



Outcomes of Best-Practice Guided Digital Mental Health Interventions for Youth and Young Adults with Emerging Symptoms: Part II. A Systematic Review of User Experience Outcomes

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Abstract

Although many young people demonstrate resilience and strength, research and clinical evidence highlight an upward trend in mental health concerns among those aged 12 to 25 years. Youth-specific digital mental health interventions (DMHIs) aim to address this trend by providing timely access to mental health support for young people (12–25 years). However, there is a considerable gap in understanding young people user experiences with digital interventions. This review, co-designed with Australia's leading mental health organization Beyond Blue, utilizes a systematic methodology to synthesize evidence on user experience in youth-oriented digital mental health interventions that are fully or partially guided. Five relevant online databases were searched for articles published from 2018 to 2023, yielding 22,482 articles for screening and 22 studies were included in the present analysis. User experience outcomes relating to satisfaction and engagement were assessed for each included intervention, with experience indicators relating to usefulness, usability, value, credibility, and desirability being examined. Elements associated with positive/negative outcomes were extracted. Elements shown to positively influence user experience included peer engagement, modern app-based delivery, asynchronous support, and personalized content. In contrast, users disliked static content, homework/log-keeping, the requirement for multiple devices, and social media integration. Asynchronous interventions showed high satisfaction but faced engagement issues, with combined asynchronous/synchronous interventions reporting better completion rates. DMHIs offer a promising platform for youth mental health support and has the potential to dramatically increase the reach of interventions through the adoption of technological and user experience best practices. While young people respond positively to many aspects of intervention modernization, such as interactive, app-based design, other concepts, such as social media integration, they need to be adopted by the field more cautiously to ensure trust and engagement.

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Introduction

Recent evidence highlights an upward trend in mental health concerns among those aged 12 to 25 years (Capon et al., 2023; Twenge et al., 2019). Among many contributing factors, the COVID-19 pandemic may have intensified these challenges, with most young adults (74–87%) experiencing mental health deteriorations during the pandemic (Head-space, 2020; Radomski et al., 2023). Despite the escalating number of young adults requiring greater levels of support, access to timely mental health care is currently insufficient (McGorry et al., 2022; Mei et al., 2019). Some of the common barriers to accessing support and services include perceived stigma, privacy concerns, and poor health literacy (Amone-P'Olak et al., 2023; Renwick et al., 2022). In light of these challenges and in response to reported low levels of program and support engagement and high levels of attrition, researchers are focusing on youth-oriented digital mental health interventions (Dixon et al., 2016; Kim et al., 2019).

There is growing interest in youth-oriented digital mental health interventions (DMHIs) as a means of addressing some of the challenges associated with typical face-to-face healthcare (Babbage et al., 2022; Richardson et al., 2010; World Health Organisation, 2019). These DMHIs aim to promote engagement and adherence by providing convenient support and a positive user experience (Lattie et al., 2019; Liverpool et al., 2020). A primary benefit of these interventions is their enhanced accessibility, flexibility, and scalability (Marcu et al., 2022; Philippe et al., 2022). DMHIs also offer economic benefits, as online services are generally less costly for both client and health system alike, relative to conventional face-to-face treatments. This is attributed to, for example, an absence of overhead expenses, such as renting and cleaning a physical site, and fewer staff resources required (Ben-Zeev et al., 2021; Howard & Kaufman, 2018). Importantly, DMHIs can reduce the burden on healthcare professionals, resulting in shorter waitlist times (Gagnon et al., 2016; Haleem et al., 2021). Moreover, accessing DMHIs can overcome perceived barriers such as privacy and anonymity which might otherwise deter patients from accessing face-to-face treatment (Khanna & Carper, 2022). DMHIs can also ensure treatment integrity, providing a consistent and standardized intervention in addition to the gathering of real-time participant data (Philippe et al., 2022). Integral to their success is a thoughtful user experience design that factors in the unique needs and preferences of young users, ensuring that interfaces are intuitive, content is relatable, and engagement metrics are prioritized.

Barriers to Online Interventions

Despite the recent growth and identified benefits of self-guided DMHIs, concerns regarding their sustained usage, appropriate utilization, and ongoing efficacy have been raised (Mehrotra et al., 2017; Opie et al., 2024a; Schueller et al., 2017). These issues of engagement may prevent users from fully benefiting from these interventions (Schueller et al., 2017). A further limitation of self-guided digital interventions is high attrition rates (Alqahtani & Orji, 2019; Karyotaki et al., 2015). There is currently a limited understanding of the factors contributing to such intervention attrition and specifically understanding how these retention rates can be improved (Alqahtani & Orji, 2019), though interface ease of use has been identified as a potential barrier (Andrews et al., 2018; Nielsen, 2012).

Individual factors, such as motivation and capability, can influence intervention engagement; however, this has not been extensively studied (Cross et al., 2022). Challenges such as low digital literacy, negative prior user experience, and costs associated with internet or program access can deter users. Other considerations include data security and privacy concerns associated with DMHIs, including the storage and sharing of personal data and risk management associated with distant, independent access (Galvin & DeMuro, 2020; Wykes et al., 2019).

Specific limitations for youth also exist, relating to intervention suitability, usability, and acceptability (Balcombe & De Leo, 2023; Bergin et al., 2020; Liverpool et al., 2020). For example, youth-specific DMHIs are recommended only if specific content and design requirements are met, such as the inclusion of videos, minimal text, and intervention personalization (Liverpool et al., 2020). Therefore, analysis of clinical or standardized outcomes alone may not be sufficient. Exploring user's experiences and perspectives may inform the re-design and improvements of an online intervention, with the purpose of improving clinical outcomes through sustained engagement.

User experience outcomes tell us about user's engagement with, and experience of, an intervention. They often include general feedback, satisfaction and acceptance ratings, and completion rates. To date, there are few standardized tools for measuring and evaluating a user's experience of a digital intervention with reviews reporting heterogeneity in employed measures (Ng et al., 2019; Saleem et al., 2021; Shim et al., 2017; Welsh et al., 2023). When reported, studies tend to only provide summative evaluations of users' experiences with online interventions (Inal et al., 2020). Formative evaluations instead are conducted to develop a deep understanding of user perceptions, informing the redesign and improvements of

an intervention. Formative evaluations are essential for understanding the reasons why people may be more or less likely to engage and for addressing barriers, both known and unknown. In addition to more open-ended qualitative feedback, formative evaluation seeks to collect user feedback on specific key indicators of the experience that can be used for comparing different interventions or iterations. These key indicators of user experience are the focus of the present study.

Intervention Guidance and Delivery

DMHIs can be delivered with varying levels of human interaction or support. Guided interventions involve interaction with a human support (e.g., clinician, peer) to boost engagement and offer both clinical and technical support (Heber et al., 2017; Werntz et al., 2023). The degree of guided support can vary, ranging from partially guided, with some elements intended to be completed independently, while others provide guidance for all elements. Guidance can be delivered synchronously (i.e., live human interaction; e.g., telehealth) or asynchronously (delayed human support; e.g., email, text message). Such supported interventions have been found to be more effective than non-supported, self-guided interventions (Leung et al., 2022; Schueller et al., 2017) (Garrido et al., 2019). In one study, DMHI adherence was improved through regular interaction with a trained support facilitator (Garrido et al., 2019). Similarly, Wei et al. (2020) identified that self-guided DMHIs focusing on relaxation and self-care for COVID-19 patients were beneficial for those with mild to moderate symptoms of depression and anxiety. More research is needed, however, to fully understand the impact of, and most appropriate level of human support.

Gaps in Available Research

To our knowledge, prior systematic and scoping reviews that examined DMHIs (both guided and unguided), and associated user experience outcomes such as satisfaction, usability, engagement, and acceptability, have exclusively targeted adults with no youth-specific reviews (Balcombe & De Leo, 2023; Gan et al., 2022; Saleem et al., 2021; Villarreal-Zegarra et al., 2022). Furthermore, prior reviews lack specific recommendations about the level and amount of human guidance that optimizes the young adult's user experience (Hollis et al., 2017; Lehtimaki et al., 2021). A recent systematic review identified that over 70% of preventative youth DMHIs failed to document user participation in their design and development process (Bergin et al., 2020). Overlooking youth end users' perspectives via co-design, co-development, and by embedding their feedback may result in less efficacious and appealing DMHIs (Li et al., 2022). As Opie et al. (2024b) emphasized, DMHIs must be both

effective and ensure a positive user experience is provided, necessitating the examination of not only socioemotional outcomes, but user experience outcomes also.

The Current Study

To address the aforementioned gaps and limitations and build on the promise of emerging findings, this systematic review aims to (1) identify and synthesize the literature on user experience in youth-specific, guided and partially guided DMHIs and (2) identify user experience elements within DMHIs that are associated with improved experiences and outcomes for young people. The specific user experience indicators under examination will include feasibility and fidelity; user satisfaction; completion and adherence; mode of delivery; session number; and intervention content.

Methods

We conducted a rapid systematic review to provide a timely evidence synthesis to our industry partner (Beyond Blue, Australia's most well-known and visited mental health organization) and help them to inform policy decision making. This review followed the Joanna Briggs Institute (JBI) methodology (Aromataris & Munn, 2020) and Cochrane Rapid Review methodological recommendations (Garrity et al., 2021). Our reporting of the review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA; Page et al., 2021). See Online Resource 1 for a complete PRISMA checklist. A protocol of the present review was prospectively registered in PROSPERO (registered: March 23, 2023; CRD42023405812).

Following good practice, the review methodology was codesigned and conducted alongside our key stakeholder Beyond Blue and several lived experience consumer and carer academics (Pollock et al., 2018). Collectively, the current review aimed to bring together academic, consumer, and mental health service skills, experiences, and voices.

Inclusion Criteria

The Population, Intervention, Comparator, Outcome, and Study design (PICOS) framework (McKenzie et al., 2019) guided inclusion criteria eligibility (See Table 1). Only literature written in English was included. If necessary information was not reported in-text, the study was excluded.

Table 1 PICOS framework

Concept	Concept details
Population (P)	Youth (mean age 12–25 years, inclusive) experiencing non-acute, emerging, mild-to-moderate mental ill-health symptoms, with no existing psychiatric diagnosis (i.e., indicated populations were excluded)
Intervention (I)	Young adult-specific interventions. The scope of interventions was mental health or combination interventions that focused on mental ill-health <i>and</i> alcohol and other drugs (AOD) interventions were included. Entirely AOD interventions were excluded. Interventions were required to be evidence-based or informed and developed by a mental health expert. The intervention duration was brief, defined as intervention length ranging from 1 to 12 sessions and duration ranging from 0 to 12 months. Interventions were standardized and manualized (solely or partially); digitally delivered by any digital delivery method; and individually delivered. Intervention delivery channel could be: 1. Combination delivery (partially guided <i>and</i> partially self-guided) or 2. Entirely guided. Such guided delivery could be synchronous or asynchronous. Guidance could include support from a clinician, researcher, expert by experience, or a mix of experts. There were no theoretical framework parameters around included interventions
Comparison (C)	Studies that contained within-group data (i.e., examine differences among subjects who are in the same group) and between-group data (i.e., assess differences in how two or more groups differ) were included. For studies with between-group data, the comparison group could be any of the following: placebo, non-intervened control, group receiving an equivalent in-person program, or any other varied intervention
Outcome (O)	All studies were required to report on pre-post intervention socioemotional outcomes and post-intervention user experience outcomes
Study design (S)	Primary research from published and unpublished sources in the form of experimental and quasi-experimental were included. Case control studies were also included. All included studies needed to report on pre-post program user experience data

Types of Sources

The search was limited from 14 March 2018 to 14 February 2023 due to the rapid advancement of technological interventions. Date restrictions were also applied due to the dearth of available literature pre-2018).

Search Strategy

We followed a three-step search strategy. An initial limited search of PsycINFO was conducted, followed by analysis of the text contained in the title and abstract, and of the index terms used to describe the article. This identified the keywords and index terms used for a second search across all the databases covered by this study. The second search was a systematic search of five electronic databases PsycINFO (Ovid), MEDLINE (Ovid), CINAHL (EBSCO), Cochrane Central Register of Controlled Trials (Central; via Cochrane Library). See Online Resource 2 for a complete search strategy (concept and terms) of all included databases. The third search step was an examination of additional search databases. This included searching grey literature, identifying dissertations and theses via ProQuest Dissertations and Theses. Global Trial registries were also searched to identify ongoing studies or complete but unpublished studies, these included the Australian New Zealand Clinical Trial Register (www.anzctr.org.au) and www.ClinicalTrials.gov. The first 20 pages of Google were also searched. See Online Resource 3 for a complete grey literature search strategy. Finally, to ensure a comprehensive search was conducted, reference lists of all eligible studies and pertinent systematic reviews were manually searched to identify further studies that met

inclusion criteria. Authors were not contacted for missing data. This is the same search strategy used for the first part of this study series, focusing on socioemotional outcomes of digital mental health interventions.

Study Screening and Selection

All records were imported to Endnote (2020) where duplicates were removed. Remaining studies were imported in Covidence (Veritas Health Innovation, 2020) and were screened at title and abstract level by three reviewers (JO, AV, HK). Studies were then screened at full-text level. At both title and abstract, and full-text, 75% of records were double screened.

Data Extraction

Data extraction was completed by three independent reviewers (JO, AV, HK) with disagreements resolved through conferencing. Data from each full-text article was charted by one reviewer and checked by a second independent reviewer. Data was extracted into a priori standardized data extraction forms, consistent with Tables 3 and 4.

Quality Assessment

All studies were appraised using the Quality Assessment Tool for Quantitative Studies (EPHPP, 2010). Quality appraisal checklist response options were ‘yes,’ ‘no,’ ‘unclear,’ or ‘not applicable.’ Grey literature was critically assessed using the Authority, Accuracy, Coverage, Objectivity, Date, and Significance (AACODS) checklist (Tyndall,

2010). Studies were subsequently grouped into low risk (> 75% of quality criteria met), moderate risk (> 50% of quality criteria met), or high risk of bias (< 50% of quality criteria met). An a priori decision was made not to exclude studies based on quality. One author assessed study quality for all the papers, and a second author independently assessed the study quality of 25% of the papers (inter-rater reliability = 75% agreement). All disagreements were resolved through conferencing.

Synthesis

Data were extracted from each study relating to the included population, the intervention, and intervention user experience elements reported on. To identify socioemotional outcome efficacy and user experience outcomes, we collated and categorized the extracted intervention characteristics and outcomes into a finite set of top-level elements to facilitate synthesis (Morville, 2014). Due to data heterogeneity, a meta-analysis was not feasible, with results instead being collated and tabulated following categorization, and results were reported narratively.

Intervention User Experience Outcomes

As recommended by Morville (2014), we aimed to categorize the findings into seven user experience quality factors or measures: useful, usable, findable, credible, desirable, accessible, and valuable, as shown in Table 2. Considering the substantial amount of heterogeneity in the reporting of different user experiences in different studies, mapping results extracted from each study to this well-defined set of factors enabled for synthesis. However, several of these user experience elements were excluded due to lack of data. Specifically, no study reported on the *findable* element and very limited data reported on the *desirable* and *accessible* elements. We also reported on user experience sub-elements

Table 2 User experience outcome categories used for synthesizing extracted study data

Element	Sub-element
Useful	Usefulness Acceptability Helpful
Usable	Usage/completion Attrition/adherence Engagement
Findable	–
Credible	Safety/privacy
Desirable	–
Accessible	–
Valuable	User satisfaction

of these factors. Table 3 provides population and intervention information for each included study, grouped by delivery method and Table 4 provides a summary of extracted user experience assessments from each study.

Each user experience element extracted from a study was identified as either positive or negative. This was achieved by using statistic data present in the study if its directionality was apparent (for example, 93% of participants indicated that the intervention was easy to use”). In other cases, the authors’ interpretation of collected results and comparison to provided baselines was used (for example, “the measured rate of intervention acceptance was higher than reference interventions”).

Results

Study Selection

The systematic literature search yielded 22,482 records (after removal of duplicates), of which 22,450 records were excluded at title/abstract ($n = 21,817$) and full-text level ($n = 633$). Double-screening at title and abstract resulted in inter-rater reliability (IRR) for published literature of 96% ($\kappa = 0.43$) and unpublished literature of 98% ($\kappa = 0.45$). At full-text screening, IRR was 98% ($\kappa = 0.74$) for published literature and 92.31% ($\kappa = 0.75$) for unpublished literature. A total of 31 quantitative primary studies were included in the present review (part I and part II). However, only 22 studies reported on user’s experience outcome. Hence this review will only focus on those studies. A more detailed explanation of the results of the 32 studies is provided in (Opie et al., 2024a, 2024b, this Special Issue). Figure 1 details the results at each stage of study selection and reasons for exclusion.

Study Quality Assessment

Overall, the quality of included published studies was moderate ($n = 12$, 57%); with some of high quality ($n = 5$, 24%) and the remaining of low quality ($n = 4$; 19%). The quality of included grey literature ($n = 1$; Wahlund, 2022) was weak (i.e., high risk of bias). See Online Resource 4 for a visual and tabular representation of study quality.

Study Characteristics

Table 3 provides a detailed description of included studies. Most studies were published studies ($n = 21$) and one was an unpublished dissertation (Wahlund, 2022). Study year ranged from 2019 to 2023, with a steady increase in the number of studies published per year.

All included studies reported on pre-post intervention outcomes, with nine studies including additional follow-up

Table 3 Study characteristics

Study (Year) Country Recruitment	Total sample					Name	n (AR%)	Guided support person	Intervention		# modules Duration & details	Therapy	Comparator
	Design (# arms)	Mental health concern	M age (range) F%	Pre-N (AR%)	Guided support details Async/sync				Program content/modules				
App-based (accessed through smartphone/tablet)													
Ravaccia (2022) UK School	Mixed-method (pre-post) (1-arm)	General well-being	NR	398 (80)	Telmi	398 (80)	Counselors	Peer moderators reviewed posts and ensured no one left without post response. Counselors available if risk concerns.	Async	Moderated peer support tool. Users post replies to a post, and these replies are also moderated. Posts can be filtered by topic, and resource library.	NR 2-3 months	NR	
Schueler (2019) USA Community	Pilot feasibility trial (pre-post) (1-arm)	Mental wellbeing	19.06 (18-24) 65%F	28 (18)	Pocket helper + Purple chill + Slumber time	28 (18)	Therapists coach	Phone support (up to 3 sessions) Session 1: Orientation, goals, problems, resources. Session 2: Progress & focus on specific topic/skill Session 3: Review & next steps. Coach provided text support and chance to contact outside of sessions	Async	Pocket Helper: Daily survey on stress, sleep, daily challenges. Provided tips on coping or motivational messages. Purple Chill (behavior change strategies): audio recording library on mindfulness, relaxation, breathing, imagery exercises to promote relaxation & reduce stress. Slumber Time (behavior change strategies): Sleep diaries prompts to track sleep. Includes audio recordings for rest and alarm to facilitate tracking.	NR 4 wks, App use & up to 3x30min coach sessions & optional check-in 10-15min	CBT, Pos Psych	
Sit (2022) China University	Exp. (pre-post) (1-arm)	Depression Anxiety	NR (18-25) 68%F	38 (66)	Step-by-step (SBS)	38 (66)	Trained non-specialist e-helper (incl. postgraduate intern)	E-helper & trained peer to provide minimal support by phone and text. E-helpers provided check-in & engagement motivation.	Async	Primarily app exercises: 1. Behavioral activation, 2. Self-care, 3. Relaxation.	5 8 wks, 5x wly sessions (20-30min)	CBT	
Combination delivery (e.g., Telehealth and app-based)													
Garnefski & Kraai (2023) Netherlands Community	Exp. (pre-post) (1-arm)	Depression	24.71 (>18) 77%F	31 (26)	Moodpep	31 (26)	Clinical psychology students	Personal telephone coaches (1 per wk for 15 mins) checked on users' progress, monitored depressive symptoms, encouraged participation, & referring them to GP if symptoms were severe.	Async	8 online lessons each including activities such as psychoed, case descriptions, videos, and exercises. Lesson 1: Breaking the vicious circle, 2. Physical relaxation, 3-4. Changing negative thoughts, 5. Evoking positive feeling, 6-7. Goal formulation & MI techniques to achieve goals, 8. Conclusion	8 6-8 wks, 1-2 hours per wk	CBT	
Hennemann (2022b) Germany University	RCT (2-arm)	Somatic symptom distress	24.60 (>18) 83%F	149 (6)	ISOMA-guided	ISOMA-guided: 81(0) ISOMA GoD: 68 (0)	Clinical psychologists	ISOMA-guided: Written support in form of messages, support, feedback, usage reminders	Async	8 online modules involving: 1. Psychoeducation, 2. Exercises, 3. Behavioral experiments, 4. Assignments via text, video, audio.	8 8 wly modules, N therapy time = 138 mins	CBT	Active control: ISOMA-GoD
Klimczak (2023) USA University	RCT (3-arm)	Depression Anxiety	22.53 (>18) 75%F	230 (24)	ACT guide	Phone: 77 (22) Text: 75 (21)	Trained peer-support (coach)	1. Phone call: Wkly peer coaching 2. Texts: Wkly texts from coach.	Async	All participants received ACT guide self-help web program & wkly emails with usage tips. Modules included: 1. Away moves, 2. Your mind is like..., 3. Your values, 4. Finding values, 5. Being flexible, 6. Stepping back, 7. Sitting with emotion, 8. Carrying emotions with you, 9. How you want to act, 10. Setting goals, 11. Making commitments, 12. Returning to commitments.	12 10 wks, 1-2 wly modules, 20-40mins each. Phone coaching: 10-15mins wkly call. Text coaching: 1per wk	ACT	Active control: Phone OR text peer-support coaching Inactive control
O'Connor (2020) Canada Community	Pilot RCT (2-arm)	Anxiety	15.3 (13-17) 90%F	94 (26)	Being real, easing anxiety: Tools helping electronically (BREATHE)	36 (0)	Research team member	Optional phone coaching support after Module 2 to help with exposure activities and plan; Optional email support from trained research team member to answer questions about program/treatment (including discussion of any arising issues causing distress); Auto online reminders to encourage nonusers>1wk.	Async	Website with personal tailoring features for content and animation, videos, image maps, timed prompts, on-screen pop-ups, graphics, interactive pages, activities, resources, ask the expert section, along with CBT modules: 1. Psychoeducation, 2. Realistic thinking, 3. Cognitive distortions, 4. Relaxation skills, 5. Avoiding avoidance, 6. Constructing fear hierarchy, 7. Fear hierarchy practice (imagery & in vivo), 8. Concept integration.	8 8 wks, 1 module per wk	CBT	Inactive control: Static webpage access
Radomski (2020) Canada Community	RCT (2-arm)	Anxiety	16.6 (13-17) 71%F	536 (57)	Being real, easing anxiety: Tools helping electronically (BREATHE)	258 (67)	Trained paraprofessionals	Optional telephone coaching after initial session (no therapy); Wkly reminder emails for ongoing encouragement; Check-in alert flags to contact adolescent (and potentially parent) for serious concerns.	Async	Unlimited access to resource-based webpages with 6 CBT sessions involving check-in, discover, check-out, try-out components for: 1. Psychoeducation and safety, 2. Avoidance fear hierarchy, 3. Relaxation skills, 4. Cognitive distortion, 5. Realistic thinking, 6. Concept integration and relapse prevention.	6 6 wly sessions, 30mins per session	CBT	Inactive control: Static webpage access only
Rodriguez (2021) China University	RCT (2-arm)	Depression Anxiety Stress	23.5 (NR) 74%F	54 (57)	MIND	27 (41)	Trained and supported peers	Peers provide wkly encouragement to complete program via 15-20min phone chat or WeChat text message during treatment; Nonusers received contact via WeChat text and email >1wk.	Async	Online self-guided mindfulness sessions 5-17mins involving videos, audio recordings and homework tasks for: 1. Getting started, 2. Mindfulness based activation, 3. Reconnecting with body and breath, 4. Working with	NR 4-6 wly sessions, 15-20 min wly phone chat	Mindfulness based cognitive therapy	Active control: Online program only
Stapinski (2021) Australia Community	RCT (2-arm)	Anxiety Alcohol use	21.6 (17-24) 67%F	123 (28)	Inroads	62 (0)	Clinical psychologist	Wkly email providing support, feedback, and personal suggestions; Wkly 30min phone chats/texts following Modules 1 & 4; Additional phone/email support on request by psychologist.	Async	Modules focused on: 1. Understanding patterns and motives for alcohol use, 2. Anxiety psychoeducation on cognitive, physiological, and behavioral, 3. Introduction to cognitive therapy, 4. CBT strategies for sticking to drinking limits, 5. Highlight the link between avoidance and anxiety, 6. Social support.	5 5 wly sessions, 20 mins each. Wkly phone/texts (30 mins)	CBT	Active control: Online guidelines & information
van Doorn (2022) Netherlands Community	Exp. (pre-post) (2-arm)	Perceived stress	22.38 (NR) 100%F	8 (0)	ENYOY	8 (0)	Clinical moderator and peer lived experience coaches	Bkly online contact with clinical moderator and peer lived experience coaches to work on mental health problems; Community newfeed with peers and peer workers.	Async	All participants used Sense-IT smartwatch with biofeedback off (control) to assist wearer recognizing physiological signals via notifications and vibrations, to encourage use of online ENYOY-platform to reduce stress by completing exercises (e.g. breathing). ENYOY-platform offers therapeutic exercises together with clinician, peer worker and peer support.	NR 20 days wearing smartwatch: 10 days biofeed-off (control) and 10 days biofeed-on	Pos Psych ACT CBT	Active control: biofeedback-on
Telehealth (Zoom/Videoconferencing software)													
Harra (2023) USA University	RCT (2-arm)	Anxiety Depression	19.5 (NR) 47%F	45 (29)	Unnamed	14(33)	Trained peer mentor	Zoom meetings	Sync	Unstructured therapy sessions.	4 4 wly sessions, 30-60mins each	NR	Inactive control: waitlist
Web-based (accessed through internet browser, or internet-support device: E.g., computer, phone)													
Cook (2019) UK University	RCT (3-arm)	Worry/rumination	NR (18-24) 83%F	235 (31)	RESPOND	82 (39)	Therapists/Clinicians	Written template feedback of positive steps forward after each module adapted to responses = within 2days; Personalized reminder emails for nonusers w/wk. Clinical support for severe risk.	Async	Guided and self-guided i-RFCBT involving reflection of repetitive worry warning signs, new coping strategies (e.g., relaxation, self-compassion, assertiveness), experiential exercises and action-oriented i-RFCBT plans, with use of: 1. Psychoeducation, 2. Mood diaries, 3. Experiential audio exercises, 4. Pictures, 5. Video snippets of peers.	6 6 hourly modules, 3-4 sessions per module, 1-2 weeks self-paced per module	RF-CBT	Active control: self-guided i-RFCBT Inactive control: TAU
Grudin (2022) Sweden Mental health service	RCT (3-arm)	Experiential Depression	15.4 (13-17) 59%F	32 (0)	Internet behavioral activation (i-BA)	11 (9)	Clinical psychologists	Wkly contact via written messages w/h platform. Psychologists provided daily feedback, answered questions and prompted completion if required.	Async	8 chapters: 1. Introduction, 2. Values assessment, 3-6: Continued values-based activation, 7. Putting it all together, 8. Treatment summary.	7 10 wks, 1-2 chapters per wk, 30-60 min each.	CBT	Active control: Unguided i-BA Inactive control: TAU

Table 3 (continued)

									Occasional phone calls when necessary. Sync & async				
Juniar (2022) Indonesia University	Feasibility study (pre-post) (1-arm)	Stress	24.03 (19-42) 85%	68 (63)	Rileks	68 (63)	Psychologists (e-Coaches)	Personalized written feedback on exercises via email, and provided coaching through modules by helping to identify and manage problems; No chance for youth to reply to feedback. Async	6 online sessions: 1. Psychoeducational, 2. Six-step problem-solving, 3-5. Emotional regulation, 6. Goals and warning signs, 7. Optional boosters.	6 10 wks, 6 sessions, ~60-90mins	Transactional model		
Karyotaki (2022) Netherlands University	RCT (2-arm)	Depression Anxiety	21.91 (±18) 81F%	100 (18)	Icare Prevent	48 (17)	Supervised psychology students (e-Coaches)	Templated feedback after each module, tailored to individual needs via platform messaging, less than 30 min per feedback and w/n two working days, ~2.5hrs per participant; Additional questions about treatment content answered throughout. Async	7 online sessions incl. guided exercises by e-Coaches, quizzes, slideshows during: 1. Introduction, 2. Problem identification and behavioral activation (w/elective modules), 3. Psychoeducation, 4. Cognitive restructuring, 5-6. Problem solving, 7. Future planning (w/elective modules), 8. Optional booster (reflection).	7 7 wky sessions, 45-60mins self-paced per session	CBT	Inactive control: TAU	
Kuchler (2023) Germany University	RCT (3-arm)	Mental wellbeing	25.77 (>18yr) 75F%	386 (48)	StudiCare-M	130 (58)	Psychologist (e-Coach)	Guided: E-Coaches provide written feedback. Youth could request feedback after module or ask questions. Unguided: Automated feedback after modules. Both groups have option to receive auto coach every 2 days. Async	Module content: information on stress, well-being, mindfulness with unique wky focus (e.g., dysfunctional thinking, values, goals). StudiCare-M contained wky alternating mindfulness exercises. Participants received homework tasks, where they were encouraged to practice regularly with downloadable audio files and document practice in mindfulness diary.	7 8 wks, 45-60mins each	ACT Mindfulness	Active control: Unguided Inactive control: waitlist	
Pescatello (2021) USA University	Exp. (3-arm)	Psychological distress	NR (≥18 yr) NR F%	5568 (NR)	SilverCloud (SC)	SC:1,247 (NR) SC+ therapy: 527 (NR)	Well-trained therapist-supporter	Trained supporters monitored wky progress & provided encouraging feedback & recommendations, & suicidal watch & use reminder messages for nonusers >2 wks. Async	Psychoeducational modules customized by user, involving videos, tools and quizzes related to: 1. Specific issues, 2. Body image, 3. Stress, 4. Depression, 5. Anxiety.	NR M=90 days, self-paced, M=7 logins	CBT	Active control: Adjunct therapy Active control: Therapy only	
Peynenburg (2022) Canada University	Randomized Factorial Trial (4-arm)	Depression Anxiety	23.73 (17-46) 81F%	277 (30)	UniWellbeing	MI + Booster: 68 (29)	Therapist	Therapist support with personalized messages via treatment portal on a wky basis via text. Async	Lessons include information on: 1. Symptom identification & CBT model, 2. Thought monitoring & challenging, 3. Understanding arousal symptoms & management, 4. Avoidance or safety	4 5 wks, 4 lessons, 15 mins each	CBT	Active control: MI only Active control: Booster only	
									behaviors & graded exposure, 5. Relapse prevention.				Inactive control: Standard care
Radovic et al. (2021) USA Mental health service	RCT (2-arm)	Depression Anxiety	16 (12-19) 76F%	38 (34)	Supporting our valued adolescent (SOVA)	18 (22)	Behavioral health graduate student	Blog posting and moderation. If participant referenced self-harm, moderator contact participant or emergency contact. If suicidal thinking confirmed, attempt history, future plans, moderator contacted PI for guidance. Async	Website provides: 1. Peer support, 2. Blogs (comments & discussion boards), 3. Ongoing new content (new articles).	NR 3 mnths	Integrated behavioral health model	Inactive control: Enhanced usual care	
Rice (2020) Australia Mental health service	Exp. (pre-post) (1-arm)	Social anxiety	19.8 (14-25) 47F%	89 (15)	Entourage	89 (15)	Clinical moderators Trained lived experience peer moderators	Clinician moderators providing problem-solving discussion and individually tailored therapy based on user needs and goals; Trained peer workers provided online support at least twice per wk for one month to help users feel comfortable contributing to platform and maintain use. Async	Involves an online social networking platform with <i>talking point</i> and <i>talk it out</i> features to encourage discussion and problem-solving via posts, with the use of interactive psychosocial therapy comics and modules for: 1. Psychoeducation, 3. Cognitive restructuring, 4. Reducing safety behaviors symptom.	NR 12 wks	CBT		
Wahlund ^a (2022) Sweden NR	Pilot (pre-post) (1-arm)	Excessive worry	NR (13-17) NR F%	13 (8)	BIP Worry	13 (8)	Therapist	Therapist reviewed and provided feedback within 24hrs (wk days) on completed worksheets via email-like communication via the platform. Async	Online modules containing PDF files, audio files, exercises related to modules: 1. Psychoeducation on worry, 2. Worry behaviors, 3. Exposure to thoughts, 4. Setting goals, 5. Being proactive, 6. Making decisions, 7. Letting go, 8. Summary, 9. Relapse prevention, 10. Planning for the future.	10 10 wks, 1 per wk	IU-CBT		

^aUnpublished thesis

ACT Acceptance Commitment Therapy, *Active control* Alternative intervention received, *App* Application, *AR* Attrition Rate, *Async* Asynchronous, *Auto* Automated, *Biofeed* Biofeedback, *Biwky* Biweekly, *CBT* Cognitive Behavioral Therapy, *Exp* Experimental, *F* Female, *GoD* Guidance on Demand, *i-BA* Internet-based Behavioral Activation, *iRFBT* Internet-Based Ruminative Behavioral Therapy, *Inactive control* No intervention received, *Incl* Includes/Including, *iRFBT* Internet-based Rumination-Focused Cognitive Behavioral Therapy, *IU* Intolerance of Uncertainty, *M* Mean, *Min/s* Minute/s, *MI* Motivational Interviewing, *N* Sample size, *n* subsample size, *NR* Not Reported, *Pos Psych* Positive Psychology, *RCT* Randomized Controlled Trial, *RFBT* Rumination-Focused Cognitive Behavioral Therapy, *Sync* Synchronous, *TAU* Treatment As Usual, *Wk* week, *Wkly* Weekly, *W/* With, *W/n* Within, Gray shading—Comparator not included in study

assessments. Included studies predominantly followed a RCT study design ($n = 12, 55\%$), with seven single pre-post experimental studies (32%). Ten (45%) of the studies included a single comparison group (active = 5; inactive = 5), while five studies (23%) included two or more comparison groups which comprised of inactive and active controls.

Two studies reported on diverse populations. Schueller et al. (2019) included a sample of young people experiencing homelessness that were gender diverse or questioning. The intervention sample in Radovic et al. (2021) unintentionally included approximately one third ($n = 6/20$) of individuals who did not identify as male or female. Out of the 22 studies

Table 4 Key user experience outcomes of included studies

Study (year) Intervention description	Synchronous guided intervention delivery Outcome (measure)	Key findings	Feasibility and fidelity	User satisfaction	Completion and adherence	Other measures**
Harra and Vargas, (2023)* Trained peer mentor consultation over Zoom weekly for mild to moderate symptoms of anxiety and/or depression management	1. Completion	NR		21 (61.8%) appreciated opportunity to express feelings to non-judgmental listener. 4 (11.8%) enjoyed being connecting with another. 5 (14.7%) said intervention helped to learn about self and reflect	9 (64.3%) of intervention completed all four mentoring sessions, 3 (21.4%) completed 3, 2 (14.3%) completed 2	Efficacy = Yes Efficient = NR
Study (year) Intervention description	Asynchronous guided intervention delivery Outcome (measure)	Key findings	Feasibility and fidelity	User satisfaction	Completion and adherence	Other measures
Cook et al. (2019) RCT to test whether guided Web-based RFCBT (i-RFCBT) would prevent incidence of major depression relative to usual care	1. Completion	NR		NR	<i>M</i> completion of 3.46 modules (<i>SD</i> = 2.25). 46% compliance (completion of ≥ 4 modules)	Efficacy = Yes Efficient = NR
Hennemann et al. (2022)* RCT to compare an internet-based intervention with regular psychologist support (iSOMA-guided) and identify moderators for ICBT outcomes	1. Satisfaction (acceptability (CSQ-8)) 2. Completion 3. Negative effects [safety] (INEP)	NR		In both groups (internet-based intervention with regular psychologist support), 80% reported high intervention satisfaction. (iSOMA-guided: <i>M</i> = 25.57, <i>SD</i> = 4.64; iSOMAGoD: <i>M</i> = 24.12, <i>SD</i> = 5.20) and did not differ significantly between group	Digital intervention completion rate was high. Participants in the iSOMA-guided group completed significantly more intervention modules on average (<i>M</i> = 5.22, <i>SD</i> = 2.40), compared to the iSOMA-GoD group (<i>M</i> = 4.09, <i>SD</i> = 2.75), $t(134.17) = 0.69$, $p = 0.009$, $d = 0.44$	Negative effects: 18% reported one unwanted side effect of treatment (e.g., stigmatization; financial concerns; feeling dependent on partner; difficulty making decisions; longer phases of feeling bad). The frequency of negative treatment effects did not differ significantly between groups (iSOMA-guided: 10/67, 14.9%; iSOMAGoD: 11/51, 21.6%, $X^2(1) = 0.87$, $p = .350$) Efficacy = Yes Efficient = NR
Juniar et al. (2022) To assess the feasibility, acceptability, usability, and efficacy of the Rileks web-based stress management intervention, as part of the preliminary version	1. Feasibility (SUS) 2. Satisfaction (CSQ-8)	Rileks is potentially feasible. The SUS mean score was 62.80 (<i>SD</i> = 14.74) for usability, which was lower than expected, with the lowest score for the learnability item (<i>M</i> = 2.88, <i>SD</i> = 1.27)		Rated as generally satisfactory	NR	Efficacy = Yes Efficient = NR

Table 4 (continued)

Study (year) Intervention description		Asynchronous guided intervention delivery			
Outcome (measure)	Key findings	Feasibility and fidelity	User satisfaction	Completion and adherence	Other measures
Karyotaki et al. (2022) RCT to examine effectiveness of a guided web-based transdiagnostic individually tailored iCBT	NR	1. Satisfaction with treatment (CSQ-8) 2. Usage	72% (<i>SD</i> = 7.6%) rate of satisfaction with the intervention	Participants completed approximately half of the main 7 sessions of the iCBT intervention (55%)	Efficacy = Yes Efficient = NR
Küchler et al. (2023)* RCT to evaluate the effectiveness and adherence of a revised internet- and mobile-based intervention, StudiCare-M, in an unguided and a fully guided format for college students	NR	1. Satisfaction (CSQ-8; CEQ) 2. Negative experiences (INEP)	NS differences in intervention satisfaction between UG and GoD groups	GoD participants showed significantly greater follow-up adherence after 6-months	Treatment credibility was moderate to high $M = 20.36$ ($SD = 3.78$; range 0–27) with treatment expectancy lower $M = 18.15$ ($SD = 4.04$; range 0–27). Negative experiences associated with content and e-coaching were reported more frequently with minor to moderate intensity ($t_2: n = 27$ (UG), $n = 9$ (GoD); $t_3: n = 18$ (UG), $n = 15$ (GoD)). The most frequently reported negative experiences were “I felt forced by the StudiCare training or the e-coach to do exercises that I really didn’t want to do at all.” ($n = 43$) and “By participating in StudiCare training, I spend too much time in front of the computer and neglect my hobbies and social contacts.” ($n = 19$) Efficacy = No Efficient = NR

Table 4 (continued)

Study (year) Intervention description		Asynchronous guided intervention delivery			
Outcome (measure)	Key findings	Feasibility and fidelity	User satisfaction	Completion and adherence	Other measures
Pescatello et al. (2021)* To determine whether an internet-delivered psychotherapy (SilverCloud) had comparable outcomes to psychotherapy in routine care	NR	NR	NR	Mean intervention length 89.64 days (<i>SD</i> = 67.87; range = 4–475) for SC-ONLY, 96.09 days (<i>SD</i> = 133.44; range 3–1036) for SC+TX. On average, SC-ONLY and SC+TX participants used 15% of DHMI or viewed an average of 16.27 pages (<i>SD</i> = 17.72; Range 0–101) and used an average of 3.88 tools (<i>SD</i> = 4.98; Range 0–41)	Efficacy = Yes Efficient = NR
Peynenburg et al. (2022) To examine effects of including pretreatment MI and a self-guided booster (UniWellbeing) offered 1-month after transdiagnostic iCBT for postsecondary students	NR	NR	High satisfaction (82.3% (158/193) reporting they were 'satisfied' or 'very satisfied' with treatment. 76.2% (147/193) reported confidence in their ability to manage their symptoms 'increased' or 'greatly increased' post. NS differences between intervention group on any treatment satisfaction measures ($p = 0.37 - 0.83$)	NR	Efficacy = Yes Efficient = NR
Radovic et al. (2021) RCT to pilot a peer support website intervention for adolescents (SOVA) with enhanced usual care (EUC) for depression or anxiety symptoms	NR	NR	NR	There was limited access to the website due to forgetting on not having time. 50% of adolescents reported they would forget to access the website	Efficacy = Yes Efficient = NR

Table 4 (continued)

Study (year) Intervention description	Asynchronous guided intervention delivery	Outcome (measure)	Key findings	Feasibility and fidelity	User satisfaction	Completion and adherence	Other measures
Ravaccia et al. (2022) To assess the impact of using MeToo on young people and reasons for these impacts for general wellbeing	1. Usage	NR	NR	Feasibility indicators were met: Youth gave positive intervention feedback with 98.6% reporting they would recommend to intervention to another with social anxiety	NR	At T1, 50% of youth had just started and 37% had been using MeToo for > 1 month. At T2, 54% had been using MeToo for > 1 month and 31% had just started	Efficacy = Yes Efficient = NR
Rice et al. (2020) To pilot a novel digital intervention (Entourage) for young people with prominent social anxiety symptoms, with a particular focus on the engagement of young men	1. Acceptability 2. Feasibility 3. Safety (PHQ-9; LSAS) 4. Usage	NR	NR	Feasibility indicators were met: Youth gave positive intervention feedback with 98.6% reporting they would recommend to intervention to another with social anxiety	Overall, 25.8% (<i>n</i> = 23) met the a priori acceptability criteria (logging on to Entourage = > 10 times over 10 wks). 60.7% (<i>n</i> = 54) logged in weekly over 5 wks. At post, 74.4% said Entourage provided timely support; 62.2% said Entourage therapy content relevant to developing social anxiety symptoms control; 77.0% found Entourage at least somewhat helpful	1583 total individual system logins from participants (<i>M</i> (sample) = 17.8; <i>M</i> (male) = 19.9). high participant usage of Steps modules with 1534 completed in total (<i>M</i> (sample) = 17.2; <i>M</i> (male) = 14.4) with an average of 4.2 Actions completed per user (<i>M</i> (male) = 3.9). Through-out pilot there were 19 separate Talk it Out group-based problem-solving topics pitched by participants and developed into solutions, with a total of 156 interactions for these. The Talking Point feature also received substantial engagement, with 80 contributions to these discussions from participants	All participants felt safe and adequately supported by clinicians while using the intervention: On a 5-point scale from 'not safe at all' to 'very safe,' most 94.1% (<i>n</i> = 32) reported feeling safe and no participants reported feeling unsafe. No serious adverse events reported during intervention. Efficacy = Yes Efficient = NR

Table 4 (continued)

Study (year) Intervention description	Asynchronous guided intervention delivery
Outcome (measure)	Key findings
	Feasibility and fidelity
	Completion and adherence
	User satisfaction
	Other measures
Wahlund (2022) ^a Dissertation to develop and evaluate streamlined psychological interventions (IU-CBT; BIP Worry) for adolescents and adults, specifically causal mechanisms relevant in the maintenance of excessive worry	<p>1. Completion</p> <p>NR</p> <p>92% (12/13) followed through with online intervention. Intervention module completion rates high (average completion. 9.8/10)</p> <p>NR</p> <p>Efficacy = Yes Efficient = NR</p>
Study (year) intervention	Mixed synchronous and asynchronous guided intervention delivery
Outcome (measure)	Key findings
	Feasibility & fidelity
	User satisfaction
	Completion and adherence
	Other measures
Garnefski & Kraaij (2023) Pre-post experimental study to evaluate an online self-help program, Moodpep, that provides tools to those with emerging depressive symptoms	<p>1. Usefulness</p> <p>2. User satisfaction</p> <p>3. Completion</p> <p>60.9% found program 'quite useful'. Most (56.5–73.9%) intended to continue using the techniques learned in the program.</p> <p>High satisfaction with program (M = 7.65, SD = 0.88; range 6–9) and coach (M = 8.48, SD = 1.04; range 7–10). 78.3% would recommend it to others. Most valued telephone coaching (87%), with 69.6% not preferring another coaching method, though 17.4% favored video calls</p> <p>23/31 (74.19%) program completion</p> <p>Efficacy = Yes Efficient = NR</p>

Table 4 (continued)

Study (year) intervention	Mixed synchronous and asynchronous guided intervention delivery				
	Outcome (measure)	Key findings			
		Feasibility & fidelity	User satisfaction		
		Completion and adherence	Other measures		
Grudin et al. (2022)* RCT to test the feasibility and acceptability of therapist-guided and self-guided internet-delivered BA (I-BA)	1. Treatment adherence 2. Credibility 3. Satisfaction (CSQ-8; NEQ-20)	NR	Mean treatment credibility was 14.3 ($SD=2.7$) for therapist-guided I-BA ($n=11$), 14.1 ($SD=3.9$) for self-guided I-BA ($n=9$) and 11.1 ($SD=3.4$) for TAU ($n=8$). Average treatment satisfaction at post-treatment was 24.7 ($SD=5.33$) for therapist-guided I-BA ($n=11$), 21.3 ($SD=6.8$) for self-guided I-BA ($n=9$) and 17.7 ($SD=6.3$) for TAU ($n=10$)	Mean completion of 7.5 chapters ($SD=1.0$) for adolescents and 7.4 ($SD=1.3$) for parents in therapist-guided I-BA, and 5.4 ($SD=2.5$) for adolescents and 5.9 ($SD=2.8$) for parents in self-guided I-BA. Eight adolescents (73%) and eight parents (73%) in therapist-guided I-BA, and three adolescents (30%) and four parents (40%) in self-guided I-BA had completed all eight chapters by the end of treatment. Zero participants in therapist-guided I-BA, and three in self-guided I-BA, discontinued treatment	Efficacy = Yes Efficient = NR
Klimczak et al. (2023)* To test the efficacy of a novel peer-support coaching model for college students using ACT Guide (Web-based self-directed program with telephone call (sync)/with text messaging (async) / no coaching	1. Adherence	NR	NR	Using phone <i>and</i> text coaching as interventions more effective at increasing adherence to ACT Guide vs. standard ACT Guide without coaching. Control, which used ACT Guide only, and had low adherence rates. Age moderated effect of text coaching on program adherence, with older individuals showing weaker effects of text coaching on adherence ($p=0.025$). No significant moderation effect of baseline psychological distress on adherence ($p<0.05$)	Efficacy = Yes Efficient = NR

Table 4 (continued)

Study (year) intervention	Mixed synchronous and asynchronous guided intervention delivery			
Outcome (measure)				
Key findings				
Feasibility & fidelity	User satisfaction	Completion and adherence	Other measures	
O'Connor et al. (2020)* RCT of self-directed internet website with 8 modules about BREATHE intervention & ad hoc phone and email support wherein research member could answer questions regarding intervention	1. Satisfaction 2. Adherence 3. Acceptability	13 (93%) indicated intervention easy to use and understood all materials; 5 (36%) said intervention was difficult to complete the homework pages each week. All liked that intervention was completed online, 11 (79%) indicating no concerns with privacy. 5 (36%) agreed the intervention should include social media component, 7 (50%) agreed intervention should be more personalized, and 8 (57%) agreed intervention should include a parent module. Common barriers to intervention completion were: difficulty completing exposure activities and remembering/finding time to complete modules, among other life commitments	13 (36%) completed all 8 modules and 2 (6%) complete no modules. Completers and noncompleters did not differ significantly in responses to ASQ screening questions ($p=0.32$, 0.93, 0.49, and 0.49), how they learned about the study (social media/on the web, health care provider/guidance counselor, friend, or not specified; $p=0.17$), age ($p=0.85$), or baseline MASCT scores ($p=0.44$)	Efficacy = Yes Efficient = NR
Radomski et al. (2020) RCT to compare a six-session iCBT program for adolescent anxiety compared to online resources alone, BREATHE intervention	1. Usage (UEQII – study-specific measure) 2. User experience (UEQII; study-specific measure)	Experience was significantly more positive for BREATHE than control ($p<0.001$). BREATHE users reported DHMI design and delivery factors that challenged (e.g., time constraints and intervention support) or facilitated (e.g., demonstration videos, self-management activities) use	BREATHE users had significantly higher satisfaction and acceptability ($p<0.001$), credibility and impact ($p<0.001$), and core items total scores ($p<0.001$) than control Intervention use was low ($M=2.2$ sessions, $SD=2.3$; $n=258$) and webpages ($M=2.1$ visits, $SD=2.7$; $n=278$), but higher for BREATHE (median = 6.0 (1–6); 81/258) and webpage respondents (median = 2.0 (1–9); 148/278). Adherence and usage score was higher among webpage users vs BREATHE users, but this difference was NS ($p=0.18$)	Efficacy = Yes Efficient = NR

Table 4 (continued)

Study (year) intervention	Mixed synchronous and asynchronous guided intervention delivery			
	Outcome (measure)	Key findings	Feasibility & fidelity	User satisfaction
Rodriguez et al. (2021)* RCT to investigate the efficacy of internet-based mindfulness intervention (MIND) and intervention plus peer counselor support (MIND +)	1. Adherence / completion	NR	NR	NR
			Completion and adherence	Other measures
			Youth in MIND+ (vs. MIND) has significantly less attrition and more adherence, as indicated by greater likelihood of completing post assessments (16/27, 59% vs. 7/27, 26%; $\chi^2 1 = 6.1$; $p = 0.01$) and higher course completion (72.6/100, 72.6% vs. 50.7/100, 50.7%; $t(52) = 2.10$; $P = 0.04$), respectively. NS between-group differences in daily frequency and duration of mindfulness practice	Efficacy = Yes Efficient = NR

Table 4 (continued)

Study (year) intervention	Mixed synchronous and asynchronous guided intervention delivery	Outcome (measure)	Key findings	Completion and adherence	Other measures	
		Feasibility & fidelity				
		User satisfaction				
Schueller et al. (2019) To pilot a mobile phone intervention for young adults experiencing homelessness with brief phone coaching involving up to 3 sessions over a month, text messaging and mobile mental health apps (Pocket Helper, Purple Chill, Slumber Time)		1. User satisfaction 2. Completion rates/App Use	NR	Satisfaction high, with all youth (23/23) indicating they would recommend intervention. 52% (12/23) reported being 'very' or 'extremely satisfied' with intervention. 43% (10/23) indicated intervention helpful daily tips most popular intervention element, 64% (14/22) indicated they liked them 'quite a bit' or 'a lot.' 26% (6/23) indicated liking the IntelliCare apps 'quite a bit' or 'a lot.' Coach support (11/23, 48%) and office hours (10/23, 43%) less popular than daily tips but received higher satisfaction rating than IntelliCare apps. 48% (11/23) found skills learned beneficial, 43% (10/23) regularly used skills. Intervention length deemed appropriate by most (12/23). Use of skills learned during coaching sessions significantly related to satisfaction with Pocket Helper ($r = 0.78$, $p < 0.001$) and other skills apps ($r = 0.46$, $p = 0.03$)	57% (20/35) completed all 3 phone sessions, $M = 2.09$ sessions ($SD = 1.22$). Text messages sent by youth $M = 15.06$ ($SD = 12.62$) and received $M = 19.34$ ($SD = 12.70$) messages	Efficacy = Yes Efficient = NR
Sit et al. (2022) To test the effectiveness of step-by-step behavioral activation-based mental health intervention (Step-by-Step) to address depression and anxiety symptoms		1. User satisfaction	NR	Participant mean satisfaction = 7.5 (range: 7–8), regardless of number of completed sessions (range: 3–5 sessions)	Efficacy = NR Efficient = NR	

Table 4 (continued)

Study (year) intervention	Mixed synchronous and asynchronous guided intervention delivery	Key findings	Other measures	
Outcome (measure)	Feasibility & fidelity	User satisfaction	Completion and adherence	
Stapinski et al. (2021) Evaluate psychologist-supported, web intervention (Inroads), designed with and for emerging adults, to promote adaptive coping strategies, and prevent anxiety and alcohol use concerns from progressing to chronic, co-occurring disorders	NR	2-month follow-up indicated the majority found the intervention useful or very/extremely useful (92%), of good/very good quality (97%), and would recommend it to others (92%)	39% of Inroads group completed all five modules, 51% completed = > 3 modules, 77% completed = > one module. There was a dose effect, with symptom change from baseline to follow/u on all outcomes increasing with completion of more online module	Efficacy = Yes Efficient = NR
van Doorn et al. (2022) Evaluate Sense-IT smartwatch with ENYOY-platform in reducing mental health complaints and increasing awareness of physiological parameters	1. Friendliness/Usability 2. Acceptance (Health-ITUES)	NR	NR	Efficacy = Yes Efficient = NR

Effects: *t* T-test value, *p* Significance Value, *r* Correlation, *M* Mean, *NS* Non-Significant, *SD* Standard Deviation

Acronyms: *ACT* Acceptance Commitment Therapy, *CBT* Cognitive Behavioral Therapy, *GoD* Guidance on Demand, *I-BA* Internet-Based Behavioral Activation, *iACT* Internet-based Acceptance and Commitment Therapy, *iCBT* Internet-based Cognitive Behavioral Therapy, *MI* Motivational interviewing, *NR* Not reported, *RCT* Randomized Controlled Trial, *RFCBT* Rumination-Focused Cognitive Behavioral Therapy, *UG* Unguided, *SC* SilverCloud, *TAU* Treatment As Usual, *TX* Treatment Only, *t1* Time 1, *t2* Time 2, *t3* Time 3
Measures: *CSQ-8* Client Satisfaction Questionnaire, *CEQ* Credibility Expectancy Questionnaire, *Health-ITUES/HI* Health Information Technology Usability Evaluation Model, *INEP* Inventory for the Assessment of Negative Effects of Psychotherapy, *LSAS* Life Skills Assessment Scale, *MASC2* Multidimensional Anxiety Scale for Children—2nd Version, *NEQ-20* Negative Effects Questionnaire, *PHQ-9* Patient Health Questionnaire—9 item, *SUS* System Usability Scale, *UEQII* User Experience Questionnaire for Internet-Based Interventions, *TSQ* Treatment Satisfaction Questionnaire

^aUnpublished thesis

^{**}When users reported digital mental health intervention ability to produce a desired or intended result, efficacy is marked yes. When users reported achieving maximum productivity with minimum wasted effort, efficient is marked yes

^{*}Includes comparison data

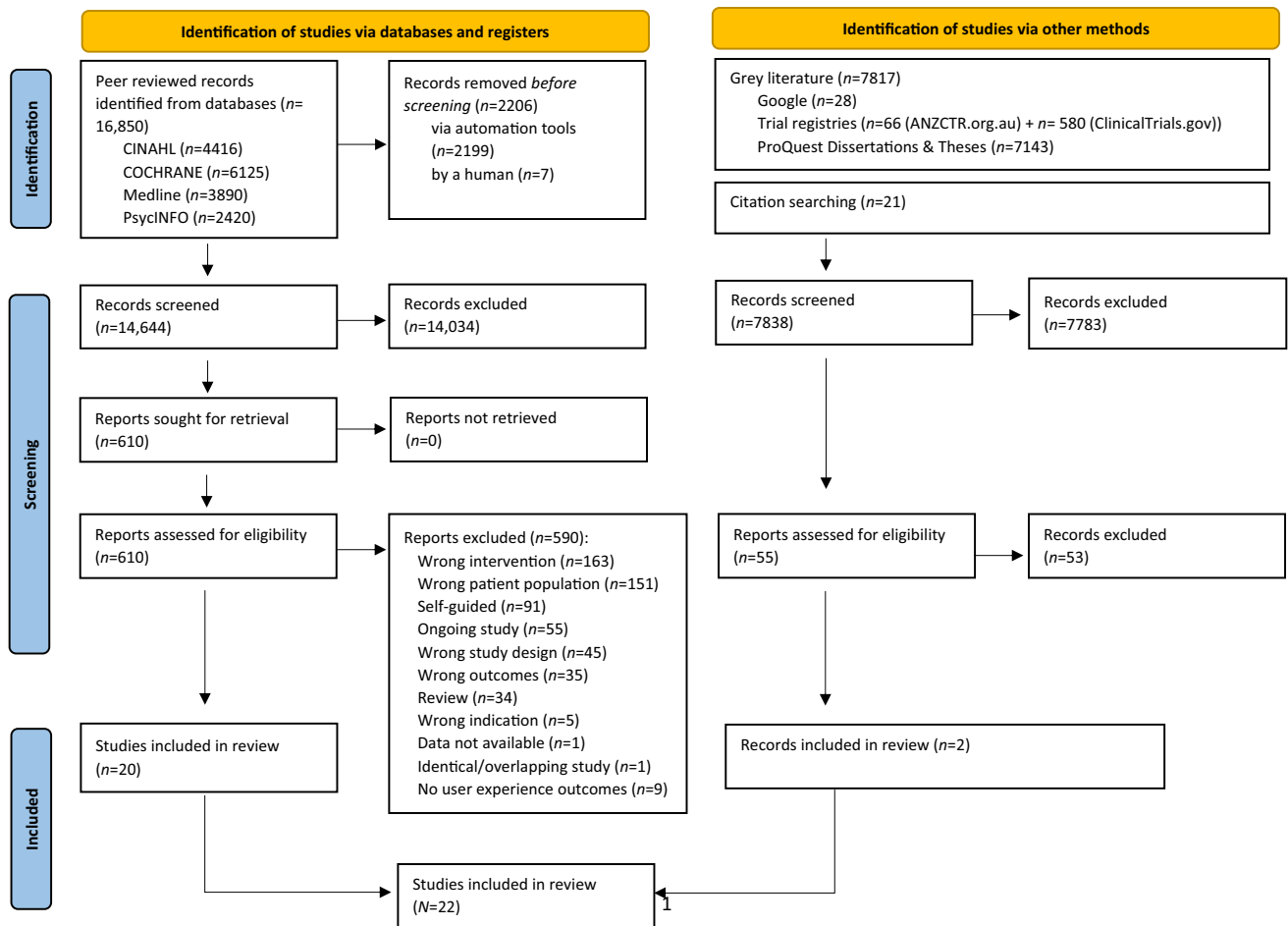


Fig. 1 PRISMA diagram of the phases of the review process and record selection

included, only 23% ($n=5$) reported on gender diverse communities (e.g., non-binary) and/or sexual orientation. No study focused specifically on under-resourced communities or socioeconomic.

Studies were most commonly from the United States ($n=5$, 23%), Canada ($n=3$, 14%), and Netherlands ($n=3$, 14%). Two studies were from Australia, China, Germany, Sweden, United Kingdom (9%, respectively), while one study was from Indonesia (5%).

Participant Characteristics

The included study sample size was highly variable, ranging from 8 to 5568 participants, with a mean sample size of 389. Excluding studies that did not report sample age range ($n=5$), the mean participant age was 20.97 years (range: 12–46). Six studies included only participants aged ≥ 18 years. Study participants were predominantly female, with a mean of 73.40% female participants across

studies. All participants displayed emerging subclinical symptomatology.

Intervention Characteristics

We identified 22 unique brief digital mental health interventions that are guided [entirely or partially; i.e., ACT guide; BREATHE (6-module version); BREATHE (8-module version); BIP Worry; Entourage; ENJOY + Sense-It; ICare Prevent; Inroads; I-BA; iSOMA; Tellmi; MIND; Moodpep; Pocket helper + Purple Chill + Slumber time; RESPOND; Rileks; SilverCloud; Step-by-step; StudiCare-M; SOVA; UniWellbeing; Unnamed ($n=1$)]. These were considered brief interventions as these included less than 12 sessions.

Intervention participation length ranged from 20 days to 12 weeks ($M=7.60$ weeks). The average number of modules per intervention was 6.87 (range: 4–12, $n=22$), and the average number of modules intended to be completed per week

of the intervention was 1.60 (range: 1–6, $n=10$). Of the 22 studies, one study (Harra & Vargas, 2023; 5%) reported on guided interventions, which provided solely human support, while 21 (95%) reported on partially guided interventions that included a combination of human support and self-guided program elements. It was beyond the scope of this review to report on entirely self-guided digital programs. Technology delivery mode was mixed: 10 interventions were web-based, three mobile app-based (Ravaccia et al., 2022; Schueller et al., 2019; Sit et al., 2022; Sun et al., 2022), one via telehealth (i.e., Zoom/videoconferencing software; (Harra & Vargas, 2023), and eight via a combination of delivery methods.

Human guidance was provided via asynchronous methods in 11 studies, and via synchronous contact only in one study. A further 10 studies provided human guidance via a combination of asynchronous and synchronous methods. Mental health professionals were the primary providers of guided intervention content ($n=8$, 38%), followed by clinicians and psychology students together ($n=5$, 24%), and researchers [$n=1$, 5% (O'Connor et al., 2020)]. Peers were the sole human support for three interventions (Harra & Vargas, 2023; Klimczak et al., 2023; Rodriguez et al., 2021). Together, peers and clinicians delivered guidance on two interventions (Rice et al., 2020; van Doorn et al., 2022), while researchers and students together delivered one intervention (Karyotaki et al., 2022). Paraprofessionals provided guidance on one intervention (Radomski et al., 2020) while clinical psychology students provided guidance in another intervention (Garnefski & Kraaij, 2023).

Delivery Method and Intervention Guidance

Web-delivery was the most frequent delivery method for asynchronous interventions ($n=9$) followed by app-based interventions ($n=1$; Ravaccia et al., 2022), and combination-delivered interventions ($n=1$; Hennemann et al., 2022). Solely asynchronously guided support was provided through email ($n=1$; Juniar et al., 2022), SMS/text messages ($n=1$; Peynenburg et al., 2022), and other messaging functions built in to the intervention platform, such as chat functions ($n=7$). Partially asynchronous guided support ($n=10$) was provided through a mix of messaging (within platform or SMS) and phone calls ($n=6$), emails and phone calls/text ($n=1$; Stapinski et al., 2021), phone calls only (Radomski et al., 2020), emails (O'Connor et al., 2020), and other channels such as online support and community newsfeeds ($n=1$; van Doorn et al., 2022).

Eleven studies were delivered solely by an asynchronous intervention, while 10 had both asynchronous and synchronous guidance. Only one intervention was solely delivered synchronously (Harra & Vargas, 2023). Due to limited data,

we reported on effectiveness findings of solely and partially asynchronously guided interventions at the aggregate level.

Personalization

Ten interventions provided some degree of personalized messages or individually tailored content. Interventions were individually tailored according to user's responses to interactive activities (e.g., pre-intervention survey, multiple choice questions, short writing activities, sorting tasks; Klimczak et al., 2023; O'Connor et al., 2020; Peynenburg et al., 2022; Rice et al., 2020) or users' needs and goals (Karyotaki et al., 2022; Rice et al., 2020; van Doorn et al., 2022). Regarding timing and frequency, personalized written feedback was provided within 2 days after session completion (Juniar et al., 2022) or on a weekly basis (Stapinski et al., 2021). In one study (Cook et al., 2019), clinicians sent personalized reminder emails if there was inactivity for more than a week, while another app allowed users to adjust the frequency and the type of notifications received (Van Doorn et al., 2022).

Intervention User Experience Outcomes

Key user experience outcomes of included studies are presented in Table 4. Several validated measures were used for assessing the user experience (User Experience Questionnaire for Internet-based Interventions [UEQII], Radomski et al. (2020); Negative Effects Questionnaire [NEQ-20], Grudin et al. (2022); System Usability Scale [SUS], Juniar et al. (2022); Client Satisfaction Questionnaire [CSQ-8], $n=5$; Credibility Expectancy Questionnaire [CEQ], Kuchler et al. (2023); Inventory for the Assessment of Negative Effects of Psychotherapy [INEP], (Hennemann et al. 2022, Kuchler et al., 2023); and Health Information Technology Usability Evaluation Model [Health-ITUES], (van Doorn et al., 2022)). Unvalidated measures were also employed in 12 studies. In order to better draw conclusions and synthesize the various and heterogeneous measures reported in different studies, the reported measures from each study were mapped to the standardized user experience elements present in Table 2 (useful, useable, findable, credible, desirable, accessible, and valuable) As shown in Table 5, most user experience measures related to usability, satisfaction, acceptance, and helpfulness (Juniar et al., 2022; Radomski et al., 2020; Rodriguez et al., 2021; Wahlund, 2022). However, no study reported on intervention findability, and limited information was reported on desirability and accessibility-related user experience factors (Juniar et al., 2022; Kuchler et al., 2023; O'Connor et al., 2020; Radomski et al., 2020; Rice et al., 2020).

Below, we report on intervention elements or identified factors that were common to interventions reporting positive user experience outcomes (e.g., statistically significant

Table 5 Common intervention elements and associated user experience outcomes

Reported evidence of positive user experience		Reported evidence of negative user experience	
User experience element	Studies	User experience element	Studies
Useful			
Usefulness			
App-based program	van Doorn et al. (2022); Overall HI $M=3.69$ (0.30) indicating moderate usability.		
Automated user notifications	van Doorn et al. (2022); Overall HI $M=3.69$ (0.30).		
Acceptability			
Mixed methods delivery (e.g., app, website)	O'Connor et al. (2020); 93% indicated intervention easy to use and understood all materials. van Doorn et al. (2022); Overall HI $M=3.69$ (0.30), indicating acceptability.	Static web-based content	Radomski et al. (2020); Experience was significantly more positive for BREATHE intervention than static web-based control ($p<0.001$).
Web-based multimedia and interactivity	Garnefski & Kraaij (2023); 60.9% found program 'quite useful'. Most (56.5–73.9%) intended to continue applying the techniques learned in the program. Rice et al. (2020); Youth gave positive intervention feedback with 98.6% reporting they would recommend to intervention to another; 74.4% said Entourage provided timely support; 62.2% said Entourage therapy content relevant to developing social anxiety symptoms control; 77.0% found Entourage at least somewhat helpful. Radomski et al. (2020); Various design elements were reported to facilitate use (e.g., demonstration videos, self-management activities). BREATHE had significantly higher credibility and impact ($p<0.001$), and core items total scores ($p<0.001$) than control.	Integration with existing social media platforms	O'Connor et al. (2020); 5 (36%) agreed the intervention should include social media component, 7 (50%) agreed intervention should be more personalized, and 8 (57%) agreed intervention should include a parent module.
Usable			
Usage/Completion			
Telehealth sessions (e.g., Zoom consultation)	Harra and Vargas (2023); 64.3% of intervention completed all four mentoring sessions.	Built-in custom social media component	Rice et al. (2020); Overall, 25.8% ($n=23$) met the a priori acceptability criteria (logging on to Entourage => 10 times over 10 wks).
		Multiple devices required (e.g., watch, phone, laptop)	van Doorn et al. (2022); Mean system usability score (SUS) was above the cut-off score ($M=63.78$, $SD=10.96$), indicating some usability issues. Half did not use the ENJOY platform ($M=3.63$, $SD=0.46$), indicating that the user-system interaction was not optimal.

Table 5 (continued)

Reported evidence of positive user experience	Reported evidence of negative user experience
User experience element	User experience element
Studies	Studies
Web-based multimedia and interactivity	<p>Garnefski & Kraaij (2023): 23/31 (74.19%) completed program.</p> <p>Grudin et al. (2022): Eight adolescents (73%) and eight parents (73%) in therapist-guided I-BA, and three adolescents (30%) and four parents (40%) in self-guided I-BA had completed all eight chapters by the end of treatment.</p> <p>Karyotaki et al. (2022): Participants completed approximately half of the main 7 sessions of the iCBT intervention (55%).</p> <p>Wahlund (2022): 92% (12/13) followed through with online intervention. Intervention module completion rates high (average completion, 9.8/10).</p> <p>Cook et al. (2019): <i>M</i> completion of 3.46 modules (<i>SD</i>=2.25). 46% compliance (completion of ≥ 4 modules).</p> <p>Henemann et al. (2022): completion rate was high. Participants in the iSOMA-guided group completed significantly more intervention modules on average (<i>M</i>=5.22, <i>SD</i>=2.40), compared to the iSOMA-GoD group (<i>M</i>=4.09, <i>SD</i>=2.75), $t(134.17)=0.69$, $p=0.009$, $d=0.44$.</p> <p>Pesciello et al. (2021): Mean intervention length 89.64 days (<i>SD</i>=67.87; range = 4–475) for SC-ONLY, 96.09 days (<i>SD</i>=133.44; range 3–1036) for SC + TX. On average, SC-ONLY and SC + TX participants used 15% of DHMI or viewed an average of 16.27 pages (<i>SD</i>=17.72; Range 0–101) and used an average of 3.88 tools (<i>SD</i>=4.98; Range 0–41).</p>
Combination-delivered program (asynchronous and synchronous)	<p>Stepinski et al. (2021): 39% of Inroads group completed all five modules, 51% completed ≥ 3 modules, 77% completed ≥ 1 module. There was a dose effect, with symptom change from baseline to follow/u on all outcomes increasing with completion of more online module.</p>
App-based program	<p>Klimczak et al. (2023): Using phone <i>and</i> text coaching as interventions more effective at increasing adherence to ACT Guide vs. standard ACT Guide without coaching.</p> <p>Schuller et al. (2019): 57% (20/35) completed all 3 phone sessions, <i>M</i>=2.09 sessions (<i>SD</i>=1.22). Text messages sent by youth <i>M</i>= 15.06 (<i>SD</i>=12.62) and received <i>M</i>=19.34 (<i>SD</i>=12.70) messages. 48% (11/23) found skills learned beneficial. 43% (10/23) regularly used skills. Intervention length deemed appropriate by most (12/23).</p>
Attrition/Adherence	

Table 5 (continued)

Reported evidence of positive user experience	Reported evidence of negative user experience
User experience element	User experience element
Studies	Studies
Combination-delivered program (asynchronous and synchronous)	<p>Klimczak et al. (2023); Using phone <i>and</i> text coaching as interventions more effective at increasing adherence to ACT Guide vs. standard ACT Guide without coaching.</p> <p>Rodriguez et al. (2021); Youth in MIND+ (vs. MIND) has significantly less attrition and more adherence, as indicated by greater likelihood of completing post assessments (16/27, 59% vs. 7/27, 26%; $\chi^2 1=6.1$; $p=0.01$) and higher course completion (72.6/100, 72.6% vs. 50.7/100, 50.7%; $t(52)=2.10$, $P=0.04$), respectively.</p>
Web-based multimedia and interactivity	<p>Kuchler et al. (2023); GoD participants showed significantly greater follow-up adherence after 6-months.</p>
Engagement	
Web or app-based program	<p>Ravaccia et al. (2022); At T1, 50% of youth had just started and 37% had been using MeToo for ≥ 1 month. At T2, 54% had been using MeToo for ≥ 1 month and 31% had just started.</p> <p>Rice et al. (2020); 1583 total individual system logins from participants ($M(\text{sample})=17.8$; $M(\text{male})=19.9$), high participant usage of Steps modules with 1534 completed in total ($M(\text{sample})=17.2$; $M(\text{male})=14.4$) with an average of 4.2 Actions completed per user ($M(\text{male})=3.9$). Talking Point feature also received substantial engagement, with 80 contributions to these discussions from participants.</p>
Peer counselling	<p>Harra and Vargas (2023); 64.3% of intervention completed all four mentoring sessions, 3 (21.4%) completed 3, 2 (14.3%) complete 2.</p>
Human- or tech-prompted group discussions	<p>Rice et al. (2020); The Talking Point feature also received substantial engagement, with 80 contributions to these discussions from participants.</p>
Valuable	
User satisfaction	<p>Radomski et al. (2020); Intervention use was low ($M=2.2$ sessions, $SD=2.3$; $n=258$). BREATHE users reported DHMI design and delivery factors that challenged use (e.g., time constraints and intervention support).</p> <p>O'Connor et al. (2020); 13 (36%) completed all 8 modules and 2 (6%) complete no modules. Common barriers to intervention completion: difficulty completing exposure activities and remembering / finding time to complete modules, among other life commitments.</p> <p>Radovic et al. (2021); There was limited access to the website due to forgetting on not having time, 50% of adolescents reported they would forget to access the website.</p>

Table 5 (continued)

Reported evidence of positive user experience		Reported evidence of negative user experience	
User experience element	Studies	User experience element	Studies
Web-based multimedia and interactivity	<p>Garnefski & Kraaij (2023); High satisfaction with program ($M = 7.65$, $SD = 0.88$; range 6–9) and coach ($M = 8.48$, $SD = 1.04$; range 7–10). 78.3% would recommend program to others. Most valued telephone coaching (87%) & most would not have preferred another coaching modality (69.6%). For some, another modality preference was video call (17.4%).</p> <p>Juniar et al. (2022); Rated as generally satisfactory.</p> <p>Hennemann et al. (2022); In both groups (internet-based intervention with regular psychologist support), 80% reported high intervention satisfaction. (ISOMA-guided: $M=25.57$, $SD=4.64$; ISOMA GoD: $M=24.12$, $SD=5.20$) and did not differ significantly between group.</p> <p>Karyotaki et al. (2022); 72% ($SD=7.6\%$) rate of satisfaction with the intervention.</p> <p>Peynenburg et al. (2022); High satisfaction (82.3% (158/193) with participants reporting they were 'satisfied' or 'very satisfied' with treatment.</p> <p>Radomski et al. (2020); BREATHE users had significantly higher satisfaction and acceptability ($p<0.001$), than control.</p>	Web-based program (i.e., asynchronous)	Küchler et al. (2023); NS differences in intervention satisfaction between UG and GoD groups.
Combination-delivered program (asynchronous and synchronous)	<p>Schneller et al. (2019); Satisfaction high, with all youth (23/23) indicating they would recommend intervention. 52% (12/23) reported being 'very' or 'extremely satisfied' with intervention.</p> <p>O'Connor et al. (2020); Mean satisfaction score among adolescents was 28.5/40 ($SD=4.0$), indicating modest satisfaction.</p> <p>Sit et al. (2022); Mean satisfaction 7.5 (range: 7–8), regardless of number of completed sessions (range: 3–5 sessions).</p>		
Telehealth sessions (e.g., Zoom consultation)	<p>Harra and Vargas (2023); 4 (11.8%) enjoyed being connected with another, 5 (14.7%) said intervention helped to learn about self and reflect.</p>		
Credible Safety/Privacy			
Telehealth sessions (e.g., Zoom consultation)	<p>Harra and Vargas (2023); 21 (61.8%) appreciated opportunity to express feelings to non-judgmental listener 'e.g., 'I felt safe...'</p>	Web-based program (i.e., asynchronous)	Hennemann et al. (2022); 18% reported one unwanted side effect of treatment (e.g., stigmatization; financial concerns; feeling dependent on partner; difficulty making decisions; longer phases of feeling bad).

Table 5 (continued)

Reported evidence of positive user experience	Reported evidence of negative user experience
User experience element	User experience element
Studies	Studies
Web-based multimedia and interactivity	Integration with existing social media platforms
Grudin et al. (2022); Mean treatment credibility was 14.3 ($SD=2.7$) for therapist-guided I-BA ($n=11$), 14.1 ($SD=3.9$) for self-guided I-BA ($n=9$) and 11.1 ($SD=3.4$) for TAU ($n=8$); Kuchler et al. (2023); Treatment credibility was moderate to high $M=20.36$ ($SD=3.78$; range 0–27) Rice et al. (2020); All participants felt safe and adequately supported by clinicians while using the intervention; Radomski et al. (2020); BREATHE users had significantly higher credibility and impact ($p<0.001$), and core items total scores ($p<0.001$) than control. Experience was significantly more positive for BREATHE than control; they had less concerns about privacy and trusted the information ($ps<0.001$).	O'Connor et al. (2020); 11 (79%) indicating no concerns with privacy.
Desirable	
Desirability	
Combination delivered (synchronous and asynchronous)	Homework content and log-keeping
O'Connor et al. (2020); 13 (93%) indicated intervention easy to use and understood all materials. All liked that intervention was completed online, 11 (79%) indicating no concerns with privacy.	Kuchler et al. (2023); The most frequently reported negative experiences were "I felt forced by the StudiCare training or the e-coach to do exercises that I really didn't want to do at all." Radomski et al. (2020); It was difficult to complete the homework due to time ($n=4$), forgetting ($n=2$), and feasibility issues ($n=2$). Schueller et al. (2019); Participants were less favourable about the IntelliCare apps (Slumber Time and Purple Chill), which involved sleep-tracking components (6/23 or 26% indicating liking them quite a bit or a lot).
Web-based multimedia and interactivity	Web-based delivery
Rice et al. (2020); At post, 74.4% said Entourage provided timely support; 62.2% said Entourage therapy content relevant to developing social anxiety symptoms control; 77.0% found Entourage at least somewhat helpful.	Juniar et al. (2022); Learnability was a challenge ($M=2.88$, $SD=1.27$). Since web-based interventions are relatively new to participants in this country (Indonesia), they had to familiarize themselves with new technical aspects related to the intervention.

Some elements are featured under multiple user experience outcomes with different study subsets

Study-element combinations were included under an outcome only when the study demonstrated some impact on said outcome

ACT Acceptance Commitment Therapy, CBT Cognitive Behavioral Therapy, GoD Guidance on Demand, HI Health Information Technology Usability Evaluation Scale, I-BA Internet-Based Behavioral Activation, iCBT Internet-Based Cognitive Behavioral Therapy, UG Unguided, SC SilverCloud, TAU Treatment As Usual, TX Treatment Only, *t*1 Time 1, *t*2 Time 2, *t*3 Time 3

Table 6 Asynchronously guided intervention user experience effectiveness data

Established evidence of effectiveness	Poor/undeveloped evidence of effectiveness
Solely asynchronous	
Cook et al. (2019); Hennemann et al. (2022); Juniar et al. (2022); Karyotaki et al. (2022); Küchler et al. (2023); Peynenburg et al. (2022); Ravaccia et al. (2022); Rice et al. (2020); Wahlund (2022)	Küchler et al. (2023); Pescatello et al. (2021); Radovic et al. (2021)
Asynchronous and synchronous	
Garnefski & Kraaij (2023); Grudin et al. (2022); Klimczak et al. (2023); O'Connor et al. (2020); Radomski et al. (2020); Rodriguez et al. (2021); Schueller et al. (2019); Sit et al. (2022); Stapinski et al. (2021); van Doorn et al. (2022)	O'Connor et al. (2020); Radomski et al. (2020)

or moderate to high percentages (i.e., > 50–100%) relating to completion, satisfaction) and negative user experience outcomes.

As shown in Table 5, DMHIs were generally found to be more *useful* and *usable* for users when they were app-based, included automated notifications, and incorporated interactive components; and less so when using static web-based content or social media components. *Usability* was also increased when programs included telehealth calls as part of a combination-delivered approach (asynchronous and synchronous), included short modules (30 min or less), and did not require the use of multiple devices. User impressions of program *credibility* were shown to also be improved by the inclusion of telehealth consultations and reduced by the inclusion of social media components. Finally, a strong negative signal was observed in user-reported *desirability* due to the inclusion of homework and log-keeping elements.

Delivery Method

A small number of studies delivered content via a mobile app (Ravaccia et al., 2022; Schueller et al., 2019; Sit et al., 2022), and others received feedback from participants that mobile app delivery would be favorable over web-based delivery (van Doorn et al., 2022). Static online content was associated with a negative user experience (O'Connor et al., 2020; Radomski et al., 2020) when compared with didactic online learning modules. Elements that allowed participants to engage with either their peers or other intervention participants (peer counseling and prompted group discussions) were also associated with positive user experiences, with participants reporting a greater sense of engagement and social connectedness (Harra & Vargas, 2023; Rice et al., 2020). Finally, participants of interventions that involved homework components or log/diary-keeping components commonly reported these aspects as undesirable (Karyotaki et al., 2022; Klimczak et al., 2023; Küchler et al., 2023; Radomski et al., 2020; Schueller et al., 2019).

Asynchronous Guided and Partially Guided Interventions

See Table 6 for a breakdown of effective and poor or yet-established effectiveness data for asynchronously guided interventions. Table 7 details user experience outcomes reported for each study, aggregated by level of guidance and delivery method.

Among asynchronous interventions, all interventions associated with high user engagement provided its users with reminders via emails or text messages after a period of delayed engagement or inactivity (> 1 week, Cook et al., 2019; Küchler et al., 2023; Rodriguez et al., 2021; five, ten, or 20 days, Hennemann et al., 2022). Furthermore, participants reported that regular reminders (i.e., on a weekly basis) were helpful (Hennemann et al., 2022; Peynenburg et al., 2022; Radomski et al., 2020) and associated with significantly greater module completion than interventions that offered irregular reminders (Hennemann et al., 2022). Radovic et al. (2021) found that asynchronously delivered interventions without regular reminders resulted in attrition.

Positive user experience outcomes were associated with asynchronously-delivered interventions that provided motivational and encouraging written feedback (Cook et al., 2019; Karyotaki et al., 2022; Küchler et al., 2023) and personalized or individually tailored messages of support from mental health professionals (Hennemann et al., 2022; Peynenburg et al., 2022; Rice et al., 2020). Similar positive user experiences were linked to receiving timely written feedback, within 24 to 48 hours after module completion (Cook et al., 2019; Juniar et al., 2022; Karyotaki et al., 2022; Küchler et al., 2023; Wahlund, 2022) and automated weekly emails or texts with personalized recommendations (Stapinski et al., 2021). Furthermore, participants reported positive experiences when coaches regularly called to monitor their progress and used motivational interviewing to promote continued participation (Garnefski & Kraaij, 2023). Positive user experiences were also tied to interventions where clinicians adhered to standardized manuals or templates for

Table 7 Studies reporting different user experience outcomes, broken down by guidance delivery and technology delivery method

Guided delivery	Useful			Usable			Desirable			Valuable	Credible	Accessible
	Acceptability	Helpfulness	Safety	Usefulness	Adverse effects	User satisfaction	Completion & adherence	Usability	Usage			
Sync						Harra and Vargas (2023) ^d				Harra and Vargas (2023) ^d		
Async	Rice et al. (2020) ^a	Juniar et al. (2022) ^a	Rice et al. (2020) ^a		Hennemann et al. (2022) ^a Rice et al. (2020) ^a	Hennemann et al. (2022) ^a Juniar et al. (2022) ^a Karyotaki et al. (2022) ^a Küchler et al. (2023) ^a Peynenburg et al. (2022) ^a	Cook et al. (2019) ^a Hennemann et al. (2022) ^a Karyotaki et al. (2022) ^a Wahlund (2022) ^a		Pescatello et al. (2021) ^a Ravaccia et al. (2022) ^b Rice et al. (2020) ^a	Rice et al. (2020) ^a Küchler et al. (2023) ^a Juniar et al. (2022) ^a Peynenburg et al. (2022) ^a Küchler et al. (2023) ^a	Küchler et al. (2023) ^a	Radovic et al. (2021) ^a
Sync & async	O'Connor et al. (2020) ^c	Garnefski & Kraaij (2020) ^c O'Connor et al. (2020) ^c Rodriguez et al. (2021) ^c		Stapinski et al. (2021) ^c		Garnefski & Kraaij (2023) ^c Grudin et al. (2022) ^a O'Connor et al. (2020) ^c Schueler et al. (2019) ^b Sit et al. (2022) ^b	Garnefski & Kraaij (2023) ^c Grudin et al. (2022) ^a Klimezak et al. (2023) ^c O'Connor et al. (2020) ^c Schueler et al. (2019) ^b Rodriguez et al. (2021) ^c Schueler et al. (2019) ^b	van Doorn et al. (2022) ^c	Radomski et al. (2020) ^a Radomski et al. (2020) ^a Radomski et al. (2020) ^a Schueler et al. (2019) ^b Sit et al. (2022) ^b O'Connor et al. (2020) ^c	Radomski et al. (2020) ^a Schueler et al. (2019) ^b Sit et al. (2022) ^b O'Connor et al. (2020) ^c	Grudin et al. (2022) ^a	Grudin et al. (2022) ^a

Studies separated based on web delivery method (^aWeb; ^bApp-based; ^cCombination delivery; ^dTelehealth)

No study reported on the findable element and it was thus excluded from results

Async Asynchronous; Sync Synchronous

Table 8 Intervention user experience outcome effectiveness separated by module/session number

	Established evidence of effectiveness	Poor or yet-established efficacy
Few sessions (≤ 6 sessions)	^a Cook et al. (2019); ^b Harra and Vargas, (2023); ^a Juniar et al. (2022); ^a Peynenburg et al. (2022); ^c Radomski (2020); ^c Sit et al. (2022); ^c Stapinski et al. (2021)	^c Radomski (2020)
More sessions (> 6 sessions)	^c Garnefski & Kraaij (2023); ^c Grudin et al. (2022); ^a Hennemann et al. (2022); ^a Karyotaki et al. (2022); ^c Klimczak et al. (2023); ^a Küchler et al. (2023); ^c O'Connor et al. (2020); ^a Wahlund (2022)	^a Küchler et al. (2023); ^c O'Connor et al. (2020)

^aSolely asynchronous interventions

^bSolely synchronous interventions

^cAsynchronous and synchronous combined

providing written feedback (Cook et al., 2019; Juniar et al., 2022; Karyotaki et al., 2022; Küchler et al., 2023).

Intervention Session Number and Associated Outcomes

See Table 8 for effectiveness based on number of sessions. No studies reported on interventions with only one or two sessions, while only one study included three intervention sessions (Novella et al., 2022). Given the limited number of single-session interventions, we aggregated studies with fewer sessions (3–6 sessions; $n=7$) and compared this to those with 7 or more sessions ($n=8$). When comparing interventions by number of sessions, we found no clear difference in user experience outcomes between studies with fewer than 6 sessions (85.71%, $n=6/7$ showed effectiveness), compared to those with more sessions (> 6 sessions; 75%, $n=6/8$ showed effectiveness).

Discussion

This systematic review sought to identify and examine the available published and unpublished literature, focusing on user experience of contemporary, youth-specific digital mental health interventions (DMHIs) targeting young people with emerging mental health symptoms (i.e., indicated prevention). Emphasis of the review was placed on brief DMHIs that are in full or in part guided by a human support personnel (e.g., peer, clinician).

Findings from the present study indicate that contemporary, technology-aided content delivery methods intended for indicated youth, that provide guided or partially guided support, are beneficial. Results highlighted that a positive user experience was associated with greater integration of these modern delivery methods. We also found that engagement with either peers or other intervention participants through peer counseling and prompted group discussions was associated with positive user experiences, with participants reporting a greater sense of engagement and social

connectedness following DMHI participation. This is in contrast to social media integration, which was shown to negatively impact user experience. Homework or log/diary-keeping components were also often reported as undesirable by intervention participants and associated with negative experiences. Notably, homework or log/diary-keeping activities were similarly associated with negative socioemotional impacts of DMHIs (Opie et al., 2024b; this issue). It was additionally found that guided interventions showed high satisfaction rates, whether the guidance was synchronous, asynchronous, or a mixture. However, disliked elements or areas requiring improvement were typically not explicitly reported on in the examined studies. Synchronous and asynchronous combined interventions were found to have higher completion rates than solely asynchronous guided interventions, with adherence rates varying depending on the delivery method used. Consistent with prior reviews (Garrido et al., 2019; Zhou et al., 2021), we identified that web-based interventions were the most frequent delivery methods, with 48% of all interventions using this delivery mode. This suggests that diversified digital delivery methods could be drawn upon to a greater degree, which may serve to enhance user experience outcomes and broaden reach.

We found that peer engagement enhanced user experience, in line with prior research on older cohorts (Riadi et al., 2022; Saleem et al., 2021). Strong preference for peer interaction has been similarly observed in another systematic review looking at guided and unguided DMHIs in young people (Garrido et al., 2019). Despite this, peer engagement is currently an underutilized resource in DMHIs (Naslund et al., 2020; Suresh et al., 2021). Peer engagement could be a first point of engagement before clinical contact, with benefits including problem normalization, reduced power structures, cost-effectiveness, and accessibility (McGorry et al., 2022). As those working in peer support roles have typically reached a degree of recovery and maintenance during life stages and experiences similar to potential participants (Suresh et al., 2021), this has been shown to enhance client motivation and empowerment (Fortuna et al., 2019).

In the present study we identified that positive user experience outcomes were associated with interventions that provided motivational and encouraging written feedback and personalized or individually tailored messages of support from a mental health professional, in support of the findings of a prior review (Liverpool et al., 2020). Similarly, positive user experiences were associated with the provision of timely written feedback, within 24 to 48 h of module completion and automated weekly emails providing personalized suggestions. Effective asynchronous interventions with high user engagement also provided its users with reminders via emails or text messages after a period of delayed engagement or inactivity. Furthermore, regular reminders (i.e., on a weekly basis) were found to be effective and associated with significantly greater module completion than interventions that offered irregular reminders (Hennemann et al., 2022). The importance of reminders was further implied in another study that showed that interventions without regular reminders resulted in users simply forgetting to access the intervention (Radovic et al., 2021). Although not youth-specific, this is consistent with a prior systematic review wherein guided DMHIs providing automated reminders were associated with enhanced user engagement (Borghouts et al., 2021).

In line with other DMHI reviews (Liverpool et al., 2020; Struthers et al., 2015), completion and adherence rates varied depending on the delivery methods used. DMHIs had high attrition rates, with app-based interventions having the highest attrition, despite being viewed most positively by youth. Attrition rates varied according to digital delivery method, with combination-delivered studies demonstrating the lowest rates of attrition (26.83%), followed by web-based (28%), telehealth-based (29%, $n = 1$; Harra & Vargas, 2023), and app-based interventions (54.67%). These findings align with a previous meta-analysis conducted by Garrido et al. (2019), who reported that drop-out rates exceeding 20% are frequently observed. Importantly, these rates should be considered together with program reach and accessibility. For interventions aiming to reach a large number of young people, app-based interventions may enjoy a greater level of uptake at the expense of greater attrition.

Study findings suggest that investment in contemporary modes of delivery is important for usability and acceptance among young people. This includes the ability for participants to access and engage with content, support, and community through their mobile device via social media accounts, comments sections as onboarding/engagement locations, rather than solely through the web (45%, $n = 10$). This will also allow for additional interactive, rather than static, content, and the personalization of delivered content and delivery mode based on user interactions. However, integration with social media will need to be performed thoughtfully to overcome the challenges it presents with user acceptability and credibility, as shown in Table 5. The

ever-increasing importance of social media in young people's lives mandates the integration of mental health support in these forums and the overcoming of these challenges.

With common integration of online social networks within daily lives, there are opportunities and constraints in using familiar social media patterns within mental health interventions. Early feedback suggests that utilizing existing social media platforms may not be desired by participants due to privacy concerns and social stigma surrounding mental illness. However, the establishment of within-intervention online communities is likely to assist engagement and positive outcomes, and also provides a mechanism for long-term support without clinical burden.

There are a number of trade-offs between improving user experience and optimizing the socioemotional outcomes from interventions. Of note, asynchronous guidance was associated with high user satisfaction, despite commonly appearing in interventions demonstrating fewer positive outcomes for depression (Opie et al., 2024b, this issue). It will be important to strike the right balance in creating a DMHI that is both effective, feasible, and palatable. Similarly, in the present study, app-based content delivery and communication were strongly preferred among the youth cohort despite attrition rates for app-based delivery being higher than alternatives, at 54.67%. Given the importance of both socioemotional outcomes and user experience (including adherence and uptake), intervention designers will need to consider trade-offs like this carefully.

Strengths and Limitations

While the current review has multiple strengths including a comprehensive search strategy, only articles published in the English language were included, which may have omitted some important studies. Moreover, half ($n = 11$) of the included studies recruited participants solely from university students with prodromal mental health concerns. This raises questions about generalizability considering the differing lived experience of many youth sub-populations, who often experience mental illness at higher rates than the general aggregated youth population (Cook et al., 2019; Klimczak et al., 2023; Sit et al., 2022). Considering and validating the unique experiences of broader groups may result in greater user experience outcomes, such as engagement, adherence, safety, and acceptability. One limitation of the current study is that it may have missed including some relevant research on digital mental health interventions (DMHIs). This is because the criteria for study inclusion required that the research report on both user experience outcome *and* a socioemotional outcome. As a result, studies that focused solely on user experience outcomes without addressing socioemotional outcomes may have been excluded.

Future Research

In the future development of guided DMHIs, the principle of *user-centered design* is key. This requires inclusion of consumer, carer, and/or intervention recommenders' input (e.g., mental health professional) throughout all phases of the development of DMHIs. Further research should focus on improving existing DMHIs by including a peer engagement component as it is currently an underutilized resource that could be a first point of engagement before clinical contact, with benefits including problem normalization, reduced power structures, cost-effectiveness, and accessibility. Further research is also required to examine differences in user experience based on module number or DMHI length. Similarly, as there is minimal research relating to single episodic interventions, we recommend exploring single session DMHIs due to their low-cost and efficient nature. The present review identified web-based programs to be the most common intervention platform; however, there was a preference for phone-based app programs (e.g., van Doorn et al., 2022). With this, future research and development projects would ideally update the formatting of these computer-only interventions to be smart-phone friendly to better suit user lifestyles and remove engagement resistance variables. Program construction should be informed by data on app usage, youth preferences and patterns, and social media engagement of target populations when moving from computer to phone-based apps.

Further DMHI research is also required to assess the utility of current interventions for diverse populations, including culturally and linguistically diverse communities, diverse socioeconomic groups, and those based in rural or regional locations. A lack of diversity in study populations limits the generalizability of interventions, highlighting the critical necessity of tailoring programs to diverse populations to account for their unique experience and meet their unique needs. There are clear constraints to methods developed and tested with predominantly white, female university students, particularly addressing findability and engagement factors for high-risk populations in need of these interventions. Further, modifications of existing interventions or the formation of specific digital mental health interventions for diverse populations is required to enhance factors such as engagement, use, relevance, and trust. Once developed, these will require assessments of efficacy.

Implications and Translation

With common integration of online social networks within daily lives, there are opportunities and constraints in using familiar social media patterns within mental health interventions. Early feedback suggests that utilizing existing social media platforms may not be desired by participants due to

privacy concerns and social stigma surrounding mental illness. However, the establishment of within-intervention online communities is likely to assist engagement and positive outcomes and also provides a mechanism for long-term support without clinical burden.

As for the number of sessions, it was difficult to draw any conclusions regarding user's experience and the number of sessions required for an efficacious intervention. While the most common number of therapy sessions a client will attend is one (Young et al., 2012), we did not identify a brief intervention with less than three sessions. This highlights the underexplored potential of single-session or very brief digital mental health interventions for youth that are evidence-based and grounded in science. This is a notable gap in the literature. Interventions should be data-driven and consumer-informed to enhance program uptake and engagement, which in turn will likely enhance clinical efficacy outcomes. Adjunctively, research further tells us that 75% of those who drop out of therapy, on average, after that single session are happy with that one session (Barbara-May et al., 2018; Josling & Cait, 2018; Söderquist, 2018). These results have been observed internationally in Australia, Canada, and Sweden). Importantly, we must hold in mind that these research fundings do not pertain to an online therapy context. However, to date, we do not have such data for the online therapy setting.

Conclusion

This review highlighted several factors that are associated with positive user's experience toward DMHIs including engagement with peers; adoption of modern, technology-aided content delivery methods; and asynchronous mode of delivery. However, while many contemporary digital modes of delivery hold promise, they also present challenges that need to be thoughtfully addressed. The future of DMHIs lies in incorporating user-centered design, prioritizing the needs and preferences of its target audience, and ensuring wise-reaching applicability by catering to diverse populations.

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Declarations

Conflicts of interest None declared.

Ethical Approval Given no human subjects were involved and all data are from secondary research study designs, La Trobe University Ethics approval was not required.

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