

Entry

# Digital Mental Health Amid COVID-19

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**Definition:** Digital Mental Health is information and communication technology used in mental health services delivered or boosted through the Internet and related technologies, smartphone and wearable technologies as well as immersive solutions (e.g., Virtual Reality and video games). It is predominantly used as self-help services or with the assistance of a (para-)professional and/or artificial intelligence for the provision of mental health promotion as well as mental ill-health identification, prevention and intervention.

**Keywords:** COVID-19; digital mental health; implementation; challenges; technology; human-computer interaction; explainable artificial intelligence; integrated methodologies; efficacy; evaluation



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## 1. Introduction

### 1.1. Evolution of Digital Mental Health

Mental healthcare resources have been inundated during the economic and biopsychosocial recovery from COVID-19 [1,2]. Although in use since the early 2000s, an opportunity has arisen for digital mental health to fill unmet needs [3–5] and answer calls to improve the quality of and accessibility to mental health care [6–8]. It was already on a trajectory to regular practice, but COVID-19 added to demand outstripping supply of mental healthcare resources making a review of digital mental health more urgent. There has been a marked rise in the use of online self-help and telehealth interventions [9–12]. Systematic reviews found telehealth to be an effective and acceptable form of service delivery at least in the short term [13]. More generally, there are calls for higher levels of evidence, ongoing evaluation, and effective embedment [9,14–16]. A rapid meta-review found telehealth, internet-based, and app-based mobile digital interventions are well-placed to mitigate psychosocial consequences at the population level with good quality evidence on usability, safety, acceptance/satisfaction, and effectiveness [17]. Mixed levels of evidence were noted: lacking for apps having successful retention strategies; limited for mental health promotion; and lack of preliminary evidence for the long-term effects, process quality, and cost-effectiveness of digital interventions [17]. This integrative review synthesizes evidence from Scopus, ScienceDirect, CrossRef and Google Scholar searches of the challenges, systemic and practical issues, new progress, ongoing problems, and approaches of digital mental health as well as a focus on young people.

### 1.2. Challenges of Digital Mental Health

There is a need for rapidly deploying and efficiently integrating effective and evaluated digital solutions for users at individual, organizational, and governmental levels [6,18–20]. However, there are hindering issues in enacting a hybrid model of care e.g., the quality of digital mental health solutions needs to be better discerned and there is a need for more studies with vulnerable and at-risk populations [18]. Two systematic reviews and meta-analyses examined the effectiveness of digital mental health interventions. The first,

for young adults with depression or substance misuse in low-income and middle-income countries, found moderate effectiveness when compared with control interventions [21]. The second, for anxiety and depression in perinatal patients in high-income countries, found nonspecialist providers may be effective in delivering counseling interventions [22]. However, only two online interventions were included. Further studies are required for digital intervention implementation processes to inform the optimal delivery and scale-up of these services.

There are a range of digital mental health interventions available for various mental health needs and conditions, from substance abuse recovery to suicide prevention [23]. Stronger evidence and new models of care will be necessary for higher accessibility, equity, and successful clinical implementation [5,20,24,25]. Predictive technologies (e.g., real-time machine learning algorithms) are useful for monitoring but should be deployed carefully as decision support tools [20,25,26]. On an operations level, there is the issue of integrating technology into mental health care delivery for diverse populations. The European Commission addressed organizational barriers (e.g., interoperability, and technical and legal issues) through a consortium action plan that also prioritized digital mental health research to target the most prevalent mental health problems and disorders [27]. Users need assistance to make informed decisions around the efficacy of digital mental health tools [13] as well as the intervention characteristics (e.g., convenience, suitability, reliability, user-friendliness, presentation, organizational integration, and cost). The adoption of digital tools has been hindered at the organizational and policy level—user-friendly workflows, decision models and protocols have been offered as solutions [19,28]. Suitable information, training, infrastructure, clinical guidelines, and policies may counter excessive information/workloads, ambiguous policies, mixed implementation, and a struggle to maintain systems [19,20].

## 2. Synthesis

### 2.1. Systemic and Practical Issues

A main barrier to equity in digital mental health interventions is that some people do not have access or skills to use digital resources [28]. There are inequities in affordable access to digital technologies for Indigenous people in Australia (63% have access to internet at home) which has a detrimental effect on cultural, social and mental health outcomes [29]. Recent efforts to implement and integrate digital mental health interventions into the United States (US) healthcare system may be helpful in reducing mental health care inequities in rural communities [30]. However, there is a lack of studies demonstrating sustainable improvements in symptoms and global functioning from specialized early intervention services [31]. Considerations other than equity include engagement, ethics, security, adaptability, and technicality [25,32]. There were mostly contextual issues noted in recent studies. An automated randomized controlled trial of an online peer-support program (Big White Wall) versus web-based information for self-management of anxiety and depression suggested a personal approach for participant engagement to explain the benefits of this novel intervention [33]. It was proposed that user engagement and satisfaction with a digital platform (Thought Spot) be related to content relevance, ease of learning, and available features [34]. The effectiveness of a digital platform with virtual coaches for cognitive behavior therapy (CBT) was explored in a qualitative study—it was important to find ways for users to be drawn to and then consistently engaged with the digital platform [35].

It was established before the current pandemic that stand-alone app-based treatments have increased affordability [36–38] but require simpler and stronger reimbursement systems [39]. ICare is an example of an adjunct online screening and intervention platform model whereby “partners will examine and compare the feasibility, acceptance, efficacy and (cost-)effectiveness, reach, and dissemination of the included online interventions” ([27], p.1). Recent adaptations of telehealth fee and reimbursement

structures have yet to be evaluated for affordability. A theoretical model was applied in a patient-centered framework—using apps from the US and United Kingdom (UK) as examples—to produce country-specific estimates of the economic value of clinical improvement [40]. The new framework was proposed to help drive research priorities for digital health by explaining the factors that influence the economic value [40]. Studies have yet to establish models of mental healthcare system (cost-)effectiveness and improvement from integrating digital mental health, e.g., cohort longitudinal studies that examine scalable screening and tracking tools delivered in a hybrid model of care. Finding a balance between scalability and fidelity was noted to be important in the proposed empirical testing of a paraprofessional (peer-to-peer) digital mental health support model [41].

## 2.2. New Progress

Digital mental health interventions are assisting the facilitation of therapy, prediction, and prevention of mental ill-health [37,38,42–44]. The COVID-19 pandemic heightened the need to counter the medical and socio-economic effects of mental ill-health via deployment of assistive, preventative, and therapeutic solutions (e.g., internet-based data collection tools, digital platforms and apps) [13,20,45,46]. A multimethod study developed a co-designed freely available resource guide that builds on existing evidence on digital mental health tools [46]. There were safety, comfort, and flexibility noted for telehealth experiences during COVID-19, although face-to-face service delivery was still preferred [47]. There is a great opportunity for digital and data-driven tools to become prominent (e.g., machine learning algorithms and artificial intelligence (AI) platforms, the Internet of Things (IoT), digital phenotyping, and immersive solutions such as virtual reality (VR)) [25]. The resources required to guide the selection, implementation, and evaluation of machine learning algorithms and artificial intelligence (AI) platforms are available online for public use [48]. Guided adoption and integration of digital tools with clinical practice is not known to have been effectively studied.

Rapid psychological screening and tracking showed promise during COVID-19 through digital phenotyping of a telehealth platform service coupled with analysis by machine learning trained models [46]. A longitudinal observational study verified the acceptability and effectiveness of AI therapy for anxiety and depression [49]. A systematic review of the effectiveness and acceptance of technology-based psychological interventions in people with diagnosed depression found mostly positive impacts from stand-alone interventions, blended treatments, or in collaborative care trials [50]. An extensive trial of the clinical and (cost-)effectiveness of blended therapy (integration of Internet and mobile-based interventions into routine psychotherapy) is aiming for a rigorous healthcare services approach that innovates service provision while exploring mechanisms of change [51]. Technology Enabled Clinical Care (TECC) was proposed in a protocol for a longitudinal cohort study of smartphone-augmented mental health treatment primarily targeting changes in mood, anxiety, and stress [52]. The use of TECC in a System Dynamics Model may improve mental health and suicide outcomes by using technology infrastructure to quickly direct to the right mode of care as patients navigate primary and secondary mental healthcare services [53]. An informatics infrastructure (an extension of electronic health records) has advanced personalized decision-making in psychiatric care through standardized data acquisition and data access (transfer, storage, and export of clinical data) [54]. This development provides the opportunity for future studies to apply and validate real-time predictive modelling.

### 2.3. Ongoing Problems

Digital mental health implementation in clinical settings requires thoughtfulness and preparedness [55], along with a higher understanding of technical and medical standards, in order to increase effectiveness, validation, and user-centered design as well as to counter ethical concerns [20]. Stakeholders need an adequate infrastructure and skills-base [25,56] as well as ethical guidance in the development, deployment, and management of digital mental health solutions [20,56]. The paradoxical efforts to advance evidence and implementation of digital mental health led to the suggestion for simulation-based research [57]. Explainable Artificial Intelligence (XAI) research with predictive technologies [58] emphasized its potential to encapsulate improvement of safety and efficacy standards through stewardship and responsible innovation [25]. A narrative review on the therapeutic alliance in digital mental health interventions for those with serious mental illnesses (particularly on the psychotic spectrum or bipolar disorder) found a better understanding of human-computer interaction is required in evidence-based studies that facilitate responsible outcomes from a three-tiered approach (patient/user, mental health care practitioner, and machine) [59]. TECC is promising with regards to systematically coordinating and delivering appropriate mental health services [60]. The use of machine learning methods for statistically predicting suicide has been cautioned [61,62]. Engagement with the individual patient/user with regards to their specific problems and circumstances is preferred because the usefulness of machine learning in clinical settings is limited by an ongoing lack of information on model building, uncertain accuracy [63–65], clinical evaluation [28]. Integration of novel models of care and support for digital infrastructure/personnel require further research [25,41,59].

### 2.4. Approaches

Digital mental health services are available online (via desktops, mobile devices, and apps), including through web chat and peer support forums as well as by phone (e.g., calls or texts), to provide crisis support, psychotherapy, counseling, psychological treatments, health promotion, education, and prevention as well as support for recovery. A systematic review of digital mental health interventions developed for mental health practitioners during COVID-19 identified social media platforms, e-learning content, online resources, and mobile applications in 11 eligible studies [66]. However, there was a low level of empirical evaluation of these interventions (27%). Challenges and limitations related to the adoption of the reported interventions were common (55%) and greater heterogeneity is required given 45% of interventions were specific to China. A narrative review of digital psychotherapy found evidence of effectiveness for depression and anxiety disorders, of mild-to-moderate severity, from multiple randomized controlled trials and a large meta-analysis [67]. An online survey of the use of digital information and communication technologies in psychological counseling before and during a COVID-19 lockdown found overall positivity in the use of technologies and web-based interventions, with most practitioners noting approximately the same client involvement/adherence rates [68]. Interestingly, there was only a slight rise in the use of some tools (i.e., video conference, social networks, and virtual rooms), and slightly less use of others (i.e., telephone calls, emails, audio conferences, online intervention platforms, smartphone/tablet apps, online forums, and chats) [68].

A systematic review found digital interventions or counseling based on communication technologies to be as effective as face-to-face sessions [69]. Similar with traditional therapy and counseling settings, quality assurance issues that require escalation may be resolved by governing agencies or professional associations [70]. Furthermore, therapists and counselors should have computer skills and online communication competencies and should follow ethics, bylaws, rules/regulations, technological malfunction procedures and crisis procedures. A rapid review on the effectiveness of digital mental health interventions for individuals with an associated chronic disease (mental and/or physical) found web-

based interventions and email had the most reports of improvement but further analyses were required before making stronger recommendations on the relevance for youth [71]. The potential for digital technologies to change clinical research and treatment is developing and a special applicability to young people experiencing mental health problems has been proposed [72]. The internet, as an information source and help-seeking promoter, as well as smartphone and wearable technologies are among promising tools. There is growing support for these approaches to be augmented in routine care especially among young people.

### *2.5. Digital Mental Health for Young People*

Young people were the third most represented population identified in a rapid scoping review of digital mental health among at-risk groups in Asia-Pacific during COVID-19 [73]. A German longitudinal study on the mental health and coping behavior of university students before and after the onset of COVID-19 found the pandemic had a moderate overall effect [74]. A protocol for impact evaluation of an Australian digital mental health model of care for youth (headspace) outlined that there are ongoing poor mental health outcomes for young people (12–25 years of age) [75]. The Asian Pacific, German, and Australian studies found vulnerable subgroups among youth may be at high risk of negative mental health impacts. Accessibility via devices, such as smartphones and high-speed Internet, and technological literacy were noted as challenges facing Asian Pacific children and youth [73]. Significant subgroups of American youth (particularly those who live in low-income and rural areas) are also experiencing marginalization because of inadequate access to the Internet, resulting in a gap during COVID-19 which is widening pediatric mental health differences [76]. Stigmatizing attitudes, accessibility, and affordability issues are experienced by Australian youth in non-urban areas, resulting in higher self-harm, suicidal ideation, and suicide attempt rates [75]. The German study found an accumulation of negative issues (i.e., preexisting stress, anxiety, depression, overexertion, and burnout) and suggested identifying those at risk to promote mental health in significant subgroups [74].

Research on digital solutions in clinical settings proposed young people as a transformative population for mental health treatment [5]. A survey of clinicians and youth mental health service users (aged 12–25) with regards to the rapid implementation of telehealth during COVID-19 found young people were the most positively satisfied and open to its continued use [77]. The digital solutions evidence base is limited to reviews, workshops, position papers, pilot studies, trials and protocols. A scoping review of online preventive interventions for youth with emerging mental health issues noted the high incidence of common evidence-based therapies and medium incidence of a blended approach (supported by a human) [78]. The review mentioned the most common psychological symptoms and disorders in youth are heightened stress, depression, anxiety, and psychosis. The most common intervention is CBT. There were a wide range of adherence rates to digital interventions (between 27.9 and 98%). The results indicated general effectiveness, usability, and acceptability of online indicated preventive interventions for a wide range of mental health complaints, and positive mental health promotion (e.g., well-being and resilience). Future research was recommended for co-design of clinical trials based on the clinical staging model with a focus on transdiagnostic mechanisms, instruments for emerging or subclinical mental health symptoms as well as a government-backed structure for financial compensation of innovation and development.

A systematic overview of meta-analyses and systematic reviews found digital mental health interventions for young people have reasonably positive effects [79]. The evidence of effectiveness was mostly found on anxiety and depression, and to a lesser extent on stress—the main concerns are evidence-based treatment content or in-person elements that may improve engagement [79]. Only a small proportion of digital platforms are evidence-based—more needs to be known about the (cost-)effectiveness of the type of service provided, target subpopulation, and the current standard of care [79]. A systematic review also concluded there needs to be higher understanding of the (cost-)effectiveness of



digital psychological interventions [80]. A randomized controlled trial is currently partly evaluating the (cost-)effectiveness of a digital alcohol moderation intervention (web app based on motivational interviewing and CBT) which was added to an existing depression treatment for young adults [81].

Innovative technologies are increasingly being used in studies on the mental health of young people. A case report on young adults with a psychotic illness found digital phenotyping via tracking on a smartphone app is a feasible way to monitor and detect patient status [82]. A proof-of-concept study with university students found early evidence that there is benefit in deploying a digital healthy-coping intervention via a chatbot for their higher levels of psychological distress [83]. There was preliminary evidence of efficacy for digital psychological interventions via games and virtual reality (VR) in children and young people [84]. A longitudinal approach to development and design as well as greater heterogeneity are required for studies evaluating digital psychological interventions [85]. A systematic review of the use of commercial off-the-shelf video games found there is efficacy for reducing stress and anxiety [86]. Video game genres included exergames, casual video games, action games, action-adventure games, and augmented reality games used on various gaming platforms, including consoles, PCs, smartphones, mobile consoles, and virtual reality systems [86]. An editorial on child and adolescent learnings of the current pandemic recommended future research designs to consider the strategic use of technology and remote learning in new educational approaches for diverse populations as well as to explain the factors that predict and improve resilience during adversity [87].

The scientific framework, methodology, and digital mental health implementation strategies for young people are marked by significant challenges including engagement, retention, fidelity, lack of personalization, and cognitive load [88]. A protocol for an evaluation study on the effectiveness of education and training of youth mental health care clinicians established that the adoption and optimization of technical solutions are integral for use in standard clinical practice [89]. The feasibility, acceptability, and initial safety profile of an online mental health service for improving help-seeking and mental health symptoms among students found: administrative barriers to uptake; time constraints for school staff to help; high drop-out rates in a series of modules; and uncertainty about improvements in help-seeking behavior and symptoms [90]. A systematic review of ethical concerns for digital mental health for young people found there is a need for better online security and data privacy as well as improved guidelines and legislation [20].

### 3. Conclusions and Prospects

Digital mental health is in its adolescence but there is efficacy for digital interventions at the population level. The novelty of the genre is unravelling amid COVID-19. It provides advantages for some populations: increased accessibility, acceptability, affordability, and availability of care, equity, autonomy and serviceability as well as an improved understanding of mental health. However, it is important to have in mind the disadvantages: concerns with efficacy, insufficient validation of technology, user engagement and retention issues, data security and privacy, marginalization (especially of the underserved and the unserved), and a lack of organizational readiness as well as over reliance on technology and clinical support. More needs to be known about the psychological symptoms and disorders for which it is effective. So far, the evidence of effectiveness is on common disorders (i.e., mild to moderate anxiety and depression) as well as stress. It is not yet established if some mental disorders can present more difficulties than others. Digital interventions for those with serious mental ill-health (on the psychotic spectrum and bipolar disorder) and chronic mental health conditions demonstrated significant promise despite being less established than for common disorders. Video conferences, social networks, telephone calls, and emails are common digital tools used amid COVID-19; audio conferences, smartphone/tablet apps, online intervention platforms and chats were used to a lesser extent. Clinical practitioners may use digital mental health guides; furthermore, trials are

underway with TECC to help achieve faster and better quality care. Young people are a discerning population for research because of their increased use of online clinical support services. Despite the challenges of providing ethical, effective, accessible, and equitable care, digital mental health is delivering innovative ways of serving those who are isolated, lonely, and at-risk of stress, anxiety, and depression. Further research is required for reliable, valid, and replicable models of care above and beyond what is established for telehealth, digital platforms, and apps. AI technologies (especially machine learning and predictive analytics), smartphone, and wearable technologies as well as immersive solutions (VR and video games) are noteworthy prospects.

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