude and behavioral intention. According to TAM, PU is defined as "the degree to which a person believes that using a particular system would enhance his or her job", while PEOU is defined as "the degree to which a person believes that using a particular system would be free of effort". Both PU and PEOU are used to measure individual internal perception of adopting a particular behavior. Behavioral intention (BI), defined as