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Original Article/Research

Technology acceptance and trust: Overlooked considerations in young people's use of digital mental health interventions

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ABSTRACT

Objectives: Digital mental health interventions (DMHIs) have potential to provide support at scale for young people, yet uptake is low. The present study investigated whether attitudes towards technology solutions in relation to perceived usefulness, perceived ease of use, and trust of DMHIs influenced young people's intentions to use DMHIs.

Methods: Young people aged 17–25 ($N = 248$) were recruited online via advertising (e.g., Facebook, Twitter) to a survey assessing attitudes of technology acceptance and intentions to use DMHIs, previous use of DMHIs, demographics, and mental health need.

Results: Participants reported relatively neutral attitudes towards DMHIs. Outcomes from linear regression indicated that greater perceived usefulness ($\beta = .24$) and trust of DMHIs ($\beta = .28$) have significant small to moderate positive associations with higher intentions to use DMHIs. Perceived ease of use ($\beta = .07$) was not associated with intentions to use DMHIs. Gender, age, previous use of DMHIs, and mental health need did not moderate unique associations between intentions to use DMHIs and perceived usefulness, perceived ease of use, and trust of DMHIs.

Conclusions: Moderate levels of technology acceptance for mental health, particularly in domains of perceived usefulness and trust of DMHIs, may represent a barrier to DMHI adoption among young people. Developers and service providers are recommended to provide information about the usefulness, effectiveness, and trustworthiness of DMHIs to improve uptake among young people.

Public interest abstract

Urgent public health attention is required to address the high prevalence of mental health problems and unmet need among young people. Digital mental health interventions (DMHIs) represent a rapidly growing mode of service with potential to offer greater access to support. However, DMHIs only present a viable solution for young people if they are accepted and used by those who need them. An investigation of whether young people's attitudes towards DMHIs may influence their willingness to use DMHIs indicated that the extent to which young people perceived DMHI's as useful, instrumental, and trustworthy in managing their mental health may influence their motivation to adopt DMHIs. Service providers are recommended to provide information about the usefulness, effectiveness, and trustworthiness of DMHIs to improve uptake among young people.

Introduction

The mental health of adolescents and emerging adults ('young people') is an area of public health warranting urgent attention globally [1]. A transitional period characterised by rapid change in multiple domains (physical, social, psychological, vocational), adolescence and emerging adulthood is a developmental stage associated with heightened risks to mental wellbeing, as young people experience major life changes related to puberty, neurodevelopment, as well as changes to identity and autonomy in social contexts [2,3]. Research indicates high prevalence of mental illness among young people with one in five individuals likely meeting criteria for a mental disorder [4]. Disease burden associated with high prevalence rates are further exacerbated by demand for treatment outstripping supply creating a treatment gap [1]. Digital mental health interventions (DMHIs), such as those delivered via smartphone apps or online, represent a rapidly growing mode of service

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with potential to offer greater access to support [5,6]. However, DMHIs only present a viable solution for young people if they are accepted and used by those who need them [7]. The purpose of the present study was to investigate whether young people's attitudes towards DMHIs may influence their willingness to use DMHIs.

Technology-mediated healthcare could mitigate gaps in services by providing access to support at scale, at low cost and at the user's convenience. The prevalence of access to smartphone technology among younger people points to a seemingly obvious solution for meeting demand in this population [6]. However, while DMHIs have been shown to be effective in randomised control trials, this does not appear to translate to real world uptake [8]. A systematic review of studies indicated that a quarter of mental health apps were never used after installation [9]. Younger people in particular may be less likely to engage with technology targeted at mental health with evidence that younger age groups are less likely to use DMHIs in treatment and they report low preference of online mental health care compared to face-face treatment [10,11].

One putative direction of research for understanding DMHI adoption is to investigate young people's attitudes that may motivate use of DMHIs. The research draws from health behaviour literature evaluating social cognitive theories of predictors of intentions to engage in treatment (e.g., Theory of Planned Behaviour, TPB; [12]). Applications of social cognitive theories to mobile health (mHealth) technology integrate technology acceptance theories (e.g., Technology Acceptance Model [TAM]; [13]) into the framework in consideration of attitudes towards technology solutions in understanding mHealth adoption [14]. The model proposes that constructs of technology acceptance, namely perceived usefulness and perceived ease of use, predict intentions to use technology and in turn mHealth adoption. An investigation of the literature demonstrates that intention to use technology is not only a frequently used predictor of behaviour generally; it is the key predictor of usage of app-based services and significantly leads to actual adoption of mHealth services [15,16].

Perceived usefulness is defined as an individual's belief that using a specific technology will improve their action, while perceived ease of use is defined as the belief that the specific technology would be effortless [13,17]. Trust of technology (trust) is also hypothesized to be an important factor, especially in environments where typical human interaction often leads to trust in other circumstances and customer retention [18]. Trust is defined as perceived instrumentality of technology i.e. the technology is seen as a means to an end, as well as when users believe the provider of the technology solution is trustworthy [19]. To that end, trust is potentially highly relevant for mental health since treatment usually involves building therapist-client alliance to optimise engagement [20].

Despite recent theoretical developments, research lags in evaluating whether attitudes towards technology solutions for mental health contributes to explaining intentions to use DMHIs among young people [21]. To the best of our knowledge, only Becker [22] examined the role of perceived usefulness, perceived ease of use and trust, as well as Theory of Planned Behaviour variables of social norms, self-efficacy, and task-technology fit in predicting intentions to use DMHIs among a community sample of emerging adults (18-35 years). Community sampling was intended to assess intentions to use DMHIs prior to service referral. A questionnaire was created assessing variables drawn from social cognitive theory within a cross-sectional survey evaluating predictors of intentions to use DMHIs using structural equation modelling. Results indicated that intentions to use DMHIs were associated with self-efficacy and trust, but not perceived usefulness, perceived ease of use, or social norms. However, the study was unable to clearly ascertain whether technology acceptance was associated with intentions to use DMHIs as it was notably underpowered for structural equation modelling ($n = 125$). A trend for perceived ease of use to predict intentions to use DMHIs was detected suggesting further research is warranted.

Research is also warranted in relation to understanding individual

characteristics that may moderate how technology acceptance and trust are associated with intentions to use DMHIs. Research examining technology acceptance in general have indicated that the influence of perceived usefulness and perceived ease of use on behavioural intentions can be stronger among males, older age groups, and previous users of technology [14,23,24]. Elsewhere in the literature, researchers have shown higher preference for online delivery among males compared to females and among those with a history of using DMHIs [10,25]. Putative moderators may also include indications of mental health need since the relevance of DMHIs may be higher in the presence of significant psychological distress [26]. Collectively, these considerations highlight the need to examine individual differences to improve our understanding of the role of technology acceptance in DMHI uptake.

In summary, researching young people's attitudes toward technological solutions for mental health is essential for establishing DMHIs as a sustainable treatment modality for them. In line with this, the aims of the present study were threefold. Due to the lack of research examining young people's attitudes of DMHIs, the first aim was to detail young people's perceived usefulness, perceived ease of use, trust of DMHIs, and intentions to use DMHIs. The second aim was to evaluate whether technology acceptance measured by perceived usefulness and perceived ease of use (Hypothesis 1) and/or trust (Hypothesis 2) were associated with intentions to use DMHIs after controlling for other psychological factors based on social cognitive theories [14]. Finally, we examined the moderating role of gender (Hypothesis 3), age (Hypothesis 4), previous use of DMHIs (Hypothesis 5), and mental health need (Hypothesis 6). It was hypothesised that unique associations between intentions to use DMHIs with perceived usefulness, perceived ease of use, and trust of DMHIs will be stronger for males, older age groups, people who have previously used DMHIs, and where mental health need is indicated.

Methods

Study design and procedures

The current study consisted of a cross-sectional design where participants were recruited to complete a survey using the Qualtrics survey platform. Recruitment was online via advertising (e.g., Facebook, Twitter). Groups of young people primarily targeted on Facebook included postgraduate student groups at The University of Edinburgh, United Kingdom. Individuals within groups were subsequently encouraged to share the study link within their individual networks to promote snowball sampling. Advertising included a link to the survey where participants were able to access participant information and informed consent, completion of which launched the survey. Participants were free to withdraw at any time without consequence. No financial incentives or prizes were offered for participation. The Human Research Ethics Committee at the University of Edinburgh, United Kingdom provided ethical approval for this study (reference number: CLIN709).

Inclusion criteria required participants to be 16 to 25 years old, resident in the UK and fluent in English. Table 1 summarises demographic characteristics of the sample. Overall, 248 (146 male) participants aged 17-25 years ($M = 23.31$, $SD = 1.914$) completed the survey. Majority of participants reported living in a city or large town ($n = 150$, 60.5%). Just over half ($n = 130$, 52.4%) had achieved a university degree and a further 29% ($n = 72$) had completed a postgraduate qualification. A significant proportion of participants reported experiencing significant psychological distress (61.3%) and almost half of all participants reported using of DMHIs in the past (46.8%).

The survey consisted of a battery of questionnaires developed for this study. At the start of the survey, DMHIs were described as apps or services to help people with their mental health, which are accessed either over the internet or on a smartphone. It was explained that this could take the form of tutorials, or courses to help people manage mental health problems like stress, anxiety, and low mood. Table 1 in supplementary information lists the items measuring intentions to use DMHIs,

Table 1
Psychosocial demographic characteristics of sample used in the current study.

Characteristics	Statistics
Gender (N, %)	
Female	101 (40.7%)
Male	146 (58.9%)
Other	1 (.4%)
Age (M, SD)	23.31 (1.91)
Education (N, %)	
GCSEs, National Certificate Level 4 or 5	5 (2%)
A-Levels, National Certificate Level 6	32 (12.9%)
Professional/vocational qualification, Higher national Certificate or Diploma	9 (3.6%)
Undergraduate university degree	130 (52.4%)
Postgraduate university degree	72 (29.0%)
Place of living (N, %)	
City or large town	150 (60.5%)
Average or small town	81 (32.7%)
Village or countryside	17 (6.9%)
Psychological distress (N, %)	
Below cut-off ^a for significant distress	96 (38.7%)
Above cut-off ^a for significant distress	152 (61.3%)
Previous use of DMHIs	
Yes	116 (46.8%)
No	132 (53.2%)

Note. ^a cut-off score of 13 or higher to identify participants with significant psychological distress; DMHIs, digital mental health interventions.

attitude, subjective norm, perceived behavioural control, trust, perceived ease of use, and perceived usefulness, adapted from guidelines published by previous developers of technology acceptance theories [24, 27] and research examples [28–30]. Standardised items for adaption for individual studies are provided by Venkatesh and colleagues [24,27]. Items were adapted for DMHIs based on author guidelines (i.e., changing the technology of interest in each statement), as well as procedures in Alam et al [16] that adapted standardised items for the purpose of assessing attitudes towards mHealth technology. Items related to trust of DMHIs were adapted from Wu & Chen [30] and added to the questionnaire battery [24,27]. Items assessing perceived usefulness, perceived ease of use, and trust of DMHIs were not subjected to psychometric analysis prior to use in the current study. Finally, participants were asked to respond to questions assessing demographic information, previous use of digital mental health interventions, and their current level of psychological distress.

Measures

Demographic characteristics

Participants were asked to disclose gender, age, highest educational level attained, and whether they lived in a rural or urban area.

Previous use of digital mental health interventions

Participants were asked whether they had previously used a DMHI (no/yes).

Perceived usefulness (PU)

The perceived usefulness scale consisted of 4 items assessing perceived usefulness of DMHIs (e.g., “Using a digital mental health intervention would improve my ability to manage my mental health.”). Items were rated on a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), with the total scale score equal to the average across items. The scale had high internal consistency ($\alpha = .90$).

Perceived ease of use (PEOU)

The perceived ease of use scale consisted of 4 items assessing perceived ease of use of DMHIs (e.g., “Using digital mental health interventions does not require a lot of mental effort.”). Items were rated on a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), with the total scale score equal to the average across items. The scale had high internal consistency ($\alpha = .80$).

Attitude (ATT)

The attitude scale consisted of 4 items assessing whether using DMHIs were favourable to their mental health (e.g., “Using digital mental health interventions to improve my mental health would be a good idea.”). Items were rated on a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), with the total scale score equal to the average across items. The scale had high internal consistency ($\alpha = .82$).

Subjective norm (SN)

The subjective norm scale consisted of 4 items assessing perceived social pressure to use DMHIs. It related to beliefs about the expectations of others and the extent to which those beliefs motivate use of DMHIs (e.g., “People who are important to me would think that I should use digital mental health interventions.”). Items were rated on a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), with the total scale score equal to the average across items. The scale had high internal consistency ($\alpha = .89$).

Perceived behavioural control (PBC)

The perceived behavioural control scale consisted of 4 items assessing control factors that might facilitate usage of DMHIs (e.g., “Using digital mental health interventions is entirely within my control.”). Items were rated on a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), with the total scale score equal to the average across items. The scale had high internal consistency ($\alpha = .77$).

Intention to use DMHIs

Two items were used to measure participants’ intentions to use DMHIs (“Assuming I have access to a digital mental health intervention, I intend to use it”; “Given that I have access to digital mental health interventions, I predict that I would use them.”), adapted from Venkatesh et al [27]. Items were rated on a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), with the total scale score equal to the average across items. The scale had high internal consistency ($\alpha = .91$).

Trust

Adapted from Wu & Chen [30], the trust of DMHIs scale consisted of 3 items assessing participants’ perceived instrumentality and certainty regarding the benefits of DMHIs (e.g., “Based on my perception of digital mental health interventions, I believe they provide good service.”). Items were rated on 7-point Likert scale, ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), with the total scale score equal to the average across items. The scale had high internal consistency ($\alpha = .82$).

Mental health need

Mental health need was determined by whether the participant reported significant psychological distress (SPD) as measured by the Kessler-6 Distress Scale (K-6; 31). The K-6 consists of a 6-item inventory of how often participants experienced distressing feelings, including nervousness, helplessness, and worthlessness over the past 30 days. Items are rated on 5-point Likert scale from 0 (*all of the time*) to 4 (*none of the time*). An aggregated total sum score represented severity of psychological distress. A standard cut-off score of 13 or higher was used to identify individuals with significant psychological distress likely requiring treatment [31,32]. Participants with significant psychological

distress were classified as having mental health need. The scale had high internal consistency for this study ($\alpha = .89$).

Data analytic plan

All analyses for the study were conducted using SPSS version 25. Preliminary analyses consisted of descriptive statistics examining scale scores for perceived usefulness, perceived ease of use, trust, and intentions to use DMHIs. Preliminary analysis also included examining whether these scales were significantly different by gender, age, previous use of DMHIs (no/yes), and/or mental health need (no/yes). Age was split into young and old groups using cut-off of 21 years as the middle value in age range for preliminary analysis. Comparisons were examined using Independent T-tests, evaluated at $\alpha = .05$.

Testing whether technology acceptance and/or trust of DMHIs contributed to explaining intentions to use DMHIs was evaluated using hierarchical linear regression modelling. This method was selected over structural equation modelling to maximise analytic power in the case of small to moderate sample size [33]. It also allowed for the individual influence of technology acceptance, exclusively represented by perceived usefulness and perceived ease of use, to be tested separately to the influence of trust of DMHIs by entering the variables in separate blocks. Variables representing participants' gender, age, previous use of DMHIs (no/yes), and mental health need (no/yes), as well as social cognitive theory scales of attitude, social norm, and perceived behavioural control were entered as covariates in the first block of the regression model. Hypothesis 1 examining the influence of technology acceptance was tested by the main effect of entering a second block of variables consisting of perceived usefulness and perceived ease of use scales into the regression model. Hypothesis 2 examining the influence of trust of DMHIs was subsequently tested by the main effect of entering a third block consisting of the trust of DMHIs scale into the model.

Interaction terms representing hypothesised moderating effects were entered as block four into the regression model to individually test Hypotheses 3 – 6. That is, Hypothesis 3 examining whether gender moderated the influence of perceived usefulness, perceived ease of use, and/or trust on intentions to use DMHIs was tested by the main effect of entering the interaction terms of gender \times perceived usefulness, gender \times perceived ease of use, and gender \times trust in the fourth regression block. Hypothesis 4 examining whether age moderated the influence of perceived usefulness, perceived ease of use, and/or trust on intentions to use DMHIs was tested by the main effect of entering the interaction terms of age \times perceived usefulness, age \times perceived ease of use, and age \times trust in the fourth regression block. Hypothesis 5 examining whether previous use of DMHIs moderated the influence of perceived usefulness, perceived ease of use, and/or trust on intentions to use DMHIs was tested by the main effect of entering the interaction terms of previous use of DMHIs \times perceived usefulness, previous use of DMHIs \times perceived ease of use, and previous use of DMHIs \times trust in the fourth regression block. Finally, Hypothesis 6 examining whether mental health need moderated the influence of perceived usefulness, perceived ease of use, and/or trust on intentions to use DMHIs was tested by the main effect of entering the interaction terms of significant psychological distress \times perceived usefulness, significant psychological distress \times perceived ease of use, and significant psychological distress \times trust in the fourth regression block. Continuous variables were transformed to z-scores for moderation analysis.

The main effect of adding technology acceptance (block 2), trust of DMHIs (block 3), and interaction terms (block 4) was ascertained by the significance of FChange ($\alpha = .05$). Post-hoc Scheffe tests examined the individual significance of perceived usefulness, perceived ease of use, and interaction terms where main effects associated with entering regression blocks were significant.

Results

Descriptive statistics of young people's attitudes of DMHIs

Descriptive statistics for intentions to use DMHIs, perceived usefulness, perceived ease of use, and trust of DMHIs, as well as comparisons on these scales by gender, age, previous use of DMHIs (no/yes) and mental health need (no/yes), are reported in Table 2. Overall, results indicated that participants had moderate levels of intentions to use DMHIs, perceived usefulness, perceived ease of use, and trust of DMHIs, indicated by a mean level response close to 5 'somewhat agree' across scale-items. The results did not indicate that these scales measuring young people's attitudes of DMHIs were different according to gender, age, or mental health need. However, the results indicated that intentions to use DMHIs, perceived usefulness, and perceived ease of use were different where previous use of DMHIs was indicated whereby average scale scores were higher for participants with previous experience of using DMHIs. Trust of DMHIs was not different by previous use of DMHIs. Correlations among variables are provided in Table 2 in supplementary information. Higher intentions to use DMHIs were significantly correlated with previous use of DMHIs (yes), as well as positive attitude, social norm, perceived behavioural control, perceived usefulness, perceived ease of use, and trust of DMHIs. Moderate correlations were indicated among scales measuring attitude, social norm, perceived behavioural control, perceived usefulness, perceived ease of use, and trust of DMHIs.

Hypotheses 1 - 2: Role of perceived usefulness, perceived ease of use, and trust in explaining intentions to use DMHIs

Table 3 summarises results of hierarchical regression modelling examining the significance of perceived usefulness, perceived ease of use, and trust of DMHIs in explaining intentions to use DMHIs. Results from testing Hypotheses 1 indicated that the addition of perceived usefulness and perceived ease of use measuring technology acceptance significantly contributed to explaining the variance in intentions to use DMHIs after controlling for covariate variables gender, age, previous use of DMHIs (yes/no), significant psychological distress (yes/no), as well as attitude, social norm, and perceived behavioural control. Scheffe post-hoc tests indicated that participants had greater intentions to use DMHIs when they reported higher perceived usefulness for DMHIs. Perceived ease of use was not associated with intentions to use DMHIs. Results from testing Hypothesis 2 indicated that the addition of trust of DMHIs significantly contributed to explaining the variance in intentions to use DMHIs after controlling for block 1 covariate variables, as well as perceived usefulness and perceived ease of use in block 2. Intentions to use DMHIs were greater when participants had higher levels of trust of DMHIs.

Hypotheses 3 - 6: Moderating role of gender, age, previous use of DMHIs, and mental health need

Results of whether gender (Hypothesis 3), age (Hypothesis 4), previous use of DMHIs (Hypothesis 5), and mental health need (Hypothesis 6) moderated unique associations between intentions to use DMHIs with perceived usefulness, perceived ease of use, and trust are also summarised in Table 3. The addition of interaction terms did not significantly contribute to explaining the variance in intentions to use DMHIs. These results indicate that unique associations that intentions to use DMHIs had with perceived usefulness, perceived ease of use, and trust of DMHIs were not moderated by gender, age, previous use of DMHIs, and mental health need.

Discussion

The aims of the current study were to examine young people's

Table 2

Descriptive statistics (mean, standard deviation) for perceived usefulness, perceived ease of use, trust of digital mental health interventions, and intentions to use DMHIs

Variable	Gender		Age		Previous use of DMHIs		Mental health need indicated		Overall (n = 248)
	Females (n = 101)	Males (n = 146)	Young (n = 29)	Old (n = 219)	No (n = 132)	Yes (n = 116)	No (n = 96)	Yes (n = 152)	
Intentions to use DMHIs	5.10 (1.27)	4.82 (1.44)	4.52 (1.58)	4.97 (1.36)	4.74* (1.39)	5.13* (1.37)	4.83 (1.53)	4.98 (1.29)	4.92 (1.39)
Perceived usefulness	5.01 (1.26)	4.92 (1.21)	4.72 (1.42)	4.97 (1.21)	4.79* (1.22)	5.12* (1.24)	4.83 (1.46)	5.02 (1.07)	4.94 (1.24)
Perceived ease of use	4.89 (1.12)	4.78 (1.10)	4.75 (1.13)	4.83 (1.11)	4.64* (1.09)	5.02* (1.10)	4.82 (1.24)	4.82 (1.02)	4.82 (1.11)
Trust of DMHIs	5.01 (1.23)	4.99 (1.15)	4.83 (1.25)	5.00 (1.20)	4.89 (1.15)	5.07 (1.27)	4.86 (1.52)	5.05 (.96)	4.98 (1.21)

Note: DMHIs: digital mental health interventions; mental health need indicated by presence of significant psychological distress measured by K-6 (≥ 13); rating scale: 1 = strongly disagree; 2 = disagree; 3 = somewhat disagree; 4 = neither agree or disagree; 5 = somewhat agree; 6 = agree; 7 = strongly agree;

* significant group differences - p -value < 0.05;

Table 3

Results from hierarchical regression modelling examining whether perceived usefulness, perceived ease of use, or trust of DMHIs contribute to explaining intentions to use DMHIs, as well as examining the moderating effects of gender, age, previous use of DMHIs, and mental health need.

Variables	B	t	Δ df	ΔR^2	ΔF
<i>Block 1 (Covariates)</i>			7	0.57	45.61*
<i>Block 2 (Technology acceptance)</i>			2	0.03	8.07*
Perceived usefulness	0.24**	3.38			
Perceived ease of use	0.07	1.12			
<i>Block 3 (Trust of DMHIs)</i>			1	0.03	20.29*
Trust of DMHIs	0.28***	4.51			
<i>Block 4 (Moderation by Gender)</i>			3	0.00	0.13
Perceived usefulness \times Gender	-0.09	-0.47			
Perceived ease of use \times Gender	0.00	-0.02			
Trust of DMHIs \times Gender	0.10	0.55			
<i>Block 4 (Moderation by Age)</i>			3	0.00	0.31
Perceived usefulness \times Age	-0.03	-0.46			
Perceived ease of use \times Age	0.03	0.52			
Trust of DMHIs \times Age	-0.04	-0.73			
<i>Block 4 (Moderation by Previous use of DMHIs)</i>			3	0.00	0.74
Perceived usefulness \times Previous use of DMHI	-0.18	-0.93			
Perceived ease of use \times Previous use of DMHI	-0.10	-0.51			
Trust of DMHIs \times Previous use of DMHI	0.25	1.34			
<i>Block 4 (Moderation by mental health need)</i>			3	0.00	0.20
Perceived usefulness \times Mental health need	0.01	0.05			
Perceived ease of use \times Mental health need	0.07	0.32			
Trust of DMHIs \times Mental health need	0.04	0.20			

Note: n=248; DMHIs: digital mental health interventions; mental health need: indicated by evidence of significant psychological distress; dependent variable: intentions to use DMHIs; covariates: gender, age, previous use of DMHIs (no/yes), mental health need (no/yes), attitude, subjective norm, perceived behavioural control; B, standardised coefficient; Δ , change; df, degrees of freedom;

* p -value < 0.05;

** significant Scheffe test result ($t^2 > F_c$) where Scheffe $F_{0.5,2,237}^c = 2 \times 3.034 = 6.068$;

*** significant Scheffe test result ($t^2 > F_c$) where Scheffe $F_{0.5,1,237}^c = 3.881$.

attitudes towards digital mental health interventions (DMHIs) informed by technology acceptance theories [13,18,23,27]; particularly, the role of perceived usefulness, perceived ease of use, and trust of DMHIs (trust) in explaining intentions to use DMHIs. Overall, young people (17-25 years) reported generally neutral attitudes of perceived usefulness, perceived ease of use, trust, and intentions to use DMHIs. Results from

linear regression modelling provided partial support for Hypothesis 1 with greater perceived usefulness associated with higher intentions to use DMHIs. Perceived ease of use was not significantly associated with intentions to use DMHIs. In line with Hypothesis 2, greater trust of DMHIs was associated with higher intentions to use DMHIs. Contrary to Hypotheses 3 – 6, unique associations of intentions to use DMHIs with perceived usefulness, perceived ease of use, and trust were not moderated by gender, age, previous use of DMHIs, and mental health need, thus were consistent across these individual characteristics.

The result that young people reported neutral attitudes in perceived usefulness, perceived ease of use, trust of DMHIs, and intentions to use DMHIs suggest that young people may not view digital health solutions as ‘best fit’ for mental health. The result contradicts previous proposals that younger people are highly amenable to the use of DMHIs given more frequent use of mobile technology [6]. Instead, the results converge with previous research showing that younger people have low preference for online delivery of mental health treatments [10,11] and less willingness to adopt technology solutions [34]. Findings were consistent by gender, age, and mental health need suggesting the assumption that young people would prefer DMHIs is not well supported [35]. However, there was evidence that young people who had previously used DMHIs had more positive attitudes towards DMHIs consistent with previous research involving adults [25]. The result suggests that experience of using DMHIs may represent a facilitator for future use of DMHIs [36].

Despite the moderate attitudes towards DMHIs, the current results highlighted the importance of young people’s acceptance of technology in understanding their willingness to use DMHIs. Significant positive associations between intentions to use DMHIs and perceived usefulness suggest that young people’s beliefs that using DMHIs will improve their ability to manage their mental health is important to the motivation of using DMHIs. Reasons for why perceived ease of use were not associated with intentions were not examined, but we posit that this could relate to generally high digital literacy among young people causing ceiling effects resulting in low covariation with intentions to use DMHIs [37]. While the results differ from Becker et al (2016), they may not be directly comparable since Becker et al’s (2016) study had low power to detect significant effects in structural equation modelling and consisted of older participants. We propose therefore the current results are preliminary but provide early evidence for perceived usefulness to influence young people’s motivation to use DMHIs.

Trust of DMHIs was also identified as a motivational factor in young people’s willingness to use DMHIs. The current results replicate previous research examining the role of trust in explaining intentions to use DMHIs (Becker, 2016) and converges with reviews suggesting that lack of trust is a barrier to engagement with DMHIs [19]. The perceived instrumentality and certainty of DMHIs to provide benefits from participation (treatment effectiveness) therefore appears important to

young people's motivation to use DMHIs [18]. It is also important to consider this finding in addition to young people reporting lower preferences for online delivery [10]. Taken together, the research suggests that younger people are potentially vulnerable to disengaging with DMHIs and that any lack of trust or transparency could reduce meaningful use of DMHIs [19,38].

Finally, there was no evidence to suggest that the unique associations between intentions to use DMHIs with perceived usefulness, perceived ease of use, and trust of DMHIs were moderated by gender, age, previous use of DMHIs, and mental health need. The collective findings preliminarily suggest that, while these individual characteristics may influence DMHI adoption, psychological processes underlying motivation to use DMHIs are relatively similar across these individual characteristics. This includes groups with indicated mental health need determined by the presence of significant psychological distress, which was a novel finding of the current study. These findings are somewhat in contrary to findings elsewhere in the literature suggesting that gender, age, and previous use of technology are potential moderators of willingness to use technology solutions [14,23,24,34] and preferences for online delivery [10,25]. It is noted that the statistical non-significance of the results for hypothesized interactions could be due to insufficient statistical power in the current study, which may explain in part the discrepancy in results across studies. Further, since no previous research have examined the moderating role of gender, age, previous use of DMHIs, and mental health need on intentions to use DMHIs, we suggest the current results are interpreted with caution unless replicated.

The results of the present study have implications for the promotion of DMHIs among young people. The first of these relate to the need to address moderate levels of technology acceptance for mental health as a barrier to DMHI adoption [10]. The findings suggest that motivation for DMHI adoption could be enhanced by targeting perceived usefulness and trust of DMHIs. Drawing from research designed to improve help-seeking for mental health [39], for instance, this could potentially be achieved for DMHIs through the development of psychoeducation informing young people about the benefits of DMHIs for improving their ability to manage their own mental health, as well as the effectiveness and trustworthiness of DMHIs [18]. To that end, future research could consider whether perceived usefulness and/or trust is amenable to change, and which should be the focus of intervention to improve young people's willingness to use DMHIs. For instance, given that perceived usefulness and trust of DMHIs have similar size of associations with the intention to use DMHIs, actions directed at one domain may have the same impact on willingness to use DMHIs as actions directed at the other. Alternatively, targeting both domains may be twice as effective in improving overall willingness to use DMHIs. These questions warrant further attention through experimental methodology to help inform the development of evidence-based educational resources. The second line of promotion relates to implementation of DMHIs in healthcare. Given preference for human interaction, human support from therapists or peer groups to interact with others may help to increase trust of DMHIs leading to improved engagement [40].

Despite the contributions of the current study, there are several limitations that represent other directions for future research. First, the study recruited participants online and thus was limited to existing internet users. Second, self-selection bias was also apparent with significant proportion of participants reporting significant psychological distress. Third, the sample was highly educated, having achieved degree or postgraduate qualifications, and the mean age was skewed to the higher end of the age range, thus may not be representative of all young people. Future research would benefit from a population-based approach to recruitment to minimise any effect of self-selection while maximising representativeness of population [41]. We also did not assess health beliefs which could influence intentions to use DMHIs [14]. This was done because the current study was focused on examining the moderating role of actual rather than perceived mental health need [42]. However, future research could examine putative interactions

between health beliefs and technology acceptance in influencing motivations to use DMHIs. Finally, the collection of data capturing actual use of DMHIs would enhance our understanding of how motivational processes influence DMHI adoption. This should include investigating temporal changes in technology acceptance and trust of DMHIs to understand the process by which initial usage becomes a facilitator for future use of DMHIs.

Conclusion

The present study represents a novel step towards understanding the factors that influence young people's willingness to use digital mental health interventions. Contrary to assumptions, young people generally reported neutral attitudes towards technology solutions for mental health in relation to intentions to use DMHIs, technology acceptance, and trust of DMHIs. However, the current results indicated that motivation to use DMHIs was significantly associated with young people's perceived usefulness as well as trust of DMHIs. The results suggest the potential to influence young people's motivation to use DMHIs by addressing their beliefs that using DMHIs will improve their ability to manage their mental health. Outcomes indicate that developers and service providers should focus on addressing these psychological factors to improve DMHIs uptake among young people.

Authors contributions

Both authors contributed equally to the conduct of the study and preparation of manuscript.

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Informed consent and ethics approval

Details on page 5. The Human Research Ethics Committee at The University of Edinburgh provided ethical approval for this study. The study was performed in accordance with the 1964 Declaration of Helsinki and its later amendments. Participants provided informed consent prior to inclusion in the study and were free to withdraw at any time without consequence at any time.

Availability of data and material

Data is not available to be shared.

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Declaration of Competing Interest

Authors declare that they have no conflict of interest.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.hlpt.2022.100686](https://doi.org/10.1016/j.hlpt.2022.100686).

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