



# Adoption of Mobile Apps for Mental Health: Socio-psychological and Technological Factors

Soontae An<sup>(✉)</sup> and Hannah Lee

Division of Communication and Media, College of Social Sciences,  
Ewha Womans University, Seoul, Korea  
soontae@ewha.ac.kr, hoyl222@naver.com

**Abstract.** The purpose of this research is to explore the factors affecting intention to use a mobile application for mental health in South Korea. Based on the Health Belief Model and Extended Technology Acceptance Model, this research aims to advance our understanding of mobile app adoption for mental health. A total of 218 men and women participated in an online survey. Results showed that perceived usefulness and perceived ease of use had significant effects on all stages of behavioral intention: app subscription, information seeking, information sharing, and following recommendations. Subjective norm and output quality were also significant predictors for intention to use a mobile app. Results provide useful insights for utilization of mobile apps to address mental health issues in Korean society.

**Keywords:** Mental health · Mental health app · Mobile app  
Extended Technology Acceptance Model

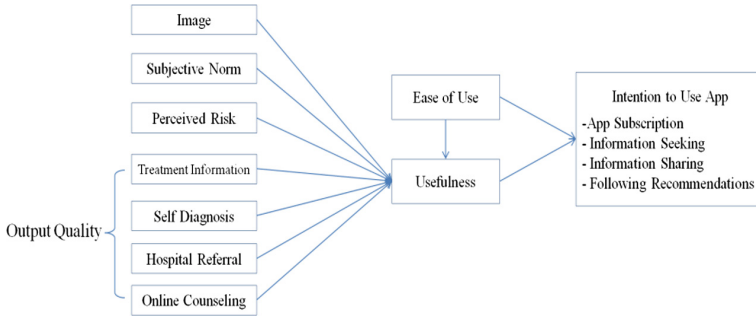
## 1 Introduction

### 1.1 Purpose of Research

The purpose of this research is to explore the factors affecting intention to use a mobile application for mental health in South Korea. Despite the high suicide rates and increasing mental health illness [1], little attention has been paid to mobile applications as a tool to help people receive appropriate help and treatment. Given the high penetration of smartphones among Koreans [2], mobile applications are a promising venue for prevention and treatment of mental illnesses in Korean society. Based on the Health Belief Model and Extended Technology Acceptance Model, we explored socio-psychological and technological factors in determining people's intention to use a mobile application for mental health.

### 1.2 Research Model

As shown in Fig. 1, perceived *Ease of Use* and perceived *Usefulness* are two primary factors influencing adoption of mobile applications for mental health. Extended Technology Acceptance Model (TAM2) posits that *Subjective Norm*, *Image* and *Output Quality* influence people's perceived *Usefulness* which, in turn, leads to *Intention to*



**Fig. 1.** Proposed research model

Use, along with perceived *Ease of Use* [3]. *Perceived Risk* is one of the key constructs in Health Belief Model (HBM), a widely used theoretical framework to understand health behaviors [4]. By integrating HBM and TAM2, this research aims to advance our understanding of mobile app adoption for mental health.

*Subjective Norm* was defined as “A person’s perception that most people who are important to him/her think he/she should or should not perform the behavior in questions” (p. 302) [5]. *Image* was operationalized as “the degree to which use of an innovation perceived to enhance one’s status in one’s social system” (p. 195) [6]. *Perceive risk* was operationally defined as “one’s subjective perception of the risk of contracting a health condition and feelings concerning the seriousness of contracting an ailment or of leaving it untreated” [7]. *Output Quality* was defined as users’ perceptions of “how well the system performs the tasks that match their job relevance” (p. 985) [8]. *Output Quality* was measured by four dimensions in the current study: treatment information, self-diagnosis, hospital referral, and online counseling.

Perceived *Ease of Use* was defined as “the degree to which a person believes that using a particular system would be free of effort” [9]. Perceived *Usefulness* referred to “the degree to which a person believes that using a particular system would enhance his or her job performance (p. 320) [9]. Finally, *Intention to Use* was measured by four outcome variables: subscription of the mobile app, information seeking, information sharing, and following recommendations [10].

## 2 Methods

A total of 228 people participated in the online survey. Among the participants, 51.3% were males while 48.7% were females. Their average age was 39.16 years (Min = 20.00, Max = 58.00, SD = 10.45). Table 1 shows basic characteristics of the sample.

The online survey was conducted by a professional research firm. Screen shots of a mobile app were shown with explanations of its key features. The mobile app is currently provided by the Ministry of Patriots and Veterans Affairs in South Korea. After showing features of the mobile app, participants’ intention to use the app as well as other factors were measured.

**Table 1.** Sample characteristics

Variables	N (%)	Variables	N (%)
<b>Gender</b>		<b>Income</b>	
Male	117 (51.3%)	Less than \$1,000	14 (6.1%)
Female	111 (48.7%)	\$1,000–\$2,000	19 (8.3%)
		\$2,000–\$3,000	52 (32.8%)
<b>Age</b>		\$3,000–\$4,000	46 (20.2%)
20~30 years	58 (25.4%)	\$4,000–\$5,000	72 (31.5%)
30~40 years	60 (26.3%)	More than \$5,000	25 (11.0%)
40~50 years	59 (25.9%)		
50~60 years	51 (22.4%)		
		<b>Experience of Psychotherapy</b>	
<b>Education</b>		Yes	29 (12.7%)
Lower than high school degree	6 (2.6%)	No	199 (87.3%)
High school graduate	34 (14.9%)		
College graduate	171 (75.0%)		
Graduate student	17 (7.5%)		

Key descriptive statistics are as follows: *Usefulness* (Four items,  $M = 3.6$ ,  $SD = .66$ , Cronbach's  $\alpha = .81$ ), *Ease of Use* (Three items,  $M = 3.62$ ,  $SD = .70$ , Cronbach's  $\alpha = .79$ ), *Subjective Norms* (Two items,  $M = 2.87$ ,  $SD = .89$ , Cronbach's  $\alpha = .77$ ), *Image* (Two items,  $M = 2.80$ ,  $SD = .81$ , Cronbach's  $\alpha = .73$ ), *Perceived Risk* (Six items,  $M = 3.61$ ,  $SD = .68$ , Cronbach's  $\alpha = .83$ ), *Output Quality* (Twelve items,  $M = 3.60$ ,  $SD = .65$ , Cronbach's  $\alpha = .94$ ), and *Intention to Use the Mental Health App* (Seven items,  $M = 3.47$ ,  $SD = .66$ , Cronbach's  $\alpha = .87$ ). Scales for measuring all variables were adopted and modified based on Venkatesh and Davis [3]'s and Lin [11]'s items. Each statement was measured on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree).

### 3 Results

#### 3.1 Attitudes Toward Mental Health Services

First, we examined barriers deterring use of mental health services. About half of participants (47.8%) mentioned social stigma as a barrier. Table 2 shows a list of barriers including lack of information (17%) and shame (9.6%).

**Table 2.** Barriers of mental health care use

	Lack of information	Medical mistrust	Treatment cost	Shame	Stigma	Total
N (%)	40 (17.5%)	30 (13.2%)	27 (11.8%)	22 (9.6%)	109 (47.8%)	228 (100%)

Next, participants were asked: "If you are suffering from mental health problems, who would be the first to ask for help?" As shown in Table 3, most participants responded that they would look for mental health information via the Internet (40.8%), followed by family (25.4%) and doctor (11.8%).

**Table 3.** The first help-seeking for mental health crisis

	Most likely	Second most likely	Third most likely	Total index
Friends	17 (7.5%)	27 (11.8%)	39 (17.1%)	14400
Family	58 (25.4%)	<b>55 (24.1%)</b>	36 (15.8%)	<b>32000</b>
Doctor	27 (11.8%)	48 (21.1%)	35 (15.4%)	<b>21200</b>
For myself	26 (11.4%)	39 (17.7%)	<b>45 (19.7%)</b>	20100
Internet	<b>93 (40.8%)</b>	41 (18.0%)	43 (18.9%)	<b>40400</b>
Religion	6 (2.6%)	13 (5.7%)	12 (5.3%)	5600

### 3.2 Correlations Among Variables

Table 4 displays Pearson Correlations among variables.

**Table 4.** Correlations between variables

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Subject Norm	1												
2. Image	.71**	1											
3. Treatment Information	-.49**	-.58**	1										
4. Self Diagnosis	-.47**	-.54**	.79**	1									
5. Hospital Referral	-.49**	-.59**	.76**	.75**	1								
6. Online Counseling	-.51**	-.63**	.80**	.79**	.79**	1							
7. Risk Perception	-.21**	-.24**	.37**	.38**	.37**	.39**	1						
8. Usefulness	-.55**	-.62**	.79**	.74**	.72**	.79**	.39**	1					
9. Ease to Use	-.32**	-.44**	.53**	.50**	.49**	.51**	.33**	.58**	1				
10. Subscription	-.52**	-.57**	.70**	.68**	.64**	.69**	.40**	.69**	.51**	1			
11. Information Seeking	-.53**	-.56**	.70**	.61**	.64**	.69**	.42**	.67**	.54**	.70**	1		
12. Information Sharing	-.57**	-.63**	.60**	.54**	.60**	.59**	.33**	.60**	.46**	.61**	.64**	1	
13. Following Recommendations	-.42**	-.47**	.62**	.56**	.57**	.60**	.38**	.60**	.40**	.61**	.58**	.51**	1

\*p<.05, \*\*p<.01

### 3.3 Tests of the Proposed Model

Structural equation models were run to test the proposed research model with four different outcome variables (app subscription, information seeking, information sharing, and following recommendations). In this study, AMOS was used and the estimation procedure was maximum likelihood estimation. Table 5 provides information on the fit indices of the four models, indicating acceptable fits.

Three endogenous variables were tested in model 1. Perceived usefulness was found to be significantly determined by subjective norm, treatment information, self diagnosis, online counseling and perceived ease of use, resulting in an R<sup>2</sup> of .74. The dependent variable, subscription app, was significantly determined by perceived usefulness and perceived ease of use, resulting in R<sup>2</sup> of .49.

**Table 5.** Fit Indices of proposed research models

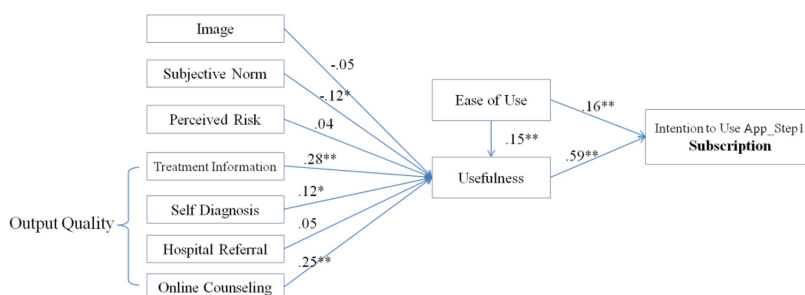
Fit index	$\chi^2$	Df	GFI	NFI	CFI	RMSEA	SRMR
Level of acceptable fit			>.90	>.90	>.90	<.06	<.05
Proposed research model 1	57.96	6	.95	.97	.97	.18	.02
Proposed research model 2	63.68	6	.95	.96	.97	.19	.02
Proposed research model 3	61.61	6	.96	.96	.97	.19	.03
Proposed research model 4	34.23	6	.97	.98	.98	.13	.03

In model 2, perceived usefulness was significantly determined by subjective norm, treatment information, self diagnosis, online counseling and perceived ease of use at  $R^2$  of .74, indicating that the variables explained 74% of the variance in perceived usefulness. The dependent variable, information seeking, was significantly determined by perceived usefulness and perceived ease of use, resulting in  $R^2$  of .49.

In model 3, perceived usefulness was found to be significantly determined by subjective norm, treatment information, self diagnosis, online counseling and perceived ease of use, resulting in an  $R^2$  of .74. Information sharing was significantly determined by perceived usefulness and perceived ease of use, resulting in  $R^2$  of .38.

In model 4, the combined effects of subjective norm, treatment information, self diagnosis, online counseling and perceived ease of use explained 73.7% of the variance in perceived usefulness. Perceived usefulness, easy to use explained 36% ( $R^2 = .36$ ) of the variance in the dependent variable, following recommendations.

Figure 2 shows the resulting path coefficients of the proposed research model 1. The results showed that subject norm ( $\beta = -.12$ ,  $p < .05$ ), treatment information ( $\beta = .28$ ,  $p < .01$ ), self diagnosis ( $\beta = .12$ ,  $p < .05$ ), and online counseling ( $\beta = .25$ ,  $p < .01$ ) significantly influenced perceived usefulness. Perceived ease of use was found to be significant in influencing both perceived usefulness ( $\beta = .15$ ,  $p < .01$ ) and intention to subscribe the app ( $\beta = .16$ ,  $p < .01$ ). We also found a significant indirect path between perceived ease of use and intention to use app, mediated by perceived usefulness ( $\beta = .09$ ,  $p < .05$ ). We noted that perceived usefulness not only played a key role in its direct effect on intention to use the app ( $\beta = .59$ ,  $p < .01$ ), but also as a mediator variable (Fig. 2).

**Fig. 2.** Path model 1 (Mental health app subscription)

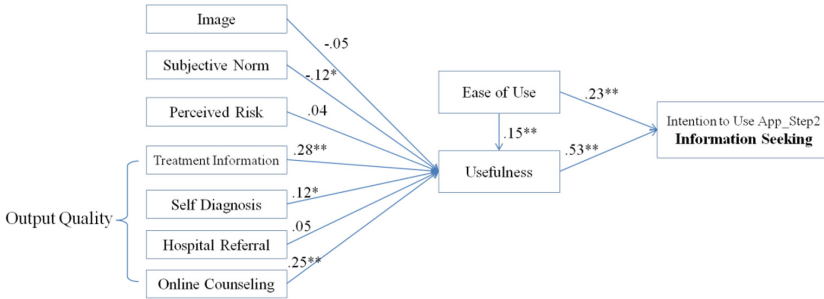


Fig. 3. Path model 2 (Information seeking)

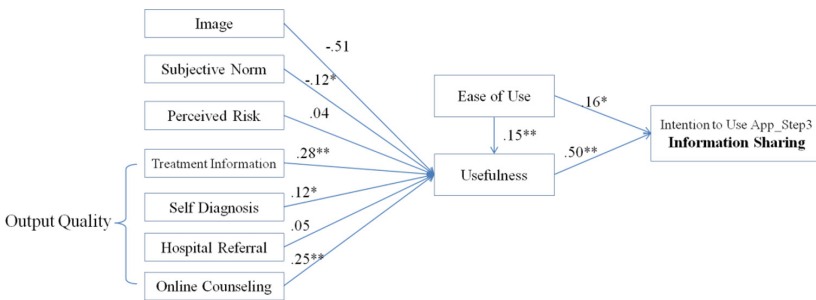


Fig. 4. Path model 3 (Information sharing)

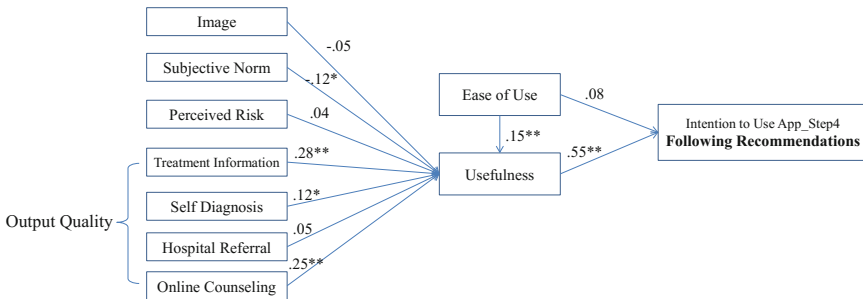


Fig. 5. Path model 4 (Following recommendations)

In model 2 (see Fig. 3) and model 3 (see Fig. 4), the same results were obtained as in model 1. In model 4 (see Fig. 5), on the other hand, perceived ease of use had no significant effect on intention to follow recommendations ( $\beta = .08, p > .05$ ) (Tables 6 and 7).

**Table 6.** Results of path model 1 and path model 2

Path	Research model 1 subscription			Research model 2 information seeking		
	$\beta$	S.E	C.R.	$\beta$	S.E	C.R.
<i>Direct effect</i>						
Subject Norm → Usefulness	-.12	.04	-2.37*	-.12	.04	-2.37*
Image → Usefulness	-.05	.05	-0.93	-.05	.05	-0.93
Risk Perception → Usefulness	.04	.04	0.99	.04	.04	0.99
Treatment Information → Usefulness	.28	.06	4.21**	.28	.06	4.21**
Self Diagnosis → Usefulness	.12	.06	1.91*	.12	.06	1.91*
Hospital Referral → Usefulness	.05	.06	0.74	.05	.06	0.74
Online Counseling → Usefulness	.25	.06	3.62**	.25	.06	3.62**
Easy to Use → Usefulness	.15	.04	3.59**	.15	.04	3.59**
Usefulness → Intention to Use	.59	.07	10.2**	.53	.07	9.12**
Easy to Use → Intention to Use	.16	.06	2.76**	.23	.06	3.99**
<i>Indirect effect</i>						
Easy to Use → Usefulness → Intention to Use	.09*	.04	–	.08*	.03	–
Subject Norm → Usefulness → Intention to Use	-.07	.04	–	-.06	.03	–
Image → Usefulness → Intention to Use	-.03	.03	–	-.03	.03	–
Risk Perception → Usefulness → Intention to Use	.02	.02	–	.02	.02	–
Treatment Information → Usefulness → Intention to Use	.16**	.05	–	.15**	.05	–
Self Diagnosis → Usefulness → Intention to Use	.07	.05	–	.06	.04	–
Hospital Referral → Usefulness → Intention to Use	.03	.04	–	.02	.03	–
Online Counseling → Usefulness → Intention to Use	.15**	.04	–	.14**	.04	–

\* $p < .05$ , \*\* $p < .01$ **Table 7.** Results of path model 3 and path model 4

Path	Research model 3 information sharing			Research model 4 following recommendations		
	$\beta$	S.E	C.R.	$\beta$	S.E	C.R.
<i>Direct effect</i>						
Subject Norm → Usefulness	-0.12	0.04	-2.37*	-0.12	0.04	-2.30*
Image → Usefulness	-0.05	0.05	-0.93	-0.05	0.05	-0.93
Risk Perception → Usefulness	0.04	0.04	0.99	0.04	0.04	0.99

(continued)

**Table 7.** (continued)

Path	Research model 3 information sharing			Research model 4 following recommendations		
	$\beta$	S.E	C.R.	$\beta$	S.E	C.R.
Treatment Information → Usefulness	0.28	0.06	4.21**	0.28	0.06	4.21**
Self Diagnosis → Usefulness	0.12	0.06	1.91*	0.12	0.06	1.91*
Hospital Referral → Usefulness	0.05	0.06	0.74	0.05	0.06	0.74
Online Counseling → Usefulness	0.25	0.06	3.62**	0.25	0.06	3.62**
Easy to Use → Usefulness	0.15	0.04	3.59**	0.15	0.04	3.59**
Usefulness → Intention to Use	0.50	0.08	7.81**	0.55	0.08	8.52**
Easy to Use → Intention to Use	0.16	0.07	2.55**	0.08	0.08	1.21
<i>Indirect effect</i>						
Easy to Use → Usefulness → Intention to Use	.08*	.03	–	.08*	.03	–
Subject Norm → Usefulness → Intention to Use	–.06	.03	–	–.06*	.03	–
Image → Usefulness → Intention to Use	–.03	.03	–	–.03	.03	–
Risk Perception → Usefulness → Intention to Use	.02	.02	–	.02	.02	–
Treatment Information → Usefulness → Intention to Use	.14**	.05	–	.15**	.05	–
Self Diagnosis → Usefulness → Intention to Use	.06	.04	–	.07	.04	–
Hospital Referral → Usefulness → Intention to Use	.02	.03	–	.03	.04	–
Online Counseling → Usefulness → Intention to Use	.13**	.04	–	.14**	.04	–

\* $p < .05$ , \*\* $p < .01$

## 4 Discussions

The main aims of this study were to identify key determinants of intention to use a mental health app. The results of path analysis showed that perceived usefulness and perceived ease of use had significant effects on all stages of behavior intention (app subscription, information seeking, information sharing, and following recommendations). In addition, the two external factors, subjective norm and output quality, were also significant in predicting intention to use app. Among sub factors of output quality, treatment information, self-diagnosis and online counseling were significantly associated with increased perceived usefulness. Hospital referral, on the other hand, had no significant effect on perceived usefulness.

Previous studies [12] have shown that social factors (subjective norm and image) influenced acceptance of new technologies. Similarly, this study confirmed the significant relationships between subjective norm and perceived usefulness. However, unlike previous studies [12], subjective norm was negatively associated with perceived usefulness. These results are likely due to the high level of mental health stigma in South Korea. This study also found online counseling to be a strong influential factor of perceived usefulness of mental health app. However, no significant relationship was found between hospital referral and perceived usefulness. The results supported current stigma researches [13] in that stigma attached to mental illnesses discourages people to help-seeking. Berger et al. [14] proved that people with stigmatized illnesses were more likely to use online health information than people with non-stigmatized conditions. Given the increasing mental health problems and the widespread use of smartphones in South Korea, mobile apps for mental health provide a great potential to aid those with symptoms receive appropriate and timely treatment and care.

## References

1. World Health Organization: World Health Statistics 2016: Monitoring health for the SDGs. [http://www.who.int/gho/publications/world\\_health\\_statistics/2016/en/](http://www.who.int/gho/publications/world_health_statistics/2016/en/)
2. Statista: Share of population in South Korea that use a smartphone from 2015 to 2021. <https://www.statista.com/statistics/321408/smartphone-user-penetration-in-south-korea/>
3. Venkatesh, V., Davis, F.D.: A theoretical extension of the technology acceptance model: four longitudinal field studies. *Manag. Sci.* **46**, 186–204 (2000)
4. Carpenter, C.J.: A meta-analysis of the effectiveness of health belief model variables in predicting behavior. *Health Commun.* **25**, 661–669 (2010)
5. Fishbein, M., Ajzen, I.: *Belief, Attitude, Intention, and Behavior*. Addison-Wesley, Reading (1975)
6. Moore, G.C., Benbasat, I.: Development of an instrument to measure the perceptions of adopting an information technology innovation. *Inf. Syst. Res.* **2**, 192–222 (1991)
7. Rosenstock, I.M.: The health belief model and preventive health behavior. *Health Educ. Monogr.* **2**, 354–386 (1974)
8. Davis, F.D., Bagozzi, R.P., Warshaw, P.R.: Extrinsic and intrinsic motivation to use computers in the workplace. *JASP* **22**, 1111–1132 (1992)
9. Davis, F.D.: Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Q.* **13**(3), 319–340 (1989)
10. Park, Y., Chen, J.V.: Acceptance and adoption of the innovative use of smartphone. *IMDS* **107**, 1349–1365 (2007)
11. Lin, S.P.: Determinants of adoption of mobile healthcare service. *IJMC* **9**(3), 298–315 (2011)
12. Schepers, J., Wetzels, M.: A meta-analysis of the technology acceptance model: investigating subjective norm and moderation effects. *Inf. Manag.* **44**(1), 90–103 (2007)
13. Cukrowicz, K.C., Duberstein, P.R., Vannoy, S.D., Lin, E.H., Unützer, J.: What factors determine disclosure of suicide ideation in adults 60 and older to a treatment provider? *Suicide Life Threat. Behav.* **44**(3), 331–337 (2014)
14. Berger, M., Wagner, T.H., Baker, L.C.: Internet use and stigmatized illness. *Soc. Sci. Med.* **61**(8), 1821–1827 (2005)