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## Asia Pacific Management Review

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# A study investigating user adoptive behavior and the continuance intention to use mobile health applications during the COVID-19 pandemic era: Evidence from the telemedicine applications utilized in Indonesia

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## ARTICLE INFO

## Article history:

Received 26 May 2021

Received in revised form

8 January 2022

Accepted 14 February 2022

## Keywords:

health Stress (HS)

Self-service technology

Mobile health apps (mHealth apps)

Expectation confirmation theory (ECT)

Continuance intention

## ABSTRACT

During the COVID-19 pandemic era that began in 2020, there has been a growing trend in the literature to tackle the problem of health stress (HS) for promoting a sense of public health. In turn, this developing area of research has a high level of relevancy linked to business and economic recovery (Čvirik, 2020). Since HS has increased sharply during the COVID-19 pandemic era, there has been a need to further investigate the balance between coping with HS and the positive continuous intention to use mobile health applications (mHealth apps) among the public. This is the first study that takes the Asia-Pacific region as its case study and empirically investigates the validity of extensions based on the theories of expectation confirmation theory (ECT) (Bhattacharjee, 2001) on user continuous behavior relating to mHealth apps during the COVID-19 pandemic. Results reveal that HS as an emotion can positively affect perceived usefulness and satisfaction in relation to the continuous intention to use mHealth apps. The differences between new and frequent users are confirmed. Discussion and implications for practices are provided in the end.

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## 1. Introduction

During the COVID-19 pandemic era that began in 2020, there has been a growing trend in the literature to tackle the problem of health stress (HS) for promoting a sense of public health. In turn, this developing area of research has a high level of relevancy linked to business and economic recovery (Čvirik, 2020). In the literature, the sense of HS has been regarded as an important motivation out of anxiety for coping with the needs of self-health monitoring and check-ups (Biduski, Bellei, Rodriguez, Zaina, & De Marchi, 2020; Lee, Han, & Jo, 2017). Since HS has increased sharply during the

post-COVID-19 pandemic time, there is a need to further investigate the balance between coping with HS and positive continuous use intentions relating to mobile health applications (mHealth apps) among the public. Especially in a time when there are many restrictions, policies of social distancing, and lockdowns mandated by a large number of nations, the prevalent use of mHealth apps can be helpful in providing required medical consultancy services and possibly be used as certification for the travel passengers. In turn, the policy for promoting the usage of mHealth apps can help rebuild the world economy and restore individual user's lifestyle.

Current literature investigates the user behavior out of security or ethical concerns of contact tracking Apps usage (Ahmed et al., 2020; Altmann et al., 2020) and smart phone Apps (including mHealth apps such as Doctor on Demand etc.) adoptive behavior for maintaining well-beings (Alam, Hu, Kaium, Hoque, & Alam, 2020; Banskota, Healy, & Goldberg, 2020). There is a trend to adopt mHealth apps for tele-medical purposes but the relevant studies scarce. As the number of mHealth apps are still growing and

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Peer review under responsibility of College of Management, National Cheng Kung University.

<https://doi.org/10.1016/j.apmr.2022.02.002>

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Please cite this article as: H.-H. Lu, W.-S. Lin, C. Raphael et al., A study investigating user adoptive behavior and the continuance intention to use mobile health applications during the COVID-19 pandemic era: Evidence from the telemedicine applications utilized in Indonesia, Asia Pacific Management Review, <https://doi.org/10.1016/j.apmr.2022.02.002>

could be new for some groups of users, i.e. self-quarantine contact tracing apps (C. S. Lee, 2021), there are still limited number of studies have provided information regarding how to sustain users to keep utilizing this IT services for maintain health and watch out for others. Drawing from this, this is the first study that takes the Asia-Pacific region as its case study and empirically investigates the validity of extensions based on the theories of expectation confirmation theory (ECT) (Bhattacharjee, 2001) on user continuous behavior after the first-time orientation relating to mHealth apps usage for seeking medical services during the COVID-19 pandemic. By probing this research topic, the critical and successful factors for mHealth app developments can be revealed.

Furthermore, self-service technologies (SSTs) are referred to services provided to users without any direct involvement or interaction with real people (Kimes & Collier, 2015; Kokkinou & Cranage, 2013). SSTs has also been referred to as the services that requires different levels of user participation. During the COVID-19 pandemic, there has been a need to investigate how people maintain well-being by following the epidemic prevention policies and mandatory SST use that is new to them. This study aims at empirically investigating the associations between HS and the continuous intention to use mHealth apps. The concept of HS is introduced in this study in the sense that it is an emotional factor that is under full investigation but should have an impact on determining the habit of mHealth app use for the purpose of maintaining health and following epidemic prevention policies, such as social distancing. The paper is composed of five sections, the literature review is presented next. The research method is documented in Section 3. The results are presented in Section 4, and a discussion and implications for the practice are given in the end.

## 2. Literature review

### 2.1. User behavior of adopting mHealth apps

Mobile health (mHealth) is a term that came from telehealth, or specifically telemedicine, which uses information technologies and their features to help doctors provide healthcare services from a distance (Dobson et al., 2017; Zhang, Liu, Wang, Zhang, & Wang, 2019). mH terminology is under development around the globe, and its healthcare services are supported by mobile communications and technologies (Martínez-Pérez, de la Torre-Díez, & López-Coronado, 2013; Klasnja & Pratt, 2012). During the COVID-19 pandemic, two main categories of mHealth apps were developed in terms of universal and country-specific apps (Ming et al., 2020). Based on Mao, Zhao, and Liu (2020), mHealth apps run on smartphones and function to educate, prevent, and transform health services to users. It is stated that the use of mobile and wireless technologies and information-communication technologies can improve health systems' efficiency and obtain a better health outcome (Rose, Jiang, & Mangematin, 2017). There are advantages to utilizing mHealth apps, such as they can help people monitor self-health status and treatments of chronic diseases; as well, they can help reduce the costs of healthcare, especially by bring critical services to rural areas in developing countries (Khalemsky & Schwartz, 2017; Valle, Nezami, & Tate, 2020).

### 2.2. The influence of convenience on perceived usefulness and satisfaction

In SST adoption, convenience is referred to as a notable variable (Berry, Seiders, & Grewal, 2002; Curran & Meuter, 2005). Cases of online banking (Ho & Ko, 2008), restaurant SSTs (Djelassi, Diallo, & Zielke, 2018; Shin & Perdue, 2019), and online retailing (Chen, Yu,

Yang, & Wei, 2018) have proven the perceived level of convenience and its impacts on use behavior. As well, studies also revealed that user satisfaction and perceived usefulness contribute in provoking the sense of continuous use intention, as explained by ECT. Results of customer loyalty in online shopping (Daud, Farida, Andriansah, & Razak, 2018; Pee, Jiang, & Klein, 2019) and the association between satisfaction and the intention to continue to use also have been validated and documented in cases of digital textbooks/libraries (Joo, Park, & Shin, 2017) and online learning applications (Daneji, Ayub, & Khambari, 2019).

We defined convenience as a "technology enables users to accomplish a task whenever and wherever they want to (Gurtner, Reinhardt, & Soyeze, 2014)." Lai and Chang (2011) illustrated that consumers can easily search for desired information in e-bookshops and read e-books at any time. The convenience value provided by the product positively affects consumers' usefulness perception. A study in mobile business application found that convenience influenced usefulness of using the application (Gurtner et al., 2014). Yoon, Jeong, and Rolland (2015) proposed that convenient values related to mobile instant messaging with friends at any place affects the perceived usefulness of this application. Dong, Chang, Wang, and Yan (2017) have explained that the perceived convenience of IOT systems is positively related to perceived usefulness. Therefore, we posit that the convenience of mHealth app makes seeing a doctor faster and easier, which enhances user's effectiveness in managing their health condition. Thus, we hypothesize:

**H1. a.** Convenience is positively associated with perceived usefulness of mHealth apps  
**H1b.** Health stress is positively associated with perceived usefulness of mHealth Apps

**H2. a.** Convenience is positively associated with satisfaction of mHealth apps  
**H2b.** Health stress is positively associated with satisfaction of mHealth Apps

### 2.3. The influence of health stress on perceived usefulness and satisfaction

Health stress refers to the degree individuals are worried about his/her health (E. Lee et al., 2017). During the pandemic, people will be more aware and stressful of their health condition (Čvirik, 2020). It is important for people to take regular check with their health status; as well, the technology is widely applied to assist automatic check or monitor people's health status (E. Lee et al., 2017). The role of emotion has been identified as one of the most important antecedents that leads to individual's usage of mHealth services in recent studies (Li, Zhang, Guo, & Wang, 2019; Zhang, Guo, Ho, Lai, & Vogel, 2021). Goyal, Chauhan, and Gupta (2021) have pointed out that individuals anxious about their health is likely to increase the perceived values of seeking information from other resources (e.g. online doctor). E. Lee et al. (2017) also indicated that health stress positively influences perceived usefulness of mHealth apps. Therefore, we believe when people encounter the HS, it will increase the value of perceived usefulness of mHealth apps and they will expect that using mHealth apps to maintain their health status. Thus, we hypothesize the following:

### 2.4. Perceived usefulness, satisfaction and continuance intention

Perceived usefulness is defined as the degree which someone believes, when they are using IT (Information technology), that IT can enhance their performance (Davis, 1989). According to Akter, Ray, and D'Ambra (2013), they revealed that the perceived value of mHealth apps adoption mainly consists of the benefits and convinces obtained. Perceived usefulness is known as the most

important factor to determine technology adoption. It was also revealed that users have reported that they need to use mHealth apps to help their own productivity and that those apps have affected people's attitude toward IT and mHealth apps. In this case, people need to check or control their health but are unable to pay visit to the doctor, so one feasible method is that users employ mHealth apps for regular health consultations and check-ups (Hollander & Carr, 2020; Lemke, Clark, & Wilson, 2011; Miele et al., 2020; Tebeje & Klein, 2021).

Perceived usefulness is initially proposed as an important determinant on information acceptance (Davis, 1989). Then, it has been proven valid in explaining information system continued to use behavior as denoted by expectation confirmation theory (ECT) (Bhattacharjee, 2001). This model focuses on the post-adoptive stage of IT use, so it reveals that perceived usefulness plays a major role in predicting user behavior. In ECT, it is explained that perceived usefulness has a positive relationship between satisfaction and continuance intention (Akter et al., 2013; Bhattacharjee, 2001). Previous research has shown that perceived usefulness has a positive influence on people's use intention (Mangkunegara, Azzahro, & Handayani, 2018), and perceived usefulness is associated with consumer satisfaction (Akter et al., 2013; Roca, Chiu, & Martinez, 2006). Based on previous research, we expect in this research's perceived value will have a positive impact toward satisfaction and continuance intention.

Continuance intention (CI) has become one of the major outcome of information system (IS) research (dependent variable) to measure the sustainability of using IS (Chen, Jong, & Lai, 2014; Johnson, Kiser, & Woolridge, 2021). Continuance is defined as a user/customer behavior when they use information & communication technology services (Cho, 2016). Previous research has defined CI as a user's behavior to continue using products/services after accepting them. In this study, we define CI as a user's intention to continue using mHealth apps. The efficiency of mHealth apps increases when users/customers are willing to continue to use them (Agarwal, Gao, DesRoches, & Jha, 2010).

CI is based on how customers keep using the same product (keep using an mHealth app). A previous study has investigated the use of mHealth apps and revealed that the perceived usefulness and satisfaction have positive effects on CI (Cho, 2016). The study conducted by Akter posited that CI is associated with satisfaction and perceived usefulness (Akter et al., 2013). Overall, we can conclude that perceived usefulness and satisfaction have impacts on CI. Thus, we hypothesize the following:

**H3a.** Perceived usefulness is positively associated with the continuance intention to use mHealth apps.  
**H3b.** Perceived usefulness is positively associated with the satisfaction of using mHealth apps.

**H4.** Satisfaction is positively associated with the continuance intention to use mHealth apps.

### 3. Methodology

#### 3.1. Research framework

The proposed research model (see Fig. 1) contains the antecedents of continuance intentions including convenience, HS, perceived usefulness, and satisfaction, which investigates the effects of convenience and HS on perceived usefulness and satisfaction. All constructs involved in the research framework is developed based on the relevant literature. Details of the research method are addressed in the followings.

#### 3.1.1. Data collection

The use of mHealth apps has become an important issue during the pandemic. This study takes an Asia-Pacific country, Indonesia, as the example. As Indonesia is the largest island country in the world, its size has increased the difficulties of citizens to see doctors in person during the COVID-19 pandemic. There are a number of mHealth apps (e.g., Halo-Doc,<sup>1</sup> Alodokter,<sup>2</sup> Yes-Dok,<sup>3</sup> and other similar MH platforms) are available during the pandemic time. In order to sustain the validity of the data, the Halo-Doc is selected as the main application for further examination as it is also the most popular mHealth apps and been supported by the governmental health department and affiliated medical centers & doctors. In order to ensure that potential respondents have had experience utilizing with mHealth apps, a screening question (Have you ever used any mHealth apps applications?) was asked at the beginning of the survey. The sample subjects were recruited by invitations among the citizens of Indonesia. The duration of the data collection period was two months in the end of 2020. These mHealth apps were newly launched in 2020 for protecting the health status and adhering to the regulations of social distancing, as this was the time when COVID-19 seriously hit the Asia-Pacific region. After recruiting the subjects, there are 472 subjects were originally collected, but 29 participants were excluded because they claimed no mHealth app experience, leaving a total of 443 valid samples obtained (validity rate is 93.9%).

#### 3.1.2. Measurement scales

The measurement scale is based on the relevant literature. Research constructs are measured by 7-point Likert scale (1 = Unlikely agree, 7 = Extremely agree).

Here are illustrations of the measurement scales:

1. Health stress: Perceived health stress from the users of mHealth apps is defined as an extrinsic utility coming from its capacity to give social or functional value in the context of a specific set of circumstances (E. Lee et al., 2017). During the COVID-19 pandemic time, public are strived by high awareness of health stress for coping with regular medical needs and pandemic preventions courses of actions. In this study, we define this construct from the inner needs of health precaution raised by personal awareness. Questions include: 1. It is hard for me to spend time for my health. 2. It is hard for me to make efforts for my health. 3. My way of monitoring my health isn't good. It implies the state of health anxiety from the inner side of the mind. It is also the initial mediation engage users to utilizing the mHealth apps.
2. Convenience: Perceived level of convenience in the context of mHealth apps adoption is defined as a judgement made by users according to their sense of control over the management, utilization and conversion of their time and effort in achieving the goals associated with access to and use of the mHealth apps information service (E. Lee et al., 2017). In this study, we particularly the sense of convenience of the time management, easiness of life to attend medical appointments, to stay health and sound.
3. Perceived Usefulness: Perceived usefulness is defined as the features provide by mHealth app as a self-service information system that users can obtain health-relevant information on demands without time and physical locations restrictions (Chen, Yang, Zhang, & Yang, 2018; Roca et al., 2006). In this study, we

<sup>1</sup> <https://www.halodoc.com/>.

<sup>2</sup> <https://www.alodokter.com/>.

<sup>3</sup> <https://www.yesdok.com/en/company/>.

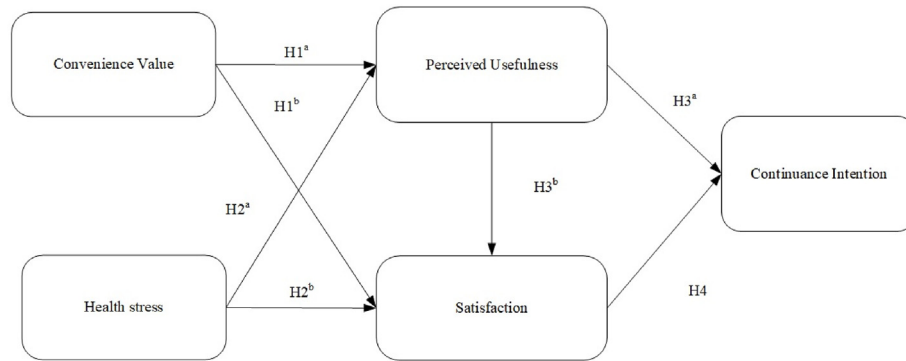


Fig. 1. Research framework.

refer the perceived usefulness in adopting mHealth apps on the perceived value for users to manage health and maintain performance and productivity in life and work.

4. Satisfaction: Satisfaction is long been addressed as an important antecedence of information system continuous to use intentions (McLean, Al-Nabhani, & Wilson, 2018). In this study, we particularly appoint the sense of perceived level of satisfaction in the context of mHealth app usage experience. The sense of perceived level of information, service and system quality are arranged.
5. Continuance Intention: Continuous intentions are referred to one salient success factor of a mHealth app as an information system (Akter et al., 2013; Bhattacharjee, 2001; Roca et al., 2006). In this study, the sense of continuous intentions is referred to future usage intentions for regularly monitoring self-health and fulfilling the medical needs.

### 3.2. Data analysis

First, confirmatory factor analysis (CFA) was applied to evaluate the construct validity of the data using AMOS 24. Second, means, standard deviations, and correlations were examined to ensure the discriminant validity of the overall data structure. Next, we implemented the structural equation model (SEM) to explore the relationships among the five constructs in the proposed research model, including convenience, HS, perceived usefulness, satisfaction, and CI. Finally, t-tests and multi-group analyses were employed to investigate whether significant differences exist between new users and existing users.

## 4. Results

### 4.1. Descriptive statistics

Table 1 describes the characteristics of the sample. The respondents tended to be young (65% younger than 26 years old), female participants (66%) dominated, well educated (86% had at least a bachelor's degree or higher). They varied in occupation (student, 18%; employee, 57%; entrepreneur, 14%; social worker, 4%; household, 7%; government employee, 1%). The largest group (56%) reported using an mHealth application at least 6–12 times per year, which means that respondents use these applications regularly (i.e., once every month or two).

### 4.2. Reliability and validity analysis

Confirmatory Factor Analysis (CFA) was performed to evaluate the goodness-of-fits of the measurement model. Results of these

measures show that the measurement model provides a good fit with  $\chi^2 = 160.655$ ,  $df = 80$ ,  $\chi^2/df = 2.008$ ,  $GFI = 0.956$ ,  $AGFI = 0.933$ ,  $CFI = 0.980$ , and  $RMSEA = 0.048$ . The factor loadings for all items varied from 0.602 to 0.906, exceeding the criteria of 0.5 (Hair, Black, Babin, & Anderson, 2010). The composite reliabilities (CR) ranged from 0.780 to 0.884, which were greater than the 0.70 recommended values by Hair et al. (2010). The average variance extracted (AVE) varied from 0.546 to 0.718, justifying the use of the constructs (AVE > 0.5). Therefore, the results indicate adequate convergent validity of the overall measurement model. Hence, the measured data collected in this study are suitable for establishing SEM. The measurement items and results of reliability are shown in Table 2.

The results shown in Table 3 reveal that only the square root of CI was less than the correlation with satisfaction; each construct's square root of the AVE was greater than correlations with other construct used in the study. Therefore, the proposed model of this study appears to have adequate discriminant validity.

### 4.3. Structural model results

Overall model fit was examined using the maximum likelihood method. The model fit of the data and proposed model was acceptable: chi-square = 262.071,  $df = 83$ ,  $\chi^2/df = 3.157$ ,  $GFI = 0.933$  (>0.9),  $AGFI = 0.903$  (>0.9),  $CFI = 0.955$  (>0.9) and  $RMSEA = 0.070$  (<0.08). In addition, the  $R^2$  of all constructs indicated a substantial level of explanation by satisfying the criterion of 0.5 (Schroer & Hertel, 2009). Fig. 2 summarizes the results of the path coefficients and  $R^2$  of this study.

### 4.4. Differences between new users and existing users

New users are users who only used mHealth apps less than six times in a year, whereas existing users are those who use at least 6–12 times in one year. Independent sample t-tests were performed to examine the differences between the two groups. As Table 4 indicates, new users differed from existing users on all scales. Existing users perceived convenience, HS, perceived usefulness, satisfaction, and CI to a significantly greater degree when compared to new users.

#### 4.4.1. Hypotheses testing results

The results of the path testing of the three models are shown in Table 5. The effect of perceived convenience (H1b) was significant on satisfaction of the users, but the results were not significant in new user or existing user group, respectively. Health stress (H2a) of the users can directly induce perceived usefulness only among new users. In addition, the effect of perceived usefulness (H3a) of the

**Table 1**  
Demographic characteristics.

Demographic characteristics	Types	Frequency	Percentage
User Type	Existing	306	69%
	New User	137	31%
Gender	Male	152	34%
	Female	291	66%
Time Zone	West	350	79%
	Central	58	13%
	East	35	8%
Age	<20	28	6%
	20–29	260	59%
	30–39	81	18%
	40–49	45	10%
	>50	29	7%
Status	Single	321	72%
	Married	122	28%
Education	High School or below	59	14%
	Bachelor	311	70%
	Master	70	16%
	Doctorate	3	<1%
Occupation	Student	78	18%
	Employee	253	57%
	Entrepreneur	62	14%
	Social Worker	14	4%
	Household	33	7%
	Government Employee	3	<1%
mHealth apps	Halo-Doc	312	70%
	Alodokter	58	13%
	Yes-Dok	24	6%
	Other mHealth apps	49	11%
Frequency using mHealth apps	Never	36	8%
	Very Rare (<5 in a year)	101	23%
	Rare (6–12 a year)	247	56%
	Often (2 times a month)	56	13%
	Very Often (>4 times a month)	3	<1%

**Table 2**  
Measurement scales and results.

Constructs	Standardized loading	CR	AVE
Health Stress (E. Lee et al., 2017)		0.883	0.718
1. It is hard for me to spend time for my health.	0.906		
2. It is hard for me to make efforts for my health.	0.906		
3. My way of monitoring my health isn't good enough.	0.715		
Convenience (E. Lee et al., 2017)		0.804	0.578
1. Using mHealth app is a convenient way to manage my time rather than visiting a doctor or hospital.	0.789		
2. Using mHealth app makes my life easier.	0.799		
3. Using mHealth app helps me stay healthy and fit more easily.	0.688		
Perceived Usefulness (Chen, Yu, et al., 2018; Roca et al., 2006)		0.884	0.717
1. Using mHealth app improves my performance.	0.851		
2. Using mHealth app improves my productivity.	0.832		
3. Using mHealth app addresses my health management.	0.857		
Satisfaction (McLean et al., 2018)		0.829	0.619
1. I'm satisfied with the experience of using mHealth app.	0.757		
2. The experience is exactly what I needed.	0.76		
3. This experience has worked out as well as I thought it would.	0.84		
Continuous Intention (Akter et al., 2013; Bhattacharjee, 2001; Roca et al., 2006)		0.780	0.546
1. My intention to continue using mHealth apps is great compared to using any alternative means (e.g., traditional health systems).	0.800		
2. I will not discontinue use of this service.	0.797		
3. I will use mHealth apps on a regular basis in the future.	0.602		

users was not significant on continuance intention in all models. To conclude, H1a, H2b, H3b, and H4 were fully supported, but H1b, H2a was only partly supported, and H6 was not supported.

#### 4.5. Common method bias

Two tests were performed to estimate the existence of common method biases (CMB). First, the variance inflation factor (VIF) was implemented to check for the multicollinearity among constructs.

The ranges of VIFs of the four independent variables are 1.47–2.49 (<3), indicating that multicollinearity is not an issue in this study (O'Brien, 2007). Second, Harman's single factor test was conducted. We found that the one common factor explained not more than 50% of the variance, suggesting that it did not account for most of the covariance among the measures (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Thus, we contend that common method bias is unlikely to be a serious concern in this study.

**Table 3**  
Means, standard deviations, correlations, and discriminant validity measures.

	Constructs	Mean	S.D.	1	2	3	4	5
1	Convenience Value	4.44	0.66	<b>0.760</b>				
2	Usefulness	4.48	0.67	0.630	<b>0.847</b>			
3	Satisfaction	4.55	0.58	0.563	0.723	0.787		
4	Health Stress	4.41	0.78	0.444	0.480	0.529	<b>0.847</b>	
5	Continue Intention	4.57	0.57	0.563	0.618	0.677	0.500	<b>0.739</b>

**5. Conclusions**

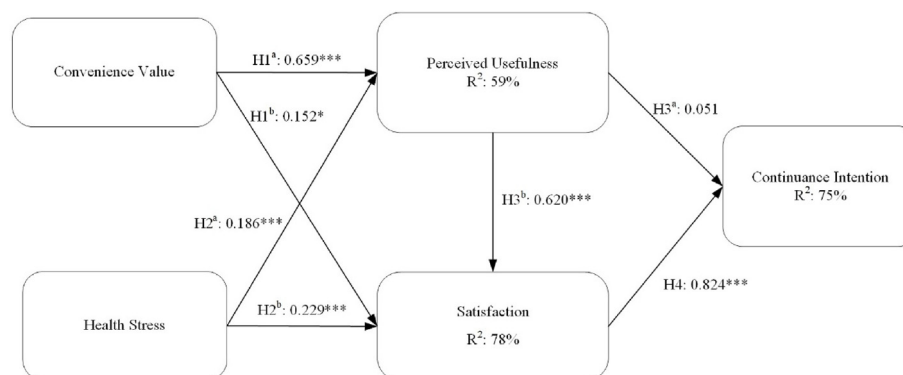
5.1. Discussions

As there is already a trend widely applied by governmental health ministries around the globe to intelligently prevent the outbreak of COVID-19, this study empirically investigated the continuous intention to use mHealth apps in the Asia-Pacific region, which had the greatest population density during the COVID-19 pandemic. This study extends our understanding about how HS can positively affect perceived usefulness and satisfaction in relation to the continuous intention to use mHealth apps.

First, convenience value and HS both are results on the level of satisfaction. This result reveals that HS run by the public should be

well maintained and promote the sense of self-health monitoring behavior by adopting SST. Given the concerns of relating to public health during the COVID-19 pandemic, the benefit of convenience by providing medical consultant and self-health monitoring services can be met via the use of mHealth apps is met and users can be fully engaged. The second contribution of this study is that it is the first study that involves the notion of stress as an emotion for the investigation of information systems used during the COVID-19 pandemic. As the sense of stress is a type of emotion encountered by users, this study has confirmed that the sense of emotion (i.e. health stress, HS) is positively related to the perceived usefulness and satisfaction of using the mHealth apps. Thus, HS can be managed or relieved wisely by utilizing mHealth apps.

Another finding of this study is that perceived usefulness does



**Fig. 2.** Results.

**Table 4**  
T-test results for new users and existing users groups.

Constructs	New Users		Existing Users		T-test between two groups
	Mean	Std.	Mean	Std.	
Convenience	4.23	0.81	4.53	0.56	3.94***
Health Stress	4.18	0.93	4.51	0.68	3.82***
Perceived Usefulness	4.28	0.86	4.58	0.54	3.80***
Satisfaction	4.38	0.69	4.62	0.51	3.75***
Continuance Intention	4.42	0.68	4.63	0.50	3.20***

**Table 5**  
Results of path testing.

Hypotheses/Groups of users	All	New User	Existing User	Results
H1a: Convenience → Perceived usefulness	0.659***	0.617***	0.690***	Supported
H1b: Convenience → Satisfaction	0.152*	0.084	0.195	Partly supported
H2a: Health stress → Perceived usefulness	0.186***	0.294***	0.058	Partly supported
H2b: Health stress → Satisfaction	0.229***	0.178**	0.279***	Supported
H3a: Perceived usefulness → Continuance intention	0.051	-0.057	0.092	Not supported
H3b: Perceived usefulness → Satisfaction	0.620***	0.741***	0.519***	Supported
H4: Satisfaction → Continuance intention	0.824***	0.966***	0.730***	Supported

not directly impact the continuous intention to use mHealth apps. It may be due to the fact that mHealth apps were a mandatory information system that was executed by governmental authorities during the COVID-19 pandemic. This finding reveals that there is no association with continuance intention, but it still greatly affects the perceived level of satisfaction. In the future, there is a need to provide improved online medical features for winning over the support of the public. Our results reveal that satisfaction of mHealth apps has a significant association with continuous use intentions. This result coincides with similar notions stressed in the literature, such as user satisfaction is key for promoting information system use.

Finally, our study contributes to the literature by providing first-hand information for revealing the adoptive behavior of general users and the differences between new and frequent users of mHealth apps. The differences between new and frequent users were confirmed. For both types of users, the association between perceived satisfaction to the continuous intention to adopt mHealth apps was confirmed. However, the association between health stress with perceived usefulness was only revealed significantly on the group of new mHealth app users. It may reflect the fact that health stress is the main antecedence promote the initial adoption of mHealth for users. It may reveal the fact the psychological concerns of SSTs user is influential to adopt the mHealth apps.

## 5.2. Managerial implications

As for managerial implications, our study points out that convenience is important determinant to perceived usefulness of mHealth app. Therefore, developers of mHealth apps should enhance the features that may facilitate the convenience of apps. For example, proving prompt feedback on health matters as a system feature is likely to increase the convenience for users. In addition, health stress is likely to increase satisfaction of using the apps. Therefore, developers of mHealth apps may offer their services to users who worried about their health (e.g. people who have to go to hospital regularly). For mHealth apps, the successful factors centered in providing services in terms of accurate and prompt information relating to issues of public health. As well, as the literature points out that an information system use habit requires much effort, including training offered by staff, encouragement obtained from received feedback, and perceived co-creation values asserted by other users.

## 5.3. Future research opportunities

This study serves a number of limitations. First, due to there is only one nation has chosen for the data collection, researchers are advised to interpret results with cautions. Secondly, this study only tackles the type of mHealth app (Halo-Doc) issued by the Health Bureau for seeking health advice. Other types of mHealth apps, i.e. self-monitoring or self-quarantine contact tracing apps are not considered in this study. Third, the sampling subjects are recruited in the urban area of the selection nation, future study can expand the selected groups of subjects who can have diverse backgrounds.

## Funding

This study was partially supported by the Ministry of Science and Technology, Taiwan, R.O.C. (grant number: MOST 109-2410-H-006-006-, MOST 109-2118-M-006-004-MY2).

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