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Acceptance of mobile mental health treatment applications

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Abstract

Mobile mental health applications are regarded as a promising solution to meet increasing demands in mental health treatment. They are used to treat mental disorders and can only be successful if the treatment population accepts and appreciates them. This research analyses the acceptance of mobile mental health applications by young adults in Germany in order to identify inhibiting factors regarding their use. To describe people's intentions to use mobile treatment applications, an extended version of the technology acceptance model (TAM) is applied. In the past, TAM has already been used to access the acceptance and adaption of new medical applications. The findings suggest that knowledge about the existence and clinical effectiveness of mobile mental health applications are considerably low. Even though, mobile applications are considered easy to use, their effectiveness in treating mental disorders is questioned by the young adults. Furthermore, concerns that personal information can potentially be revealed arise. This can additionally inhibit the acceptance of these applications. To improve the acceptance and increase future usage, mobile mental health applications should be promoted as a supporting tool that is always available for anyone and can facilitate mental treatment.

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Keywords: TAM, Mental health, E-mental health, Mobile treatment

1. Introduction

Mental health disorders such as anxiety, depression, social anxiety, or substance abuse are an increasing problem in our society. According to the World Health Organization, the gap between the need for treatment of mental disorders and the accessibility of treatment is rising, and already between 35% and 50% of mentally ill clients receive no treatment because appropriate treatment places are rare [1].

One possible solution to meet the demand for mental health treatment can be online treatment [2]. Internet or computer-based cognitive behaviour therapy programs have proven clinically effective for the treatment of a variety of mental disorders [3,4,5]. An advantage of online treatment is its time and cost effectiveness. The amount of time that clinicians require for each client is considerably less than in regular face-to-face treatment [6,7], which means that

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more clients can be supervised than in a conventional therapy setting. Despite the compelling evidence regarding the effectiveness, of computer or Internet-based treatment, the acceptance of Internet treatment outside the health sector is considerably lower[8]. Studies regarding the acceptability of web-based treatment programs among the population report mixed results. It appears that the wide-spread opinion among the population is that online treatment is only effective in cases of mild and moderate symptoms[9] and moreover restricted to certain diseases[10]. However, there are also positive beliefs about online treatment of mental diseases. Former participants in web-based treatment report higher acceptability after using the application compared to before. They are also more inclined to use such services in the future again[9]. In the case of anxiety and depression, it appears that online treatment would even be a preferable treatment option because of anonymity concerns[8]. In addition, the convenience of accessing online treatment from home, and the fact that it does not require waiting time to start with the therapy are reasons in favour of online treatment[10].

However, the majority of the research that has been conducted in this area is concerned about the usage of web-based online intervention programs that require a stand-alone PC. But today's mental health applications are mostly mobile phone applications that are carried around in one's pocket and are accessible any time. Another advantage of these smart-phone applications is that they do not only provide useful interventions and screenings to track a user's improvement, they can also make use of the smart-phone's sensors to measure current location, activity and recent calls. With these measures, the client's current condition can be assessed and momentary interventions can be triggered to assist the client in difficult and stressful situations[11,12].

This study analyses the acceptance and intention to use mobile mental health treatment applications by young adults in the Germany population. Adults between the ages of 18 and 35 are focused in this research because it might take some years until mobile mental health treatment applications are widely available. They also represent the future target population that might require mental health treatment. Additionally, young adults are open to new technology, already familiar with the use of mobile phones, and adapting to the use of mobile mental health treatment applications might require less effort for them than for older people. To infer the current acceptance and future intentional use of such applications, the technology acceptance model (TAM)[13] is used. The results lead to implications for promoting and developing greater acceptance of mobile mental health applications because the success of these applications depends on understanding peoples concerns and identifying the factors that promote or inhibit their use.

2. Method

2.1. Structural equation model

To describe people's intentions to use mobile mental health applications, a structural equation model was developed. This model is based on the technology acceptance model (TAM)[13] and on previous research about acceptance of mobile services. In previous research, TAM was introduced to estimate acceptance of technological innovations and predict their future use in companies. The main components in TAM that describe the intention to use a new technology are perceived usefulness and perceived ease of use. Perceived usefulness is the impact a user expects on their performance due to their system use; perceived ease of use describes the users anticipated effort in using the new system.

The number of concepts that explain the acceptance of new technologies were further refined and extended in TAM2[14,15], Unified Theory of Acceptance and Use of Technology (UTAUT)[16], and UTAUT2[17]. Adaptations of TAM have already been used in the context of medical applications for evaluating a variety of technologies such as a fictional online diagnosis program[18], use of virtual reality as a therapeutic tool[19], and intention to use telepsychotherapy[20].

The centre of the model developed here is represented by the perceived ease of use and perceived usefulness of mobile mental health applications. These concepts mainly influence a client's intention to use such an application when facing mental health problems (H1, H2). Furthermore, in TAM the perceived ease of use also influences the perceived usefulness (H3) of the application. To the concepts of perceived usefulness and ease of use, the concept of social influence is added.

The concept of social influence is part of UTAT, TAM3, and various research studies that evaluate the future of mobile services[21,22]. Social influence describes to which extent users perceive that their social environment, such as family members, friends, and colleagues, believe the application should be used. Therefore, social influence is

modelled to mediate the general technology perception (H4) as well as directly influence the behavioural intention (H5).

Another concept that is part of TAM3 and included into the model is self-efficacy. Since electronic treatment requires a high amount of self-dedication compared to regular face-to-face therapy, self-efficacy is an important factor for clients considering online treatment. Clients who are well aware of the fact that they cannot work through the exercises on their own should have a reduced intention to use an e-mental health solution even if these clients are convinced of the benefits of online treatment. This phenomenon is reported for online learning applications[23] and acceptance of mobile health services[24]. Self-efficacy directly influences the behavioural intention (H6) to use a new application.

A significant influencing factor for the success of online applications is trust. Lack of trust in the application and the security of personal data might adversely affect people who consider online solutions[25,26]. During online treatment, sensitive data about the client is collected, which can lead to privacy and similar concerns about online applications. Thus, this might be an discouraging factor for clients comparing to using an online application or face-to-face treatment. As the latter might provide more security concerning personal details. Therefore, the concept of trust is incorporated into the model, even though it is not default in UTAUT. The concept of trust is expected to directly influence the intention to use a mobile mental health application (H7).

Although the task-technology fit aspect is not part of the latest TAM development, it is added to the present research model. The task-technology fit model (TTF)[27] assumes that people will use technology that fits a task well. Initially, TTF was developed to evaluate workspace technologies, but was adapted to fit other purposes as well. It has already been used in combination with TAM[28] and the combined model has proven to be superior than either one alone[29]. TTF does not influence behavioural intention directly but rather effects perceived ease of use (H8) and perceived usefulness (H9). The research hypotheses are summarised in Table 1.

Table 1. Hypotheses tested in this research.

Research hypotheses	Source
H1: Perceived ease of use influences behavioural intention	30
H2: Perceived usefulness influences behavioural intention	30
H3: Perceived ease of use influences perceived usefulness	30
H4: Social influence influences perceived usefulness	21,22
H5: Social influence directly influences behavioural intention	16
H6: Perceived self-efficacy directly influences behavioural intention	23,24
H7: Trust in the application's security influences behavioural intention	25,26
H8: Task-technology fit influences perceived of ease of use	28,29
H9: Task-technology fit influences perceived usefulness of the application	27,28,29

2.2. Measurement tool

To evaluate the extended TAM, a structured questionnaire is created that is based on questionnaires that have been used in previous studies. The final questionnaire includes 33 items that measure the 7 different concepts. In the following, a short overview of the origin of the questions for the individual concepts is given. A detailed listing of the final questionnaire can be found in Appendix A. The concept of perceived usefulness is measured with 6 items and the questions are adapted from studies about mobile commerce[31,32] and user satisfaction[33]. The concept of ease of use is measured with 5 items and the questions are adapted from the original TAM[34] and further refinements were taken from a study by Bagozzi and Richard (2002)[35]. The seven questions used to measure perceived task-technology fit were previously used by Jarupathirun et al. (2007). Social influence was measured with 5 items and was utilised by Nysveen (2005) in a study on intention to use mobile services. Trust and self-efficacy consist of 4 items each. The tool to measure self-efficacy was previously applied by Park's (2009) and the measurement items for trust are adapted from UTAUT[16]. The outcome variable behavioural intention is measured with two questions and these are adopted from Parks[36] analysis regarding the acceptance of e-learning. For all questions, a 7-point Likert-type scale ranging from 1 for strongly disagree to 7 for strongly agree was applied.

2.3. Data collection and analysis

For participant recruitment of German participants of both genders within an age of 18 to 35 years, requests in various facebook survey groups were posted. Typically, students and companies use these groups for participant recruitment. In total, 125 people were recruited from December 16th, 2015, to February 16th, 2016.

The statistical analysis was done using R[37], and the structural equation model is fitted with maximum likelihood estimation routines provided by the R package lavaan[38]. The lavaan package is also used to calculate a variety of model fit measurements, to access the fit of the model.

3. Results

The general characteristics of the participants are shown in Table 2. The majority of participants are of female gender, between 18 and 30 years old, and students. Five of the participants reported to already have experience with online treatment.

Table 2. Demographic information for the participants.

Variable	Frequency	Percent (%)	Cumulative (%)	Variable	Frequency	Percent (%)	Cumulative (%)
Gender				Education			
Female	80	64.0	64.0	Primary	3	2.4	2.4
Other	45	36.0	100.0	Secondary	36	28.8	31.2
Age				College/University	86	68.8	100.0
18–25	57	45.6	45.6	Persons in household			
26–30	55	44.0	89.6	One	29	23.2	23.2
31–35	13	10.4	100.0	Two	52	41.6	64.8
Occupation				More than two	44	35.2	100.0
Student	98	78.4	78.4	Online treatment			
Working	23	18.4	96.8	Already used	5	4.0	4.0
Other	4	3.2	100.0	Never used	120	96.0	100.0

For the assessment of the model fit to the empirical data, Table 3 shows a summary of various model fit measures of the estimated structural model. Based on the calculated measures, the model appears to not fit the empirical data well. Only the RMSEA measurement can be satisfied although 0.1 is considered the highest possible cutoff. A value above this threshold indicates a poor fitting model[39].

Table 3. Goodness-of-fit measures for the model.

Fit measure	Value	Recommended value	Fit measure	Value	Recommended value
χ^2	1032.850 (P < 0.00)	P > 0.05	NFI	0.646	>0.90
RMR	0.238	<0.05	CFI	0.768	>0.93
RMSEA	0.096	<0.10	TLI	0.745	>0.90

The estimations of the connections among the concepts are summarised in Table 4. The significance level of each research hypothesis and their influence on behavioural intention or preceding concepts are listed as well. Significant estimates support the initially assumed hypotheses proposed by the literature.

The standardised estimates of the latent variables are shown in Table 5 as well as the estimated Cronbach alpha values for the questionnaires to measure the concepts. The estimated Cronbach alpha values indicate that the internal consistency of responses to the questionnaires ranges from good to acceptable. The only concept indicated to have questionable consistency is social influence with a Cronbach alpha value of 0.647.

Table 4. Standardised estimates of the structural model (*P < .05, **P < .01).

Hypotheses	Endogenous variable	Exogenous variable	Standardised estimate	SE	P value
H8	Perceived ease of use	Task-technology fit	0.310	0.095	0.008**
H9	Perceived usefulness	Task-technology fit	0.600	0.072	<0.001**
H3		Perceived ease of use	0.232	0.060	0.002**
H4		Social influence	0.277	0.076	0.001**
H6	Behavioural intention	Self-efficacy	0.322	0.133	0.020*
H7		Trust	-0.329	0.105	0.004**
H2		Perceived ease of use	-0.207	0.105	0.069
H1		Perceived usefulness	0.002	0.165	0.989
H5		Social influence	0.212	0.144	0.147

Table 5. Standardised estimates of the latent variables, mean and standard deviation from participant's responses.

Variable	Latent variable	Standardised estimate	Cronbach alpha	Mean (STD)	Variable	Latent variable	Standardised estimate	Cronbach alpha	Mean (STD)
Task-technology fit	TTF1	0.831	0.884	3.42 (1.39)	Behavioural intention	BI1	0.859	0.835	2.34 (1.51)
	TTF2	0.865		3.45 (1.49)		BI2	0.850		2.66 (1.73)
	TTF3	0.858		4.21 (1.55)	Trust	T1	0.691	0.722	4.78 (1.87)
	TTF4	0.305		2.36 (1.46)		T2	0.185		5.27 (1.58)
	TTF5	0.851		3.21 (1.34)		T3	-0.736		3.28 (1.67)
	TTF6	0.787		4.01 (1.45)		T4	-0.860		3.22 (1.39)
	TTF7	0.613		5.34 (1.28)	Perceived ease of use	EOU1	0.457	0.700	4.16 (1.38)
Perceived usefulness	PU1	0.856	0.884	4.17 (1.53)		EOU2	-0.533		2.65 (1.42)
	PU2	0.635		2.91 (1.35)		EOU3	-0.322		3.64 (1.40)
	PU3	0.911		3.98 (1.55)		EOU4	0.847		4.80 (1.28)
	PU4	0.504		4.17 (1.48)		EOU5	0.697		5.42 (1.20)
	PU5	0.776		4.80 (1.47)	Self-efficacy	SE1	0.814	0.758	4.46 (1.44)
	PU6	0.763		4.03 (1.52)		SE2	0.396		4.62 (1.27)
Social influence	SI1	0.869	0.647	3.21 (1.25)		SE3	0.792		3.63 (1.62)
	SI2	0.751		3.42 (1.42)		SE4	0.545		4.92 (1.41)
	SI3	0.741		3.23 (1.21)					
	SI4	0.267		1.94 (1.29)					
	SI5	-0.137		4.46 (1.74)					

4. Discussion

In this study, theories of technology acceptance are used to build a structural equation model which is then evaluated with empirical data in order to analyse the acceptance of mobile applications for the treatment of mental disorders in the German population. The results suggest that the concept of trust and self-efficacy show a possible direct impact on the acceptance and future use of mobile mental health applications.

Thus, the concept of trust could be of great importance for mobile mental health applications as it may contribute to a person's consideration when facing mental health problems. Leakage or loss of personal data is still a major concern as such online applications will use sensitive data. Many people greatly fear divulging personal information online. The influence of perceived self-efficacy when considering mobile mental health applications is supported by this analysis. A lack of obligation and an absence of expected commitment, might parallel to online education programs lead to low success for mobile treatment applications.

This analysis shows no significant direct influence of perceived usefulness on behavioural intention. Nonetheless, it still arguably has an indirect influence. This is because perceived usefulness reflects the population's knowledge about the new application. Knowledge about these applications, their clinical effectiveness, possibility for treating a wide range of mental disorders such as depression, stress or substance dependence, and availability is still quite low in the targeted population. When young adults are more aware and informed about mobile mental health applications, willingness to use such applications in the future will possibly increase. Furthermore, the results indicate that mobile mental health applications should not be promoted as a replacement for personal therapy and qualified treatment but

rather as a supporting and quickly available tool. The participants indicate that mobile applications are perceived as useful and can provide helpful information regarding mental health problems, but disagree that mobile applications are sufficient for treatment of mental disorders. Therefore, task-technology fit can influence the perceived usefulness of these applications and the perceived ease of use.

The hypothesis that social influence has a direct effect on behavioural intention to use mobile treatment applications cannot be supported, although their direct influence was suggested in the original UTAUT model[16]. This may because mental health treatment is considered more personal than other technology adaption. On the other hand, certain social influences could discourage mobile mental health application uptake. Yet mobile phone use is ubiquitous, and use of these applications can be kept private even from family or friends, so neither of these social factors should affect use. Unlike behavioural intention, the empirical analysis suggests that social influence does affect the perceived usefulness of these applications. Opinion and experience of friends and family contribute to the perception of technologies. Therefore, openness in discussing mental disorders and their treatment with mobile application or the support of treatment with mobile applications further contributes to the acceptance of mobile treatment and can increase their future use.

Apparently, the usability of mobile applications is not a concern for the targeted users. As initially assumed in this study, the younger German population is experienced with the use of smart-phones and does not consider the use of mobile treatment application a challenge. But the influence of the perceived usefulness on perceived ease of use, as suggested by the TAM model[30], is supported by this analysis. Therefore, the expectation that mobile applications are easy and intuitive to use might indirectly influence the perception of mobile mental health treatment.

4.1. Limitations

A participant selection bias is possible since all participants are Internet users and, thus more likely to be experienced with technology and think favourably about it. Also the research demographic age between 18 and 35 years introduces an additional bias. Therefore, a generalisation of the findings to the entire German population is not feasible.

Second, cultural differences are not considered in this study, but this still permits an analysis of acceptance in the German population overall. Still, cultural differences might influence the choice of mobile mental health applications so these results may not translate to other nations or cultures.

Finally, the sample size is low for the estimation of this model. A higher sample size should permit more accurate estimation of the influence of the individual concepts that have been indicated to be relevant by this study.

5. Conclusion

The main contribution of this paper is the proposed model for user acceptance of mobile mental health applications and its analysis. The model aims to describe the acceptance and adoption of mobile mental health treatment by the population. For the evaluation of the model, data was collected in an online survey targeting young adults in Germany. The model estimated from the data suggests that trust, social influence, and task-technology fit may influence people's adoption of mobile mental health applications. However, young adults in Germany are little aware that mobile mental health treatment already exists and that these applications are effective for a wide range of diseases. People are possibly worried that mobile treatment is a cheap and inadequate replacement for conventional psychotherapy and human interaction. But this is not the case. Mobile applications are a support tool that can provide a little bit of help at any time. They could even become a valuable tool in regular face-to-face therapy. Mobile mental health applications are likely to become widely accepted and used in the future when the population is better informed about their possibilities and security of personal data can be ensured.

This paper also makes a contribution in integrating additional concepts such as self-efficacy and task-technology fit into TAM. The data supports the hypothesis that task-technology fit can influence perceived usefulness as well as perceived ease of use. Self-efficacy might also influence behavioural intention in the case of mobile mental health treatment. In future, the proposed structural model for acceptance of mobile mental health treatment scenarios can be further refined to determine influential factors in subsequent studies or to re-evaluate acceptance after a promotion campaign.

Appendix A. Survey questionnaire

Table A.6. Survey questionnaire.

Construct	Abbreviation	Measurement items	Adopted from
Task-technology fit	TTF1	Mobile mental health applications are adequate for the described scenario.	40
	TTF2	Mobile mental health applications are compatible with the task of treating mentally ill clients.	
	TTF3	Mobile mental health applications are helpful.	
	TTF4	Mobile mental health applications are sufficient.	
	TTF5	Mobile mental health applications fit the task well.	
	TTF6	Mobile mental health applications are useful for treating people.	
	TTF7	Mobile mental health applications are useful to provide information to people.	
Social influence	SI1	Your friends and family think that mobile mental health applications are a useful thing.	32
	SI2	Your friends and family think that mobile mental health applications would be useful for you.	
	SI3	Your friends and family would also use mobile mental health applications.	
	SI4	Do you often discuss the advantages of mobile treatment with your friends/family.	
	SI5	Would your friends and family be surprised if you use a mobile mental health application.	
Ease of use	EOU1	I find it easy to get the benefits from a mobile mental health application.	35,34
	EOU2	Using an mobile mental health application will be complicated.	
	EOU3	Using an mobile mental health application will take a lot of effort	
	EOU4	I find mobile mental health applications are easy to use	
	EOU5	Learning to operate a mobile mental health application would be / is ease for me.	
Perceived usefulness	PU1	I find mobile mental health to be useful to improve my life in general.	34
	PU2	Using a mobile mental health application would improve my life quickly.	
	PU3	I would find mobile mental health applications useful.	
	PU4	Using a mobile mental health application would make me save time.	31,32
	PU5	I think that mobile mental health applications provide very useful services.	
	PU6	Mobile mental health applications are an improvement to the services it supersedes.	33
Trust	T1	I feel apprehensive about using a mobile mental health application.	16
	T2	Using mobile mental health applications would not divulge my personal information.	41
	T3	Using mobile mental health applications is entirely within my control.	42
	T4	I think that mobile mental health applications are secure to use.	43
Self-efficacy	SE1	I feel confident finding information and advice in a mobile mental health application.	36
	SE2	I have the necessary skills for using an mobile mental health application successfully.	
	SE3	I feel confident using the mobile mental health application regularly.	
	SE4	I feel confident to work through all interventions that the application provides me.	
Intention to use	BI1	I intend to use a mobile mental health application.	36
	BI2	I intend to check the availability of a suited mobile mental health application.	

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