The Overall Perception of Telemedicine and Intention to Use Telemedicine Services: A comparison between frequent travelers and non frequent travelers

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Abstract

With the development of new technology such as Internet and telecommunication, telemedicine has become a new alternative for potential users to get quick access to medical services regardless of the geographical limitation. The purpose of this study is to understand the potentials of using telemedicine and the possibility of applying telemedicine into tourism industry by comparing the differences on intention to use between frequent and non-frequent traveler groups. Six factors, efficiency, financial costs, reliability, perceived ease of use, perceived usefulness and interaction are identified to form the overall service perception, and the relationships between such perception and intention to use were tested using SEM. The results show that frequent travelers have higher perceptions and hence intention to use telemedicine which provides evidence for tourism companies such as hotels to incorporate telemedicine as a value-added service.

BIOGRAPHICAL SKETCH

Zhen Lin was born in Beijing, the capital of China. She was graduated from the College of Tourism and Service Management, Nankai University in Tianjian, with a bachelor degree in tourism management. With a strong interest towards hotel management, she decided to pursue a master's degree in hotel administration at Cornell University after graduation.

Zhen' interest in the hospitality industry was developed from past internships at Walt Disney Company and Mandarin Oriental Hotel Group. At Cornell, she was exposed to all kinds of courses, activities and internships that helped her to gain a deeper understating of the hospitality industry from the perspectives of operations, marketing, finance and etc. These experience greatly broadened her horizon and helped her to further pursue a career in this industry.

This work is dedicated to

my parents, who always give me unconditional support and love,

and my advisors, for their generous patience and guidance.

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I would like to express my sincere gratitude to Professor Chris Anderson for joining my special committee and showing me the beauty of quantitative analysis. My very first statistics class was taught by Prof. Anderson, from which I developed my interest in statistics and decided to learn more about data analysis. Without his help and guidance, the thesis would be quite different now.

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I. Introduction

With the rapid development of internet and information technologies in the 20th century, a surging number of opportunities have been arising in the integration of new technologies and healthcare industry and one of the most critical progresses made in the 1970s is telemedicine (Blyth, W. John, 1990). World Health Organization (2009) adopted a broad definition and defined telemedicine as "the delivery of health care services by professionals using information and communication technologies for the purpose of exchanging information, treatment, research and education". American Telemedicine Association (2011) gives the following definition that "telemedicine is the use of medical information exchanged from one site to another via electronic communications to improve a patient's clinical health status." As reviewed by Nihal and Elif (2002), telemedicine can take the following two forms: store and forward, which means data collected from patients can be stored and then transmitted to professionals to be further analyzed, such as electronic medical records (EMR); and synchronous interaction, which provides in-time communication and interaction with patients (Putzer and Park, 2012) through phones, videoconferencing and etc. Nowadays, a lot of services regarding both forms are available, including consultation, remote diagnose and even treatment, and follow-up recovery services. From patient's perspective, telemedicine makes it easier for them to get access to health services, keep track of their health conditions and make full use of the information, especially for people living in rural and remote area where medical resources are not always available or adequate (Berman, 2005). Besides, With the widely applied mobile technology, telemedicine has become more accessible for the general public.

Massive researches have been conducted to study the acceptance and intention to use telemedicine services. For example, information quality and technical performance (Sicotte et al., 2011), access and communication (Bakken, et al., 2006) and other factors including service quality have been identified in past researches to have impacts on telemedicine satisfaction and then affect the

acceptance. In terms of intention to use, traditional technology acceptance models have been adapted to telemedicine field and it has been proved that perceived usefulness and perceived ease of use have positive effects on behavioral intention to use telemedicine (Hu et al., 1999; Zailani et al., 2014) and the actual use. Some other factor, including prior experience (Or and karsh, 2009), reduced time and costs (Eikelboom and Atlas, 2005), service quality (Choi, et al., 2004) and so on are also identified to have impacts on intention to use telemedicine. However, from previous studies of new technology-based services, understanding the formation of overall service perception can be a better approach to measure intention (Kim et al., 2007). Therefore, one major contribution of this paper is to identify all the potential first level factors and form a second level perception measurement, and then propose an integrated model of telemedicine perception and intention to use. What is more, past researches seldom explored the differences between the relationships of overall perception and intention to use across groups, so this paper aims to fill in this research gap.

The application of telemedicine services in other industries, such as senior living (Gillespie et.al, 2016) and family care (Subramanian, 2005), is commonly seen in researches. However, it is quite rare to see the integration of telemedicine with hospitality, especially hotel and tourism industry. With the rising need of tourism activities and customer's increasing attention to their own health in traveling (Tolkach, et al., 2015), it is necessary to explore ways for tourists to have better access to quality medical services, keep track of their health status and be able to manage their health efficiently. One possible way to achieve this goal is through telemedicine to balance medical resources without the limitations of geographical location. Compared with people with less needs of traveling, frequent travelers are more likely to get exposure to health-related risks due to infection (Wynberg et al., 2012) or frequent change of environment, and they have been demonstrated to have quite different characteristics such as perception of service quality (Mowlana and Smith, 1993), and hence behaviors. It is reasonable to assume that frequent travelers would have different perceptions of telemedicine services and possibly higher intention to use telemedicine. Therefore, the second major contribution of this study is to compare the differences

on telemedicine service perceptions and intention to use across frequent traveler and non-frequent traveler groups. With the factors identified, we can have a better sense of the barriers and opportunities in further developing telemedicine and fully utilize telemedicine in traveling, so that potential users are able to manage their health effectively in traveling without going to local hospitals.

As discussed above, acceptance study of new technology and even telemedicine is not rare in the US. However, telemedicine acceptance research is still uncommon and has just begun to emerge in China, due to the reason that telemedicine was introduced to and developed in China relatively recent. Consequently, without the support of data, such research mainly remains at the stage of qualitative study. Even though telemedicine, especially patient-driven Apps and online portals, is new to Chinese market, there are great developing potentials according to market research (CIConsulitng, 2015). Therefore, the third contribution of this study is filling in the research gap of telemedicine acceptance in China with quantitative analysis. What is more, based on Vantakesh and Zhang (2010)'s study, the cultural differences have influence on technology adoption. So this paper aims to develop a telemedicine acceptance model in the context of Chinese market and integrate factors identified from service quality, customer satisfaction as well as intention to use.

In conclusion, the contribution of this study has three folds: first of all, a higher order measurement model for overall telemedicine service perception is proposed and integrated with intention to use. Second, a comparison of models between frequent versus non-frequent travelers reveals new findings on their differences in telemedicine perception and intention to use. Finally, this paper fills in the gap of Chinese telemedicine researches.

II. Literature Review

2.1 Telemedicine and its development in China

2.1.1 Telemedicine in China

As a developing country with a huge population of more than 1.3 billion, China faces the problems of balancing medical resources and making healthcare available to rural, middle and western areas. Therefore, telemedicine attempts were initiated relatively early in China in 1980s. In 1986, a shipping company in Guangzhou tried out remote diagnosis for its own employees. And then in 1988, Chinese People's Liberation Army (PLA) General Hospital initiated videoconferencing with foreign hospital to share information and knowledge (Zhao, etc, 2010). At the beginning phase, telemedicine in China mainly served for the purpose of consultation. In the 90s, with the support of national departments and policies, infrastructure such as internet and telecommunication systems has been developed across the whole country. Three major network, which are International MedioNet of China (IMNC), GHN and PLA, were established. Telemedicine was able to be applied into more practical situations (Xue and Liang, 2007). For instance, China and US shared medical information for the first time through real-time interaction over videoconferencing. In the 21st century, telemedicine has developed rapidly with the widespread Internet, 3G mobile communications and wearable devices (Sun et al., 2013). In the meantime, major provinces in China had begun the process of establishing telemedicine systems within and across provinces. Based on Gong and Su's (2015) research, around 69% of provinces have already had or are currently building telemedicine centers with different scales till 2015.

The current state of telemedicine in China can be concluded from the following aspects: Because of the large population of patients, different healthcare treatment and services are needed in China. Consequently, all kinds of telemedicine markets exist, while several markets take dominant positions, such as traditional B2B videoconferencing, B2C diagnosis, online consultation, remote monitoring, medical education, elder care, international diagnosis/ treatment and self-health

monitoring through wearables (CIConsulting, 2016). In terms of online consultation and diagnosis, not just hospitals and clinics have gradually developed their own website and mobile Apps that such functions, but information system and software developers has also entered this market. Major Internet companies such as Baidu and Tecent also developed businesses into telemedicine based on their strengths in big data. From a study of telemedicine market, the market value reached 2.2 billion in 2013, and CIConsulitng (2016) predicted the market to reach 17.2 billion in 2018. So we can expect online consultation via websites and mobile Apps to grow with the growth of entire market. The telemedicine online portals and mobile Apps enable not only the patients who need medical services or long term care (Zhan et al., 2011) but also the general public to manage their health in daily life. However, telemedicine service that targets travelers specifically is not available now.

2.1.2 Academic achievement

Although telemedicine is an emerging industry with a history of around 30 years in China, many researches have already been conducted in this field. Based on the literature review, those researches can be classified into three categories: first of all, many researches compared the development of telemedicine in China with that in foreign countries (Zhao et al., 2014; Hongchun and Dongya, 2014) to identify potential problems within infrastructure development, policy establishment, service volume and training (Gong and Su, 2015) and then provided insights for future trends. Second, some researches are done to investigate the clinical application of telemedicine. For example, in Li Xuefei et al (2013)'s literature research, telemedicine in China mainly applied to remote monitoring for maturity and management of chronic diseases, such as diabetes and high blood pressure. And they found out that most clinical researches regarding telemedicine use control group, but the randomness of sample and the way of controlling groups are not specified.

A small proportion of studies examined telemedicine from service management prospective.

Generally, the telemedicine process is studied as a service delivery system, and researchers tried to come up with a service delivery mode that suits China's environment and patient's needs. For instance, Liao Sheng-wu et al (2015) compared the service mode of developed countries with that of China, identified problems existed in current mode and then provided corresponding suggestions. ZHAI Yun-Kai (2016) designed a service delivery model that consists of four parts, which are telemedicine service application, service verification and arrangement, expert consultation and diagnosis, and finally quality evaluation. Factors that might influence the model such as recognition of services, technologies, communication quality and etc. are also discussed.

Compared with US researches, where the experiments or empirical studies are based on specific telemedicine projects (Mair et al., 2000; Bakken et al., 2006; Cranen et al., 2011) and then the change of perception and satisfaction are measured through, telemedicine service researches in China used merely literature review or observation and quantitative research is quite rare. Therefore, quantitative studies are needed to examine the previous work and provide more evidence to support the theories. What is more, the development of telemedicine technologies is rapid, so it is necessary to keep track of those new changes and conduct up-to-date researches.

2.2 Factors Affecting Overall Telemedicine Perception

Based on Zeithaml's (1988) research, an overall perception can be concluded as customer's overall assessment of product/services with the consideration of perceived benefits and risks, and hence perceived quality, price and value all have an impacts on overall perceptions. In the telemedicine researches, Demiris et al. (2004) adapted this concept of overall perception to study patient's impressions on telemedicine benefits as well as risks by Telemedicine Perception Questionnaire (TMPQ) based on a tele-homecare project. Four major dimensions that forms perception were idenified, which are quality of homecare, time and money, virtual visit related factors and general impressions. The TMPQ was then tested in subsequent studies of tele homecare and other factors such as communication (Buysse et al., 2010; Lee and Rho, 2013), privacy (George et al, 2009), intimacy (Yoder et al., 2012), accessibility (Lee and Rho, 2013), sense of control (Finkelstein et

al., 2011;) and etc. were identified to be influential on perception. However, few researches are able to consider "all" factors and measure the overall perception. Since this paper also aims to study the perception of telemedicine, therefore, the TPQM forms the theoretical foundation for identifying those perception factors, but the influence of new technology such as online portal and mobile Apps should be taken into account. The following factors were identified from literature review and semi-structure interviews.

Financial Costs and Efficiency

Two potential concerns that might affect service evaluation and intention to use telemedicine are financial costs and efficiency, which consists of both money and time investments (Gong and Su, 2015, Wang et al., 2006) studied perceived financial resources, which is the perception of the ability to cover financial costs, and found that high resources lead to higher intention to use mobile services. In the domain of telemedicine, costs related to getting access to medical service using internet or mobile technology and the actual cost of medical services are potential concerns that might affect user's evaluation of service and intention to use (Kraai et al., 2011). In terms of efficiency, time have been interpreted as speed of delivery (Pratibha, 1996; Sohn, 2008) and waiting time in the context of Internet and electronic using and both of them have been found to have significant impacts on overall perception. For instance, Dellaert and Kahn (1999) found that time spent on getting the information have negative effects on websites evaluation. George et al. (2009) found that for African Americans and Latinos, one of the perceived advantages of using telemedicine is reduced waiting time. Therefore, we give the following hypotheses:

H1: Efficiency is one of the factors that can be used to measure overall perception of telemedicine services.

H2: Financial cost is one of the factors that can be used to measure the overall perception of telemedicine services

Perceived Ease of Use

Initially identified by Davis (1986), perceived ease of use has been proved to have significant influence on intention to use by numerous researches. Generally, ease of use refers to accessibility to service and technology operations. For example, it has been pointed out in previous researches of internet revisiting that the ease to find information and to navigate is one of the most important determinants (Rice, 1997; Kaynama, 1997). In the evaluation of telemedicine service experience, the ease of equipment use (Demiris et al., 2004) and availability of such equipment and medical resources (Holden and Dew, 2008; Finkelstein et al., 2011) are identified to have influences on the perception of services. It makes intuitive sense if getting needed information is difficult or the whole service delivery process is complex, customers probably would have negative perceptions of the quality and less intention to use it next time.

H3: Perceived ease of use can be used to measure the overall perception of telemedicine services.

Perceived Usefulness

Similar to perceived ease of use, perceived usefulness is also a major concept originated from technology acceptance studies (Davis, 1986), which means that customers consider the technology system to be useful in improving their performance. And the positive outcomes from using the system is also related with positive perceptions of usefulness (Venkatesh, 1999). In the telemedicine studies, it has been proved that patients have great concerns on the success of treatment (Holden and Dew, 2008), efficacy (Nam et al., 2013) or the success of outcomes (Kraai et al., 2011). These factors can be used as sub-dimensions or substitutes of perceived usefulness to measure telemedicine perception and satisfaction. Therefore, we propose the following hypotheses:

H4: Perceived usefulness can be used to measure the overall perception of telemedicine services.

Reliability

Reliability is the ability to perform the promised service dependably and accurately (Parasuraman et al. 2005), which indicates the importance of service process. In the health sector, reliability of healthcare services has been proved to have significant impacts on service perceptions (Babakus

and Mangold, 1991). In terms of telemedicine reliability, since telemedicine is mainly based on internet, telecommunication systems as well as mobile technology, so one potential concern associated is the identity of those online doctors and their qualification (George et al., 2009) since the qualification is directly related to the success of outcome. Another risk is the safety of personal information and privacy (Zhang and Jun, 2002) that negatively influence perception of service and intention to use. Yoder et al. (2012) also pointed it out that patients are sometimes reluctant to sensitive questions regarding their symptoms or personal information in their study of using videophone. In this study, security and privacy are considered sub-dimensions of reliability.

H5: Reliability is one of the factors that can be used to measure the overall perception of telemedicine services.

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Interaction

In the Internet environment, service providers often cannot provide real-time response (Zhang and Jun, 2002) and hence negatively affect service evaluation. In telemedicine, communication is another common concern that affect the perception of telemedicine services. For example, Lee and Rho (2013) found that communication is one of the four factors in patient's perception of mobile health monitoring services and patients have expressed concerns of the intimate relationship with multiple service providers, hospital staff and even other users. In this case, the degree of communication or interaction with service providers can be either a perceived benefit or a disadvantage of telemedicine for patients. Another aspects of interaction comes from the lack of face-to-face communication (Papps and Seale, 2009). When using telemedicine online portal or Apps to get medical service, patients can simply stay at home and get direct access to health professional through their own computers or mobile phones, transmit their health records collected by wearable devices and then get corresponding medical services they need. Consequently, patients have much less face-to-face interaction with medical staff (Alain et al. 2013). Frances Mair (2000) also indicated the fact that although patients can accept tele-consultation, they have concerns of this kind of service delivery mode in terms of the communication with service providers. Therefore,

the increasing needs for interaction might lead to lower service evaluation. Therefore, we propose the following hypothesis:

H6: Interaction is one of the factors that can be used to measure the overall perception of telemedicine services.

2.3 The Relationship between Perception and Intention to Use

The rapid development of information technology has stimulated relative studies of new technology acceptance since the 1980s. With theoretical acceptance model, organizations are able to manipulate factors that influence consumer's intention to use new technology and therefore control consumer behaviors. Davis (1986) initially developed technology acceptance model for the purpose of studying computer use behaviors. In this model, perceived usefulness (PU) and perceived ease of use (PEOU) are two major determinants of attitude, which in turn influences intention to use. Besides, PU has direct influence on intention to use as well. Due to different research context, there are many adapted version of this model, and one of the most commonly used ones developed by Davis (2000) further identified external variables of PU and PEOU. Subjective norm, which refers to the influence of other people' opinions that are of importance to you, was tested to have both direct and indirect relationship with intention to use.

Besides the measurement of behavioral use, end-user satisfaction is also a way to measure acceptance of new technology (Brown, 2002). Customer satisfaction is closely related to service quality since "Satisfaction (or dissatisfaction) results from experiencing a service quality encounter and comparing that encounter with what was expected" (Oliver, 1980). In other words, satisfaction is a subjective feeling and emotions caused by the perceived difference between expectations and service quality. Besides the commonly used service quality model (Parasuraman et al., 1985), expectancy-disconfirmation model developed by Oliver (1981) is another frequently used tool to measure satisfaction, in which perception of service plays an important role. Compared with use, which can be directly observed, satisfaction is relatively difficult to measure, but it is not rare to see some models developed based on satisfaction by identifying influential factors.

In the context of telemedicine, most of the researches were conducted from the clinics and health professionals' perspectives. Models such as technology acceptance, service quality and satisfaction have been adapted to fit into different medical service areas, cultural backgrounds and targeted objects. For example, Paul et al. (1999) examined physician's acceptance of telemedicine using technology acceptance model and found out the model is generally applicable with some limitations on explaining attitudes and intentions. Akter et al. (2013) identified three dimensions, system, interaction and information quality, each with two or three sub dimensions to measure service quality perception of m-health. And they validated that such quality measurements are helpful in predicting satisfaction as well as behavioral intentions. In this research, the influencing factors mentioned in the previous section are all identified in service quality, satisfaction or technology acceptance studies, which means these factors have influence on intention to use either directly or indirectly. Therefore, we can assume the overall perception formed by these factors will also have influence on intention to use and propose the following hypotheses to examine such relationship:

H7: Telemedicine service perception has positive impact on intention to use

2.4 Differences between Frequent Versus Non-frequent Travelers

Although little is done in understanding the needs for health care in travelling, as there is an increasing attention to health care, we can assume the same among travelers. Needless to say, no one wants to "travel with hope, but return ill" (Porter, 1992). From Rogers et al.' s study (2002), more than half international business travelers have reported travel related health problems based on a sample 140 employees. Since international travelling might be riskier in getting involved with health problems compared to domestic travelling, it is reasonable to assume that health problems are a potential factor that would increase traveler's concerns about traveling, affect their activities and hence influence the general traveling experience. Therefore, examine whether they can accept telemedicine as a means to manage their health effectively in traveling can be helpful to provide value-added services and better experience for travelers.

Different from that in other industries, the mobile and telecommunication technologies are considered as a part of overall traveling experience (Eriksson, 2003). Technology acceptance models have been adapted to tourism industry and tested as well. For instance, Kim et, al (2008) constructed an acceptance model to examine tourist's attitude towards and actual behavioral intention to use mobile technology through SEM, and factors such as perceived ease of use, perceived usefulness, trip experience and technology experience are identified to have impacts.

Based on the traveling frequency, travelers can be categorized into two major groups, namely frequent and non-frequent travelers. It has been proved by previous literature that frequent travelers have different perceptions on services and thus behavioral intention in travel activities. First of all, since frequent travelers have more experience with the services they can get within traveling, they know what to expect with definite expectations (Knutson, 1988; Lai and Hitchcock, 2017). So they can be sensitive to quality, price and other issues with new services that can provide them greater travel choice (Mowlana and Smith, 1993). That is to say, frequent travelers probably have greater sensitivity to telemedicine services and thus have different service perceptions. Second, Rivers et al. (1991) found that frequent traveler have strong attachment to benefits. The goal of using of telemedicine in tourism is to help travelers manage their health more effectively and thus frequent travelers are supposed to have higher perceptions of telemedicine services. Another fact is that frequent travelers are predominantly business travelers (Toh and Hu, 1988; Rivers, 1991) so they share some common characteristics. In terms of perception of costs, business travelers value free or reasonably priced services such as Internet (Gustafson, 2012) and controlling costs is necessary. So they probably would higher perceptions on reduced costs. For efficiency, business travelers have the needs to stay productive and efficient while traveling, and they value free Internet and high speed access to services (Dunn and Tucker, 2013). And the perceptions of ease of use and usefulness of technology are also high for business travelers. So we can assume frequent travelers also value convenience more than anything else (Rivers, 1991) and thus have higher perception on efficient services. Then for reliability, Weaver et al. (2007) found out that people are better able to evaluate service quality with more travel experience so we can assume that frequent travelers are

better able to perceive reliability. Lastly, for interaction, the responsiveness, communication frequency and doctor's attitude can all contribute to convenience and service quality and thus frequent travelers are expected to have higher evaluation on interaction.

Another characteristic that might affect frequent traveler's perception of services is that they normally have higher education, income and status, and thus they have more freedom in organizing their travel activities (Doyle and Nathan, 2001). So frequent travelers have the tendency to use advanced technology such as mobile devices in trips (Kim et al., 2008; Oh et al., 2009) to maintain such flexibility. So we can assume that they also prefer to use telemedicine in traveling as a means to manage health and probably as a value added service that can enhance their overall travel experience.

Although there is no explicit definition of frequent traveler and hotels and airlines generally have different standards for their frequent flyer or stayer programs, based on the prediction of China National Tourism Administration, the average annual travels per person is going to be 3.7 times for Chinese people. That also corresponds to previous definition of frequent traveler in Woodside et al.'s (1987) research. Therefore, we used 4 times as the cut point in this paper with frequent travelers traveling more than 4 times a year and non-frequent travelers less than 4 times and propose the following hypotheses:

H8a: Compared with non-frequent traveler, frequent travelers have higher telemedicine service perceptions in terms of the value of efficiency, financial cost, reliability, perceived ease of use, perceived usefulness and needs for interaction.

8b: Compared with that of non-frequent traveler, frequent travelers have higher intention to use telemedicine services

III. Methodology

3.1 Sample

To ensure the randomness and quantity of data, we decided to distribute survey via a data collection platform Sojump, which is one of the biggest platform in China with more than 12 million users. Since the study is targeted at Chinese telemedicine industry, it is assumed that Sojump can better reach the Chinese market despite of the bias that all the respondents are frequent users of such survey platform, so they might have higher tendency to accept advanced technology associated with Internet. A total of 776 questionnaires were randomly distributed online in two weeks, and after checking all responses based on the answers to attention checkers and completion time, 411 were considered valid.

3.2 Measurements

Due to the fact that the users of telemedicine service are still the minority compared to the whole population and so are the travelers, there is no existing data that can be applied to this research directly. To avoid the influence of zero experience, we decided to conduct experimental research to collect first-hand data and ask participants to fully imagine themselves of using telemedicine services in a particular scenario. And then they can answer the questions based on such perceptions. Therefore, an experimental survey is designed.

Bitner (1990) pointed out that written scenarios can better control variance as well reduce random noise in experiments. Therefore, in this paper, the survey adopted the written scenario method and the scenarios are described in detail for the purpose of reducing as much variance as possible. For example, not only the complete service process is described with pictures showing each service stage, but also provides the details of conversation, doctor's attitude and final results. As can be concluded from the literature review, there are many service forms within telemedicine. We chose to set the scenario on the use of patient-driven Apps, which has great developing potential because

of the growing number of mobile users. Then, eight attitudinal measurements were developed for efficiency, financial cost, reliability, perceived ease of use, perceived usefulness, interaction, and intention to use. In this study, we adopted the 7-point Likert-scale (1932) from the range of 1=Strongly Disagree to 7=Strongly Agree, which is commonly used in all kinds of questionnaires related to attitude questions. Demographic questions including age, gender, education background, residence, travel frequency and frequency of using medical services were asked in the last section.

The measurements are adapted from telemedicine satisfaction and acceptance surveys. Each factor is measure by 3 to 6 statements. And the final section of survey captures the demographic information of participants, including age, gender, education level, location, travel frequency and average times of using medical services.

3.2.1 Efficiency

The measurement of efficiency was adapted from the scale developed by G Demiris et al. (2000). In their study, efficiency refers to the travel time for both patients and nurses. In our research, through preliminary focus group discussion and pilot study, the travel times within the telemedicine service process are all identified and listed as separated items, such as the travel times to, from and within hospitals, diagnosis speed as well as the time spent on searching for telemedicine services. Respondents were asked to select their levels of agreement on whether telemedicine reduced unnecessary waiting time and enhanced healthcare service efficiency. DiStefano et al (2009) found that using average scores can help to "retain the scale metric" so that the interpretation is easier and useful in "comparison across factors when there are differing numbers of items per factor". Based on this finding, we used average scores for Efficiency in following analysis.

3.2.2 Financial Cost

The measurement for financial cost was adapted from Wang et al.'s research on consumer's intention to use mobile services. They defined perceived financial resources to be the abilities or

resources that consumers believe they have in order to use mobile systems, such as the money to pay for the services or devices. In this study, similar to efficiency, we identified all the aspects that have reduced financial costs within the whole telemedicine service process, such as cost on traveling, registration and medical services, and measured participant's perceptions of costs using 5 items. After factor analysis, the item describing no concerns on medical insurance was found to have low communalities extraction and was deleted. And the rest items have good loadings. Similar to efficiency, average scores are used to interpret financial cost.

3.2.3 Reliability

As a commonly used factor in measuring customer satisfaction, a lot of questionnaire have developed similar measurement for reliability. In this study, we mainly adapted the scales from Bakken et.al's research (2006), in which reliability refers to the reliability of service outcome, service providers and service safety. Through pilot study, we summarized 5 items to measure reliability from the perspectives of accuracy of diagnosis, expertise of telemedicine service providers, credibility of service information provided by telemedicine Apps and the reliability of the platform in terms of technology. As discussed above, average scores are used to interpret this factor.

3.2.4 Perceived Ease of Use

The measurement for perceived ease of use is also commonly seen in technology acceptance researches. In this study, this measurement was directly adapted from Davis's TAM model (1989), in which ease of use is defined as customer's perception of using the technology system with little effort. In the telemedicine service process, efforts are potentially needed in getting access to telemedicine services, understanding and learning new technology and actual use of telemedicine services. Therefore, respondents were asked to evaluate statements including "I think getting access to telemedicine is easy", "I think it is easy to understand the form and service process of telemedicine", "I think it is easy to use telemedicine" and "I do not need the assistance use

telemedicine services in this scenario". Average scores instead of factor scores are used in this measurement.

3.2.5 Perceived Usefulness

Same as perceived ease of use, the measurement for perceived usefulness is adapted from TAM model. Davis (1989) defined usefulness as customer's belief in improved performance or better outcome with new technology system. In telemedicine acceptance studies, perceived usefulness generally refers to the later dimension. 3 items that measure perceptions of telemedicine outcome, such as "telemedicine solved my problems" and "telemedicine is useful in health management", are adapted to our questionnaire. Average scores are used in the following analysis for perceived usefulness.

3.2.6 Interaction

Based on Yip et al.'s (2003) study on patient's satisfaction of using telemedicine services, several items that are related to communication frequency were used in their questionnaire. This study adapted their scale and re-worded some of the items so that they can fully fit into the context of scenario. Finally, 5 items were kept to measure perceptions of communication accessibility, frequency, quality as well as doctor's attitude in communication. Similar to previous factors, average scores are used to retain the matric.

3.2.7 Intention to Use

Intention to use comes from the positive attitude towards the experience or product. This study aims to measure the presence and intensity of intention to use telemedicine after imaging the whole service process. The measurement for intention to use was adapted from Nysveen et al.'s scale with one item measuring if customers have the willingness to use telemedicine in the future and the other

item measuring the level of such willingness. Another item measuring customer's willingness to recommend telemedicine services to families and friends is adapted from Hu et al.'s (1999) scale.

3.3 Procedure

The questionnaire was developed initially in English and then translated into Chinese Mandarin. To ensure that the descriptions of scenarios and questions are understandable and professional, a focus group of eight Chinese graduate students were gathered. Each participant was asked to filled out the questionnaire first and then together discussed each section one by one. Based on their opinions, the scenario was changed to be more detailed and realistic, and adjustments of words and grammar were made. Then a pilot study was conducted to test the reliability and validity of measurement. 120 questionnaires were randomly distributed online, and 60 valid ones were collected. From the analysis of data, small changes were further made.

IV. Results

First of all, descriptive analysis would be applied to understand the demographic characteristics of the sample. Then factor analysis is used to assess the reliability and validity of statements and extract factors. T test and ANOVA are also used to compare the difference in means of different groups with other variables being controlled. Finally, multi-group structural equation modeling (SEM) is applied to study the relationships between intention to use and all the measurements with items and test hypotheses. In the following section, data analysis results will be shown in details.

4.1 Sample Characteristics

Of all respondents, 54.5% were male and 45.5% were female. Since we restricted the age to between 25 and 65, so there were no respondents younger than 25 or older than 65 and they all have had at least one business travel experience. More than half (57.7%) is between 25-35, and people above 45 years old are only 8% of all participants. As for education background, the majority of respondents (82%) have bachelor degrees or equivalent. Half of the them travel less than 4 times

a year and around 12% travel more than once a month. As stated in literature review, people travel more than 4 times a year can be considered frequent travelers in China. Our sample shows a good balance between the number of frequent versus non-frequent travelers. In terms of needs for medical services, the distribution is similar to the needs of traveling, 53% seeks for medical service less than 3 times a year, whereas 42% requires it more than 3 times but less than 12 times. In addition, 45.5% of the participants have had past experience with telemedicine services.

Table 1: Demographic Information of Respondents

Demographics	**Categories**	**Percentage**
Gender	Male	54.5
	Female	45.5
Age	25-34	57.7
	35-44	35.0
	45-54	6.6
	55-65	0.7
Education	High school and below	4.1
	Bachelor	82
	Master and above	13.9
Residence	North	34
	South	66
Travels/year	Less than 4 times	50.4
	Above 4 times	49.6
Medical services/year	Less than 4 times	53.3
	4 to12times	42.3
	Above 12 times	4.4

4.2 Reliability and Validity of the Measurement Model

As the basis of measurement instrument analysis, reliability, the ability to measure consistency, and validity, which refers to measurement accuracy (Tavakol & Dennick, 2011), were examined first. To examine the reliability of questionnaire and whether the items are able to loaded into corresponding factors, we conducted confirmatory factor analysis and computed the Cronbach's Alpha to test internal consistence of the measurements. Items that are unreliable should be

identified and removed in this process. As a result, 30 items are proved to be reliable, and all dimensions mentioned above can be extracted from factor analysis. With one unreliable item in the Cost dimension removed, all dimensions have a cronbach's alpha ranging from 0.7 to 0.9 as shown in table 2, and composite reliability (CR) values are all above the threshold of 07, which indicate high reliability of the measurement instruments within one dimension.

Table 2: Cronbach's Alpha and Correlation

	Measurements	Cronbach's Alpha	AVE	CR	1	2	3	4	5	6	7
1	Efficiency	0.774	0.536	0.852							
2	Cost	0.702	0.543	0.825	.708*						
3	Reliability	0.909	0.737	0.933	.625*	.623*					
4	Ease of use	0.849	0.693	0.900	.695*	.542*	.592*				
5	Usefulness	0.832	0.752	0.901	.718*	.607*	.764*	.634*			
6	Interaction	0.848	0.642	0.900	.735*	.700*	.754*	.669*	.812*		
7	Intention to use	0.921	0.811	0.945	.666*	.608*	.739*	.547*	.810*	.770*	

* indicates significance on 0.05 level

For validity, construct validity that measures correspondence between items is tested by factor analysis as well as correlations. In this study, only convergent and discriminant validity need to be checked since all items were adapted from previous literature. The factor loading for each items ranging from 0.6 to 0.9, and variances explained for each dimension are 53.58%, 54.26%, 73.70%, 69.31%, 75.28%, 64.24% and 81.08% respectively, which indicates good convergent validity. And from the correlations, we can observe significant correlations between variables. Since the measurements are all discriminant concepts, the correlation suggests good validity.

Table 3: Measurements in Questionnaire

Items	**Means**	**SD**	**Factor Loadings**
Efficiency			
I think telemedicine saves time in traveling to hospitals and waiting for registration	6.05	0.97	0.755
I think telemedicine saves time of unnecessary physical examination and therefore makes the diagnosis efficient	5.19	1.46	0.750

I think telemedicine saves the time in traveling different departments within the hospital	5.94	1.04	0.744
I think telemedicine saves time in giving medicines and paying for the fees	5.41	1.31	0.699
The time spent on searching and getting the App is short	5.60	1.12	0.710
Financial Cost			
I think telemedicine save money on traveling to and from hospitals	6.03	0.99	0.757
I think telemedicine saves registration fee	5.54	1.35	0.793
The costs for downloading telemedicine App and using the internet is minimal	5.70	1.19	0.745
The service fee of telemedicine is reasonable	4.73	1.51	0.643
Reliability			
I think the diagnosis is reliable in this scenario	5.21	1.23	0.874
I think the doctor who provides telemedicine service is professional	5.28	1.23	0.855
Even without physical examination, doctor can learn about my health condition in this scenario	4.95	1.40	0.876
The information (comments on doctors, fees, etc) provides by this App is accurate and reliable	5.07	1.22	0.869
The telemedicine App will not have technical problems	4.88	1.42	0.816
Perceived Ease of Use			
I think getting access to telemedicine is easy, such as downloading and installing the App	5.79	1.06	0.856
I think it is easy to understand the form and service process of telemedicine	5.62	1.12	0.854
I think it is easy to use telemedicine	5.74	1.06	0.838
I do not need the assistance of medical service providers or technicians to use telemedicine services in this scenario	5.54	1.21	0.780
Perceived Usefulness			
I think telemedicine can solve my problems	5.25	1.22	0.868
I can understand my health conditions in time and manage my health	5.59	1.13	0.869
I think telemedicine is useful	5.77	1.00	0.865
Interaction			
I can get more attention from medical service providers via telemedicine	5.46	1.12	0.832
I feel comfortable communication with medical service providers through telemedicine	5.36	1.19	0.820
Communication with medical service providers through telemedicine is similar to face to face communication	4.88	1.55	0.731

I can get in touch with telemedicine service providers when needed	5.53	1.13	0.767
The communication frequency is reasonable in this scenario	5.47	1.05	0.851
Intention To Use			
In general, I think telemedicine is acceptable	5.66	1.11	0.880
I will choose telemedicine next time if needed	5.32	1.28	0.895
I will always choose telemedicine whenever I need medical services	5.18	1.38	0.920
I will recommend telemedicine to families and friends	5.31	1.31	0.907

4.3 An Overall Measurement Model for Telemedicine Perception

To test the measurement model for for overall perception on telemedicine perception, we used Amos to conduct confirmatory factor analysis and fitted the measurement model. The standardized estimates for each factor are 0.80, 0.76, 0.84, 0.72, 0.90, 0.91 respectively and these positive estimates are all significant on .05 level (table 4). And the overall model fit is examined by $\chi 2/df = 0.845$ with a p-value = 0.518, which suggests that the model is fit. GFI is 0.997, AGFI is 0.985, CFI is 1.000 and RMSEA is 0.000, and hence all other goodness-of-fit indices also suggest very good overall model fit (Kline, 2015). Therefore, we can confirm the hypotheses 1 to 6 that efficiency, financial costs, reliability, perceived ease of use, perceived usefulness and interaction affect the overall perception of telemedicine services and such influences are positive.

Table 3: Measurement model of overall perception

Paths	Standardized Estimates	T values	P values	Model Fit
Perception->efficiency	0.80	19.411	***	$\chi 2/df = .845$
Perception->costs	0.76	19.411	***	p-value = .518
Perception->reliability	0.84	18.320	***	GFI = .997
Perception->usefulness	0.72	18.652	***	AGFI = .985
Perception->ease of use	0.90	21.231	***	CFI = 1.000
Perception->interaction	0.91	21.740	***	RMSEA = .000

4.4 The Impact of Overall Perception on Intention to Use

A structural regression model was established to test the hypothesis that overall perception has positive impact on intention to use telemedicine services using maximum likelihood procedure. The goodness-of-fit indices ($\chi 2/df$ =3.121, GFI=0.956, AGFI=0.922, CFI=0.982 and RMSEA=0.072) indicating that the overall model fit is good, although the p-value for chi-square is not significant on 0.05 level. The impact of overall perception on intention to use telemedicine is 0.90 and this positive impact has significant p-value, therefore, hypothesis 7 is confirmed by the regression model. After taking the relationship between perception and intention to use into consideration, the standardized estimates changed a bit for the measurement model, but the significant positive influences remain the same.

Table 4: Structural regression model of overall perception and intention to use

Paths	Standardized Estimates	T values	P values	Model Fit
Perception->efficiency	0.79	19.388	***	$\chi 2/df$ =3.121
Perception->costs	0.75	19.388	***	p-value = .000
Perception->reliability	0.84	19.221	***	GFI = .956
Perception->usefulness	0.70	18.381	***	AGFI = .922
Perception->ease of use	0.91	21.548	***	CFI = .982
Perception->interaction	0.90	21.290	***	RMSEA = .072
Perception->intention	0.90	17.609	***	

4.5 Comparison of Between Frequent and Non-frequent travelers

4.5.1 Comparison of Means

Based on the descriptive analysis, we can see that around half of the participants travel less than 4 times. So we used 4 as a cut point and categorized travelers into non-frequent group (travel less than 4 times per year) and frequent group (more than 4 times per year). Based on the independent-samples T-test with travel frequency as the grouping variable, we get higher means of each dimensions for the frequent traveler group. Although the mean differences for each factor is not very huge, the significance of Efficiency is .001 while others are all .000, which means the differences are significant on a 0.05 level (Table 5). So compared with non-frequent travelers, those

who travel with a high frequency generally have higher perceptions on efficiency, cost, reliability, ease of use, usefulness and interaction. This result can be further examined in the following multi-groups structural equation modeling.

Table 5: T-test for Different Travel Frequency Groups

Factors	t	df	Mean of Group1	Mean of Group2	Sig. (2-tailed)	Std. Error Difference
Efficiency	-3.288	406.096	5.50	5.78	0.001	0.084
Cost	-4.193	405.926	5.31	5.69	0.000	0.089
Reliability	-6.450	408.549	4.75	5.42	0.000	0.125
Ease of use	-5.159	403.018	5.45	5.90	0.000	0.088
Usefulness	-5.258	408.998	5.30	5.78	0.000	0.093
Interaction	-4.809	408.908	5.12	5.57	0.000	0.093

Group 1: Non-frequent traveler group
Group 2: Frequent traveler group

4.5.2 Multi-group Structural Model: Frequent vs. Non-frequent Travelers

The measurement model and regression model discussed above confirmed the positive effects of those factors on overall perception and the positive influence of overall perception on intention to use. To further understand the difference between frequent travelers and non-frequent travelers, we divided the data into two groups with 207 cases in the first group (non-frequent traveler) and 204 cases in the second group (frequent traveler) so that the sizes of both group are almost identical and continued to examine the multi-group models. First of all, we examined two multi-group measurement models with different constraints settings on the loading weights. Each model contains 6 indicators and in the unconstrained model, no constraints was set on the loading weights, while in the equal loading constraints model, we set equal W1, W2, W3, W4, W5 and W6 across two groups. The comparisons of those two models reveals that assuming equal loading weights in two groups can better fit the data. And then multi-group regression model was built based on this assumption, as shown in figure 1. By holding the loading weights equal in measurement model, we aim to examine the regression weights from overall perception to intention to use.

In the reduced model (equal loading model), the p-value for chi-square is significant (0.000), but all other goodness-of-fit indices met the threshold (RMSEA=0.05, GFI=0.93, AGFI=0.90, CFI=0.98 and AIC=233.26) which indicates good overall model fit. A comparison of the full model (unconstrained model) with the reduced model is shown in table 6. Although the indices for two models are almost identical, but the AIC value and the RMSEA for the reduced model are smaller and hence the reduced model is preferred.

Table 6: Goodness-of-fit Indices of regression models

Models	df	χ^2	p	RMSEA	GFI	AGFI	CFI	AIC
Unconstrained Loading (ULSR)	68	150.88	.000	.055	.932	.890	.977	234.88
Equal Loading (ELSRALL)	69	151.26	.000	.054	.932	.891	.977	233.26

By comparing the standardized estimates of reduced model in two groups, we can still observe the significant positive impacts of influencing factors on telemedicine service perception and of perception on intention to use (table 7). Another interesting result revealed from the analysis is that the standardized estimates are all higher in the frequent traveler group than those in the non-frequent traveler group and thus confirms our hypothesis that frequent travelers have different overall perceptions on telemedicine service and higher intention to use telemedicine services.

Table 7: Standardized Estimates of the Model for Two Groups

Paths	Standardized Estimates	T values	P values
Perception->efficiency	0.77	19.50	***
Perception->costs	0.71	19.50	***
Perception->reliability	0.78	18.93	***
Perception->usefulness	0.61	18.69	***
Perception->ease of use	0.88	21.86	***
Perception->interaction	0.87	22.00	***
Perception->intention to use	0.83	17.32	***

***indicates significance

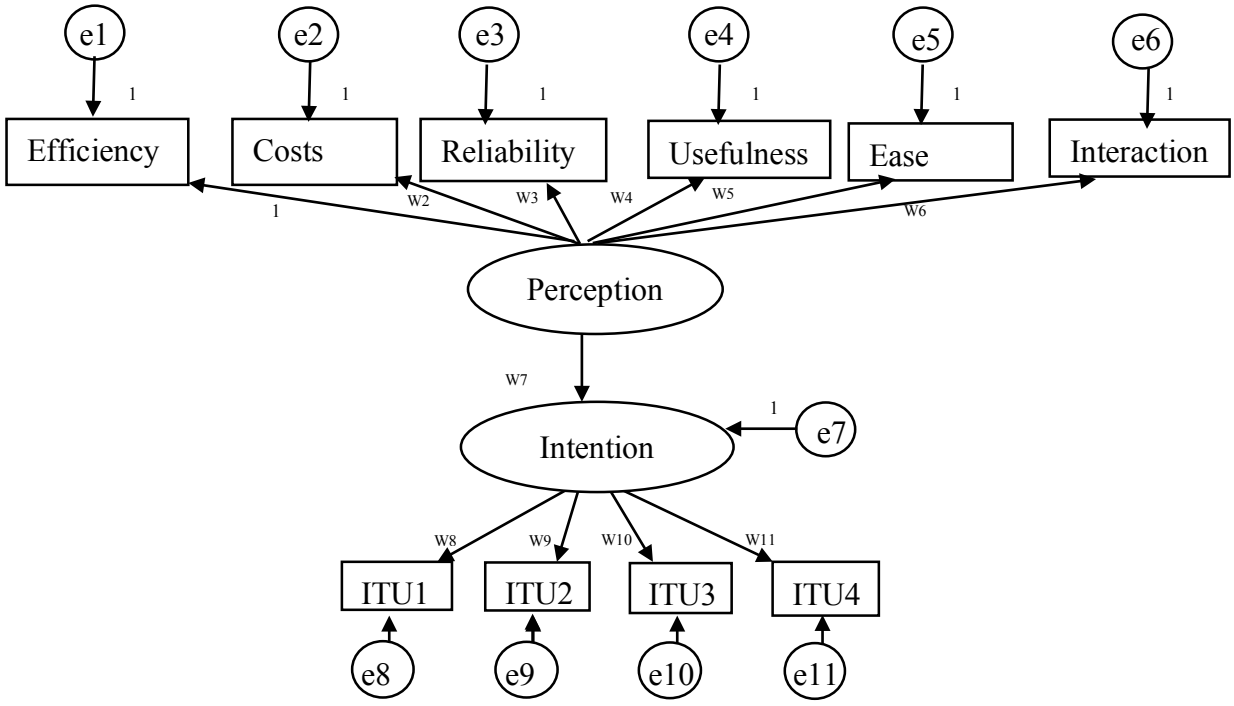
Group 1: Non-frequent traveler

Paths	Standardized Estimates	T values	P values
Perception->efficiency	0.83	19.50	***
Perception->costs	0.80	19.50	***
Perception->reliability	0.88	18.93	***
Perception->usefulness	0.74	18.69	***
Perception->ease of use	0.92	21.86	***
Perception->interaction	0.93	22.00	***
Perception->intention to use	0.96	17.32	***

***indicates significance

Group 2: Frequent traveler

Figure 1:



V. Discussion and Implication

This research aims to study the overall perception of telemedicine services and its impact on user's attitude and behavioral intention to use it in their daily life as a means to manage health efficiently, and further study the possibilities of incorporate telemedicine with tourism, so that travelers, especially frequent travelers, are able to get access to medical resources whenever and wherever needed. To achieve this goal, a sample was collected in China, which is considered a market with great developing potential for telemedicine, and the factors that have impacts on intention to use are identified and examined by the experimental study.

From the above results, we can conclude the following findings: First of all, from the measurement model, all six factors can be loaded on telemedicine perception in two different travel frequency groups. Hence, all the hypotheses are proved that higher efficiency, reliability, perceived ease of use and usefulness, lower financial cost and needs for interaction result in higher perceptions. The positive relationship between overall perception on telemedicine services and intention to use is also confirmed by the structural regression model. Based on the value of standardized estimates, we can conclude that the user of telemedicine Apps generally value perceived ease of use and interaction most, followed by efficiency and reliability. While financial costs and usefulness play less essential role in the overall perception of telemedicine services. Then by comparing the frequent versus non-frequent traveler groups' measurement model, we can conclude that the mechanism of forming the overall perception and the relationship between overall perception and intention to use are the same for two groups. However, for frequent traveler, the intention to use telemedicine is stronger, which is resulted by their higher perceptions on all influential factors. This can probably be explained by the fact that telemedicine can help them to maintain flexibility in traveling.

As for the managerial implications of the findings, the paper provides guidance mainly for telemedicine service providers, such hospital and App developers, to focus on characteristics such

as efficiency, financial cost, reliability, ease of use, usefulness and interaction frequency in order to make users satisfied and increase their intention to use. To be more specific, users think the most important aspect of telemedicine App is ease of use. Thus, the design of the App should be user friendly with all relative information and resources accessible. What is more, users expect not to increase the interaction with doctors, and the doctors are expected to respond in time and with good attitude. Particular trainings should be provided to the doctors to help them get familiar with the online diagnosis service pattern. Appropriate allocation of time on real life work and online work should be considered when scheduling doctors in order to make sure that the request of patients can be taken care of in time. Although the reliability, costs and usefulness are less valued, they still have impacts on satisfaction and intention. Therefore, relative factors such as the qualification of doctors, the stability of platform and the protection of personal information should be taken into account when designing and implementing telemedicine services.

Another implication is for tourism companies, such as hotels whose core businesses are from business travelers and frequent travelers. Since they have higher intention to accept this new technology, hotels can consider to work with healthcare firms to offer such telemedicine service as a value-added service. One the one hand, travelers are able to get access to medical services immediately when they feel unwell, and one the other hand, travelers can also use telemedicine services as a health management tool and keep track of their health status. What is more, it can also be used as a marketing tool that can change the way of healthcare service delivery in traveling and thus provide better travel experience.

The contributions of this paper have three folds: first of all, this research not only identified the potential first-level factors but also successfully loaded them onto a high order factor which is the overall perception. And then studied the impacts of those factors on perception and intention to use from by considering them as an entirety. As indicated by Wixom and Todd (2005), an integrated model of technology acceptance is not only helpful in understanding and implementing service characteristics identified by satisfaction but also helpful in predicting behavioral use. Second, this

paper not only investigated the intention to use telemedicine in daily life, but also took a step further to study the possibility of using telemedicine in tourism industry. The results showed significant behavioral intention differences by comparing the frequent and non-frequent traveler groups and people with more travel demands have higher tendency to accept telemedicine with higher perceptions of services. The reason behind higher acceptance probably can be explained by Doyle and Nathan's (2001) study on frequent traveler's characteristics that they are managers and professionals with higher levels of education. Those findings can provide useful evidence introduce telemedicine into tourism industry, aid in the designing and implementation of telemedicine online portals and ultimately support the integration process of healthcare and tourism. Finally, since the research is targeted at Chinese telemedicine market and the sample was collected from China, this research can fill in the gap of the telemedicine studies in China. As discussed in the literature review section, although telemedicine has a history of more than 20 years' development in China, relative studies are still rare and mostly are qualitative due to the difficulty in collecting first hand data. This study provides quantitative support for previous literatures.

However, there are several limitations in this study related to the research design and data collection. First of all, due to the limitation of time and actual feasibility, we used written scripts to describe scenarios. However, video-based methods or lab experiments might reduce more interpretation variance (Seawright and Sampson, 2007) so that participants are able to fully imagine themselves in those situations with more variables being controlled. Second, for the purpose of study, the scenarios are simplified and only describe one similar situation, which is using telemedicine Apps to get online consultation, while in reality, each telemedicine service experience can be quite different each time for each person. Third, because of the time limitation on data collection, we chose online distribution which has the possibilities to bias our results from the following two ways: respondents are all online survey platform users, so they are more familiar with Internet and telecommunication technologies. As a result, they probably are more open to new technologies such as telemedicine. What is more, most of the participants live in cities, so the difference in perceptions between urban and rural groups cannot be compared.

Future researches can expand on the following aspects: first of all, different research methods such as video-based or observations on actual use of telemedicine services can be conducted. Second, more factors that can possibility influence satisfaction should be investigated and added to the current model. Third, future studies can also look into other types of telemedicine services, and physicians and hospitals attitude towards telemedicine usage. The paper only considered those factors that would influence customer perception and intention to use, such as financial cost and efficiency. However, if considering from physician or hospital's perspective, costs or time probably cannot be further reduced. Therefore, telemedicine acceptance research should also be conducted from their perspective and give development suggests with all stakeholders being considered. Finally, demographic influences on acceptance, which is not addressed in this research, can also be further explored.

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