INVESTIGATING THE EFFECTS OF NEGATIVE HEALTH MOOD ON ACCEPTANCE OF MOBILE HEALTH SERVICES

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ABSTRACT

The public's slow acceptance of mobile health (mHealth) services significantly impedes mHealth providers' performance gains. Therefore, these providers devise persuasive strategies to motivate more individuals to use their services. However, the relationship between persuasion cues and motivational factors remains largely unknown. This study integrates the elaboration likelihood model and motivational model to investigate individuals' mHealth services use intention by considering the effect of negative health mood. A questionnaire survey was conducted, with 270 responses collected to validate our research model and hypotheses. The results indicate that mHealth service matching and mHealth source credibility are positively associated with both intrinsic and extrinsic motivations, which in turn affect use intention. While negative health mood has no significant direct effects on intrinsic motivation and use intention, it positively influences extrinsic motivation. In addition, negative health mood moderates the relationship between two critical persuasive cues and motivational factors. Specifically, negative health mood strengthens the effect of mHealth source credibility but weakens the effect of mHealth service matching on extrinsic motivation. Limitations and implications for research and practice are discussed.

Keywords: Mobile health; Negative health mood; Elaboration likelihood model; Motivational model.

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1. Introduction

Representing one emerging application of mobile information communication technology in the health sector, mobile health (mHealth) services are a form of health information technology that uses mobile devices to deliver timely and ubiquitous health information and services to meet individuals' healthcare needs [Akter et al. 2011; Akter and Ray 2010]. Existing mHealth studies have demonstrated great potential benefits for both individuals and governments, including reduced healthcare costs, improved treatment outcomes, personal health data management, and more efficient processes within healthcare services [Hoque and Sorwar 2017; Zhao et al. 2017]. In coping with infectious diseases, in particular, mHealth services can provide users with timely outbreak detection and disease surveillance and guide public health officials to enact a precise response [Wood et al. 2019]. Although the prevalence of mobile phones and thousands of healthcare apps available online provide an ideal situation for the development of mHealth services, the level of acceptance of mHealth services among the public remains low [Kwon et al. 2017; Ye et al. 2019], thus preventing providers and users from reaping the potential benefits of this promising service. Therefore, it is urgent for mHealth providers to understand how to motivate users and persuade them to accept mHealth services.

Although prior studies have significantly extended our knowledge of mHealth services acceptance, some critical research gaps remain. First, while adoption of mHealth services mainly derives from motivations [including both extrinsic and intrinsic motivations) of the focal individuals [Cocosila 2013; Kwon et al. 2017; Veríssimo 2018], our understanding of the antecedents that motivate mHealth services acceptance is limited. In the literature, scholars have identified several critical antecedents of mHealth services acceptance, which can be categorized based on their alignment with either extrinsic motivation (e.g., perceived usefulness, performance expectancy, perceived risks, information and service quality, etc.) or intrinsic motivation (e.g., perceived enjoyment and hedonic motivation) [Alam et al. 2020; Deng et al. 2018; Duarte and Pinho 2019; Okazaki et al. 2015; Zhao et al. 2017]. In order to better explain technology appropriation and understand the managerial implications, it is critical to further explore the antecedents of both extrinsic and intrinsic motivations [Cocosila and Turel 2019; Ke et al. 2012]. In our context, individuals are more likely to have limited knowledge of mHealth services; therefore these services need to be promoted to individuals, and service providers need to try every possible method of persuading individuals to adopt mHealth services. That is, mHealth services uniquely require providers to take measures to embed central cues (e.g., argument quality, doctors' information quality, and doctors' service quality) and peripheral cues (e.g., source credibility, the mHealth app's reputation, and institutional assurance) into the service in order to persuade individuals to adopt it [Chen et al. 2018; Meng et al. 2019]. However, the extant literature has developed little knowledge regarding how providers persuade individuals to adopt mHealth services through increasing their intrinsic and extrinsic motivation, leading to user motivations behind mHealth services being under-examined. Accordingly, we propose the first research question: *Whether persuasive cues within mHealth services influence users' intrinsic and extrinsic motivations, which in turn predict their acceptance of mHealth services?*

Second and more importantly, negative health mood, which is described as a situation in which individuals with a diagnosed illness evaluate their health status in a manner reflecting negative moods like fear, depression, and anxiety [Anderson and Agarwal 2011], often affects existing or potential mHealth service users. However, the effect of negative health mood on mHealth service acceptance has not been well studied. Furthermore, in contrast with users of other IT applications, users of mHealth services are often experiencing illness, which is more likely to induce a negative mood. Accordingly, individuals with health negative moods (e.g., worry and health anxiety) are more likely to conduct health-related activities such as online health information seeking and consulting [Lagoe and Atkin 2015; Lee and Hawkins 2016; te Poel et al. 2016]. Therefore, the second research question is: *Whether a user's negative health mood influences her/his intrinsic and extrinsic motivations and adoption intention regarding mHealth services?*

In addition, such individuals may respond differently to persuasion, as individuals in various mood states can process persuasive cues in different ways [Petty and Briñol 2015]. In other words, central persuasive cues and peripheral cues may influence individuals' decision-making in different ways, which is determined by their negative health mood [Bless et al. 1990; Bohner et al. 1992; Petty et al. 2015]. It is, therefore, crucial to examine how negative health mood interacts with persuasive cues in affecting individuals' perceptions of extrinsic and intrinsic motivations, thus improving their decision processes regarding the acceptance of mHealth services. Examining the role of negative health mood in mHealth acceptance will not only yield a better understanding of how such special users respond to mHealth but also extend the mood literature. Accordingly, the third research question is: *Are the effects of persuasive cues on a user's intrinsic and extrinsic motivations contingent on her/his negative health mood?*

To address the above research questions, drawing upon the elaboration likelihood model [ELM, Petty and Cacioppo 1986] and the motivational model [MM, Davis et al. 1992], this study develops and tests a model integrating the relationships among persuasive cues and motivational factors to better understand the antecedents of

mHealth acceptance. In particular, our study tests the effects of persuasive cues (i.e., mHealth service matching as central cues and mHealth source credibility as peripheral cues) on both intrinsic and extrinsic motivations, which in turn affect individuals' use intentions. Furthermore, we examine the effects of negative health mood on motivational factors and use intention regarding mHealth services and the contingent role of negative health mood in the persuasion process. To validate the research model and hypotheses, structural equation modeling (SEM) was employed to analyze our data and test our hypotheses with a valid sample of 270 respondents in China.

Our study makes several theoretical and practical contributions. Theoretically, although acceptance of mHealth services has been widely explored in the last few years, most previous studies mainly rely on various technology acceptance theories to explain the acceptance of mHealth services. Our study is one of the first that empirically investigates the effects of persuasive cues on intrinsic and extrinsic motivations in the context of mHealth services from the ELM perspective. By doing so, our study provides a comprehensive understanding of acceptance of mHealth services and the antecedents of intrinsic and extrinsic motivations in the persuasion process. In addition, this study provides a new lens for understanding mHealth services acceptance by examining the contingent role of negative health mood on the relationship between persuasive cues and motivational factors, which has rarely been investigated in prior studies. In practice, mHealth service providers can utilize the findings of this study to develop persuasion strategies targeting individuals experiencing negative health moods, thereby motivating more people to use mHealth services.

The remainder of this paper is organized as follows. We first discuss mHealth services, negative health mood, the ELM, and the MM, which have all been investigated in prior studies. This is followed by our description of the key theoretical constructs and relationships. We then present all hypotheses related to the research questions, followed by the presentation of the research method and data analyses. Finally, we discuss the results and the implications for research and practice before drawing final conclusions.

2. Literature Review

2.1. Mobile Health Services

Mobile health (mHealth) services refer to health services and information delivered through mobile communication devices such as mobile phones [Akter et al. 2010; Free et al. 2010; Varshney 2014]. Compared with traditional health services, mHealth services have several potential benefits for users, such as facilitating healthcare service delivery, improving delivery processes, and reducing healthcare costs [Balapour et al. 2019; Shin et al. 2017]. Moreover, mHealth services as a self-management tool empower users with health information and data, supporting their healthcare decision-making and health promotion [Cocosila and Turel 2019; Varshney 2014]. Further, mHealth services can effectively support public health and the work of health professionals and administrators [Veríssimo 2018; Wood et al. 2019].

The extant literature on mHealth services acceptance is rich and extensive, employing multiple research theories and models. Examples include the technology acceptance model [Deng et al. 2018; Okazaki et al. 2015; Shareef et al. 2014; Zhao et al. 2017], the unified theory of acceptance and use of technology [Alam et al. 2020; Duarte and Pinho 2019], protection motivation theory [Guo et al. 2015; Rai et al. 2013; Sun et al. 2013; Zhao et al. 2017], the motivational model [Cocosila 2013; Cocosila and Archer 2010; Cocosila and Turel 2019], and the elaboration likelihood model [Chen et al. 2018; Meng et al. 2019]. In addition, the acceptance of mHealth services is associated with individuals' social demographics and health characteristics [Carroll et al. 2017], such as age [Deng et al. 2014; Guo et al. 2015; Guo et al. 2016; Zhao et al. 2017], gender [Guo et al. 2015; Rai et al. 2013], education and income [Rai et al. 2013], health consciousness [Meng et al. 2019], health rationality [Zhang et al. 2020] as well as perceived health conditions [Deng et al. 2014; Rai et al. 2013]. Previous studies have widely explored the antecedents of mHealth services acceptance from a technology-centric perspective and examined the moderating effects of individuals' demographic and health characteristics. However, to our best knowledge, the question of how persuasive cues within mHealth services influence the mHealth service use motivations of individuals in a negative health mood remains under-explored.

2.2. Negative Health Mood

In consumer behavior research, mood refers to a phenomenological property of an individual's subjectively perceived affective state [Gardner 1985]. The mood might differ from emotion in its effects on behavior, a conclusion indicated by the finding that emotion—but rarely mood—interrupts ongoing behavior [Clark and Isen 1982]. According to Gardner [1985], there are two types of moods, namely, positive (e.g., cheeriness, peacefulness, and sexual warmth) and negative (e.g., anxiety, guilt, and depression). Gardner [1985] also argued that mood states have significant effects on consumers' decision-making and behavior. In their management information systems [MIS] research, Venkatesh and Speier [1999] indicated that individuals with negative moods have a lower intention to use a given technology than do individuals with positive or neutral moods. In addition, empirical research has

shown that negative mood states (e.g., anxiety and anger) have negative or insignificant effects on IT use [Adya and Phillips-Wren 2019; Beaudry and Pinsonneault 2010].

An individual's mood is closely linked to his/her health condition, and individuals who are diagnosed with serious diseases (e.g., cancer and lung disease) may experience negative mood states such as fear, depression, and anxiety [Trumbo et al. 2007]. On their part, Dalton et al. [2009] confirmed that a medical diagnosis of cancer may result in a negative mood such as depression. In the process of an individual's decision-making under conditions of risk and uncertainty, the impacts of a negative health mood such as worry, fear, dread, or anxiety on behavior are stronger [Loewenstein et al. 2001]. Prior literature on health behavior has revealed that negative health mood is positively associated with using health-related IT such as online health information seeking [Lagoe and Atkin 2015; te Poel et al. 2016] and the use of electronic health records [Anderson and Agarwal 2011].

However, we still know little about the extent to which negative health mood influences individuals' intrinsic and extrinsic motivations as well as use intentions regarding mHealth services. On the basis of the above discussion, we postulate in our study that potential users of mHealth services are experiencing unfavorable health conditions that lead to negative health mood states. We anticipate that during the persuasion process, the same information provided by mHealth services leads to different levels of elaboration and different motivations to adopt mHealth services in individuals according to their negative health moods.

2.3. The Elaboration Likelihood Model

The elaboration likelihood model [ELM, Petty and Cacioppo 1986] has been proposed as a general theory of attitude formation and modification in the social psychological literature, postulating that attitude can be changed through two relatively distinct processes: a central route and a peripheral route. The central route refers to information recipients expending thoughtful effort in scrutinizing issue-relevant arguments and in presenting the true merits of their arguments. In contrast, the peripheral route posits that an individual's attitude change occurs as a result of simple positive or negative cues, such as attractive and credible sources [Petty and Cacioppo 1986]. These two routes play different roles in modifying individuals' attitudes. A change in human perception through the central route is considered more stable and enduring than a change enacted through the peripheral route [Petty and Cacioppo 1986].

According to the ELM, information recipients exposed to a certain persuasive argument use various elaboration processes in different contexts. Petty and Cacioppo [1986] purported that a person's motivation and ability influence the level of elaboration in which they are likely to engage. Information recipients possessing both motivation and ability will conduct an effortful elaboration of the issue-relevant arguments as they modify their attitudes. Ability and motivation constitute part of the elaboration likelihood theoretical constructs, with the term elaboration suggesting that information recipients integrate their personal attributes into communication information processing [Petty and Briñol 2015; Petty et al. 1999].

Importantly, ELM theory also holds that the persuasion process can be influenced to some extent by individuals' moods. From the perspective of message recipients, a negative mood (in comparison with a neutral or positive mood) during message exposure increases the elaboration likelihood from the central route [Bless et al. 1990; Bohner et al. 1992; Petty et al. 2015]. In particular, Wegener et al. [1994] demonstrated that a negative mood leads to more persuasion than positive or neutral moods when the message is framed negatively, but it leads to less persuasion when the message is framed positively. Raghunathan and Trope [2002] investigated the function of negative mood on information processing and found that negative mood increases motivation to process information more elaborately. However, other scholars have observed contradictory results. According to the hedonic contingency view, a happy mood can lead to greater message processing than a sad mood because happy people are more attentive than sad people to the hedonic consequences of their actions [Wegener and Petty 1994; Wegener et al. 1994]. Furthermore, Wegener et al. [1995] found that when they encounter an uplifting message, individuals in a happy mood can engage in greater message scrutiny than those in a sad mood. However, individuals in a negative mood will feel that it is unnecessary to scrutinize the message for its hedonic consequences.

We deliberately choose the ELM as the research model of interest in our study because it not only reveals that attitude change and human perception modifications are closely related to the influence process, but it also explains why an informational message may encounter two distinct processes of attitude formation (central and peripheral routes]. In the context of MIS research, individuals following the central route can be influenced by the argument quality of the message, such as the potential benefits of system acceptance, the availability and quality of system support, and the costs and returns of system acceptance [Bhattacherjee and Sanford 2006]. Following the peripheral route, an individual can be persuaded by the attractiveness, likeability, and credibility of the source, such as endorsements from IT experts, the number of users, and the charisma of endorsers [Bhattacherjee and Sanford 2006; Sussman and Siegal 2003]. Thomas et al. [2019] found that central cues (e.g., accuracy, completeness, and quantity of online reviews) and peripheral cues (e.g., reviewer expertise, product/service rating, and website reputation) are

positively associated with online review credibility, thus increasing consumers' purchase intentions. In the context of mHealth, Chen et al. [2018] found that perceived usefulness (as a central cue) and trust in the app (as a peripheral cue) are positively associated with continuance intention and with privacy concerns, which increase the effects of both central and peripheral cues on continuance intention.

In our study, we focus on two critical persuasive cues. The first is mHealth service matching, which is defined as the extent to which the healthcare services generated by mHealth match users' needs [Tam and Ho 2005]. The second is mHealth source credibility, which refers to the extent to which individuals believe that a given mHealth service is reliable, trustworthy, and professional [Bhattacherjee and Sanford 2006]. In general, individuals adopt mHealth services because the service can potentially satisfy the individuals' needs by providing relevant benefits. Towards this end, mHealth service matching can be considered a central cue that can positively change the attitudes of individuals. Moreover, health services are relevant to individuals' health issues, such that individuals adopting a certain mHealth service may particularly further consider whether it can be trusted and relied upon, failing which these individuals would turn to other mHealth services [Deng et al. 2015; Gottschalk et al. 2020]. Although trustworthiness and reliability cannot directly offer benefits, they can ensure the realization of the benefits. Thus, mHealth source credibility can be conceptualized as a peripheral cue that can potentially change individuals' attitudes [Chen et al. 2018; Meng et al. 2019].

2.4. The Motivational Model

The motivational model (MM) was proposed by Davis et al. [1992], and it enables the prediction of IT acceptance behavior. Previous studies have often distinguished between two broad classes of motivations for performing an activity: intrinsic motivation and extrinsic motivation [Davis et al. 1992; Venkatesh and Brown 2001]. With intrinsic motivation, it is purported that users start to use a technology when it is based on inherent interests and enjoyment. However, with extrinsic motivation, it is suggested that a technology is adopted for a separable outcome or external rewards [Davis et al. 1992; Ryan and Deci 2000]. Therefore, Davis et al. [1992] classified perceived enjoyment as a type of intrinsic motivation and perceived usefulness as a type of extrinsic motivation. According to Davis et al. [1992], extrinsic motivation has a stronger impact on IT adoption than intrinsic motivation. The rationale is that individuals adopt a new IT because it is instrumental in achieving tasks and not because the use of the IT itself is inherently rewarding. However, in contrast with extrinsic motivation alone, intrinsic motivation will explain significant variances in usage intentions [Davis et al. 1992; Ryan and Deci 2000].

Based on this model, intrinsic and extrinsic motivations have been identified as key determinants of individual behavior in the context of MIS [Alam and Campbell 2017; Khern-am-nuai et al. 2018; Rahrovani and Pinsonneault 2020; Zhang et al. 2017b]. On their part, Alam and Campbell [2017] indicated that volunteers' intrinsic and extrinsic motivations have positive effects on their participation in cultural crowdsourcing work and intrinsic motivation plays a more critical role in the initial stage. Khern-am-nuai et al. [2018] explored the effects of extrinsic motivation (monetary reward) on individuals writing reviews on an online platform. The authors found that extrinsic motivation increases reviewers' participation in writing online reviews at the early stage when monetary rewards are introduced, while such participation weakens in the later stage. Rahrovani and Pinsonneault [2020] found that intrinsic motivation is positively associated with IT users' innovative IT use and extrinsic motivation positively influences two different types of innovative behaviors (innovative IT use and innovating with IT).

Compared with the technology acceptance model (TAM), the MM is considered more appropriate for investigating users' acceptance and use of a new technology in a sensitive domain such as healthcare [Cocosila and Archer 2010]. As a result, the MM has often been used to understand individual motivations in the healthcare context. For instance, Zhang et al. [2017b] and [Zhang et al. 2017a] indicated that extrinsic and intrinsic motivations have various degrees of effects on the knowledge sharing intention of health professionals and normal users in online health communities. Specifically, intrinsic motivation has greater effects on the knowledge sharing intention of health professionals, while extrinsic motivation has greater effects on the knowledge sharing intention of normal users. In the context of mHealth services, Cocosila and Archer [2010] revealed that intrinsic motivation, rather than extrinsic motivation, plays a crucial role in the adoption of mHealth services. Cocosila and Turel [2019] indicated that intrinsic and extrinsic motivations positively influence individuals' intentions to use mHealth services, while intrinsic motivation has a positive impact on extrinsic motivation. Although both intrinsic and extrinsic motivations have been explored in the mHealth services acceptance literature, we have scant knowledge about the antecedents of these two motivational factors from the persuasion perspective. Therefore, this study is conducted to examine the influence of two persuasive cues on intrinsic and extrinsic motivations in the context of mHealth services acceptance.

3. Research Model and Hypotheses

On the basis of the previous discussion, we propose our research model (Figure 1), which incorporates the constructs of negative health mood as well as the elaboration likelihood model (ELM) and the motivational model

(MM). Both the ELM and the MM provide prominent research frameworks for understanding the antecedents of IT acceptance [Angst and Agarwal 2009; Davis et al. 1992; Sussman and Siegal 2003], while the relationships between the ELM and the MM still constitute a research gap in the context of IT acceptance. On the basis of prior empirical studies of the ELM and MM in the IT adoption domain, we, therefore, expect that two persuasive cues (mHealth service matching and mHealth source credibility) are closely associated with individuals' intrinsic and extrinsic motivations. Hence, we postulate that the perceptions of both intrinsic and extrinsic motivations can be explained by factors classified by the ELM as central and peripheral cues. Furthermore, we propose negative health mood as a moderator affecting the relationship between our two persuasive cues and deem it as having direct influences on two motivational factors and use intentions for mHealth services.

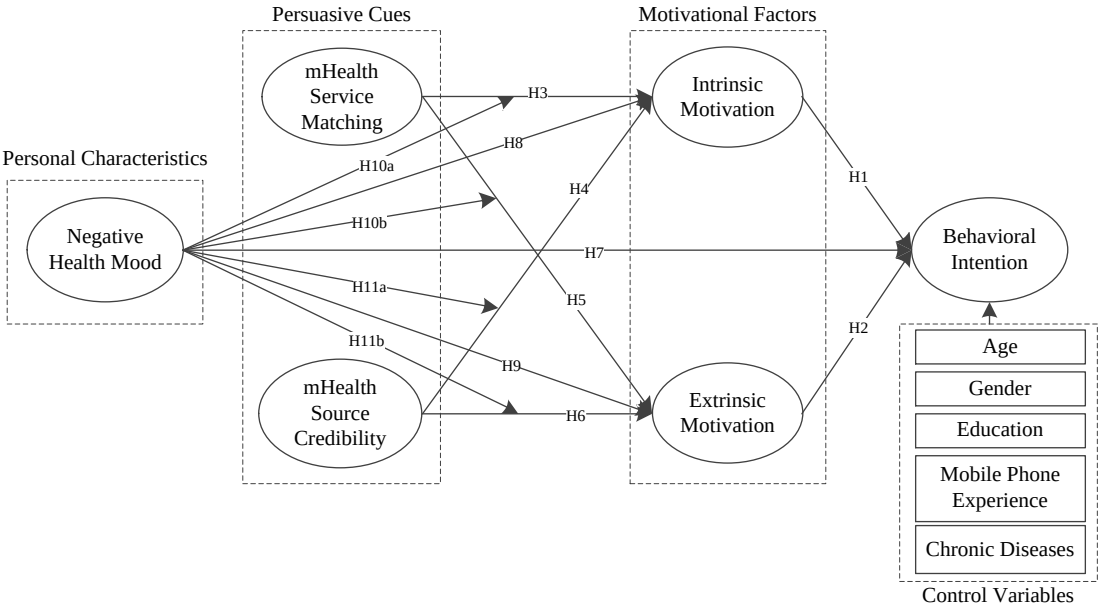

Figure 1: Research Model

3.1. Effects of Motivational Factors

Within the motivational model [Davis et al. 1992], individuals' intrinsic and extrinsic motivations are represented as perceived enjoyment and perceived usefulness, respectively, thus influencing intention to use a new IT. In the MIS domain, intrinsic and extrinsic motivations significantly and positively influence the participation in a crowdsourcing platform [Alam and Campbell 2017], knowledge sharing in online health communities [Zhang et al. 2017a; Zhang et al. 2017b], continuous intention to use massive open online courses [Lu et al. 2019], and innovative IT use [Rahrovani and Pinsonneault 2020]. With respect to the acceptance of mHealth services, intrinsic and extrinsic motivations are found to be two major explanatory factors [Cocosila 2013; Cocosila and Turel 2019].

In our study, mHealth services provide individuals with a new channel to access personalized and interactive health information and services. Through mHealth services use, individuals may experience more enjoyable and challenging feelings than they may experience through traditional healthcare services. Therefore, if individuals are inherently motivated to use mHealth services because they perceive service use as enjoyable, they are more likely to have a higher degree of intention to use mHealth services. From the perspective of extrinsic motivation, individuals could gain substantial potential benefits from mHealth services, such as ubiquitous personalized health services, lower healthcare costs, and more efficient healthcare processes [Akter et al. 2010]. If individuals perceive mHealth services to be useful, they are more likely to possess the extrinsic motivation to use them. Thus, we hypothesize that:
H1: Intrinsic motivation increases individuals' behavioral intentions to use mHealth services.
H2: Extrinsic motivation increases individuals' behavioral intentions to use mHealth services.

3.2. Effects of Persuasive Cues

Individuals' intrinsic and extrinsic motivations are two direct determinants of intention to use mHealth services [Cocosila 2013; Cocosila and Turel 2019]. Intrinsic motivation in our study refers to individual use of mHealth services in order to experience inherent satisfaction and feelings of pleasure, joy, and fun [Cocosila 2013]. Based on the basic tenet of the ELM [Petty and Cacioppo 1986], individuals' attitudes toward mHealth services acceptance can be modified by two persuasive cues: mHealth service matching and mHealth source credibility. From the

perspective of a central cue, based on the work of Tam and Ho [2006], mHealth service matching refers to the extent to which mHealth services match the needs of potential users. If mHealth services are able to provide services that match individuals' needs, individuals are more willing to undertake more cognitive effort to elaborate the information about the potential personal benefits of mHealth from the central route. Thus, we postulate that a higher level of mHealth service matching may increase individuals' satisfaction and positive feelings toward acceptance of mHealth services; thereby, individuals perceiving higher levels of mHealth service matching are stronger in their intrinsic motivation to use mHealth services.

The second cue examined here, mHealth source credibility, is defined as the extent to which individuals believe the mHealth service is reliable, trustworthy, and professional, according to Bhattacherjee and Sanford [2006]. Because of health information asymmetry between health professionals and normal users, individuals with limited expertise and knowledge are more likely to evaluate unfamiliar health information based on mHealth source credibility [Eastin 2001; Gottschalk et al. 2020]. Therefore, individuals lacking health-related expertise and knowledge still gain professional and reliable health information and services when they perceive a higher level of mHealth source credibility [Deng et al. 2015], thus leading to satisfaction and enjoyment when they decide to accept mHealth services. On this basis, we hypothesize that:

H3: mHealth service matching has a positive effect on individuals' intrinsic motivation.

H4: mHealth source credibility has a positive effect on individuals' intrinsic motivation.

Extrinsic motivation as a form of perceived usefulness refers to a situation where individuals expect that using mHealth services is helpful and useful in managing their health [Cocosila 2013]. Prior research on the ELM has confirmed that perceived usefulness can be explained by informational influences and that ELM processes are influential to the extent that they contribute to the perceived usefulness. Moreover, Sussman and Siegal [2003] found that both central and peripheral cues positively influence perceived usefulness. Similarly, Bhattacherjee and Sanford [2006] used the ELM to investigate individuals' behavioral intentions regarding IT usage, and the authors found that argument quality and source credibility have positive effects on the perceived usefulness of a new IT. Chen et al. [2018] indicated that service quality and information quality of doctors, as central cues, are positively associated with perceived usefulness of mHealth apps.

In the study of mHealth services, when individuals perceive that mHealth services could match their needs and preferences, they are more likely to engage in information processing from the central route. In other words, the higher level of mHealth service matching refers to more truthful, relevant, and helpful information embedded in mHealth services, promoting the perceived usefulness of mHealth services. In addition, individuals who cannot evaluate the argument quality of mHealth services may choose a less effortful peripheral route decision process to evaluate the perceived usefulness of mHealth services. When individuals receive health services from a reliable and trusted mHealth provider, they will perceive mHealth services as more useful. On this basis, we hypothesize that:

H5: mHealth service matching has a positive effect on individuals' extrinsic motivation.

H6: mHealth source credibility has a positive effect on individuals' extrinsic motivation.

3.3. Direct Effects of Negative Health Mood

Negative health mood refers to an individual's negative mood linked to their health conditions [Anderson and Agarwal 2011]. Previous research indicates that individuals' health conditions are tightly interlinked with their negative moods. For example, when individuals have contracted a serious disease, they will experience moods such as fear, depression, and anxiety related to their health [Dalton et al. 2009; Trumbo et al. 2007]. Individuals in a negative health mood are more willing to undertake preventive or promotional health behaviors such as influenza vaccination [Chapman and Coups 2006], quitting smoking [Dijkstra and Brosschot 2003], and cancer screening [McCaul and Mullens 2003]. Similarly, Anderson and Agarwal [2011] found that individuals in negative health moods are more willing to provide access to their personal health information in return for the use of healthcare IS. When individuals have a higher level of negative mood because of their health conditions, they are more prone to conduct safety behaviors such as online health information seeking in order to reduce their apprehensions and fears surrounding their health conditions [Lagoe and Atkin 2015; te Poel et al. 2016]. Therefore, we expect that individuals with negative health moods will have a higher willingness to use mHealth services. Thus, we hypothesize that:

H7: Negative health mood increases individuals' behavioral intentions to use mHealth services.

Specifically, individuals in a negative health mood may believe that they will be diagnosed with severe disease and may feel unsafe and uncertain regarding their health conditions [Anderson and Agarwal 2011]. Accordingly, they may be intrinsically motivated to use mHealth services for accessing health services and information with the aim of reducing their negative mood regarding their health. Therefore, individuals in a negative health mood will perceive that they enjoy using mHealth services, thus improving their mood level. On the other hand, when individuals feel really dreadful about their health conditions, they may express a stronger willingness to improve

their current health status by using mHealth services to obtain benefits such as accessing highly-personalized healthcare services and improving their healthcare outcomes. Therefore, we propose that individuals in a negative health mood have greater intrinsic and extrinsic motivations regarding the acceptance of mHealth services. Accordingly, we hypothesize that:

H8: Negative health mood increases individuals' intrinsic motivation to use mHealth services.

H9: Negative health mood increases individuals' extrinsic motivation to use mHealth services.

3.4. Moderation Effects of Negative Health Mood

Based on the basic tenets of the ELM [Petty and Cacioppo 1986], mood, as one of an information recipient's characteristics, can influence their processing strategy and the level of elaboration likelihood. According to Venkatesh and Speier [1999], individuals in a negative health mood maintain a lower level of intrinsic motivation and long-term use intention of an IS. According to the perspective of information processing and the hedonic contingency view, a happy mood leads to a greater level of information processing than that of a sad mood [Wegener and Petty 1994]. However, individuals in a negative mood are not willing to scrutinize the information in order to ascertain the hedonic consequences [Wegener et al. 1995]. Similarly, a meta-analysis by Hullett [2005] found that individuals in a positive mood have greater motivation to participate in message processing than individuals in a negative mood. Further, depressed moods are found to be associated with decreased motivation, thus decreasing the likelihood of message elaboration [Bless et al. 1990].

In the context of our study, according to Wegener et al. [1995], individuals who feel worried and anxious about their health conditions are less likely to process persuasive cues about mHealth services (e.g., argument quality, doctors' information quality, and doctors' service quality) systematically from the central route. In such a situation, individuals in a negative health mood are more prone to expend few efforts to elaborate central cues (e.g., mHealth service matching) about mHealth services, thus weakening their perceptions of usefulness and enjoyment related to using mHealth services. Therefore, the effects of mHealth service matching on intrinsic and extrinsic motivations will be weakened when individuals are in a negative health mood. Accordingly, we propose that negative health mood may negatively moderate the effects of mHealth service matching on intrinsic and extrinsic motivations in the persuasion process. We, therefore, hypothesize that:

H10a: Negative health mood weakens the relationship between mHealth service matching and intrinsic motivation.

H10b: Negative health mood weakens the relationship between mHealth service matching and extrinsic motivation.

Furthermore, individuals experiencing negative health moods are more prone to process peripheral cues (e.g., mHealth source credibility) during the persuasion process [Wegener et al. 1995]. Since health services are seen as credence goods, patients often suffer information disadvantage relative to physicians because they lack relevant health-related knowledge and experience [Gottschalk et al. 2020]. Therefore, source credibility of information plays a more important role in persuading individuals to form clear attitudes regarding the use of mHealth services. For example, the reputation of a health services provider is very important in developing patients' trust [Yang et al. 2015]. Similarly, Deng et al. [2015] indicated that individuals in poor health who are looking for information about their condition are more likely to choose a trusted health information provider. Accordingly, individuals are more prone to be persuaded to use mHealth services by peripheral cues (e.g., mHealth source credibility) when they are in a negative health mood [Wegener et al. 1995], thus leading to higher perceptions of usefulness and enjoyment related to using mHealth services. On this basis, we anticipate that mHealth source credibility as a peripheral cue will have stronger effects on intrinsic and extrinsic motivations when individuals are in a negative health mood. Hence, we hypothesize that:

H11a: Negative health mood strengthens the relationship between mHealth source credibility and intrinsic motivation.

H11b: Negative health mood strengthens the relationship between mHealth source credibility and extrinsic motivation.

4. Methodology

This research took place in Shanghai, China. We conducted a questionnaire survey to collect data by collaborating with a local community that aims to provide daily healthcare services for local residents through mobile phones. A total of 876 residents were officially registered with the community service center. First, with the support of the manager of this community, we listed all 876 residents and assigned a sequential number to each subject (1, 2, 3, …, 876). Second, we figured out the sample size (n=292) and used a random number generator to select the sample. Finally, we obtained 292 random numbers, which make up one-third of the total. Two screening criteria to select the target participants were followed as follows: (1) participants have not adopted mHealth services; and (2) participants demonstrated a negative mood-related to their health condition. Furthermore, considering that mHealth service diffusion is still at the early stage, survey participants may have little knowledge or information

relevant to mHealth services. According to the work of Davis et al. [1989] and Morris and Venkatesh [2000], technology acceptance studies always present an introduction to the innovation before subjects' responses are measured. Therefore, to ensure that participants understood the new innovation before we asked them to complete the questionnaire, we provided them with a brief introduction to mHealth services and showed the mHealth app to respondents. In the end, of 292 questionnaires, 270 usable ones were obtained, with a response rate of 92%. The high response rate can be explained by the support from the community's volunteers and our incentive of RMB 20 (2.55 euro) supermarket coupons for participants. Furthermore, according to the work of Wolf et al. [2013], the number of valid questionnaires meets a range of sample size requirements (i.e., from 30 to 460 cases) for structural equation modeling (SEM), indicating that our valid sample size (270 cases) is appropriate for this study. The demographic characteristics of the respondents are summarized in Table 1.

Table 1: Demographic Profile of the Respondents

Characteristics	Statistics	
	Number	Percentage
Gender		
Male	125	46.29
Female	145	53.70
Age		
21–30 years	120	44.44
31–40 years	69	25.56
41–50 years	38	14.07
51–60 years	43	15.93
Level of education		
Primary school	2	0.74
Secondary school	75	27.77
Pre-university	88	32.59
University	71	26.29
Postgraduate	34	12.59
Years of mobile phone usage		
＜2 years	19	7.03
2 ~ 4 years	25	9.26
5 ~ 6 years	46	17.03
7 ~ 8 years	44	16.29
9 ~ 10 years	52	19.25
≥ 10 years	84	31.11
History of chronic diseases		
Yes	45	16.66
No	225	83.33

Commonly used measures from previous studies were adapted to support content validity. We used multi-item perceptual scales to evaluate all the theoretical constructs. Each construct was reworded to relate specifically to the context of mHealth acceptance, according to pre-validated instruments from prior research. The measures for mHealth service matching were adapted from Tam and Ho [2005]. The measures for mHealth source credibility were adapted from Bhattacherjee and Sanford [2006]. The scales for intrinsic motivation and extrinsic motivation were developed on the basis of and tested by using those of Davis et al. [1992], which have been subsequently validated [Venkatesh 1999]. The measures of negative health mood were adapted from Anderson and Agarwal [2011]. Furthermore, behavioral intentions were developed and tested according to the work of Deng et al. [2014]. Drawing on pre-validated instruments from prior research, we reworded these theoretical constructs to relate specifically to the context of mHealth acceptance. Next, we used backward translation to ensure consistency between the commonly used measures in English and the Mandarin Chinese language version [Mullen 1995]. We initially translated these measures into Mandarin. Following this, we translated the Mandarin version into the English version in order to check for consistency. After we developed the preliminary questionnaire, we received feedback from two mobile health researchers to improve the content validity of the questionnaire. Additionally, we conducted a pretest with 30 postgraduates and Ph.D. students. According to their suggestions and feedback on the questionnaire, we revised the questions and deleted similarly phrased items. The theoretical constructs and measurements are presented in the Appendix. A 7-point Likert scale was used for all questionnaire items.

5. Data Analysis

5.1. Method of Data Analysis

The partial least squares (PLS) method was used to test the research model, as this technique has several relevant advantages. First, PLS can predict all loadings and weights of indicators and causal relationships among the constructs in multi-stage models [Fornell and Bookstein 1982; Gefen et al. 2011]. Second, in contrast to covariance-based structural equation modeling (CB-SEM), PLS is based on regression and uses the notion of "variance explained" to understand the relationship between the model and the data [Petter 2018]. Third, unlike CB-SEM, PLS does not require normal distributional assumptions by the maximum likelihood method to estimate models when specifying the measurements and structural model [Hair et al. 2019; Khan et al. 2019; Shiau et al. 2019]. Fourth, it is suitable for complex models with complicated moderating effects [Chin et al. 2003; Wetzels et al. 2009], which is the case in our research.

The data analysis was conducted in two stages. In the first stage, the measurement model was assessed to ensure its appropriateness; in the second stage, the structural model was examined and the stated hypotheses were tested [Hair et al. 1998].

5.2. Measurement Model

The reliability, convergent validity, and discriminant validity of the measurement model were examined as indicators of the goodness of fit of the measurement model. Reliability was assessed by examining Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE) [Fornell and Larcker 1981]. According to Nunnally and Bernstein [1994], a value of at least 0.70 for Cronbach's alpha indicates adequate reliability. In our study, the threshold values of CR and AVE were 0.70 and 0.50, respectively, consistent with Chin [1998]. As perceived in Tables 2 and 3, all constructs satisfied the criteria for reliability. The CRs for these constructs ranged from 0.881 to 0.938, and the AVEs varied from 0.650 to 0.835. These results suggest that all indicators were above the cutoff values, implying good construct reliability [Fornell and Larcker 1981]. All the item loadings of each construct were significant and above the suggested cutoff value (0.700), indicating convergent validity [Chin 1998]. All item loadings on expected constructs were greater than their cross-loadings on other constructs, and the correlations of the constructs were significantly smaller than the square roots of the AVE of each construct, hence indicating that the constructs have good discriminant validity. To validate this result, we used the heterotrait-monotrait (HTMT) ratio of correlations to further assess discriminant validity, drawing upon the multitrait-multimethod matrix [Henseler et al. 2015]. Table 4 shows that the HTMT values for all constructs were not above the suggested threshold value (0.85). Accordingly, the results of both methods demonstrated acceptable discriminant validity of all the theoretical constructs.

Table 2: Correlations and Discriminant Validity

	Mean	Standard Deviation	Cronbach's Alpha	Composite Reliability	AVE	BI	MSM	MSC	IM	EM	NHM
BI	5.265	1.118	0.901	0.938	0.835	**0.913**					
MSM	5.049	1.045	0.891	0.924	0.753	0.657	**0.867**				
MSC	4.917	1.025	0.897	0.928	0.764	0.367	0.559	**0.874**			
IM	5.171	1.053	0.874	0.922	0.799	0.471	0.574	0.639	**0.806**		
EM	5.381	0.896	0.876	0.915	0.728	0.501	0.604	0.527	0.631	**0.853**	
NHM	3.094	1.284	0.829	0.858	0.826	0.140	0.186	0.148	0.144	0.154	**0.908**

Note BI: behavioral intention; MSM: mHealth service matching; MSC: mHealth source credibility; IM: intrinsic motivation; EM: extrinsic motivation; NHM: negative health mood.

Table 3：Loadings and Cross-Loadings for Measurement Items

	BI	MSM	MSC	IM	EM	NHM
BI1	**0.908**	0.608	0.325	0.475	0.469	0.185
BI2	**0.898**	0.560	0.319	0.430	0.440	0.089
BI3	**0.936**	0.630	0.363	0.488	0.463	0.133
MSM1	0.611	**0.810**	0.470	0.458	0.467	0.217
MSM2	0.513	**0.852**	0.497	0.494	0.475	0.087
MSM3	0.573	**0.928**	0.511	0.549	0.562	0.153
MSM4	0.586	**0.879**	0.468	0.541	0.582	0.173
MSC1	0.334	0.520	**0.872**	0.491	0.462	0.149
MSC2	0.289	0.457	**0.885**	0.421	0.419	0.148
MSC3	0.331	0.494	**0.903**	0.424	0.473	0.081
MSC4	0.326	0.480	**0.835**	0.422	0.484	0.132
IM1	0.478	0.525	0.427	**0.816**	0.549	0.075
IM2	0.350	0.425	0.343	**0.770**	0.504	0.113
IM3	0.377	0.456	0.410	**0.824**	0.517	0.162
IM4	0.425	0.490	0.438	**0.816**	0.601	0.154
EM1	0.411	0.505	0.445	0.608	**0.831**	0.117
EM2	0.408	0.503	0.416	0.520	**0.852**	0.127
EM3	0.466	0.522	0.437	0.574	**0.871**	0.145
EM4	0.422	0.531	0.497	0.599	**0.860**	0.172
NHM1	0.024	0.142	0.112	0.066	0.008	**0.669**
NHM2	0.011	0.093	0.044	0.020	0.009	**0.683**
NHM3	0.171	0.145	0.122	0.178	0.192	**0.925**
NHM4	0.081	0.177	0.139	0.066	0.091	**0.728**

Note BI: behavioral intention; MSM: mHealth service matching; MSC: mHealth source credibility; IM: intrinsic motivation; EM: extrinsic motivation; NHM: negative health mood.

Table 4. HTMT Results

	MSM	MSC	IM	EM	NHM	BI
MSM						
MSC	0.626					
IM	0.645	0.721				
EM	0.680	0.592	0.719			
NHM	0.202	0.149	0.133	0.107		
BI	0.733	0.408	0.525	0.562	0.101	

Note BI: behavioral intention; MSM: mHealth service matching; MSC: mHealth source credibility; IM: intrinsic motivation; EM: extrinsic motivation; NHM: negative health mood.

5.3. Common Method Bias Assessment

Since the survey data captured by all measurement scales of our study were collected from a single source at one point in time, it is necessary to rule out the potential for common method bias, which can compromise the validity of the results [Podsakoff et al. 2003]. We examined the possibility of common method bias with Harman's single factor test [Harman 1976]. The results indicated that the five constructs accounted for 65.9% of the variance, while the first construct only explained 20.8% of the variance, which is smaller than the threshold value of 50% in Harman's single factor test [McFarlin and Sweeney 1992]. Thus, the assessment indicates that common method bias is not an issue in this study. In addition, we further tested for common method bias based on a procedure proposed by Liang et al. [2007]. First, we introduced a factor named method comprising all indicators of the principle constructs in the existing research model. Second, we calculated and then compared the variances of each indicator in the research model explained by the principal constructs and by the factor name method. Accordingly, we found that the average variances explained by the principle constructs and by the factor named method were 0.75 and 0.012, respectively. The ratio of these two results was about 63:1. Otherwise, most of the indicators' loadings on the factor named method were found to be non-significant. Overall, based on the results of these two procedures, we found that common method bias is not a serious concern for our study.

5.4. Structural Model

The structural model was also analyzed using PLS, with the results presented in Figure 2. The structural model was assessed by checking the significance of path coefficients (β) between the various factors. In particular, the results indicated that intrinsic motivation (β = 0.264, $p < 0.01$) and extrinsic motivation (β = 0.317, $p < 0.01$) positively influenced behavioral intention, thereby lending support to H1 and H2. With respect to persuasive cues, mHealth service matching had significant positive effects on intrinsic motivation (β = 0.328, $p < 0.01$) and extrinsic motivation (β = 0.619, $p < 0.01$), hence H3 and H5 are supported. Moreover, mHealth source credibility positively affected intrinsic motivation (β = 0.449, $p < 0.01$) and extrinsic motivation (β = 0.169, $p < 0.10$); hence, both H4 and H6 are supported. From the perspective of direct effects, negative health mood was found to have no significant effect on behavioral intention (β = 0.055, $p > 0.10$) and intrinsic motivation (β = 0.022, $p > 0.10$), hence H7 and H8 are not supported. In addition, negative health mood had a significant positive effect on extrinsic motivation (β = 0.286, $p < 0.05$); thus H9 is supported. Furthermore, regarding the results of control variables, age (β = -0.070, $p > 0.10$), gender (β = -0.029, $p > 0.10$), education (β = -0.083, $p > 0.10$), and history of chronic diseases (β = -0.037, $p > 0.10$) were found to have no significant effects on intention to use mHealth services. However, years of mobile phone usage had a significant positive effect on behavioral intention (β = 0.102, $p < 0.05$). These factors fully explained 31.0% of the variance in behavioral intention.

Following the recommendation of Henseler and Chin [2010], we applied the two-stage PLS approach to test moderating effects. Since formative indicators, the independent variables of the present study, are not assumed to reflect the same underlying factor, the pairwise multiplication of a formative indicator and the moderator is not feasible [Chin et al. 2003]. Besides, the orthogonalization approach lacks enough statistical power and its superiority (e.g., parameter and prediction accuracy) for composite models remains unclear in comparison with the two-stage approach [Henseler and Chin 2010]. Therefore, in such a case, the two-stage PLS approach is more appropriate for estimating the resulting moderation effects in this study. In the first stage, we obtained the main effects of the PLS model and saved the estimates for the latent variable score. In the second, stage, the interaction term was built up between the independent variable and the moderator using the latent variables scores. Table 5 shows the PLS analysis results for the interaction term. Negative health mood had no significant moderating effect on the association between mHealth service matching and intrinsic motivation (β = -0.049, $p > 0.10$); thus, H10a is not supported. However, negative health mood negatively moderates the relationship between mHealth service matching and extrinsic motivation (β = −0.690, $p < 0.01$); thus H10b is supported. The moderating effect of negative health mood on the relationship between mHealth source credibility and extrinsic motivation is not significant (β = 0.043, $p > 0.10$); hence, H11a is not supported. However, negative health mood had a positive moderating effect on the relationship between mHealth source credibility and extrinsic motivation (β = 0.377, $p < 0.01$); therefore, H11b is supported. The results related to each hypothesis are summarized in Table 6.

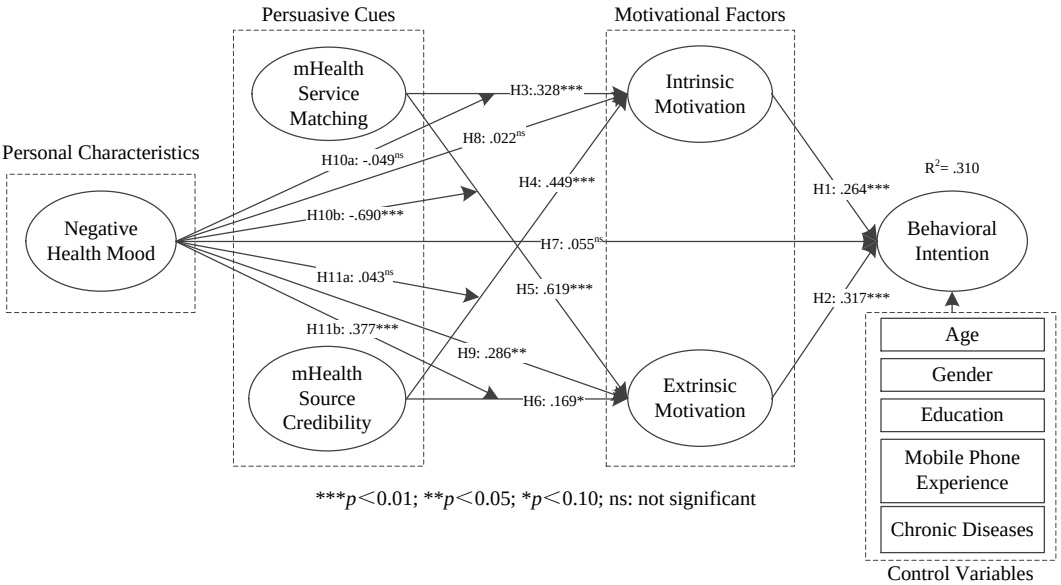

Figure 2: The Results of the Research Model

Table 5: The PLS Analysis Results for the Interaction Term

Interaction term	Path coefficient (independent variable)	Path coefficient (moderator)	Path coefficient (interaction term)	R^2 (interaction model) (%)
NHM╳MSM→EM	0.446***	0.030^{ns}	-0.690***	0.429
NHM╳MSC→EM	0.273***	0.016^{ns}	0.377***	0.477
NHM╳MSM→IM	0.311***	0030^{ns}	-0.049^{ns}	0.419
NHM╳MSC→IM	0.464***	0.016^{ns}	0.043^{ns}	0.477
Note BI: behavioral intention; MSM: mHealth service matching; MSC: mHealth source credibility; IM: intrinsic motivation; EM: extrinsic motivation; NHM: negative health mood; ***$p<0.01$; ns: not significant.				

Table 6: Summary of Hypothesis Testing Results

Description of Hypothesis	Result
H1: Intrinsic motivation increases individuals' behavioral intentions to use mHealth services.	Supported
H2: Extrinsic motivation increases individuals' behavioral intentions to use mHealth services.	Supported
H3: mHealth service matching has a positive effect on individuals' intrinsic motivation.	Supported
H4: mHealth source credibility has a positive effect on individuals' intrinsic motivation.	Supported
H5: mHealth service matching has a positive effect on individuals' extrinsic motivation.	Supported
H6: mHealth source credibility has a positive effect on individuals' extrinsic motivation.	Supported
H7: Negative health mood increases individuals' behavioral intentions to use mHealth services.	Unsupported
H8: Negative health mood increases individuals' intrinsic motivation to use mHealth services.	Unsupported
H9: Negative health mood increases individuals' extrinsic motivation to use mHealth services.	Supported
H10a: Negative health mood weakens the relationship between mHealth service matching and intrinsic motivation.	Unsupported
H10b: Negative health mood weakens the relationship between mHealth service matching and extrinsic motivation.	Supported
H11a: Negative health mood strengthens the relationship between mHealth source credibility and intrinsic motivation.	Unsupported
H11b: Negative health mood strengthens the relationship between mHealth source credibility and extrinsic motivation.	Supported

6. Discussion and Implications

6.1. Key Findings

This study, based on the elaboration likelihood model and the motivational model, develops a unified model to explain the mHealth services acceptance behavior of individuals in a negative health mood. We identify mHealth service matching and mHealth source credibility as persuasive cues influencing individuals' intrinsic and extrinsic motivations, thus affecting the intention to use mHealth services. Additionally, we postulate that negative health mood has direct effects on motivational factors as well as use intention and that it also moderates the effects of two persuasive cues on motivational factors, thus influencing use intention. There are four major findings from this study.

First, mHealth service matching and mHealth source credibility, represented as central and peripheral cues, respectively, have significant effects on intrinsic and extrinsic motivations, which both influence users' intentions to use mHealth services. This result shows that both mHealth service matching and mHealth source credibility are significant antecedents of motivational factors in the persuasion process. Furthermore, consistent with previous studies [Cocosila 2013; Cocosila and Turel 2019], we find that intrinsic and extrinsic motivations have significant influences on intention to use mHealth services. The rationale is that unique attributes of mHealth services (e.g., accessibility, personalized solutions, immediacy, location-based information, interactivity, and mobility) could improve individuals' perceptions of the usefulness and enjoyment associated with mHealth services [Akter et al. 2013], thus leading to their acceptance intention. In addition, we found that extrinsic motivation has a stronger effect than intrinsic motivation on use intention regarding mHealth services. This result is consistent with the basic tenet of the motivational model [Davis et al. 1992], which indicates that individuals adopt a new IT because of its instrumental functions rather than the inherent enjoyment of using the IT itself.

Second, we find that negative health mood has no significant effects on use intentions regarding mHealth services or on intrinsic motivation, but it significantly influences extrinsic motivation—a finding inconsistent with our hypothesis. An explanation for this non-significant result is grounded in the fact that healthcare services are closely related to an individual's functional abilities and life quality. Although individuals in a negative health mood may be willing to accept mHealth services, accepting inappropriate healthcare services may jeopardize an individual's current health status and even threaten his/her life [Fichman et al. 2011]. One possible reason is that

health services are considered as a form of credence goods [Gottschalk et al. 2020]. Individuals lacking health-related health knowledge and experience need to rely more on the source credibility of mHealth services when they are making decisions regarding the use of mHealth services. Therefore, individuals in a negative health mood may make usage decisions by processing relevant information (e.g., mHealth source credibility) related to mHealth services.

Third, negative health mood weakens the association between mHealth service matching and extrinsic motivation, but it has no significant effect on the association between mHealth service matching and intrinsic motivation. This result indicates that individuals experiencing a negative health mood adhere less to the central cue, such as mHealth service matching, in the formation of extrinsic motivation. This finding is consistent with the work of Wegener et al. [1995], which indicates that individuals in a negative mood are unlikely to engage in information processing based on the central cue. However, the result also shows that the central cue does not significantly influence intrinsic motivation when individuals are in a negative mood. One possible explanation for this unsupported finding, based on protection motivation theory, is that individuals in poor health are eager to use mHealth services to eliminate health threats from diseases [Rai et al. 2013; Zhao et al. 2017]. Therefore, during the persuasion process, individuals in a negative health mood may choose relatively simple cues (source credibility and reputation) to evaluate the features of mHealth services, such as perceived usefulness rather than perceived enjoyment.

Fourth, negative health mood strengthens the association between mHealth source credibility and extrinsic motivation, but it has no significant effect on the association between mHealth source credibility and intrinsic motivation. This result shows that individuals in a negative health mood may perceive a higher level of usefulness of mHealth services by evaluating mHealth source credibility. However, mHealth source credibility is not associated with intrinsic motivation when individuals are experiencing negative moods. This unsupported hypothesis could be explained by individuals' preferences for choosing healthcare services based on factors such as insurance, operation level, nursing quality, and equipment conditions [Jiang et al. 2020]. Therefore, during the persuasion process, individuals who worry about their health conditions may be attentive to the utilitarian outcomes (e.g., extrinsic motivation) of mHealth service use rather than its hedonic outcomes (e.g., intrinsic motivation).

6.2. Theoretical and Practical Contributions

This study yields three theoretical contributions. First, it adds new knowledge regarding mHealth services acceptance based on an integrative model of the elaboration likelihood model (ELM) and the motivational model (MM). The findings confirm the critical role of persuasive cues in predicting intrinsic and extrinsic motivations in the context of mHealth services. More importantly, our study addresses a research gap in mHealth services acceptance literature by specifically examining how intrinsic and extrinsic motivations can be influenced by persuasive cues in the first place, which has received almost no research attention [Cocosila 2013; Cocosila and Turel 2019].

Second, although prior studies have explored the effects of individuals' health-related mood status on their health decisions in the context of health behaviors [Chapman and Coups 2006; Dijkstra and Brosschot 2003; McCaul and Mullens 2003], this study is, to the best of our knowledge, the first to test the effects of negative health mood on individuals' intrinsic and extrinsic motivations and decision-making regarding the use of mHealth services. The findings indicate that negative health mood positively influences extrinsic motivation but has no significant effect on intrinsic motivation or use intention. Therefore, future research should emphasize the role of extrinsic motivation when investigating individuals' acceptance of mHealth services when they feel worried or anxious about their health conditions.

Third, the findings of this study provide a novel insight into individuals' responses to persuasive cues regarding mHealth services by investigating the contingent role of negative health mood on the relationship between persuasive cues and motivational factors in an integrative research model. We found that negative health mood shapes various ways that individuals faced with a decision about mHealth service use process persuasive cues in the formation of intrinsic and extrinsic motivations. Therefore, this study sheds light on how individuals in a negative health mood process persuasive information differently from individuals who are in positive or neutral health moods. This finding is helpful in potentially identifying the optimal conditions for promoting user motivation, and hence this work provides valuable references for future studies on mHealth service acceptance.

This study also has several practical implications. First, as our results show, mHealth service matching and mHealth source credibility positively influence intrinsic and extrinsic motivation, thus increasing an individual's intention to use mHealth services. Therefore, practitioners should try to construct persuasion strategies to cultivate intrinsic and extrinsic motivations with the aim of attracting potential users and expanding their consumer scale. With regard to the central cue in our study, mHealth service matching, practitioners are advised to deliver quality and highly personalized health information and services to meet individuals' healthcare needs at the highest possible

level. Informed by the findings related to the peripheral cue, practitioners should cooperate with authorized hospitals and healthcare institutions and recruit more well-known health professionals to service mHealth platforms in order to further improve source credibility.

Second, the findings of this study indicate that although negative health mood is found to have no effect on behavioral intention, it strengthens the effects of mHealth source credibility but weakens the effects of mHealth service matching on extrinsic motivation. Accordingly, practitioners need to create carefully targeted persuasive strategies with the aim of increasing individuals' extrinsic motivation based on users' personal characteristics such as negative health moods. Unlike normal users of a generic IT, mHealth users may present negative health moods because they are suffering from various diseases, thus influencing their decision-making regarding the acceptance of health IT [Anderson and Agarwal 2011]. Considering such a situation, practitioners should utilize mHealth source credibility as a peripheral cue to persuade individuals to increase their extrinsic motivation when those individual users are experiencing a negative healthcare mood. Such a personalized persuasive strategy could persuade more potential users to accept mHealth services, thus contributing to the diffusion of mHealth services from a user-centric perspective.

6.3. Limitations

There are several limitations to our research. First, since this study was conducted in China, future similar studies should be carried out in a Western context because individuals from different cultures may have different negative moods associated with their health conditions. Second, our study tested the effects of negative health mood on use intention within a general population. However, individuals' negative health moods may be associated with disease types such as chronic diseases and emergent diseases. For example, individuals with chronic diseases may experience a negative health mood for a long time and then revert to a neutral mood. Future research should explore nuances within the population by distinguishing user groups with different disease types. Third, it is necessary to examine the long-term effects of negative health mood on mHealth services acceptance in future research. The reason is that negative health mood may be durable, causing different, lasting effects on individuals' use intentions regarding mHealth services.

7. Conclusion

Although mHealth services are currently evolving dramatically on a global scale, prior studies have mainly focused on technology-centric antecedents that influence mHealth acceptance behaviors and thereby generally ignored health-related factors like negative health mood. Our research has proposed an integrative framework integrating negative health mood, the ELM, and the MM, and through a survey has investigated individuals' intentions to use mHealth services. Our research develops a clearer perspective on how negative health mood affects the information elaboration of potential mHealth users. The results have good explanatory power for predicting the mHealth use intentions of individuals experiencing negative health moods. This study improves understanding of how individuals in a negative health mood can be persuaded to form intrinsic and extrinsic motivations to use mHealth services, thus enriching the current mHealth services acceptance literature. The results of our study will assist mHealth service providers to customize their persuasive strategies to motivate individuals in a negative health mood to accept mHealth services. Consequently, this study serves not only as an exploratory investigation of negative health mood related to persuasive cues and motivational factors in the context of mHealth services acceptance, but it also provides a basis for future research in mHealth acceptance and diffusion.

Acknowledgment

This study was partially funded by the National Natural Science of China (72001094, 72071054, 71571068，71871074, 71871073), the Philosophy and Social Science Fund of Education Department of Jiangsu Province (2020SJA0875), the Key Projects of Philosophy and Social Sciences Research of Chinese Ministry of Education (19JZD021), and the Fundamental Research Funds for Central Universities HIT.BRET.2021002.

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Appendix

Survey Items

Behavioral Intention Adapted from Deng et al. [2014]	
BI1	I have a strong intention to use mobile health services.
BI2	I intend to learn about using mobile health services.
BI3	I plan to use mobile health services to manage my health.
mHealth Service Matching Adapted from Tam and Ho [2005]	
MSM1	The healthcare services offered by mHealth are my preferences.
MSM2	The healthcare services offered by mHealth are good.
MSM3	The healthcare services offered by mHealth are my favorites.
MSM4	I think that the healthcare services offered by mHealth are what I want.
mHealth Source Credibility Adapted from Bhattacherjee and Sanford [2006]	
MSC1	mHealth services will be reliable.
MSC2	mHealth services will be trustworthy.
MSC3	mHealth services are supposed to be credible.
MSC4	mHealth services should be offered by experts.
Intrinsic Motivation Adapted from Davis et al. [1992]	
IM1	I find that using mHealth services will be enjoyable.
IM2	The actual process of using mHealth services will be pleasant.
IM3	I will have fun using mHealth services.
Extrinsic Motivation Adapted from Davis et al. [1992]	
EM1	Using mHealth services would improve my health status.
EM2	Using mHealth services will make it easier for me to manage my healthcare.
EM3	Using mHealth services would enhance the effectiveness of managing my healthcare.
EM4	I would find mHealth services to be useful for my health management.
Negative Health Mood Adapted from Anderson and Agarwal [2011]	
NHM1	I have an intense loathing for my present state of health.
NHM2	At present, I feel extreme dread about my health conditions.
NHM3	I feel deep sorrow over my health issues.
NHM4	Health problems are tiresome for me.