The Journey from Non-Immersive to Immersive Multi-user Applications in Mental Health Care: Systematic Review

Iveta Fajnerova, Lukáš Hejtmánek, Michal Sedlák, Markéta Jablonská, Anna Francová, Pavla Stopková

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Abstract

Background: Over the past 25 years, the development of multi-user applications has seen significant advancements and challenges. The technological development in this field has emerged from simple chatrooms, through videoconferencing tools to the creation of complex, interactive, and often multisensory virtual worlds. These multi-user technologies have gradually found their way into mental health care, where they are used in both dyadic counseling and group interventions. However, some limitations in hardware capabilities, user experience designs, and scalability may have hindered the effectiveness of these applications.

Objective: The present systematic review aimed at summarizing the progress made and the potential future directions in this field while evaluating various factors and perspectives relevant to remote multi-user interventions.

Methods: The systematic review was performed based on Web of Science (WoS) and PubMed database search covering articles in the English language published from January 1999 to March 2024 related to multi-user mental health interventions. Several inclusion and exclusion criteria were determined before and during the records screening process performed in several steps.

Results: We have identified 49 records exploring the multi-user applications in mental health care, ranging from text-based interventions to interventions set in fully immersive environments. The number of publications exploring this topic is growing since 2015, with a large increase during COVID-19 pandemic. The majority of digital interventions were delivered in a form of video-conferencing, with only a few implementing immersive environments. The studies utilized professional or peer supported group interventions or a combination of both approaches. The research studies targeted diverse groups and topics, from nursing mothers to psychiatric disorders or various minority groups. Most group sessions happened weekly, or in case of the peer-suport groups, often with flexible schedule.

Conclusions: We have identified many benefits to multi-user digital interventions for mental healthcare. These approaches provide distributed, always available and affordable peer support that can be used to deliver necessary help to people living outside of areas where in-person interventions are easily available. While immersive virtual environments have become a common tool in many areas of psychiatric care, such as exposure therapy, our results suggest that this technology in multi-user settings is still in its early stages. Most identified studies investigated mainstream technologies, such as video conferencing or text-based support, substituting immersive experience for convenience and ease of use. While many studies discuss useful features of virtual environments in group interventions, such as anonymity or stronger engagement with the group, we discuss persisting issues with these technologies, which currently prevent their full adoption. Clinical Trial: N/A

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Results: Clarification of the terminology around multi-user interventions in VR is provided to ensure a clear understanding of the collaborative nature of multi-user applications. We report various parameters for all selected records analysed during the review, providing a synthesis of reviewed sources by means of applied multi-user technologies, intervention methods and target groups, study designs, and outcome measures.

Conclusions: The systematic review focuses on several perspectives relevant to multi-user interventions in mental health care. The first perspective focuses on the environmental elements and user-friendliness of the interface used, as intuitive features could enhance user experience and promote engagement in mental health interventions. The second perspective represents the shift from non-immersive to immersive applications and potential benefits of individual technologies for mental health interventions. Third, the issues related to identity sharing vs. anonymity, and the Proteus effect is considered to provide some perspective for future designers of multi-user VR applications to create a safe and supportive virtual environment. Finally, the current progress in evidence-based therapeutic strategies and interventions in multi-user VR applications will be reviewed to provide the perspective for methodological approach in future studies to ensure effectiveness and positive outcomes and provide valuable support to individuals seeking mental health care using multi-user VR applications.

Introduction

Thousands of studies are exploring self-help apps, which deliver immediate on-demand psychological help to people otherwise waiting on in-person therapy. There are multitude of research projects aimed at exploring the efficiency of online tools or virtual environments in addressing anxiety or affective disorders. However, the majority of the current investigation into technologies and mental health care is focused on single-user experiences. The therapist can be in the room while the patient experiences a phobia-inducing situation, the health care provider suggests a particular mHealth app for the patient to use between the sessions, but most of these apps lack human interaction and contact.

One of the determining factors of effective psychotherapy is establishing a functional relationship between the therapist and the client. In the case of group interventions, the establishment of mutual communication between clients in the group plays a crucial role. But while technological advances have modernized, simplified and increased the availability of therapeutic interventions to people who might have had difficulties in accessing them in the past, the question of the importance of human contact and whether it can be substituted or replaced in online environments is still unclear.

Meanwhile, multi-user tools and virtual environments could actually provide useful intervention programs for a therapeutic dyad or a whole group (three and more participants).

There are tens of thousands of various social groups meeting and supporting each other in various areas related to mental disorders and mental health, such as postnatal depression. People search for peer support not only on social media, but also in various virtual environments, where they form dedicated groups. Such support groups have appeared in many popular video games, such as World of Warcraft, Minecraft or recently in VR enabled social applications, especially VRChat[1].

This review aims to focus on the applications and procedures of mental health care interventions that use such multi-user platforms, where professionals or peers work with clients side by side and which use the technology as a means to connect, not substitute the human contact.

We set off to answer the questions, what has changed in the field of group therapy and remote therapy in the past 25 years, what technologies have been tested and deemed functional, which groups seem to benefit most from such interventions and what new platforms including immersive virtual reality have to offer in future mental health support.

Group therapy and its role in mental health care

Group psychotherapy or group therapy is a form of psychotherapy in which one or more therapists treat a small number of clients together as a group. Group psychotherapy is based not only on the interaction of therapists with a group of patients but also on the interactions between patients or clients themselves.

In the original concept of psychodynamic and interpersonal group therapy, the group dynamics, i.e. relationships and interactions between members and the therapist, is used for therapeutic

purposes. The group context and group process are considered the main mechanism of change by developing, exploring and examining interpersonal relationships within the group.

The term group therapy can also refer to any form of psychotherapy which takes place in a group setting, such as group cognitive behavioural therapy. The therapist may also use other psychological methods such as education and training of specific skills that may not require members to interact with each other.

An even broader concept of group therapy may refer to any helping process that takes place in a group, such as support groups for people with a variety of mental health conditions, skills training groups focusing on improving social skills in people with mental disorders, and psychoeducation groups providing clients information about their disorder and ways of coping.

Group psychotherapy offers several advantages over an individual therapy format. Using group therapy format, more patients can reach the treatment at the same time at a reasonable cost and one therapist may interact with several patients at the same time. This is highly important given the fact that only a small number of psychiatric patients, e.g. those presenting with anxiety symptoms, actually receive adequate psychological care[2], mainly due to high financial costs and low availability of treatment in some countries.

The experience of being part of the group itself could have therapeutic effects, as is the case in self-help or support groups. Other treatment factors specific to group therapy that emerge from the interpersonal setting include feeling connected to the world and being respected and valued by others[3]. Other specific treatment factors were proposed, including vicarious and interpersonal learning, social support, experiencing universality, altruism, fostering hope and a sense of belonging and relatedness[4]. Group therapy may therefore provide a source of corrective relational experiences[5,6].

There are some studies showing an increase in the rating of group therapeutic factors across treatment duration as well as a relationship to treatment outcome for patients with anxiety disorders, although systematic evaluation of these factors is insufficient[7–9].

In more structured therapies, such as group cognitive behavioral therapy (CBT), psychoeducation and learning new skills, such as relaxation, cognitive restructuring, and exposure, are important components for the healing process and symptom management. In group therapy, patients can share their experiences and often find it helpful to meet other people with similar problems. For individuals with social phobia, a group setting can provide opportunities for therapeutic exposure. For some patients, e.g. those suffering from obsessive-compulsive disorder, others may provide usual standards and act as peer models of healthy behaviour.

On the other hand, there are also disadvantages to group therapy. Participants must be willing to share their personal experiences and fears, which they might find difficult. Some patients consider this format challenging to such an extent, that it can prevent their engagement in the group that becomes an obstacle to treatment. The group setting also provides less time and opportunities to deal with individual topics and some patients may feel to be overlooked. Organisation of the group meetings is more difficult and the scheduled time of the group meetings may not be convenient for everyone. Also, managing the therapeutic group requires additional skills and specific training from the therapist compared to individual therapy.

Effectiveness of CBT group therapy is well supported[10]. The results of a meta-analytic review indicated that a promising strategy for reducing anxiety disorder incidence rates can be anxiety prevention group programs[11]. Researchers have not found significant differences between group and individual CBT for treatment of anxiety disorders in adults (e.g. [12,13]), as well as in youths [14,15]. Group CBT was also superior to wait list control groups and/or produced equivalent results when compared to other active treatments, i.e. individual psychotherapy and pharmacotherapy[12,16,17].

The online communication in healthcare – from chatrooms to virtual worlds

The increased use of digital tools has significantly affected how people manage their mental health care. The need for online social support has been gradually rising due to free social media and communication platforms. People look online for information and knowledge about their condition, but they also seek guidance and support from peers and professionals. Over the past 25 years, there has been a remarkable evolution in how people connect and communicate in online spaces in general. The rapid technological development is clearly visible in the transition from text-based chatrooms to videoconferencing that represents a significant shift in the way we interact with others. Current advances resulting in creation of “virtual worlds” and immersive virtual devices provides another crucial milestone. So how have these technologies been utilized in mental health care over the years?

In the late 1990s and early 2000s, online communication primarily revolved around text-based chatrooms. These platforms allowed users to engage in real-time conversations with others who shared similar interests or demographics. However, interactions in chatrooms were limited to text, and there was minimal visual or auditory engagement. This approach has been mostly utilized in a form of peer-support groups and peer-to-peer communities, mostly addressing depression and social support in general (for review see [18]). Chat rooms are even nowadays extensively used in various forms. Social networking sites have gained massive user-bases and advanced tools, presenting an opportunity to deliver online mental health interventions to many people. Review covering application of social networking sites in mental health care[19] pointed out that such an approach, mostly aimed at mental health literacy or specific symptoms (e.g. depression), shows high acceptability and engagement. Despite promising results there is a lack of high-quality evidence supporting its effectiveness.

Voice chats became more prevalent in online spaces during the mid-2000s. Voice added a new dimension to online interactions, enhancing the sense of presence and immediacy in virtual conversations and allowing for some nonverbal communications cues (e.g. voice intonation etc.). Even bigger improvement came in the late 2000s when videoconferencing became available as a means of online communication. Videoconferencing (e.g. Skype, Zoom, and Microsoft Teams) provides a more immersive experience by enabling face-to-face interactions, allowing participants to see each other's facial expressions, gestures, and partially also their body language in real-time. The contact feels more personal, human, it is simple to understand and use, and for these reasons, videoconferencing is a popular platform in healthcare remote group interactions even today. A systematic review of home-based support groups delivered via videoconferencing shows that such an approach is feasible as it can replicate group processes such as bonding or cohesiveness with outcomes similar to in-person groups[20].

Videoconferencing support groups have demonstrated to enable engaging with others with similar problems, improve accessibility to peer groups and development of health knowledge, skills and insights provided during the intervention.

Another significant advance came with the development of "virtual worlds", virtual environments typically created for the needs of the gaming industry (e.g. Second Life, World of Warcraft, Minecraft) enabling not only online communication, but direct interactions in virtual worlds typically using computers. In recent years, a range of Extended Reality (XR) technologies have gained traction, offering even more immersive and interactive online experiences. These immersive technologies include Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR). Immersive VR headsets like HTC Vive and Meta (Oculus) Quest allow users to enter virtual worlds, interact with digital environments, and engage with others in virtual spaces. AR and MR lenses like Pokémon Go and Snapchat overlay digital content onto the real world, blending virtual and physical experiences. Virtual worlds (e.g. Metaverse) in combination with immersive headsets offer novel opportunities for delivering group-based mental health interventions. These technologies can simulate real-life social interactions, provide engaging and interactive experiences, and enhance the sense of presence and connection among participants.

The importance of online multi-user tools and platforms for health care has been further enhanced during the COVID-19 pandemic (beginning to emerge worldwide in 2020) that has exacerbated social isolation and mental health challenges, particularly among various marginalized communities (e.g. elderly, and mothers of newborns, cultural minorities, and people suffering from various psychiatric disorders etc.). These groups often face unique challenges that contribute to feelings of isolation, including limited access to resources, societal stigma, and changes in social support networks. The pandemic has further isolated these populations due to lockdowns, social distancing measures, and restrictions on in-person gatherings. We therefore assume the increased occurrence of tools supporting social communication in mental health care in this period, as the number of XR applications focused on mental health in general has increased rapidly during the pandemic.

Objectives of the systematic review

This systematic review aims to conduct a literature review with regard to the use of online multi-user interventions to support mental health that facilitate communication in dyadic and/or group interventions. The main objective of this review is to systematically explore and interpret evidence about this type of interventions, specifically about their methods and systems (multi-user technologies) applied. The second objective is to evaluate their acceptability, suitability, safety and identify potential gaps and opportunities for future research.

Methods

Review guidelines

This systematic review includes primary sources related to the use of multi-user interventions in the context of mental health care. The review follows the principles of the updated Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA 2020) guideline [21,22].

Search strategy

Several inclusion and exclusion criteria were determined before and during the records screening process. The database search covered articles in the English language published from January 1999 to March 2024 related to multi-user mental health interventions. For the identification of records, the inclusion criteria were established as follows: (1) record should be related to mental health care; (2) intervention should be conducted in two or more people; and (3) the intervention itself should be administered or mediated via digital technology. The opinion papers, research protocols, review papers, and papers without original research were excluded. Two academic database sources, Web of Science (WoS) and PubMed, were used for the systematic review search using the search queries listed in Table 1.

Table 1. Database search queries for records identification.

Database	Search query
WoS	PY=(1999-2024) **AND** TS=((virtual OR digital OR app OR "computer program") **AND** (mental OR psychological OR psychiatric OR depress* OR anxiety) **AND** (therapy OR teletherapy OR psychotherapy OR intervention OR treatment) **AND** (multi-user OR multiuser OR "multi user" OR multi-patient OR multipatient OR "multi patient" OR multi-participant OR multiparticipant OR "multi participant" OR multi-respondent OR multirespondent OR "multi respondent" OR multi-proband OR multiproband OR "multi proband" OR dyadic OR triadic OR collaborative OR cooperative OR "group therap*" OR "group teletherap*" OR "group intervention*" OR "group treatment*" OR "group support*" OR "therapy group*" OR "teletherapy group*" OR "intervention group*" OR "treatment group*" OR "support group*"))
PubMed	(1999:2024[dp]) **AND** (virtual[Title/Abstract] OR digital[Title/Abstract] OR app[Title/Abstract] OR "computer program"[Title/Abstract]) **AND** (mental[Title/Abstract] OR psychological[Title/Abstract] OR psychiatric[Title/Abstract] OR depress*[Title/Abstract] OR anxiety[Title/Abstract]) **AND** (therapy[Title/Abstract] OR teletherapy[Title/Abstract] OR psychotherapy[Title/Abstract] OR intervention[Title/Abstract] OR treatment[Title/Abstract]) **AND** (multi-user[Title/Abstract] OR multiuser[Title/Abstract] OR "multi user"[Title/Abstract] OR multi-patient[Title/Abstract] OR multipatient[Title/Abstract] OR "multi patient"[Title/Abstract] OR multi-participant[Title/Abstract] OR multiparticipant[Title/Abstract] OR "multi participant"[Title/Abstract] OR multi-respondent[Title/Abstract] OR multirespondent[Title/Abstract] OR "multi respondent"[Title/Abstract] OR multi-proband[Title/Abstract] OR multiproband[Title/Abstract] OR "multi proband"[Title/Abstract] OR dyadic[Title/Abstract] OR triadic[Title/Abstract] OR collaborative[Title/Abstract] OR cooperative[Title/Abstract] OR "group therap*"[Title/Abstract] OR "group teletherap*"[Title/Abstract] OR "group intervention*"[Title/Abstract] OR "group treatment*"[Title/Abstract] OR "group support*"[Title/Abstract] OR "therapy group*"[Title/Abstract] OR "teletherapy group*"[Title/Abstract] OR "intervention group*"[Title/Abstract] OR "treatment group*"[Title/Abstract] OR "support group*"[Title/Abstract])

Both queries performed the search in the title, abstract, and keywords of the database records. Specifying keywords in the queries for the term “multi-user” was crucial in order to incorporate studies that use inconsistent terminology. By adding a wide range of alternative keywords – such as “multi patient”, “dyadic”, or “group therapy” – the number of results from the databases dramatically increased. The export from the databases was conducted on 09 April 2024. All records were screened based on the predefined inclusion criteria.

Data selection process and records eligibility

The search returned 2,679 records from the databases (WoS = 1,540; PubMed = 1,139). These were processed by automation tools – 987 were identified as duplicates and 56 were marked as ineligible as they were incomplete or did not fit the publication type criteria (e.g., poster abstracts). This resulted in the number of 1,636 records being moved from the identification phase to the screening phase. The overview of the records selection process is documented in the PRISMA 2020 flow diagram (see Figure 1).

The screening phase consisted of three manually conducted screenings with the help of a self-hosted NocoDB database viewer. The records were assessed by five reviewers consisting of

experienced scientific researchers of our research team. In the screenings 1 and 2, the reviewers read through the abstracts of all records and tagged them with predefined categories based on the inclusion and exclusion criteria. The screening 3 consisted of reading and assessing full-texts of the records. Each screening had its tagging categories that helped the reviewers decide whether the record is eligible or not.

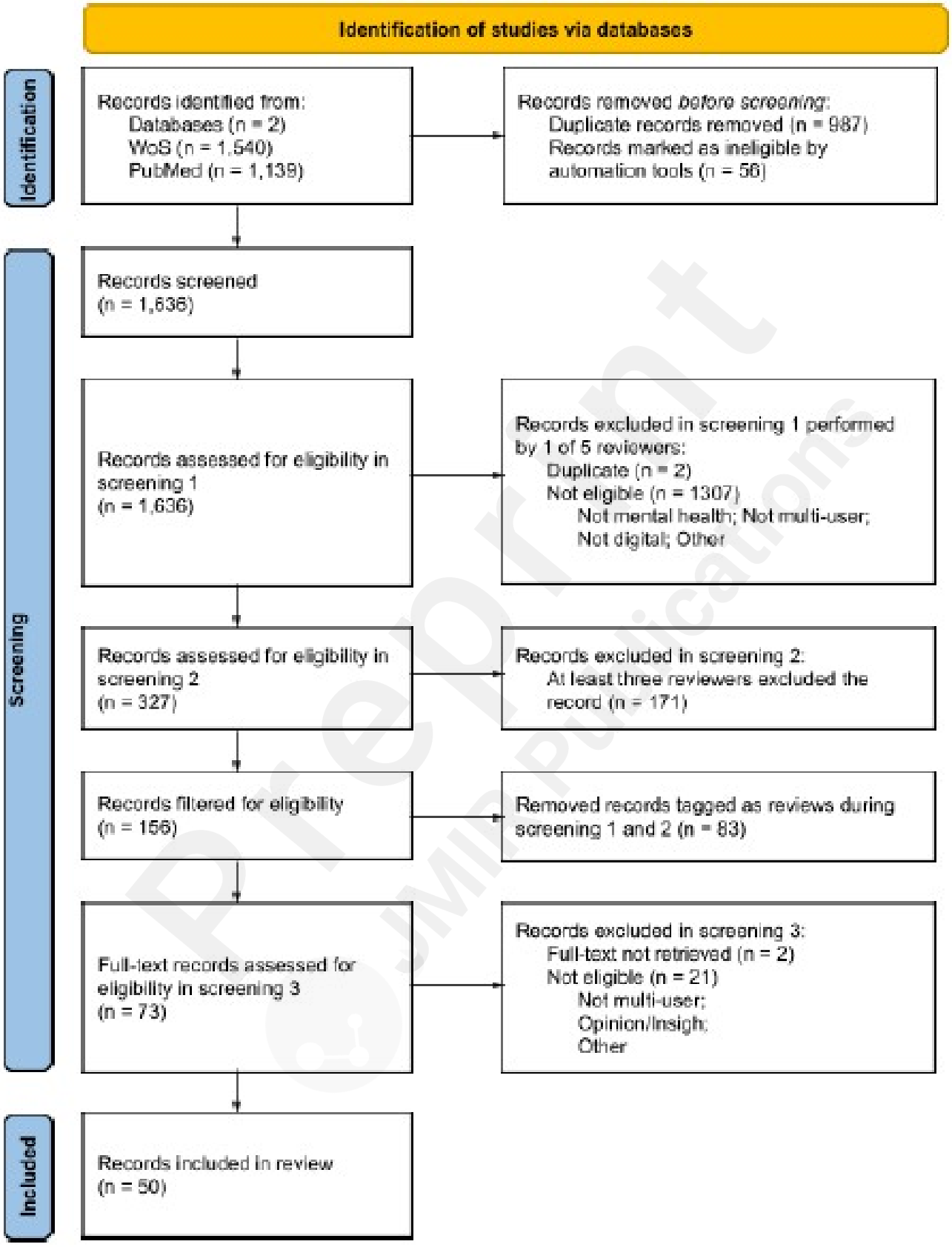
Screening 1 started with 1,636 records and each record was assessed by a single reviewer (from 5 reviewers in total). The listed reasons for excluding the record were if it was not aimed at mental health (e.g. focused on use of technologies in physical therapy), it did not include any multi-user experiences (e.g. use of self-care apps), it was not delivered through digital mediums (e.g. digital medium used for scheduling sessions or data recording, not for therapy), it was discovered to be a duplicate, it was a protocol or an opinion without data or other, unspecified reasons. This process left us with 313 records. This process resulted in the exclusion of 1,309 records.

The screening 2 started with 327 records and each record was assessed by multiple reviewers to achieve objectivity. Every record that was tagged by at least three reviewers as not matching inclusion criteria was excluded. The exclusion criteria were similar as in screening 1; however, to limit the number of records, we also excluded records that dominantly focused on online mental health care in response to COVID-19 pandemic (e.g. in healthy population, students etc.). We also excluded records focusing on secondary caregivers (e.g., peer support groups for parents of psychiatric patients), and interventions utilizing AI chatbots. This resulted in 171 records being excluded.

Before the screenings 3, the number of eligible records was 156. At this moment, we filtered out the 83 records that were tagged during screenings 1 and 2 as being reviews. This resulted in 73 records being moved to screening 3 for further analysis during which every author focused on extracting relevant information through independent full-text reviews. During this process, another 23 records were excluded, most commonly because it was revealed that the intervention was not in fact multi-user or that the record only described opinions or insights of the authors.

In total, 50 records were considered as eligible and proceeded through the screening phase to be included in our systematic review. The full-texts of these records were read and summarized, each by a single researcher, and information about procedures and study designs, means of intervention administration (technology, hardware), target groups, sample sizes, outcome measures and other parameters were extracted.

Figure 1. PRISMA 2020 flow diagram for the overview of the selection process.



Results

Standardization of Terminology

The performed systematic review had to overcome considerable complications related to unclearly defined or not established terminology regarding multi-user online tools. Studies utilizing these technologies adopted very broad terminology based on the context of online platforms used, often referring to virtual environments ranging from simple online forums to virtual worlds. We decided to group these technologies as chatrooms, voice chat, videoconferencing and virtual worlds. The virtual worlds include both low-immersive desktop use up to immersive visualization using VR headsets (see Table 2 and 3). A much bigger challenge was the search for applications that are designed for use by multiple users, allowing communication and interaction. Here the terminology was quite diverse, with the term multi-user appearing only in a few rare cases. Some of the applications refer to communication or collective applications, but most of the records simply refer to group interventions or therapies, which alone made the search strategy very difficult, as the term “group” is often used in connection with the research method (experimental/therapeutic/control group). The search thus required a very laborious elimination of all false-positively selected articles that did not address any group activities. This inconsistency in terminology regarding the term “multi-user” creates a potential negative selection bias when searching for records in the scientific body of knowledge. Despite the elaborated query incorporating many possible variations of the terms used for multi-user technologies, some records could be potentially missed if the research teams used terms not included in our query.

Multi-user technologies in mental health care

The systematic search led to 50 records that present studies aimed at dyadic and/or group interventions. Even though we covered 25 years of progress it is apparent that most of the published works appear after the year 2015 (only two records appear before). This suggests that even though chat rooms and videoconferencing were available for more than a decade sooner, they did not find their way to clinical care as fast as could be expected.

As mentioned before, we were interested both in dyadic interventions, allowing communication between the patient (client) and the professional or peer, and the multi-user interventions allowing interaction of three and more participants. Our search identified 10 studies applying only dyadic interventions (20%), 37 studies using multi-user technologies (74%) and three studies (6%) combining both approaches. Studies presenting multi-user interventions are presented in Table 2, while the list of purely dyadic interventions is presented in a separate Table 3.

Table 2 - Studies using Group digital interventions for 3 and more users

Authors	Year	Title	Multi-	HW	Expert/	Group	Meetin	Target	Sample	Study type	Control	Intervention - short	OutcomeMeasures
Ronen, et al. [31]	2024	Acceptability and Utility of a Digital Group Intervention toe	Text,Vid	Mobile	Peer ,Ex pert	3+	Weekly /	perinatal depression	N=10	Pilot study	0	IMAGINE - Digital Group Intervention to Prevent	Patient Health Questionnaire (PHQ-9), Perceived Stress
Pokowitz et	2024	Mood Lifters for Graduate	Video	Mobile,	Peer	3+	Weekly	the	total 227	mixed	1	Mood-lifters - peer-led	experience with Mood Lifters,
Conroy, et al. [29]	2024	Learning from Adolescents and Caregivers to Enhance	Video confere	Not specified	Expert	3+	Weekly	adolescents (with	total = 33	Qualitative study	0	telehealth Dialectical Behavior Therapy for-	qualitative study focus groups
Penwell, et al. [28]	2024	Traditional versus virtual partial hospital programme for eating disorders: Feasibility and preliminary comparison of effects	Video confere	Not specified	Expert	2,3+	Daily	patients with earing disorders	feasibility study	0	Virtual Partial Hospital Programme (PHP) for eating disorders	Eating Disorder Examination-Questionnaire (EDE and Impairment Scale (OASIS; Norman et al., 2006 The Anxiety Sensitivity Index (ASI; Reiss et al., 1986) The Brief Experiential Avoidance Questionnaire	The Overall Anxiety Severity
Wang, ,et al.,2023	2023	Randomized controlled pilot	Video	Monitor	Peer	3+	Weekly	medical	N=24	RCT	1	peer led remote	State Trait Anxiety Inventory
Brownstone, et al. [26]	2023	Sharing Lived Experience:Video Describing a Virtual Counselor-confere Facilitated LGBTQ plus Support Group for Disordered Eating	Not specified	Monitor	Peer ,Ex pert	3+	Weekly	sexual and gender minority (SGM) individuals with disordered eating	total 27	Quasi experiment al study	0	LGBTQ+ Virtual Support Group for individuals with eating disorders	The survey also included the following open-ended questions: (a) What prompted you to sign up for the LGBTQ+ Support Group?, (b) In what ways has the LGBTQ+ Virtual Support Group supported your eating disorder recovery process?, (c) In what ways has
Hollis, et al [25]	2023	Online remote behavioural intervention for tics in 9-to 17-	Text	Monitor	Expert	2,3+	Unsche duled	children aged 9–17	total 224 participant	RCT	1	online therapist- and parent-supported therapy	The primary clinical outcome was tic severity, secondary
Zimmerman, et al. [24]	2023	Telehealth treatment of patients with major depressive disorder during the COVID-19nce pandemic: Comparative safety, patient satisfaction, and effectiveness to prepandemic in-person treatment	Video confere	Not specified	Expert	3+	Daily	Major Depressive Disorder (MDD)	total = 836 ; virtual interventio n = 294 ; in-person interventio n = 542	report	1	telehealth treatment for- major depressive disorder	2 experimental groups (VIRTUAL treatment vs. IN-PERSON treatment) - compared the effectiveness of partial hospital care of patients with Major Depressive Disorder (MDD)
Gerson, et al [23]	2023	Patients' experiences with virtual group gut-directed	Video confere	Not specified	Expert	3+	Weekly	people with	total = 21	Qualitative study	0	virtual, group-based, gut-directed hypnotherapy-	qualitative study interview

Authors	Year	Title	Multi-	HW	Expert/	Group	Meetin	Target	Sample	Study type	Control	Intervention - short	OutcomeMeasures
Hunt, et al.	2023	South African university	Video	Monitor	Peer ,Ex	3+	Weekly	university	10-12	Qualitative	0	Online Group CBT	qualitative semi structured
Xie, et al. [40]	2023	Building Emotional Awareness and Mental Health (BEAM): an open-pilot and feasibility study of a digital mental health and parenting intervention for	Video confere nce,Text confere nce	Mobile, Monitor	Peer ,Ex pert	3+	Weekly	Mothers with elevated depression scores with	41, dropout to 25 by the end	feasibility study	0	Digital mental health and parenting intervention for mothers of infants	The mHealth App Usability Questionnaire (MAUQ) was used to assess participants' perception of the app usability after program
Wright et al. [39]	2023	A virtual mother-infant postpartum psychotherapy	Video confere	Monitor	Peer ,Ex pert	3+	Weekly	Mothers with a	4-6	feasibility study	0	MOMBABY - live video-based 12-week interactive	Patient-reported clinical symptoms and parenting-
Finnerty,et al.	2023	Online group music therapy:	Video	Monitor	Expert	3+	Weekly	Healthy	15-28	RCT	1	Online group music therapy	Questionnairs: State and Trait
Kruzan, et al. [37]	2022	Use of a Mobile Peer Support App Among Young People With Nonsuicidal Self-injury: Small-scale Randomized Controlled Trial	Text	Mobile	Peer	3+	Unsche duled	young people with NonSuicidal Self-Injury (NSSI)	total =131 ; n = 67 ; control = 64	RCT	1	Talklife - Mobile Peer Support App for Young-People With Nonsuicidal Self-injury	primary outcomes: nonsuicidal self-injury frequency (assessed with self-injury form checklist from NSSI-AT) - nonsuicidal self-injury urges (assessed with two items adapted from Alexian Brothers Urge to Self-Injure Scale) - readiness to change (assessed with the Readiness Ruler)
Mi, et al. [36]	2022	Intraindividual, Dyadic, and Network Communication in a	Text	Mobile	Peer	3+,2 duled	Unsche	addiction recovery	N=268 (complete	Quasi experiment	0	Seva ("selfless caring") - mobile health app for	Actions related to in-system communication were
Ali, etal. [35]	2022	Recruitment, adherence and	Text	Monitor	Peer	3+	Weekly,	young	total 50,	RCT	1	ProYouth OZ - Internet-	Eating disorder symptoms
Mendelson, et	2022	Remote group therapies for	Video	Monitor,	Expert	3+	Weekly	schizophrenia	total 28 (at	feasibility	0	Remote group therapies for	feasibility, acceptability and
El Ayadi, et al. [33]	2022	A Mobile Education and Social Support Group Intervention	Voice confere	Mobile	Peer ,Ex pert	3+	Weekly	new mothers	total 29 participant	feasibility study	0	A Mobile Education and Social Support Group	Intervention feasibility and acceptability
Zaccari, et al. [32]	2022	Synchronous Telehealth Yoga and Cognitive Processing Group Therapies for Women Veterans with Posttraumatic Stress Disorder: A Multisite Randomized Controlled Trial Adapted for COVID-19	Video confere nce,Text	Mobile, Monitor	Expert	3+	Weekly	women veterans with post-traumatic stress disorder (PTSD) secondary	total = 117	RCT	1	Synchronous telehealth yoga and cognitive processing group therapy for women veterans with PTSD	randomized controlled trial (RCT) - measured outcomes of PTSD symptoms and psychophysiological markers of stress - Clinician Administered PTSD Scale for Diagnostic and

Authors	Year	Title	Multi-user	HW	Expert/ Peer	Group size	Meeting	Target Group	Sample	Study type	Control (1=yes/	Intervention - short description	OutcomeMeasures
Fell, et al, [51]	2022	Acceptability of A Virtual Mind-Body Group Intervention for Teen Siblings of Children	Video conference	Not specified	Expert	3+	Weekly	teenage (age 14-17) siblings of	total = 35	mixed methods study	0	Sib-Chat - Virtual Mind-Body Group Intervention for Teen Siblings of Children	quantitative and qualitative post-intervention feedback survey
Dabit, et al. [50]	2021	Improving social functioning in people with schizophrenia-spectrum disorders via mobile experimental interventions: Results from the CLIMB pilot trial	Text,Video conference	Mobile	Peer	3+	Weekly	patients with Schizophrenia Spectrum Disorders (SSD)	total = 24 ; intervention = 12 ; control = 12	Pilot study	1	mobile experimental interventions for social functioning improvement in people with schizophrenia-spectrum disorders	primary outcome: - Social Functioning Scale (SFS) secondary outcomes: - abbreviated Quality of Life Scale (aQLS)
Abedishargh, et al. [49]	2021	Effectiveness of Internet-Based Cognitive Behavioral Therapy in Weight Loss, Stress, Anxiety	Video conference,Voic	Mobile	Expert,Peer	3+	Daily	Obesity - depression, anxiety and	N=90 - ICBT experimen	RCT	1	ICBT (Internet based CBT) virtual group for stress, anxiety and depression in	the Depression Anxiety Stress Scale (DASS) and BMI
Yeshua-Katz [48]	2021	The Role of Communication Affordances in Post-Traumatic Stress Disorder Facebook and	Text	Mobile, Monitor	Peer	3+	Unscheduled	military veterans with PTSD	total = 34	Qualitative study	0	Online support groups (OSGs) for military veterans with PTSD	qualitative in-depth interviews and survey methods
Craig, et al. [47]	2021	Adapting Clinical Skills to Telehealth: Applications of Affirmative Cognitive-	Text,Video confere	Not specified	Expert	3+	Weekly	LGBTQ+ youth	NA	Qualitative study	0	AFFIRM - CBT 8-session group intervention designed for LGBTQA+ youth	case study
Craig, et al. [46]	2021	AFFIRM Online: Utilising an Affirmative Cognitive-Behavioural Digital Intervention to Improve Mental Health, Access, and Engagement among LGBTQA plus Youth and Young Adults	Video conference,Text	Monitor	Expert,Peer	3+	Weekly	LGBTQA+ youth and young adults	6–14	Quasi experimental study	0	AFFIRM - CBT 8-session group intervention designed for LGBTQA+ youth	Brief COPE Inventory The 21-item Beck's Depression Inventory-II (BDI-II] The Stress Appraisal Measure for Adolescents (SAMA) The 12-item Hope Scale (HS)
Strand, et al. [45]	2020	Combining online and offline peer support groups in community mental health care	Text	Monitor	Peer	3+	Unscheduled	various psychiatric diagnoses	total 14	Qualitative study	0	ReConnect - Internet-based peer support portal for people with long-term	open-ended questions on recovery processes (focus groups)
Tsai, et al. [44]	2020	Effects of a smartphone-based videoconferencing program for older nursing home residents	Video conference	Mobile	Expert,Peer	3+	Unscheduled	nursing home residents	total 62, the interventio	Quasi experimental study	1	smartphone-based videoconferencing program for older nursing home	feelings of loneliness, depressive symptoms and quality of life
Robinson-Whelen, et al., [43]	2020	Promoting psychological health in women with SCI: Development of an online self-esteem intervention	Virtual World	Monitor	Expert,Peer	3+	Weekly	spinal cord injury (SCI)		RCT	0	self-esteem intervention in the form of real-time group sessions in Second Life - a free online virtual world	We included three subscales (7-item Interpersonal Support, 13-item Spiritual Growth/Self-actualization, 7-item Stress Management) from the Health Promoting Lifestyle Profile-II (HPLP-II)2
Vogel, et al. [42]	2019	Smoking Cessation Intervention Trial Outcomes for Sexual and Gender	Text	Not specified	Peer ,Expert	3+	Daily	smokers (addiction)	N=500 (251 = interventio	RCT	1	Smoking cessation intervention using Facebook groups	articipants reported their smoking status and other health risk behaviors at

Authors	Year	Title	Multi-user technology	HW	Expert/ Peer	Group size	Meeting Frequency	Target Group	Sample	Study type	Control (1=yes/ 0=no)	Intervention - short description	OutcomeMeasures
Sawyer, et al. [61]	2019	The Effectiveness of an App-Based Nurse-Moderated Program for New Mothers With Depression and	Text	Mobile	Expert	3+	Unscheduled	new mothers with depression	total 133 (standard care 61, interventio	RCT	1	eMums Plus - App-Based Nurse-Moderated Program for New Mothers With Depression and Parenting	Primary outcomes were the level of maternal depressive symptoms, quality of maternal caregiving, the
Campbell et al. [60]	2019	A Customized Social Network Platform (Kids Helpline Circles) for Delivering Group Counseling to Young People	Text	Mobile	Expert	3+	Unscheduled	young people experiencing family	105 participants responded	Exploratory study	0	Kids Helpline Circles - A Customized Social Network Platform for Delivering Group Counseling to Young	social support, anxiety and depression level, self-esteem, qualitative questions on user experience, perceived
Tait, et al.[59]	2019	A Digital Intervention Addressing Alcohol Use Problems (the Daybreak Program): Quasi-Experimental	Text	Mobile, Monitor	Expert,Peer	3+	Unscheduled	individuals with alcohol-related	398 people in the intervention group	Quasi experimental study	1	the Daybreak Program: A Digital Intervention Addressing Alcohol Use Problems	The primary outcome was change in alcohol risk, other outcomes included the number of standard drinks
Granado-Font, et al. [58]	2018	Coping Strategies and Social Support in a Mobile Phone Chat App Designed to Support Smoking Cessation: Qualitative	Text	Mobile	Peer ,Expert	3+	Unscheduled	smokers during first 3 months of the	total = 102	Qualitative study	0	Tobbstop app - Mobile Phone Chat App Designed to Support Smoking Cessation	descriptive qualitative study - content analysis of text messages posted to the chat - aimed at the emotions
Galliers, et al. [57]	2017	Experiencing EVA Park, a Multi-User Virtual World for People with Aphasia	Virtual World	Monitor	Expert	3+	Daily	people with aphasia	N=20	Quasi experimental study	0	EVA Park, a Multi-User Virtual World for People with Aphasia	interactions in the virtual world (coding exercise), video recordings (participant interacting with EVA Park
Knowles, et al. [56]	2017	A pilot study of virtual support for grief: Feasibility, acceptability, and preliminary outcomes	Text,Virtual World	Virtual reality	Expert	3+	Weekly	widow(er)s	total 30, 18 adults participated in the VR	feasibility study	1	virtual support for grief in Second Life	The Geriatric Depression Scale, The Yearning in Situations of Loss, Sleep Quality Index, Loneliness
Carolan et al. [55]	2017	Increasing engagement with an occupational digital stress management program through the use of an online facilitated	Text	Mobile, Monitor	Peer ,Expert	3+	Unscheduled	working people - y. This study compares	84 individuals	RCT	0	WorkGuru - CBT web-based stress management intervention	engagement wellbeing at work IWP dass-21
Nosek,et al. [54]	2016	An Internet-Based Virtual Reality Intervention for Enhancing Self-Esteem in Women With Disabilities: Results of a Feasibility Study	Virtual World	Not specified	Expert	3+	Weekly	women with disabilities	total = 19	feasibility study	0	self-esteem 7-session interactive group intervention in SecondLife, using avatars with voice and text communication	pre- and postintervention questionnaires on feasibility - Rosenberg Self-Esteem Scale (RSE) + Hudson Index of Self-Esteem (ISE) - Center for Epidemiologic Studies Depression Scale 10
Bohleber, et al. [53]	2016	Can We Foster a Culture of Peer Support and Promote Mental Health in Adolescence Using a Web-Based App? A	Text	Mobile	Expert,Peer	3+	Unscheduled	adolescents in switzerland		Quasi experimental study	1	The Companion App - Web-based app giving adolescents access to a peer mentoring system and	Trier Inventory of Chronic Stress Satisfaction with social support (Fragebogen zur
Lemma and Fonagy[52]	2013	FEASIBILITY STUDY OF A PSYCHODYNAMIC ONLINE GROUP INTERVENTION FOR DEPRESSION	Text	Not specified	Expert	3+	Unscheduled	depression	N=24 randomly divided into 2	feasibility study	1	Online Group Dynamic Interpersonal Therapy for depression	the Patient Health Questionnaire (PHQ-9); the Generalized Anxiety Disorder Scale (GAD-7)

Table 3 - Studies using Dyadic digital interventions

Authors	Year	Title	Multi-user technology	HW	Expert/ Peer	Group size	Meeting Frequency	Target Group	Sample size	Study type	Control (1=yes/ 0=no	Intervention - short description	Outcome Measures
Schefft, et al. [71]	2024	Evaluation of the internet-based intervention Selfapy in participants with unipolars	Text, Voice conference	Mobile	Expert	2	Weekly	depression	N=401	RCT	1	Selfapy - internet-based intervention for depression	Quality of life The WHOQOL-BREF
Li and Yip [70]	2023	Remote arts therapy in collaborative virtual environment: A pilot case	Virtual World	Virtual reality	Expert	2	Weekly	unspecified people with higher stress	-N=3	Qualitative study	0	Remote arts therapy in collaborative virtual environment Unity	Percived Stress Scale, The Warwick-Edinburgh Mental Wellbeing Scale,
Arakawa, et al. [69]	2023	Effectiveness of mHealth consultation services for preventing postpartum	Video conference, Voice	Mobile	Expert	2	Unscheduled	pregnant women	total 734, mHealth group	RCT	1	emotional support related to pregnancy and childcare delivered through the LINE	Risk of elevated postpartum depressive symptoms; self-efficacy,
Bozkurt and Cesur [68]	2023	The effect of the Ebe Evimde application on the self-efficacy and anxiety	Video conference	Mobile, Computer	Expert	2	Unscheduled	mothers in the second to fifth; postpartum	total = 120 intervention	RCT	1	Ebe Evimde (My Home Midwife - web-based software to use in the postpartum period (self-	pretest and posttest of self-efficacy and anxiety Postpartum Specific
Yeo, et al. [67]	2023	A Digital Peer Support Platform to Translate Online Peer Support for Emerging	Text conference	Not specified	Peer ,Expert	2	Unscheduled	Emerging adulthood (19 - 25 years)	2	RCT	1	Acceset - a stand-alone digital peer support platform that uses a digital text-based intervention	Rosenberg Mattering Scale. General Anxiety Disorder
Crowell, et al. [66]	2020	Mixed Reality, Full-Body Interactive Experience to Encourage Social Initiation for Autism: Comparison with a Control Nondigital Intervention	Virtual World conference	Virtual reality	Peer	2	Once	children with ASD	two children playing	Quasi experimental study	0	Lands of Fog - a Mixed Reality system with full body interactive environment created to foster social and collaborative behaviors in	Social Initiation EDA, HRV Anxiety (STAI) CBCL Collaborative Actions
Shorey and Ng, [65]	2019	Evaluation of a Technology-Based Peer-Support Intervention Program for	Text, Voice conference	Mobile	Peer	2	Weekly	mothers at risk of depression	20 mothers at risk of	Qualitative study	1	Technology-Based Peer-Support Intervention Program for Preventing Postnatal	A qualitative semistructured interview focused on postnatal
Topooco, et al [64]	2019	Evaluating the Efficacy of Internet-Delivered Cognitive Behavioral Therapy Blended With Synchronous Chat Sessions to Treat Adolescent Depression: Randomized Controlled Trial	Text conference	Computer	Expert	2	Weekly	adolescents with depression	total = 70	RCT	1	ICBT (internet-delivered intervention for adolescent depression	Beck Depression Inventory-II at posttreatment secondary outcomes: - Mood and Feelings Questionnaire (MFQ - Beck Anxiety Inventory (BAI - Social Interaction Anxiety Scale (SIAS
Shorey, et al. [63]	2019	Evaluation of a Technology-Based Peer-Support Intervention Program for,	Video conference, Text,	Not specified	Peer	2	Unscheduled	Mother succeptible to postnatal	2 trained peer and a mother	RCT	1	technology-based peer-support program for mothers 4 weeks postpartum	Edinburgh Postnatal Depression Scale
Depp, etal. [62]	2010	Mobile Interventions for Severe Mental Illness Design and Preliminary Data From	Text	Mobile	Expert	2	Daily	bipolar disorder or schizophrenia	9	Open Trial	0	Mobile interventions for severe mental illness	qualitative feedback

As our primary focus is on multi-user technologies allowing the interaction between 3 and more participants, the further reports will be relevant for the 40 studies which incorporated more than 3 people interacting with each other (see Table 2), excluding the purely dyadic interventions, to avoid the confusing overlap in interventions combining both approaches.

In terms of the hardware devices used, the majority of the reviewed studies were performed online using mobile phones (n=18, 36%) or computers (n=17, 34%), or did not specify devices used by the target population (n=11, 22%). Importantly, only one study used VR headsets.

In means of technological tools the reviewed studies utilized various multi-user platforms. Text form of communication (Chat rooms, social network groups, forums) were used in the 24 studies (48%), voice chat without video was used in 2 studies (4%), videoconferencing in 21 studies (42%) and the most advanced technology of virtual worlds was used only in 4 studies (8%). The proportion of multi-user technologies utilized is comparable in professional-led vs. peer-supported interventions (chat rooms 44.2% vs 51.4%, voice chat 7.7% vs. 10.8%, video conferencing 38.5% vs. 32.4%, or virtual worlds 9.6% vs. 5.4%). Even though there is some trend towards chat rooms in interventions with peer support, the review results do not suggest any preference towards specific multi-user technology based on this parameter.

In means of frequency, the online interventions allowed variable, both synchronized and asynchronous group interventions, in some cases combining multi-user or dyadic approaches with self-help mHealth applications. We therefore refer only to the frequency of multi-user or dyadic interventions specifically. These were provided either on daily bases, (n=5, 10%), weekly (n=21, 42%), or in an unscheduled or asynchronous manner allowing the participants to connect at any time point (mostly in case of support chats, n=15, 30%).

Clinical methods and measured outcome

Most of the studies aimed at peer support groups and stress reduction in different age and target groups. Larger portion (64%) of the reported interventions were led by a professional (typically clinicians, psychotherapists, facilitators or coaches n=32 for multi-user, n=7 for dyadic). Smaller portion (46%) of interventions allowed peer support (n=23 for multi-user, n=4 for dyadic) that was in some studies combined with expert-led interventions (n=16).

When led by professionals, the reviewed interventions typically applied CBT interventions adapted for online group therapy or other approaches like dialectic behavioural therapy, art therapy or hypnoses. The peer support groups typically focused on parenting, addiction and stress reduction methods.

The study designs used in the reviewed records were mostly RCT (n=19), pilot feasibility studies (n=11), quasi experimental studies (n=8) and qualitative research (n=8). Two of the studies combined quantitative and qualitative approaches (mixed methods) and two other studies were in the form of reports or exploratory studies.

The reviewed studies focused on various categories of target groups (similar for multi-user and dyadic) while addressing topics relevant for these groups. These included pregnant women or mothers of new-borns (parenting, self-esteem or self-efficacy), adolescents, young adults and university students (prevention, stress reduction), patients with eating disorders, depressive

patients and patients with post-traumatic stress disorder (psychoeducation and symptom reduction), patients with addiction disorders (e.g. smoking cessation), and less represented target groups that included minorities (LGBTQA+), patients with psychotic disorders (recovery), and children with autism spectrum disorders (training of social interactions).

The sample size across studies goes from 3 to hundreds of participants depending on the type of the study (qualitative vs. quantitative). The size of different intervention groups also varies, but in the majority of studies, the intervention groups led by a professional included 5 to 10 participants present synchronously. When the intervention was asynchronous, or only peer support was provided, the group size was not always specified or corresponded to the size of the whole sample.

Regarding outcome measures used, the majority of multi-user and dyadic studies used scales for depression and anxiety, social support, self-esteem and coping, and a variety of stress measures (including physiological markers) and health scales. Some of the studies used in addition (or as a main tool in the case of qualitative studies) qualitative interviews with participants. Feasibility studies often included measures on engagement and acceptability of tested interventions (user experience).

Discussion

Pros and cons of online multi-user interventions

New technologies allowing multi-user communication and interaction offer innovative solutions for delivering mental health care remotely. They play a crucial role in addressing social isolation and mental health disparities by providing accessible, culturally sensitive, and innovative group-based mental health care to be conducted online, while overcoming barriers related to geographical distance and mobility.
Overall, the technological innovations leading to transition from chatrooms (incl. social network sites) to voice chat, videoconferencing and later to immersive virtual environments, reflects the ongoing evolution of online communication technologies, driven by advancements in internet connectivity, software development, and user demand for richer and more engaging virtual interactions with other human subjects. This is also reflected in the utilization of multi-user technologies in clinical research focused on mental health reviewed in this paper.

The above reviewed technologies enable various forms of mental support, ranging from general peer support groups, through peer-led interventions up to therapist-led group therapy sessions that provide a convenient and accessible alternative to traditional in-person services. Online interventions utilizing freely-available tools or existing mHealth applications typically require fewer resources than in-person meetings, making them more affordable for organizations and participants alike.
Online therapy meetings also eliminate geographical barriers, allowing people from different locations to connect easily. Participants can join group sessions from the comfort of their homes, making it more convenient for patients, while eliminating transportation barriers (e.g. rural environments, elderly, physical disability), overcoming other limitations and stressors created by the mental conditions that should be addressed in the therapy (e.g. agoraphobia or social phobia). This explains why many of the reviewed research studies report good acceptability and usability(e.g. [31,33,51]) of these technologies in the target populations,

potentially increasing the adherence of patients. By leveraging these technologies, mental health care providers can bridge the gap in access to services and support the well-being of these underserved populations.
Moreover, it was suggested that online group-based interventions and support groups foster a sense of community and peer support, allowing participants to connect with others who share similar experiences and challenges. Peer-led support online groups can be especially beneficial, providing a safe space to share experiences, exchange coping strategies, and receive validation and encouragement from peers as needed.
Online platforms can be designed to meet the cultural and linguistic needs of minority populations, offering support groups and therapy sessions facilitated by professionals who understand their unique experiences and backgrounds. Culturally sensitive interventions[46,47] can help reduce stigma and increase engagement in mental health care among marginalized communities.

Despite many positives, several disadvantages experienced by the participants should be considered. The most crucial factor in means of group interventions is the limited non-verbal communication, as online meetings often lack the richness of face-to-face interactions, and participants miss out on many non-verbal cues such as body language and facial expressions. In addition, building rapport and fostering a sense of togetherness can be more challenging in virtual space compared to in-person interactions due to additional factors. As the meetings are often performed from home environments, participants may be also more prone to distractions, leading to decreased engagement during the social communication (e.g. in videoconferencing). Another challenge is represented by the technical issues that may occur during the online intervention. Connectivity problems, audio/video glitches, and other technical difficulties can easily disrupt the flow of online meetings and hinder effective communication.

Increasing Immersion in Multi-user Interventions

Despite a certain delay, it is evident that with the gradual advancement of technological innovations aimed at multi-user interactions, these tools are slowly making their way into mental health care. This is also apparent from results of our systematic review, demonstrating that over the years the reviewed studies show a gradual progress in utilized technologies. Based on our findings, chatrooms and videoconferencing still represent the most prevalent multi-user technologies used in research studies focused on mental health care performed in groups. The popularity of chatrooms is relevant also in current studies, despite their apparent disadvantages (such as nonverbal cues limited to emoji's). This is probably due to their simple design and ease of use. They allow both synchronized and asynchronous communication protocols, making it more feasible and beneficial especially in design protocols where self-care methods and psychoeducation tools are combined with support from peers or a professional[58]. However, purely text-based online support does not make use of many important features of interventions taking place in groups communicating directly, mostly in the form of videoconferences.
Videoconferencing provides a higher quality of communication in group settings. In addition to the spoken word (elements of vocal expressions available also in voice chat), it also provides non-verbal cues relevant for effective communication such as facial expressions or hand gestures. These factors may increase the level of interactions and sense of presence, especially due to the synchronized communication model. However, it could be argued that the fact that each person is sitting in a different place during the video call, could create a barrier in the

communication (e.g. distractors present in the surrounding environment, various environmental contexts). Moreover, videoconferencing usually provides a screen representation for each of the connected participants in separate windows, thus creating a separate space representation for each participant. This could potentially lead to problematic situations during group communication, as some communication aimed at a specific person may not be correctly directed and understood, because we cannot look through the screen directly at the person we are talking to in the group. These limitations could create potentially significant drawback related to a sense of presence.

In contrast, more complex multi-user VR environments (virtual worlds) enable us to create a common space that the participants share in the same moment providing a more immersive experience than traditional videoconferencing, allowing for a greater engagement. Virtual worlds offer the potential for more naturalistic social interactions, including spatial sound and visible gestures, which can enhance the sense of being together. This may potentially increase the feeling of togetherness and thus provide experience similar to the one provided in face-to-face group settings. These potentially beneficial features of VR could play a crucial role in the effective communication in groups and should be therefore addressed in more detail in future studies.

In addition, VR worlds (e.g. Second Life) allow participants to customize their avatars (e.g. receiving personal objects such as jewellery or clothes as rewards for completing tasks and goals and shared environments (e.g. dim the lights for relaxation exercises, teleport to other venues), fostering their creativity and self-expression that could occur during in-person interactions[54]. The professional or peer moderating the group session may have better control over the content and dynamics of virtual meetings, enabling them to create safe and supportive environments for targeted participants.

Some constraints should be however considered in VR interventions, mainly due to technical demands, as virtual worlds may require specialized hardware and software to access them. These technical requirements could be a barrier for some individuals and are probably also the reason why the VR interventions are yet not so frequently used in clinical settings despite many other advantages. Entering the virtual worlds does not require a VR headset in general, as it can be presented on a traditional computer screen, at the expense of a lower immersion level.

In contrast, highly immersive virtual devices could enable stimulation through multiple sensory modalities, by incorporating features such as haptic feedback, spatial audio, and realistic environmental elements, that can further enhance immersion and user engagement that could be addressed in future clinical studies. Immersion in the context of multi-users VR interventions could enhance social interactions and collaboration among participants. By creating shared virtual spaces where users can interact and engage with each other, multi-user VR applications can foster a sense of community and support among individuals seeking mental health interventions.

Anonymity in Online MH Interventions

Beyond already mentioned pros and cons, there are some security concerns, as online meetings may be vulnerable to privacy breaches and security threats, especially when using commercial software without adequate safeguards in place. On the other hand, the online multi-user interventions allow anonymous interactions that represent a significant factor potentially affecting the experience of interacting individuals and intervention outcomes. In some cases, participants may feel more comfortable sharing personal experiences or concerns in an online setting where they can maintain anonymity. This can be achieved more or less in all above

listed multi-user platforms, but it also might present a challenge. While chat rooms can be easily anonymized, videoconferencing promotes more personal interactions. Even though some anonymity can be achieved by confidentiality of names and other personal information, the face and voice of the participant are usually shown during the intervention, making it more comparable to in-person interactions. However, this factor allows the participants to interact and observe also some non-verbal cues (face expressions and some gestures, but body posture is usually not visible) during the videoconferencing. Virtual reality simulations combine some of the advantages of the above listed methods. Utilization of virtual avatars the participants choose in the virtual environment, allows them to stay anonymous. In case a full body avatar is used, even the body posture and hand gestures can be replicated in the virtual scene. Some current VR headsets, such as Meta Quest Pro or Vision Pro, also allow recognition and replication of face expressions and eye movements (gaze direction, blinking), which could represent a very important feature in future virtual multi-user interventions and has been already implemented in popular social apps, such as VRChat[1].

Importantly, the Proteus effect should be also considered in multi-user VR interventions. This phenomenon relates to the behaviour of an individual, present in virtual worlds that mimics the characteristics of the virtual avatar chosen. This effect is based on the individual's knowledge about what other users who are part of that virtual environment typically associate with the characteristics represented by this avatar. This factor could have both beneficial effects (e.g. in increasing self-confidence and courage) and negative influence on the behaviour of the participant (e.g. an increase in antisocial behaviour towards other members of the group), and should be therefore always considered in future utilization of VR avatars in multi-user clinical interventions.

Limitations

The main study limitation is in the synthesis of the selected records. The above reported variability of target groups, study designs, methods and outcome measures used in the reviewed records prevents us from a more rigorous synthesis of the reported studies, which are not mutually comparable. As our main objective was to address the rate of occurrence or popularity of multi-user digital interventions for mental health care, we did not focus in detail on the efficiency of individual applications and synthesis of their clinical outcomes.
Another limitation is related to the query used for database search of the selected records. The inconsistency in terminology used in the reviewed articles particularly in context of "multi-user" technologies creates a potential negative selection bias that could create a gap in publications that are using different terminology not covered by the authors of this review.

Conclusions and future directions

Overall, while online group meetings and virtual worlds offer unique advantages and opportunities for connection, they also present challenges that must be addressed to ensure effective communication and engagement during group interventions. Balancing the benefits of accessibility and convenience with the limitations of technology and social interaction remains a key consideration in leveraging these platforms for mental health support and peer mediation.
As technology continues to evolve, we can expect further innovations in how people connect and collaborate in virtual spaces, shaping the future of remote communication and

collaboration. Based on the technological progress in VR and MR devices and multi-user virtual environments, potential benefits of these platforms could be utilized in mental health care in the near future. Recent developments have shown promise in leveraging the immersive nature of VR to create engaging and effective mental health interventions in multi-user setups.
The introduction of AI chatbots represents the next logical step in digital interventions. AI technology is not yet sufficiently advanced to be fully comparable to human communication, especially when simulating experts and peers, errors and glitches in verbal and non-verbal communication have substantial impact. Nevertheless, further technological developments in this area will surely lead to significant advances over time, especially in dyadic communication agents providing scalable and available first contact in mental health care.

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Conflicts of Interest

The authors have no financial or non-financial competing interests to disclose that are relevant to the content of the article.

Data availability

Original data (imported list of records), database merge and screening results and source code for generating summary outputs are available on request on GitHub.

Abbreviations

CBT: Cognitive behavioural therapy
HW: Hardware
MH: Mental Health
mHealth app: Mental Health application
MR: Mixed Reality
VR: Virtual Reality
RCT: randomized controlled trial

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Supplementary Files

CONSORT (or other) checklists

PRISMA checklist.
URL: http://asset.jmir.pub/assets/cd6cb668fa96ec0c4f4586945b56f920.pdf