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Assessing health literacy and its impacts among people accessing unguided internet-delivered cognitive behaviour therapy for depression and anxiety: a treatment-seeking cohort study

Alana Fisher [a,b], Madelyne Bisby [a], Taylor Hathway[a], Atria Rezwan[a], Julie Ayre [c], Danielle Muscat [c], Nickolai Titov [a,b] and Blake Dear [a,b]

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ABSTRACT

Objective: This study examined the health literacy of individuals accessing unguided internet-delivered cognitive behaviour therapy (iCBT) for depression and/or anxiety, and its association with sociodemographics, clinical characteristics, and treatment outcomes.

Methods: Adults ($N = 570$) in an unguided iCBT trial completed measures of sociodemographics, past/concurrent mental health treatment use, quality-of-care, depression and anxiety symptoms, and health literacy across the nine Health Literacy Questionnaire (HLQ) domains.

Results: Higher average scores were observed for HLQ domains '*Appraisal of health information*' and '*Understand health information well enough to know what to do next*' with lower scores in '*Ability to actively engage with healthcare providers*' and '*Navigating the healthcare system*'. Lower scores on one or more HLQ domains were associated with younger age, female gender, culturally and linguistically diverse backgrounds, speaking a main language other than English, higher baseline depression and anxiety symptoms, use of crisis and emergency services, non-contact with general practitioners or other health professionals, and poorer quality-of-care ($ps > 0.025$).

Discussion: Individuals with diverse health literacy strengths and challenges appear to access and benefit from unguided iCBT, though research is needed to characterise health literacy and its impacts in related settings.

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Health literacy; mental health; internet-delivered cognitive behaviour therapy (iCBT); digital interventions; treatment uptake; treatment engagement

Introduction

Digital mental health treatments, such as internet-delivered cognitive behaviour therapy (iCBT) provide highly accessible psychological support at low or no cost to consumers. Drawing on evidence-based psychological principles and traditional face-to-face therapies, most commonly cognitive behaviour therapy (CBT), these treatments use online modules and other resources to provide therapeutic information and teach psychological skills. These digital treatments have been shown to have similar efficacy to face-to-face therapies when provided with therapist support (Carlbring et al., 2018; Donker & Kleiboer, 2018; Hedman-Lagerlöf et al., 2023). Meanwhile, unguided digital therapies, provided without clinician support, are also efficacious (Morgan et al., 2017; Pauley et al., 2023) and potentially even more scalable. Digital mental health treatments have the potential to address inequities in mental healthcare access and outcomes by overcoming many of the systemic barriers to traditional face-to-face treatment (Borghouts et al., 2021).

Despite this, digital mental health treatments – especially those delivered in an unguided (i.e. self-guided) format – continue to show lower uptake and engagement in real-world settings compared to research trials (Fleming et al., 2018), which may compromise their effectiveness, cost-effectiveness, and overall utility

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(Donkin et al., 2011, 2013). For people to effectively and equitably benefit from digital mental health treatments, it is critical that these treatments are provided in a way that meet people's needs and capabilities.

One key determinant of people's ability to access and engage with healthcare services is their health literacy. Health literacy refers to '*the personal competencies and organisational structures, resources and commitment which enable people to access, understand, appraise and use information and services in ways which promote and maintain good health*' (Nutbeam & Muscat, 2023, p. 3). Across various health conditions, including mental health conditions, lower levels of health literacy have been implicated in poorer healthcare outcomes. For example, lower health literacy has been associated with poorer healthcare access and quality, higher psychological distress, poorer self-management skills, more negative attitudes towards healthcare treatments, lower adherence to treatment recommendations, poorer aftercare engagement, higher rates of hospitalisations and greater use of emergency care (Berkman et al., 2011; Dahl & Hosler, 2020; Degan et al., 2020). Importantly, health literacy represents a modifiable determinant of an individual's health status and health outcomes, which is sensitive to change following intervention (Jacobs et al., 2016; Walters et al., 2020).

Early health literacy research focussed on an individual's basic reading, comprehension or numeracy skills, referred to as functional health literacy (Nutbeam, 2000). Health literacy has since been viewed as encompassing not only an individual's functional health literacy but also their personal skills and knowledge to interact with the healthcare system (i.e. interactive or communicative health literacy) and critically evaluate health information to actively participate in healthcare (i.e. critical health literacy) (Nutbeam, 2000). The Health Literacy Questionnaire (HLQ) (Osborne et al., 2013) conceptualises health literacy as a multidimensional construct comprising nine separate domains. It collects information on how people use and understand health information, how they manage their health, and interact with healthcare providers. In doing so, the HLQ characterises the specific health-related skills and tasks where people encounter difficulties. This knowledge can then be used to guide the design and implementation of interventions that leverage end-user strengths while accommodating any challenges they face.

To date, only a few studies have taken a multidimensional approach to measuring health literacy in the context of mental health conditions (Degan et al., 2020). This is a critical research gap because higher rates of low health literacy are seen among those with mental health difficulties compared to the general population (Degan et al., 2020). For example, in an Australian study of people attending community-based mental health treatment mental health consumers had lower scores on almost all HLQ domains than the general population averages (Degan et al., 2019). Health literacy difficulties in this sample were most evident in appraising health information, navigating the healthcare system, and finding high quality health information (Degan et al., 2019). While this study provided comprehensive insights into the health literacy profiles of people seeking mental health treatment, its cross-sectional design precluded any investigation into the relationship between their health literacy and outcomes, such as later treatment engagement and response. Improved understanding about mental health users' health literacy could lead to the development of interventions or resources to help support people with health literacy difficulties to engage with and benefit from mental health treatment. Moreover, by knowing which groups are more likely to report health literacy difficulties, we can target these efforts more effectively.

In light of the above, this study aimed to examine:

(1) the health literacy of people accessing unguided iCBT for symptoms of depression and anxiety;
(2) the relationship between health literacy and several sociodemographic and clinical characteristics, past and concurrent mental health service use;
(3) the impact of health literacy on their treatment uptake, completion, and outcomes

Methods

Research design

Data for the current study were collected as part of a randomised control trial (RCT) testing an unguided iCBT program in an international treatment-seeking sample, the results of which will be reported elsewhere.

The trial was prospectively registered on the Australian and New Zealand Clinical Trials Registry (ANZCTR ref: 12621001554853).

Participants

Adults aged 18 years and older were eligible to participate if they: (i) had internet and computer access for the duration of the trial; and (ii) self-reported current difficulties with anxiety and/or depression.

Exclusion criteria were: (i) self-reporting risk of self-harm or suicide and (ii) being unable to read or understand English.

Procedure

This research received ethical approval from Macquarie University's Human Research Ethics Committee (ref: 520211080734189). Prospective participants registered their interest for the trial via the eCentreClinic, a specialist research unit and not-for-profit initiative of Macquarie University, Australia, which provides people with access to free online psychological treatment through participation in research trials. The trial was advertised via the eCentreClinic's social media accounts (e.g. Facebook, X/Twitter), with advertising posts containing a link to the clinic's homepage. Upon landing on the clinic homepage, participants navigate to their treatment or 'course' of interest, where they find brief information outlining what treatment involves, who it is suitable for and the focus of the current research trial.

Prospective participants read the Participant Information and Consent Form (PICF) and, after consenting, completed an initial assessment comprising brief questionnaires (10–15 min) that determined eligibility, asked for contact details, and assessed sociodemographic and other background characteristics, symptoms of anxiety and depression, and health literacy.

All eligible participants received access to the treatment either immediately or after 8-weeks (i.e. waitlist control; after the immediate treatment group had finished treatment) (see ***Treatment***); ineligible participants were encouraged to contact their local primary healthcare provider or general practitioner (GP).

Participants were asked to complete a series of questionnaires immediately prior to starting the treatment (i.e. pre-treatment), midway through the treatment (i.e. week 5), and 8 weeks after starting the treatment (i.e. week 9, post-treatment). The questionnaires completed at the application stage, pre- and post-treatment are the focus of the current study. See ***Materials and Measures***.

Treatment

The treatment employed in the current study, The Wellbeing Course, is an established evidence-based transdiagnostic iCBT program for people with symptoms of anxiety and/or depression (Dear et al., 2016; Titov et al., 2013, 2015). It comprises five modules or 'lessons' which are based on core CBT components, such as psychoeducation, cognitive restructuring, behavioural activation, graded exposure, and relapse prevention), which are delivered over eight consecutive weeks. It also contains case studies drawing on the experience of previous participants, 'DIY' homework-style exercises and additional resources targeting skill areas (e.g. assertive communication, management of sleeping difficulties). Several trials have demonstrated that the Wellbeing Course is safe and clinically efficacious in the treatment of depression and anxiety in both the therapist-guided and unguided versions (Dear et al., 2016; Titov et al., 2013, 2015). Furthermore, the Wellbeing Course has been implemented in routine clinical care in Australia and Canada, with results replicating those in clinical trials (Hadjistavropoulos et al., 2022; Titov et al., 2020).

The current study utilised the unguided version of the treatment, which did not include any therapist contact before or during the treatment. Instead, participants' suitability and eligibility for the treatment were determined by a clinical researcher (AF), who reviewed participant responses to an initial screening and assessment survey. Upon starting and throughout treatment, participants received automated emails at the start of each week to log in and complete lessons along with any scheduled questionnaires. Up to three reminder emails were sent based on participant activity (e.g. not logging in). Participants were

Table 1. Measures used in the current study.

Measure	Timepoint/s	Overview
Health Literacy Questionnaire (HLQ)	Initial assessment	This 44-item scale measured different dimensions of an individual's health literacy across nine independent domains: (1) feeling understood and supported by healthcare providers; (2) having sufficient information to manage my health; (3) actively managing my health; (4) social support for health; (5) appraisal of health information; (6) ability to actively engage with healthcare providers; (7) navigating the healthcare system; (8) ability to find good health information; and (9) understanding health information well enough to know what to do. Domains 1–5 are scored on a 4-point Likert-type scale (strongly disagree = 1, disagree = 2, agree = 3, strongly agree = 4); domains 6–9 are scored on a 5-point Likert-type scale (cannot do or always difficult = 1, usually difficult = 2, sometimes difficult = 3, usually easy = 4, always easy = 5). For each domain, an average score is derived, where lower scores indicated lower health literacy levels. In the current sample, internal consistency at baseline was acceptable (α = .77–.85).
Patient Health Questionnaire 9-Item (PHQ-9)	Initial assessment; pre-, post-treatment	This 9-item measure assessed depression symptoms (Kroenke et al., 2009). In the current sample, internal consistency of the measure was found to be good (α = .84).
Generalized Anxiety Disorder 7-Item (GAD-7)	Initial assessment; pre-, post-treatment	This 7-item measure assessed symptoms of anxiety; it is based on the DSM-IV criteria for GAD but has been found to be sensitive to five different anxiety disorders (Löwe et al., 2008). In the current sample, internal consistency of the measure was found to be good (α = .89)
The Modular Survey Common Performance Measures	Initial assessment	This 10-item scale forms part of the Centers for Substance Abuse Treatment and Substance Abuse and Mental Health Service Administration's common set of performance measures for mental health and substance abuse services (Bartlett et al., 2006). At initial assessment, items measured self-reported quality-of-care based on participants' general interactions with the healthcare system and providers (e.g. 'I am treated with respect'; 'I help to develop my service/treatment goals') (Bartlett et al., 2006). Items are rated on a 4-point Likert-type scale from 'Strongly disagree' to 'Strongly agree', with higher scores reflecting higher quality of care. In the current sample, internal consistency of the measure was found to be good (α = .88).
Mental health service and treatment utilisation	Initial assessment	Purpose-designed yes-no questions asked about the following with regards to mental health difficulties: past or concurrent help-seeking with a GP or other health professional, past or concurrent use of prescription medications or psychological treatment, use of crisis support, and use of emergency services.
Sociodemographic characteristics.	Initial assessment	At initial assessment, purpose-designed questions on age, gender, educational attainment, country of birth, country of residence, ethnicity, First Nations' status, main language spoken, culturally and linguistically diverse background, relationship status, employment status, and urban/rural/remote location were administered.

made aware that the team included clinical psychologists (MB, BD), and would be monitored for risk and symptom deterioration throughout treatment. Participants were also advised to email the team if they experienced any technical difficulties or had questions.

Materials and measures

Participants in both groups completed the following questionnaires at specified timepoints throughout the trial (see Table 1).

Sample size and analyses

All analyses were conducted using SPSS (version 28). For all analyses, $p < .025$ was set as the threshold of statistical significance to adjust for the multiple statistical tests. To increase power for the current study, data from the treatment period for both the treatment and waitlist control groups were combined.

For the current study, we recruited a sample size of N∼500 at baseline (i.e. initial assessment) to allow for high attrition (∼50%), considering the unguided nature of the treatment being offered. A final sample of n∼250 (across the two groups at post-treatment) was powered for multiple regression models with approximately 20 predictor variables based on formula for calculating sample size of $N > 50 + 8\text{ m}$ where 'm' = predictor variable (Tabachnick et al., 2007). It was anticipated that the regression model testing up to 25 predictors of treatment response may include: relevant background sociodemographic (~n = 5) and clinical/service use variables (~n = 5), HLQ domains (n = 9), and number of treatment modules completed (n = 1).

Descriptive analyses were completed to describe the health literacy characteristics of the sample at baseline (**Aim 1**). For each HLQ domain, means/SD for each HLQ domain were obtained. To support interpretation and allow comparisons with the Australian national Health Literacy Survey (Australian Bureau of Statistics, 2018), we calculated frequencies of responses indicating difficulties on each HLQ domain. Average scores of 2 or less out of 4 on HLQ domains 1–5 (i.e. corresponding to 'strongly disagree'/'disagree'), and 3 or less out of 5 on HLQ domains 6–9 (i.e. corresponding to 'sometimes/usually/always difficult or cannot do') were taken as having difficulties.

A series of t-tests and a one-way ANOVA were then performed to ascertain any differences in HLQ domain scores at baseline as a function of categorical sociodemographic variables (e.g. gender, educational attainment, culturally and linguistically diverse background, geographical location [city, urban and rural], and First nations' status) (**Aim 2a**). Pearson correlations examined potential bivariate relationships between HLQ domain scores and other continuous variables at baseline (e.g. age, quality-of-care, PHQ-9, and GAD-7 scores) (**Aim 2b**). Correlations were classified as weak ($r < .04$), moderate ($r = .04–.07$) and strong ($r > .07$; Dancey, 2008).

Next, binomial logistic regressions were used to establish associations between HLQ domain scores at baseline and past/concurrent mental health service utilisation/treatment (**Aim 2c**), Wellbeing Course uptake (i.e. started lesson 1), course completion (i.e. 4 or more lessons completed), and clinically meaningful improvement (≥ 30% improvement on PHQ-9 and GAD-7 from pre to post treatment) (**Aim 3a**). To account for missing data at post-treatment, regression analyses were conducted with intention-to-treat principles using multiple imputation to generate missing values. The multiple imputation procedure entered time, group status, lesson completion, HLQ scores, and baseline symptom severity as predictors of missingness (Karin et al., 2018).

Finally, hierarchical multiple regressions were planned to establish whether HLQ domain scores at baseline uniquely predicted Wellbeing course uptake, course completion, and clinically meaningful improvement (≥ 30% improvement on the PHQ-9 and GAD-7 pre- to post-treatment), over and above those HLQ domain-related variables identified in Aim 2 (**Aim 3b**).

Results

Between the 30th of May 2022 and the 1st of February 2024, 596 applicants were assessed for eligibility, and of these, 570 were eligible to participate (95.6%).

As seen in Table 2, participants were aged 42.0 years on average, predominantly female (88.2% of the total sample), living in Australia (92.3%), English speaking (94.0%), had completed university level education (58.4%), and were employed on a full-time or part-time basis (57.5%). A smaller proportion of participants identified as having a culturally and linguistically diverse background (18.2%) or being First Nations (2.6%).

As seen in Table 3, most participants reported currently experiencing symptoms of depression (72.2%) and/or anxiety (93.3%) that were chronic (i.e. >80% with symptoms for at least one year). Most participants had seen a GP (86.7%) or other health professional (81.9%) and had previously taken prescription medication (70.2%) and/or received psychological therapy (75.8%) for their mental health. A minority had used crisis support (26.3%) or emergency services (15.1%) for their mental health. On average, participant baseline scores for depression (PHQ9; $M = 13.25$) and anxiety (GAD7; $M = 11.78$) were in the moderate range. Meanwhile, 395 participants (69.3%) met the clinical cut-off for depression and 351 (61.6%) for anxiety (≥10 on the PHQ9 and GAD7, respectively).

Aim 1- HLQ domain scores

Table 4 displays the mean and standard deviations of HLQ domain scores at baseline, and the proportion of participants whose average scores reflected having difficulties on each domain.

In this sample, higher average scores were seen for HLQ domains '*Appraisal of health information*' ($M = 2.87/4$, $SD = 0.47$) and '*Understand health information well enough to know what to*

Table 2. Sociodemographic characteristics of the sample (n = 570).

Variable	
Age *M* (*SD*)	42 (12.8)
Gender *n* (%)	
Female	503 (88.2%)
Male	60 (10.5%)
Non-binary	7 (1.2%)
Country *n* (%)	
Australia	526 (92.3%)
Location *n* (%)	
City	374 (65.6%)
Urban region	113 (19.9%)
Rural or remote	83 (14.6%)
Identifies as culturally and linguistically diverse *n* (%)	104 (18.2%)
Identifies as First Nation *n* (%)	15 (2.6%)
English as main language *n* (%)	535 (94%)
Highest level of education *n* (%)	
Year 10 or below	37 (6.5%)
Year 12	62 (10.9%)
Trade/Apprenticeship	45 (7.9%)
Undergraduate diploma/associate diploma	93 (16.3%)
Bachelor's degree	231 (40.5%)
Master or Doctoral degree	102 (17.9%)
Employment *n* (%)	
Full time paid work	207 (36.3%)
Part time paid work	121 (21.2%)
Casual work	55 (9.6%)
Student	41 (7.2%)
At home parent	34 (6%)
Unemployed	55 (9.6%)
Registered sick or disabled	23 (4%)
Retired	34 (6%)

Table 3. Baseline clinical and service use characteristics of the sample (n = 570).

Variable	
Current depressive episode?[a] *n* (%) yes	411 (72%)
Length of current depressive episode?	
Less than 6 months	49 (11.9%)
6 months to 1 year	38 (9.2%)
1–5 years	99 (24.1%)
6–10 years	56 (13.6%)
More than 10 years	169 (41.1%)
Current anxiety episode?[a] *n* (%) yes	532 (93.3%)
Length of current anxiety episode?	
Less than 6 months	38 (7.1%)
6 months to 1 year	49 (9.2%)
1–5 years	144 (27.1%)
6–10 years	72 (13.5%)
More than 10 years	229 (43%)
Seen GP for mental health?	494 (86.7%)
Seen mental health professional?[b]	467 (81.9%)
Psychologist	395 (69.3%)
Counsellor	227 (39.8%)
Psychiatrist	177 (31.1%)
Social Worker	59 (10.4%)
Nurse	39 (6.8%)
Ever taken prescription medication for mental health?	400 (70.2%)
Currently taking prescription medication for mental health?	260 (45.6%)
Ever received psychological therapy for mental health?	432 (75.8%)
Currently receiving psychological therapy for mental health?	155 (27.2%)
Ever used a crisis support service for mental health?	150 (26.3%)
Ever visited an emergency department for mental health?	86 (15.1%)
Depressive symptoms *M* (SD)	13.25 (5.81)
Anxiety symptoms *M* (SD)	11.78 (5.39)

Note: Depressive symptoms measures using Patient Health Questionnaire 9-item (PHQ-9), Anxiety symptoms measured using General Anxiety Disorder 7-item (GAD-7) scale.

[a] Participants self-report yes or no.

[b] Participants could indicate more than one health professional.

Table 4. HLQ domain scores for the sample (n = 570).

Domain	Mean	Range	SD	Reported difficulties related to domain[a] n %
HLQ 1: Feeling understood and supported by healthcare providers	2.81	1–4	0.63	94 (16.5)
HLQ 2: Having sufficient information to manage my health	2.64	1–4	0.53	64 (11.2)
HLQ 3: Actively managing my health	2.78	1–4	0.52	56 (9.8)
HLQ 4: Social support for health	2.54	1–4	0.58	122 (21.4)
HLQ 5: Appraisal of health information	2.87	1–4	0.47	31 (5.4)
HLQ 6: Ability to actively engage with healthcare providers	3.26	1–5	0.72	220 (38.6)
HLQ 7: Navigating the healthcare system	3.13	1–5	0.70	250 (43.9)
HLQ 8: Ability to find good health information	3.72	1.2–5	0.62	87 (15.3)
HLQ 9: Understanding health information well enough to know what to do next	3.95	1–5	0.57	36 (6.3)

Note: [a]Mean score 2 or less on domains 1–5 (corresponding to 'disagree'/'strongly disagree'); Mean score 3 or less on domains 6–9 (corresponding to 'sometimes'/'usually'/'always difficult or cannot do').

do next' (M = 3.95/5, SD = 0.57). Lower average scores were seen for HLQ domains '*Ability to actively engage with healthcare providers*' ($M = 3.26/5$, $SD = 0.72$) and '*Navigating the healthcare system*' (M = 3.13/5, SD = 0.70). Across the nine HLQ domains, the proportion of participants whose average score reflected having difficulties varied (Range: 5.4% [HLQ domain 5] to 43.9% [HLQ domain 7]) (Table 4).

Aim 2 (a) Sociodemographic differences in HLQ domain scores

Table 5 displays differences in HLQ domain scores across sociodemographic characteristics. Male ($M = 3.53$, $SD = 0.63$), and First Nations participants ($M = 3.72$, $SD = 0.53$) reported significantly higher scores for domain 6: '*Ability to actively engage with healthcare providers*' compared to female ($M = 3.23$, $SD = 0.72$; $p = 003$) and non-First Nations participants ($M = 3.25$, $SD = 0.72$; $p = .013$), respectively.

Additionally, participants who spoke English as their main language ($M = 3.97$, $SD = 0.57$) scored significantly higher on domain 9: '*Understanding health information well enough to know what to do*' than those who did not ($M = 3.68$, $SD = 0.62$; $p = 004$).

By contrast, participants who identified as having a culturally and linguistically diverse background ($M = 2.64$, $SD = 0.68$) scored significantly lower on domain 1: '*Feeling understood and supported by healthcare workers*', compared to those who did not (M = 2.84, SD = 0.62, $p = .003$).

No significant differences on any of the HLQ domains ($ps > .025$) were found as a function of participants' place of residence (i.e. living in a city, other urban, or rural area), university attainment, nor employment status.

Table 5. Associations between HLQ domain scores and categorical sociodemographic variables.

	HLQ 1	HLQ 2	HLQ 3	HLQ 4	HLQ 5	HLQ 6	HLQ 7	HLQ 8	HLQ 9
Culturally and linguistically diverse background									
t	2.93	0.73	1.92	1.78	1.98	−0.36	0.98	1.06	1.29
p	**0.003**	0.466	0.056	0.076	0.048	0.718	0.329	0.289	0.198
First Nations identity									
t	−1.82	−0.70	−0.36	0.17	−0.85	−2.48	−2.05	−1.24	−1.58
p	0.069	0.482	0.722	0.869	0.396	**0.013**	0.041	0.215	0.115
Gender									
t	0.83	−0.38	0.42	1.74	−0.56	3.02	1.33	0.34	0.40
p	0.405	0.707	0.675	0.083	0.575	**0.003**	0.184	0.738	0.688
University attainment									
t	0.28	−1.80	−1.81	−1.74	−1.15	−1.674	−1.13	−2.05	−1.26
p	0.778	0.073	0.071	0.083	0.25	0.095	0.26	0.041	0.208
Employed									
t	−1.52	0.24	−0.52	0.95	−1.66*	−0.36	−0.01	1.05	1.54
p	0.129	0.812	0.604	0.343	0.098	0.717	0.996	0.297	0.123
Main language English									
t	1.24	−1.36	1.13	0.91	0.87	0.43	0.75	1.26	2.92
p	0.216	0.177	0.261	0.365	0.386	0.669	0.456	0.209	**0.004**
Locality									
F	0.65	0.76	0.92	0.25	0.47	0.36	0.76	1.09	0.33
p	0.521	0.469	0.397	0.783	0.625	0.701	0.467	0.339	0.722

*Equal variances not assumed.

Table 6. Correlations between HLQ domain scores and other continuous variables at baseline.

	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1	HLQ 1	1												
2	HLQ 2	.442**	1											
3	HLQ 3	.257**	.415**	1										
4	HLQ 4	.502**	.465**	.335**	1									
5	HLQ 5	.327**	.486**	.421**	.290**	1								
6	HLQ 6	.565**	.444**	.198**	.492**	.241**	1							
7	HLQ 7	.546**	.556**	.206**	.489**	.280**	.779**	1						
8	HLQ 8	.305**	.518**	.207**	.285**	.507**	.563**	.670**	1					
9	HLQ 9	.233**	.281**	.164**	.201**	.351**	.520**	.551**	.719**	1				
10	PHQ9	−.133**	−.226**	−.138**	−.274**	−0.043	−.286**	−.331**	−.219**	−.188**	1			
11	GAD7	−.124**	−.209**	−0.032	−.166**	−0.020	−.290**	−.269**	−.209**	−.134**	.637**	1		
12	Age	.113**	0.038	0.031	−0.047	0.016	.125**	.150**	0.028	0.052	−.146**	−.199**	1	
13	Quality of care	.443**	.399**	.173**	.422**	.247**	.467**	.449**	.236**	.138**	−.156**	−.110*	0.035	1

Note: HLQ = Health Literacy Questionnaire; PHQ9 = Patient Health Questionnaire 9-items; GAD7, = Generalised Anxiety Disorder Scale 7-items.
**Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.025 level (2-tailed).

Table 7. Binary logistic regression analyses comparing health literacy according to treatment history.

HLQ 1	HLQ 2	HLQ 3	HLQ 4	HLQ 5	HLQ 6	HLQ 7	HLQ 8	HLQ 9
Ever seen GP or primary care physician for mental health								
2.24***	0.88	1.00	0.83	1.26	0.96	0.84	0.95	1.09
(1.54–3.24)	(0.56–1.4)	(0.63–1.59)	(0.54–1.2)	(0.75–2.1)	(0.69–1.35)	(0.59–1.2)	(0.64–1.41)	(0.72–1.66)
Ever seen health professional for mental health								
1.86***	0.94	**1.63***	0.81	**1.68***	1.18	0.83	1.05	1.05
(1.34–2.59)	(0.62–1.41)	**(1.09–2.45)**	(0.56–1.17)	**(1.07–2.65)**	(0.89–1.58)	(0.61–1.13)	(0.75–1.49)	(0.73–1.53)
Ever taken medication for mental health								
2.01***	0.88	1.07	1.07	1.39	1.1	0.87	0.95	0.98
(1.5–2.69)	(0.63–1.24)	(0.76–1.51)	(0.79–1.46)	(0.94–2.04)	(0.86–1.40)	(0.67–1.12)	(0.71–1.28)	(0.71–1.34)
Currently taking medication for mental health								
2.54***	**1.69****	0.78	1.42	1.37	**1.52****	**1.41***	1.13	0.93
(1.74–3.7)	**(1.12–2.54)**	(0.52–1.18)	(1.0–2.01)	(0.86–2.17)	**(1.13–2.04)**	**(1.05–1.9)**	(0.80–1.59)	(0.64–1.35)
Ever received psychological support/therapy								
1.58**	1.09	1.47	1.00	**1.62***	1.06	0.85	1.04	0.99
(1.17–2.13)	(0.76–1.57)	(1.02–2.11)	(0.72–1.39)	**(1.07–2.44)**	(0.82–1.38)	(0.65–1.13)	(0.76–1.42)	(0.71–1.39)
Currently receiving psychological support/therapy								
2.35***	1.49	**1.68***	1.23	1.06	1.08	1.20	0.86	0.80
(1.64–3.38)	(1.01–2.19)	**(1.11–2.54)**	(0.87–1.73)	(0.68–1.65)	(0.82–1.42)	(0.90–1.61)	(0.62–1.19)	(0.55–1.15)
Ever used crisis support service for mental health								
1.09	1.00	1.49	**0.66****	1.25	**0.75***	**0.70****	**0.69***	**0.64****
(0.81–1.47)	(0.70–1.42)	(1.03–2.14)	**(0.48–0.91)**	(0.83–1.87)	**(0.58–0.96)**	**(0.54–0.92)**	**(0.51–0.92)**	**(0.46–0.88)**
Ever visited emergency department for mental health								
1.16	**0.47****	1.12	**0.50*****	1.34	0.71	**0.63****	**0.66***	**0.62***
(0.80–1.67)	**(0.30–0.74)**	(0.72–1.74)	**(0.34–0.73)**	(0.82–2.22)	(0.52–0.96)	**(0.46–0.87)**	**(0.46–0.94)**	**(0.43–0.91)**

*$p < .025$, **$p < .01$, ***$p < .001$.
Note: Odds ratio (95% CI) reported. All analyses considered ‘No’ as the reference category.

Aim 2 (b)- Associations between HLQ domain scores, clinical characteristics, and age

Table 6 displays the bivariate correlations between each of the HLQ domains and clinical characteristics. Small negative correlations were observed between one or more HLQ domains, PHQ-9 and GAD-7 scores at baseline (all ps < .01). By contrast, small to moderate positive correlations were observed between one or more HLQ domains and general quality-of-care (ps < .01), as well as age (ps < .01).

Aim 2 (c)- Associations between HLQ domain scores at baseline and service use

The binomial logistic regression output and associated significance levels are displayed in Table 7. Higher scores on one or more HLQ domains were significantly associated with having ever seen a GP or any other professional for mental health concerns (ps < .025), having ever used or currently using medication for mental health (ps < .025) and having ever received or currently receiving psychological support/therapy (ps < .025).

By contrast, lower scores on one or more HLQ domains were significantly associated with having ever used a crisis support service (ps < .025) or emergency department visit for mental health (ps < .025).

Aim 3 (a)- Associations between HLQ domain scores and treatment outcomes

The regression output exploring the associations between HLQ domains at baseline and treatment uptake, completion and clinically meaningful improvement is presented in Supplementary Files 1 and 2. Among eligible participants (n = 570), 367 (64.4%) started the course. Of those who started, 199 (54.2%) completed the course, and 108 (29%) and 100 (27%) reported a meaningful improvement on the PHQ9 and GAD7 pre- to post-treatment, respectively. The binomial logistic regression analyses revealed no significant relationships between baseline HLQ domain scores and course uptake, course completion, nor clinically meaningful improvement in symptoms of anxiety or depression (all ps > .025; see Supplementary Files 1 & 2). Based on these non-significant findings, the planned regression analyses to determine whether HLQ domain scores uniquely predict outcomes were not necessary.

Discussion

This is the first known study to examine the health literacy characteristics of people accessing a digital mental health treatment, specifically unguided iCBT, and to explore associations between health literacy and treatment outcomes. Study findings identified a range of health literacy strengths and challenges in this sample. At assessment, greater health literacy difficulties were associated with individuals identifying as female, younger, having a culturally and linguistically diverse background, and speaking a main language other than English. From a clinical and service use perspective, greater health literacy difficulties were found amongst individuals indicating higher baseline depression and anxiety symptoms, use of crisis and emergency services, poorer general quality-of-care, and no contact with a general practitioner or other health professional for their mental health. However, health literacy difficulties were not found to be associated with uptake of, completion nor clinically meaningful improvement following unguided digital mental health treatment.

Average health literacy scores for the current sample were similar to those reported for community-based mental health treatment-seeking sample (Degan et al., 2019) but lower than for physical health samples (e.g. diabetes, cancer) (Degan et al., 2019) and the general adult population (Beauchamp et al., 2015). Given that health literacy relies on a combination of social and cognitive skills, it could be that mental health conditions including depression and anxiety symptoms (e.g. social withdrawal, diminished motivation and concentration) have a unique negative impact on a person's health literacy (Clausen et al., 2016; Mantell et al., 2020). Additionally, the negative relationship between depression and anxiety symptoms and one's self-confidence or self-efficacy (Carpinello et al., 2000) may contribute to lower health literacy scores on the HLQ. This suggestion is based on the notion that higher HLQ scores may in fact reflect greater confidence in one's ability to perform health-related tasks rather than actual abilities and skills per se (Dobson et al., 2014).

Interestingly, there was substantial variability in the proportion of participants whose scores indicated having difficulties in each HLQ domain (5.4–43.9%). This compares to a narrower range of 3–17% in the national Health Literacy Survey sample of almost 6000 Australian adults (Australian Bureau of Statistics, 2018). In our sample, the highest rates of health literacy difficulties were on extrinsic or system-related domains (i.e. '*Ability to engage with healthcare providers*' and '*Navigating the healthcare system*'), while the lowest rates were on intrinsic or individual-level domains (i.e. '*Appraisal of health information*' and '*Understanding health information well enough to know what to do*'). These findings suggest that unguided digital mental health treatments appear accessible to people with a diverse range of health literacy capabilities and difficulties. Moreover, by virtue of their internet delivery mode, these treatments may especially appeal to people whose health literacy difficulties relate to navigating and interacting with the mainstream healthcare system and healthcare providers. This finding also appears to support investments by different governments to develop digital mental health services, by suggesting that these interventions will likely be accessed by people who experience health literacy difficulties.

As noted earlier, health literacy difficulties were greater among participants belonging to priority need populations (e.g. younger, identifying as culturally and linguistically diverse, speaking a main language other than English) or having a more complex or higher-risk clinical presentation (e.g. more severe depression and anxiety symptoms at baseline, indicating use of emergency or crisis support services, and no contact with a general practitioner or other health professional for mental health). Broadly speaking, these observed relationships were consistent with those in prior research using the HLQ (Australian Bureau of Statistics, 2018; Beauchamp et al., 2015; Rheault et al., 2019). Further, these findings suggest that those groups who are disproportionately affected by health literacy difficulties and typically underrepresented in other healthcare contexts (Brown et al., 2016; Cross & Singh, 2012; Wohler & Dantas, 2017) may have encountered fewer barriers to accessing unguided digital mental health treatment. As such, unguided digital mental health treatments by virtue of their low cost, ease and flexibility of access in terms of time and place, and offer of anonymity may cater to a more vulnerable group of patients who require additional support; that is, patients who are less likely to have an established relationship with a healthcare professional and are more likely to engage with services in times of psychological distress.

It is noteworthy that, even though greater health literacy difficulties correlated with higher or specific need population characteristics, it was not associated with treatment uptake, completion, nor clinically meaningful improvement. This lack of associations between health literacy and treatment outcomes further strengthens the body of evidence showing that digital treatments are accessible, acceptable, feasible, and efficacious for users with a diverse range of backgrounds and needs, including those with more severe mental health symptoms (Tremain et al., 2020). It could also be that some health literacy domains were less relevant to the current digital care context. For example, unguided digital treatments may place fewer demands on certain health literacy capabilities (e.g. '*Navigating the healthcare system*' and '*Ability to engage with healthcare providers*') and greater demands on others. As such, future research could explore the relationship between health literacy and treatment outcomes in other digital care contexts, such as therapist-guided or blended treatments, where capabilities in these domains may be more relevant.

In considering the current findings, it is important to acknowledge some limitations. Firstly, participants self-referred to the trial, which was conducted at a specialist research clinic with limited advertising. Therefore, our sample may be biased towards people who are more proactive about managing their health and have the knowledge and skills to take part in a research trial. Secondly, the current sample was mainly female, university educated, and belonging to the dominant language and culture group. These characteristics are typical of samples in other studies of digital treatment for common mental health conditions (Sin et al., 2020) and of people who access face-to-face and some (e.g. Bassilios et al., 2022) but not all digital mental health service (e.g. Staples et al., 2022). Our findings should therefore be examined in different contexts before firm conclusions are drawn. Additionally, a much larger proportion of our participants (>80%) had previously sought professional help for their mental health, compared to those who access routine care digital mental health services (<50% ever spoken to a GP) (Titov et al., 2020). Due to their prior help-seeking experience, our sample may have had greater insight into their health literacy capabilities and difficulties. Finally, this study used a well-developed digital treatment that has been iteratively developed and designed to be accessible (e.g. plain language, information presented in written and visual formats). As such, future research directions might include determining whether these findings hold with less well-developed or other types of digital interventions (e.g. a self-help app), and whether health literacy might change or improve as a result of completing digital treatment.

In sum, findings from the current study provide valuable insights into the health literacy capabilities and difficulties of people accessing an unguided digital mental health treatment. Despite exhibiting sociodemographic characteristics consistent with more highly health literate populations, this sample still indicated some health literacy difficulties. These difficulties were especially pronounced in organisational or system-level domains (e.g. '*Navigating the healthcare system*' and '*Ability to engage with healthcare providers*'). Greater health literacy difficulties were seen among participants with priority population characteristics and with more complex clinical presentations and service use profiles. This said, health literacy difficulties did not show any relationships to subsequent treatment uptake, completion, nor clinically meaningful improvement in symptoms. Thus, despite having health literacy difficulties which make accessing other healthcare services challenging, people do access, take up and benefit from unguided digital treatments. Encouragingly, this suggests that digital interventions may also hold promise for increasing access to care for groups who experience health literacy challenges, although further research is needed to replicate and this work to different contexts.

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No potential conflict of interest was reported by the author(s).

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Data availability statement

Based on current ethics approval, participants' data are only accessible to members of the research team.

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