Digital approaches to adolescent mental health

A review of the literature

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Key messages

- Mental health interventions increasingly build on the opportunities provided by new digital technologies.

- An increasing number of studies show that digital approaches have the potential to address the mental health and wellbeing difficulties of young people – for example, reducing depression and anxiety or helping to detect emerging mental disorders among adolescents.

- However, most studies on digital approaches and mental health centre on the Global North, and there are gaps in knowledge about how technology can be used to support adolescents in low- and middle-income countries.

- It is important that a range of actors are included when designing, implementing and evaluating digital approaches to young people's mental health, and that inequalities of access (mediated by factors such as gender, age, socioeconomic background and location) are addressed.

Acknowledgements

Contents

List of boxes and tables

Boxes

Tables

Acronyms

AI	artificial intelligence
ASD	Autism Spectrum Disorder
CCGs	Clinical Commissioning Groups
EMA	European Medicines Agency
EQUIP	Ensuring Quality in Psychological Support
GNAT	Gloomy Negative Automatic Thought
HIC	high-income country
ICT	information and communication technology
IoT	Internet of Things
KFT	Kazakhstani Family Together
LMICs	low- and middle-income countries
mhGAP	Mental Health Gap Action Programme
MHPSS	mental health and psychosocial support
MOOC	Massive Open Online Course
MMA	mobile medical apps
NLP	natural language processing
NSPCC	National Society for the Prevention of Cruelty to Children
PIU	problematic internet use
THET	Tropical Health and Education Trust
WBIE	web-based learning and management system
WHO	World Health Organization

1 Introduction

Digital technologies have advanced and spread rapidly (Higgs et al., 2014). As the cost of connectivity and hardware is decreasing, access to digital technologies is increasing around the world (OECD, 2018). The number of global internet users has more than tripled in a decade, rising to an estimated 3.8 billion in 2018 (WEF, 2019). Almost half of the world's population is connected to the internet (OECD, 2018) and around 65% are estimated to have access to a mobile phone (WEF, 2019).

In many low- and middle-income-countries (LMICs), digital media are becoming more accessible and affordable, even though inequalities persist (Livingstone et al., 2017). It is estimated that in LMICs, 45%–89% of people have access to mobile phones, 45%–54% to smartphones and 7%–18% to the internet (Huang et al., 2019). The number of mobile subscribers in Africa tripled between 2010 and 2015 (Livingstone et al., 2017) and a World Bank report (2014 cited in Hampshire et al., 2015) suggests that more Africans have a mobile phone than a toilet.

Young people are more engaged with digital technologies than ever before (Montague et al., 2015), especially with the internet and mobile phones. Those aged 15–24 are most connected to the internet: 71% of youth are estimated to be online worldwide, compared to 48% of the total population (UNICEF, 2017). Research also suggests that children are accessing the internet at an increasingly younger age. Under 18s are estimated to account for a third of worldwide internet users and children under 15 are as likely to use the internet as adults aged over 25 (UNICEF, 2017).

Digital divides mirror economic inequalities. For example, African youth are least likely to have access to the internet. Around 60% are not online, compared to 4% in Europe (ibid.). But it is estimated that over 50% of those in the 15–24 age group in low- and middle-income countries have access to smartphones (Uhlhaas and Torous, 2019).

Health interventions increasingly build on these new technological opportunities. eHealth – using technologies for health promotion (see Table 1) – has been recommended by the World Health Organization (WHO) as a health service-strengthening strategy (Huang et al., 2019). To use Higgs et al.'s (2014: 165) words: eHealth provides an opportunity for 'reaching, teaching, connecting, motivating and empowering individuals and groups to address specific health concerns'. The global digital health market has been valued at $118 billion (WEF, 2019) and a recent study identified more than 15,000 mobile apps for healthcare, at least 29% of which are targeted at mental health (Anthes, 2016 cited in Grist et al., 2017).

Mental health is one of the fastest-growing sectors of the digital health market (WEF, 2019). Investment and funding for start-ups targeting this area tripled between 2014 and 2019 (ibid.). Mobile medical apps (MMAs) are particularly fast-growing, with over 10,000 consumer-targeted apps currently available online (ibid.). Money spent on health and fitness apps is also rising. For example, spending on the top five mindfulness apps in iOS and Google Play grew by 130% over the course of 2018 (ibid.). An increasing number of studies show that digital approaches have the potential to address the mental health and wellbeing difficulties of young people, for example, reducing depression and anxiety (Osborn et al., 2020) or helping to detect emerging mental disorders among adolescents (Uhlhaas and Torous, 2019).

The Covid-19 pandemic is exacerbating mental health challenges, particularly for those already marginalised due to poverty, socio-economic distress and insecurity. At the same time, it has meant that face-to-face therapy and other support is currently less feasible (Hamady and Marinos, 2020). A review of the literature finds that Covid-19 has negative effects on

mental health and that digital approaches are suited to mitigating psychosocial consequences (Rauschenberg et al., 2020). Therefore, developing digital approaches to mental health is more pressing than ever before.

However, most studies on digital approaches and mental health centre on the Global North. New efforts are underway in countries of the Global South with Africa representing the largest volume of such research, particularly South Africa, followed by Nigeria, Ghana, Uganda, Ethiopia and Tanzania (Livingstone et al., 2017). But gaps in knowledge about how technology can be used to support adolescents in LMICs remain (e.g. Osborn et al., 2020). Some studies (e.g. Huang et al., 2019) have called for more research on how the rapid growth of technology can be used to address mental health promotion to young people, especially in low-and middle-income countries.

To address this gap, this rapid literature review investigates digital approaches to addressing adolescent mental health and psychosocial-related challenges with a focus on LMICs, particularly Tanzania and Vietnam. The review is embedded in a two-and-a-half-year project to address the mental health needs of adolescents in schools, the community and at institutional level in Tanzania and Vietnam through the co-creation and application of digital and non-digital technologies, funded by Fondation Botnar.

The search strategy involved bibliographic database searches (Web of Science, PubMEd, Scopus, Google Scholar), hand searching (relevant websites of international organisations, NGOs and think tanks) and snowballing (i.e. looking for sources identified in relevant articles/reports). The review also benefited from input and recommendations from advisors working in the area of mental health. Literature in English from 2005 onwards was included. The focus was on LMICs (especially Vietnam, Tanzania, sub-Saharan Africa, Southeast Asia) and mid- (11–15) and older (16–19) adolescents, but some relevant global literature and literature on other age groups was included.

Table 1 outlines some definitions of digital technologies in health contexts that this review builds on. The report is divided into three main sections that evolve around the following research questions:

- Which digital approaches have been developed to address the mental health and wellbeing of young people?
- What are the advantages and disadvantages of using digital approaches to address the mental health and wellbeing of youngpeople?
- What works and what does not work to address the mental health and wellbeing of young people with digital approaches? What are the gaps in the literature?

Table 1   Definitions of digital technologies used in health contexts

Term	Definition
Information and communication technology (ICT)	ICTs capture 'the entire information and communication technology infrastructure' (Livingstone et al., 2017: 6). This includes networked, mobile and other media (e.g. online radio, television, film or press) and internet services (e.g. information, gaming, social media, streaming, apps and other services).
Digital media	Digital media includes 'the devices (usually mobile), connections (usually the internet), contents (games, websites, video-sharing, etc.) and services (such as social networking sites) that children may access and use in their daily lives' (Livingstone et al., 2017: 12).
Social media	Social media is defined as 'the interaction and exchange among and between individuals and virtual communities through a variety of different platforms, including blogs, wikis, podcasts, forums, message boards, review and opinion sites, and social networking' (Higgs et al., 2014: 167). This includes websites/apps like Facebook, Twitter and Instagram.
Transmedia	Transmedia is related to social media. It refers to 'media content with linkages across media forms and platforms, which may or may not have a narrative component, including traditional (e.g. radio, TV dramas, street theatre) and new media technologies (e.g. SMS, social media)' (Higgs et al., 2014: 167).
Mobile devices	Mobile devices or mobile technologies include mobile phones, portable/mobile patient monitoring devices (e.g. digital blood pressure cuffs), personal digital assessment devices (e.g. Apple's Siri, Amazon's Alexa) and other wireless devices (e.g. baby monitors, walkie-talkies) (Huang et al., 2019: 807).
Digital literacy	UNESCO (2019) defines digital literacy as 'the ability to access, manage, understand, integrate, communicate, evaluate and create information safely and appropriately through digital devices and networked technologies for participation in economic and social life'.
eHealth or e-health	eHealth is defined as 'the use of information and communication technology (ICT), such as computers, mobile phones, communications satellite, patient monitors, and other technology tools for all aspects of health information, services, and integrated systems' (Huang et al., 2019: 807).
mHealth or m-health or mobile health	mHealth is a subcomponent of eHealth. It refers to mobile technologies (e.g. phone, tablets) 'used to address the health needs of individuals, communities, and societies' (Higgs et al., 2014: 166).
Online health seekers	Online health seekers are 'internet users, who use search engines, websites, message boards, and other online resources to inform themselves on health matters' (Gallager and Doherty, 2009: 99).
Telemedicine	Telemedicine refers to online medical services (Chipise et al., 2019), such as online medical appointments by trained health professionals.
Telepsychology	Telepsychology refers to online mental health services (Chipise et al., 2019), such as online counselling or therapy by trained health professionals.

2 Which digital approaches have been developed?

Many digital approaches that address mental health and well-being of adults and young people have been developed. Table A1, in Annex 1, provides an overview of some digital approaches to address youth mental health, including information on target groups, objectives, funders, main components and impact.

We can group these around four criteria:

1. stage of mental healthcare continuum
2. type of intervention
3. target group
4. type of technology.

2.1 Stages of mental healthcare continuum

Technology has the potential to support individuals at different stages of the mental healthcare continuum (WEF, 2019). This includes:

- **Self-care, well-being, prevention**, for example, through health and fitness apps, such as Calm and Headspace, or with the help of health trackers, information on websites or online talks/podcasts.
- **Diagnosis and advice**, for example, through online symptom checkers, mood scores, chatbots, phone helplines, online support or text services.
- **Treatment plans and management**, for example through online therapies, virtual counselling, support apps, digital reminders or trackers (ibid.).

2.2 Types of interventions

Digital technologies can be used for many types of mental health interventions. Often, interventions address at least one (and usually more than one) of the categories below:

Information and education: These interventions aim to educate users by providing information about mental health and wellbeing. This can include web-based/computerised training modules, MOOCs (Massive Open Online Courses) (see e.g. Suicide Research and Prevention, 2020; WHO, 2020) or advice and resources through websites and apps (see e.g. Childline, 2020; The Mix, 2020; Young Minds, 2020). For young people, learning modules often include real-life stories, video-clips, films, games, cartoons or images.

Reflection and participation: Interventions that focus on enabling reflection through participatory learning include digital storytelling, games, problem-based learning exercises, digital reading and writing reflection activities or digital mood trackers. Much has been written about the advantages of using digital story telling – also referred to as participatory video – with young people. This usually involves workshops during which young people create stories/videos, which are then recorded with mobile phones, cameras or webcams, and edited in software such as iMovie, Movie Maker, Photo Story and PowerPoint. These can potentially be shared via electronic distribution systems, such as YouTube, Vimeo, or Voice Thread. Digital storytelling can encourage creativity, reflection

and discussion and foster critical thinking (Pieterse and Quilling, 2018).

Group-based digital support: These popular interventions tend to use social media groups or multimedia platforms, such as chat rooms or online discussion forums, to encourage young people to connect with others in similar situations (e.g. Sobowale et al. 2016). Many young people want to use digital tools to interact socially with peers, to share problems, give each other advice and relate to other's experiences (Kenny et al., 2016). Social networking sites are very popular in Vietnam and have behavioural impact on Vietnamese youth (Tran et al. 2017 cited in Tran et al., 2018). Tran et al. (2018) suggest incorporating social networks in mHealth apps to increase acceptability and usage. Other studies in Vietnam confirm young people's interest in sharing mental health problems with online peers (Nguyen et al., 2013 cited in Sobowale et al., 2016). However, given the risk of cyberbullying (see section 3.2), it is recommended to moderate interactions between users. For example, all posts on the MeeTwo (2020) youth mental health platform are first checked by a moderator.

Individual digital support: Online support to address young people's mental health concerns, such as through online counselling, telepsychology, telepsychiatry, phone coaching, e-communication, e-support and online therapy, is becoming more popular. Research from various countries suggests that online therapy can be as effective as face-to-face therapy (Chipise et al., 2019). A review of the global literature found that telemental health applications were successful in the areas of child psychiatry, depression, dementia, schizophrenia, suicide prevention, posttraumatic stress, panic disorders, substance abuse, eating disorders and smoking prevention (Hailey et al. 2008). Some young participants in studies from Ireland (Kenny et al., 2016) and Vietnam (Sobowale et al., 2016) suggested that web pages should connect young people to mental health professionals, while Sobowale et al. (2016) argue that psychotherapy delivered via the internet is a novel way to address the mental health treatment gap for young people in Vietnam.

2.3 Target groups

Digital approaches to addressing the mental health of young people often target young people directly. Some interventions are aimed at parents, teachers and health professionals to improve their knowledge of young people's mental health challenges and how to best support them.

Young people: Interventions targeting young people can be divided in two groups – universal interventions and interventions for students with specific symptoms or concerns. Some research suggests that interventions focused on all youth in a setting may be beneficial in treating and preventing mental health problems (Osborn et al., 2020). This can also avoid the problem of being labelled or stigmatised for seeking mental health services (ibid.). Digital interventions have been most successful when they respect children's contexts, needs, interests and perspectives (Livingstone et al., 2017). For example, research with young people (aged 13–19) in the UK (Goodyear et al., 2019) found that understanding young people's agency in digital health contexts offers insights into developing health-related interventions. When designing an intervention, it is recommended to ask young people about the following:

- They types of technology they like to use for different purposes (Tran et al., 2018).
- Their preferences regarding content, format, and display of tools (ibid.).
- Whether they prefer audio or video (in case of telepsychology) (Hamady and Marinos, 2020).
- What digital expertise is available and how the intervention can support digital skills (Livingstone et al., 2017).

Teachers and school health personnel: Some interventions target teachers and school health personnel (Huang et al., 2019). For example, in Brazil, a web-based learning and management system (WBIE) approach, including web-education videos, online discussion forums, web conference and support text messaging, was found to have impacted positively on teachers' ability to support students (Pereira et al., 2015 cited in Huang et al., 2019).

Mental health professionals/paediatric services: Mental health professionals are increasingly obtaining mental health-related resources online (Clarke et al., 2017). In a scoping review of eHealth approaches to addressing child mental health, Huang et al. (2019) found that some interventions targeting paediatric professionals used e-learning strategies and web-education models, such as videos or e-demonstration and sharing guidelines/forms/prompts. Some interventions combined these e-learning activities with e-collaboration, consultation or feedback. One study found, for instance, that distance learning with web-based education, consultation, and feedback on child mental health screening can encourage paediatric care services to use behavioural screening tools (Desitno et al., 2017 cited in Huang et al., 2019). Involving health professionals has three main advantages:

- It can help to understand the needs and concerns of health professionals and improve their knowledge, which can ultimately improve treatment and interventions for young people (Huang et al., 2019).
- Healthcare professionals can contribute to the development and approval of health-related digital tools (Tran et al., 2018). This can address concerns about a lack of quality and adherence to evidence-based practices of youth mental health apps (Uhlhaas and Torous, 2019).
- Building on the expertise of health professionals can also increase acceptability among users, who may be reassured that the technology is based on reliable professional knowledge (Tran et al., 2018).

Families: In their scoping review of eHealth approaches to addressing child mental health in LMICs, Huang et al. (2019) found that most family-focused interventions aimed to improve parents' child mental health knowledge and behaviour management skills through web-based parenting modules and e-communication or e-support, such as phone coaching, e-reminders, feedback messaging, emails or social media groups. Some interventions also focused on supporting parents, such as through wellness promotion, group-based and e-support services.

The review finds that all parent-focused interventions reported positive impacts on parenting and about half reported to have positively affected child mental health. Because of Confucian values, parents in Vietnam have a strong influence on young people (Sobowale et al., 2016), but due to limited knowledge about mental illness and stigma, they may not seek help for their children. Sobowale et al. (2016) argue that web-based resources providing psychoeducation can fill these knowledge gaps for parents in Vietnam.

2.4 Types of technology

Digital approaches to young people's mental health and well-being can involve different types of technologies, which all have advantages and disadvantages (Uhlhaas and Torous, 2019).

Phones without internet access: Some interventions in LMICs, and high-income countries (HICs), use text messages to provide health-related information or to remind people to participate in mental health-related activities (Huang et al., 2019). Text messaging is scalable and can work on simple mobile phones (Uhlhaas and Torous, 2019), which are more available in low-income settings. They are less intrusive than phone calls and work particularly well as reminders or for follow-up between sessions (Montague et al., 2015).

Phones without access to the internet can also be used for coaching and counselling phone calls (see e.g. Wazi, 2019). Young people in Australia described telephone calls as more 'personal', 'friendly and welcoming' and 'comforting' than text messages (Montague et al., 2015). A review of the global literature found that telephone-based telemental health interventions were more successful than video conferencing (Hailey et al. 2008).

Smartphones, computers, tablets with internet access: Interventions have relied on smartphones, computers or tablets to convey information (e.g. via email, websites), to encourage group discussions and support (e.g. social media, apps, platforms, chat bots), for participatory learning/reflection (e.g. online games, digital storytelling) or individual counselling. Table A1 provides examples of some digital approaches to address

Students use computers at a school in Tanzania. © International Institute for Communication and Development

adolescent mental health and is based on the interventions/studies that came up following our search strategy. It is far from comprehensive, but offers an overview of what has been done and indicates the outcomes of interventions, where available.

Smartphones tend to be the most common device used by young people in low-income countries to access the internet (e.g. Osborn et al. 2020); see Box 1. App-based technology interventions that can be used on smartphones are rapidly evolving (Uhlhaas and Torous, 2019) and allow for greater functionality and adaptability (Gonsalves et al. 2019). 'Serious games' can entertain but also educate, train, or change behaviour (Gonsalves et al. 2019), but tend to be costly to create (Pendergrass et al. 2019). Maintaining and updating apps and responding to the fast paced nature of technology also tends to be expensive (WEF, 2019). Using existing technologies (e.g. phone consultations over WhatsApp) is cheaper than developing new tools.

Artificial intelligence (AI) is increasingly entering healthcare. Through approaches such as deep learning, AI can learn from the world around it and predict outcomes. Natural language processing (NLP) analyses human use of language and interprets someone's tone, inflection, energy and pitch during phone calls to provide therapists with additional information (WEF, 2019).

Internet of things (IoT) refers to devices and sensors that are connected to the body and the internet, (e.g. devices that track people's heart rate, step count devices or wearable apps). The information generated could potentially be shared with trusted professionals to inform decisions about treatment or to track the progress of treatment (WEF, 2019). Virtual reality devices could also potentially be used for mental health interventions (Uhlhaas and Torous, 2019).

Box 1   Young people's use of technology in Tanzania and Vietnam

In Vietnam, internet use has become more affordable and widespread, with youth making up the vast majority of users (Sobowale et al., 2016). Most young people access the internet through smartphones (Sobowale et al., 2016; Tran et al., 2018), with the Android operating system being dominant (Tran et al. 2018). Young people were found to use smartphones to access social networking sites (Sobowale et al., 2016), but also for listening to music, texting, gaming and watching movies (Tran et al., 2018; Do et al., 2020). Even though not commonly used, young Vietnamese people seem interested in using mental health-related technology (Sobowale et al., 2016; Tran et al., 2018).

Similarly, research suggests that young people in Tanzania are increasingly accessing the internet, most commonly via smartphones (Pfeiffer et al. 2014). Ethnographic research on a university campus (Kenny, 2018) found that mobile phones are very important to Tanzanian youth in terms of identity, personhood and relationships. Most young people use the internet for social media, especially WhatsApp, Facebook, Vine (Kenny, 2018), Twitter and YouTube (Pfeiffer et al., 2014). They also use it for reading news, watching videos, homework and computer games (Pfeiffer et al., 2014). Youth in Tanzania use search engines such as Google to find health-related websites and information (ibid.), but not much is known about digital mental health services.

3 Advantages and disadvantages of using digital approaches

Using digital approaches has some advantages over face-to-face mental health interventions, but does come with challenges.

3.1 Advantages

Young people are interested in digital technology, making digital approaches to mental health attractive (WEF, 2019). UNICEF (2017) research found that 40% of four million young people interviewed around the world liked learning about health or school on the internet. Studies from Australia (Montague et al., 2015) and Vietnam (Sobowale et al., 2016; Tran et al., 2018) also found that young people welcomed using digital approaches for mental health interventions. For example, young people in Australia (Montague et al., 2015) described technology-facilitated mental health interventions as 'engaging' and 'empowering'.

Creative and innovative solutions: Technology potentially offers new solutions and approaches to addressing young people's mental health (Huang et al., 2019), and can make treatment more appealing and interactive. For example, game-based approaches can make learning more meaningful, engaging, visual and interactive (Gonsalves et al. 2019). Technology can also provide innovative solutions for health providers with diagnosis and developing treatment plans; for instance, AI and machine learning can generate new insights into disease subtypes and can optimise screening and treatment (WEF, 2019).

Access and reach: As will be discussed in section 3.2, the cost of acquiring and using digital technologies may exclude economically disadvantaged young people from digital interventions. However, digital technologies can also improve access to services and information for previously unconnected and under-served communities (Livingstone et al., 2017). They can overcome geographical barriers to treatment and engage hard-to-reach groups (Grist et al., 2017), such as those living in remote locations with limited psychiatric providers (Ramtekkar, 2019), those from disenfranchised and minority populations (Clarke et al., 2017), or those unable to access face-to-face therapy, for example because of medical conditions or financial constraints (Chipise et al., 2019). A report by the World Economic Forum (WEF) (2019: 14) describes digital mental health interventions as 'equalising', as they have the potential to reach all individuals 'regardless of race, country, income or gender'.

This may be particularly important in LMICs. For example, Osborn et al. (2020) argue that low-cost digital self-help interventions that do not require trained professionals are particularly useful in low-resource contexts. Sobowale et al. (2016: 2) argue that internet interventions in Vietnam 'extend care beyond the walls of the traditional mental health facilities, allowing access to care at a distance'.

Flexibility: Compared to face-to-face interventions, digital approaches have the advantage of constant availability and immediate support (Grist et al., 2017). Since tech-based mental healthcare is available 'anytime, anywhere, any way' (WEF, 2019: 7), it offers the flexibility to fit users' specific needs. Young people may be more likely to use mental health services when they can choose when and where to access them (WHO, 2019).

Students in Tanzania use laptop computers. © Ericsson Connect to Learn

Cost effective: Around half of those experiencing mental health problems worldwide are not treated (WEF, 2019); one reason for this is widespread underinvestment in mental health services. Technology-enabled mental health services have the potential for scalability at low marginal cost (ibid.), increasing service capacity and efficiency (Grist et al., 2017) and addressing resource challenges (Huang et al., 2019). Digital technology can reduce the cost of deployment of services and expand the capabilities of community health workers (Sachs et al., 2015 cited in Livingstone et al., 2017). For example, research suggests that internet therapy is cost-effective compared to live therapy, pharmacological treatments, and no treatment (Hedman et al., 2012 cited in Sobowale et al., 2016).

Online mental health treatment also tends to be cheaper for users than face-to-face support, which may mean that people unable to afford traditional mental health services can access online support (Clarke et al., 2017). For Vietnam, Sobowale et al. (2016) argue that digital approaches are an attractive option for addressing youth mental health, since they can be used widely with little or no help from providers. However, some digital approaches can be costly

to provide, especially serious games (Pendergrass et al. 2019) or apps that need to be updated and maintained (WEF, 2019).

Anonymity and stigma: Persistent stigma is a key barrier to many people around the world, including young people (Grist et al., 2017), seeking help and treated for mental health conditions (WEF, 2019). Online services can help address this issue, as they can be anonymous, offering a safe space for those not ready to talk about their mental health challenges in a face-to-face settings (WEF, 2019). For example, research suggests that those with stigmatised illnesses, such as anxiety, depression or herpes, were significantly more likely to use the internet for health information than those with non-stigmatised illnesses, such as back pain and diabetes (Berger et al., 2005 cited in Gallager and Doherty, 2009).

Skills and empowerment: Using digital approaches for mental health can also help develop young people's digital skills. In a literature review focused on China, India and Vietnam, Lim and Nekmat (2008 cited in Livingstone et al., 2017) concluded that media literacy skills can empower youth to express themselves and to raise societal awareness about issues that concern them. Mental

health technologies can also be empowering, as they can allow people take responsibility for their own mental health (WEF, 2019).

Building digital skills can be especially important for girls, who tend to have less advanced digital skills than boys (Livingstone et al., 2017; see also Box 2). It can support employment and personal development, for example, empowering girls to participate in political movements, to campaign on gender-based issues or choose partners online (UNESCO, 2019). Girls with digital skills may have more options and information when making choices that affect their health and wellbeing, their careers and life trajectories (ibid.). Semali and Asino (2014) found that entrepreneurial women in Tanzania believe that mobile phones and apps improve their literacy and linguistic skills, personal communications, social and business networks and inter-group relations.

3.2 Disadvantages

Risk of exclusion: Even though digital approaches have the potential to extend access to populations who would otherwise not seek mental health treatment, there is a risk that they exclude some groups such as:

- **Young people who lack access to technology** (Huang et al., 2019). One does not only need a working phone, but also airtime, battery charge, network signal and financial resources to maintain this in order to access information and help (Hampshire et al., 2015).
- **Young people with low literacy or digital skills** (Huang et al., 2019) who lack 'technical know-how' and skills to access relevant information and online mental health services.
- **Young people who are unaware of digital approaches** to mental health. 15–21-year-olds and parents participating in focus groups in Danang, Vietnam suggested that one of the main barriers to using digital approaches for youth mental health was a lack of awareness of web-based interventions. Participants said that many young people were unaware of mental health websites (that were not well advertised) and mental health issues more generally (Sobowale et al., 2016).[1]

Box 2   Gender gaps in access to technology and digital skills

Data from across the world points to gender gaps in access to technology and digital skills, with wider gaps in LMICs (Livingstone et al., 2017). In households with access to digital technologies, girls tend to get access at a later age than boys. Older boys are also more likely to be allowed to use some of their earnings for mobile phone access, while girls' income is more likely to be used for family survival (ibid.). In Tanzania, for instance, research suggests that girls are less likely to use the internet over concerns they will meet the 'wrong people' online as well as norms restricting female freedom (Pfeiffer et al., 2014).

However, the rapid decline in price of connectivity and hardware means the main access barrier for women and girls is educational, not technical (UNESCO, 2019). Women tend to be less likely to know how to use smartphones, the internet and social media and to understand safeguarding information in digital mediums (ibid.). There are also gender gaps in digital skills, from the lowest skill proficiency levels (e.g. using apps on a phone) to the most advanced (e.g. analysing large data sets) (ibid.). Although interventions have tried to address gender inequality, digital skills gaps appear to be widening, with the largest gender gaps in digital skills reported in South Asia and sub-Saharan Africa. Studies suggest this is due to patriarchal cultures and norms (ibid.).

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1   However, this may also be related to limited availability of online information on adolescent mental health, specifically in the Vietnamese language (Tran et al., 2018).

All of the above may mean that young people in areas most in need of remote mental health services (e.g. in rural settings in low-income countries) may find it hardest to access them (Hampshire et al., 2015). If inequalities are not accounted for, ICT in development can potentially exacerbate forms of exclusion (Livingstone et al., 2017).

Technological limitations: Technology and digital media may be particularly unreliable and difficult to use in low-income settings (Livingstone et al., 2017) due to limited access to electricity and internet connection issues (Hamady and Marinos, 2020). Registered psychologists in South Africa (Chipise et al., 2019) raised concerns about technological issues compromising the effectiveness of online therapy. In a digital storytelling intervention with girls in Tanzania, poorly functioning touch pads and microphones not picking up sound properly caused difficulties (Duveskog et al., 2012). Technological difficulties are exacerbated if participants lack digital skills, as found in digital story telling interventions in South Africa (Pieterse and Quilling, 2018) and Tanzania (Duveskog et al., 2012).

Non-verbal cues and relationships: Technology is also limited in terms of picking up non-verbal cues, which may make it harder for therapists to express empathy or to correctly interpret what clients say (Chipise et al., 2019). Registered psychologists in South Africa (ibid.) also said that it was difficult to control clients' environment during online therapy (e.g. a client may be disturbed without the psychologist being aware).

To facilitate relationship building between therapist and user, Huang et al. (2019) recommend including names and photos of treatment team members on the website/app. During consultations, Hamady and Marinos (2020) suggest trying to establish eye contact and making extra effort to engage the child/adolescent. Similarly, Ramtekkar (2019) recommends using verbal and non-verbal communication skills (e.g. facial expressions) in video counselling.

Ethics and confidentiality: In many countries, especially LMICs, there is insufficient ethical guidance for online mental health treatment (Chipise et al., 2019). For example, Chipise et al. (2019) found that the existing South African ethical code for psychologists does not address online therapy. South African registered psychologists raised concerns that online therapy makes it difficult to obtain informed consent; if individuals confirm consent online they may simply skim through the online form (Chipise et al., 2019).

Although digital approaches can offer anonymity (see section 3.1), the location where tools are accessed poses a risk to confidentiality due to restricted privacy in certain settings. For example, focus groups with 20 youth (15–21 years) in Danang, Vietnam (Sobowale et al., 2016) found that young people living in dormitories or accessing mental health resources via internet cafes were worried about privacy. Similarly, psychologists in South Africa were concerned that a client's family may be able to access information about online therapy if they shared a computer at home (Chipise et al., 2019).

Data security: If no proper security system is in place, data security may also be compromised. For example, psychologists in South Africa raised concerns about the security of online therapy records due to hackers (Chipise et al., 2019). Data leakages can significantly harm both beneficiaries and therapists (Hamady and Marinos, 2020).

Accuracy of information and scams: Concerns have also been raised about the quality and accuracy of online mental health resources and tools. Relying on low-quality information from the internet without professional advice could negatively impact a patients' health (Gallager and Doherty, 2009). A survey with 900 professionals working with young people in Ireland (Clarke et al., 2017) found that users did not trust the quality of information provided on health websites, while a review of young adolescents and digital media in LMICs (Livingstone et al., 2017) notes that it remains unclear whether young people have sufficient discernment to judge what health-related information to trust. There is also a risk of scams or unqualified individuals providing mental health advice. Chipise et al. (2019) recommend that clients verify their therapists' registration on independent websites.

Emergency situations: Compared to face-to-face interventions, digital approaches may also be less effective in detecting and dealing with emergency

situations. Online therapy makes it difficult to act immediately in case of a suicide risk (Chipise et al., 2019). Most websites reviewed in Table A1 included a disclaimer saying that their service was not an emergency service along with links to emergency support (e.g. Wazi, 2019).

Not suitable for some groups: Some illnesses and subgroups may be less suitable for digital mental health treatment. Hamady and Marinos (2020) advise against telepsychology (unless face-to-face treatment is impossible) for children with severe intellectual or learning disabilities, Autism Spectrum Disorder (ASD), schizophrenia spectrum and other psychotic disorders, severe substance-related and addictive disorders or individuals whose primary problems are relationship-based.

Negative impacts of technology on mental health: There is a growing body of literature pointing to the negative effects of technology on adolescents' mental health and there are questions as to whether digital approaches are therefore less suitable for addressing mental health issues. Some research suggests that while moderate internet use (one to two hours a day) can be positive for children's and young people's mental health, excessive internet use (over six hours a day) is likely to negatively affect mental wellbeing (OECD, 2017 cited in OECD, 2018). Problematic Internet Use (PIU) has been associated with anxiety and depression (Anderson et al., 2017 cited in Do et al., 2020), while excessive use of digital technologies and social media can lead to negative sleep patterns, harmful body images (OECD, 2018) and obesity (UNICEF, 2017). Mobile phones and the internet can also be used to distribute harmful content, such as pornography (Livingstone et al., 2017) and harmful verbal language. Girls have been found more likely than boys to report upsetting or harmful experiences online (Livingstone et al., 2017). Furthermore, there child protection risks with predators being able to contact unsuspecting children through anonymous and unprotected social media profiles and game forums (UNICEF, 2017).

Although online spaces can provide young people with intimacy and connection by providing opportunities to connect with peers, they can also be a place of aggression, hostility (Weinstein and Selman 2016) and cyber-bullying – referring to bullying in the online space, such as creating and sharing offensive messages or comments, spreading rumours, excluding individuals from online groups and other forms of harassment (OECD, 2018).

Research in Vietnam found parents were concerned about their children's internet use, for example, believing that online gaming had negative effects on their health and academic performance (Sobowale et al., 2016).[2] In a study of 1,200 Vietnamese young people (Do et al., 2020) 34.4% said they felt anxious or uncomfortable if they did not use the internet for a day and around 60% believed that frequent internet use affected their health. A school-based survey (Nguyen et al. 2020) with 11-year-old students in Hue City found that almost one tenth had been cyberbullied (17.6% reported having been the victim of school bullying). Those students who had experienced cyber-bullying had significantly higher risks of self-harm.

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2   Related to these concerns, the Vietnamese government has imposed restrictions on internet cafes and added taxes to curtail youth online gaming (Sobowale et al., 2016).

4 Conclusions, lessons learned and gaps in the literature

Young people around the world are becoming increasingly connected (Livingstone et al., 2017), with mobile devices and internet connections becoming more accessible and affordable (OECD, 2018). In Vietnam (Tran et al., 2018) and Tanzania (Pfeiffer et al., 2014), most young people access the internet through smartphones and are particularly interested in social media platforms.

Young people's interest in and access to digital technologies presents great potential for mental health interventions. Digital approaches can provide innovative, creative and interactive solutions and may be more attractive to young people who tend to be interested in technology. Tech-based approaches have the potential to extend access and reach to marginalised and remote populations as well as offering flexibility and potential scalability at low cost. The anonymity of accessing online mental health resources may also reduce barriers such as stigma related to mental health challenges. Digital approaches can also improve young people's digital skills and be empowering.

However, the review also found that digital approaches may exclude those who lack digital skills, do not have access to digital technology or are unaware of digital interventions. Such interventions may face technological limitations and there are concerns over ethics, confidentiality and data security. They are also less suitable for emergency situations and for young people with specific mental health disorders.

An understanding of these strengths and weaknesses can help to develop digital interventions. The following sections summarise some key lessons learned for designing, implementing and evaluating digital approaches to young people's mental health.

4.1 Targeting and inclusion

Include different actors: It can help to include young people, health professionals, teachers and families in youth mental health interventions. For example, in their scoping review of global e-health interventions to address children's mental health, Huang et al. (2019) recommend that interventions consider needs across multiple contexts, such as family/home and service provider contexts, and explore the link between these.

Address gender and other inequalities: As discussed in section 3.2, young people's access to digital tools is mediated by factors such as gender, age, socio-economic background and location. It is important to identify these inequalities in order to promote broad and equal access. This combat rather than exacerbate the digital divide and promote equality (WEF, 2019). Livingstone et al. (2017) recommend, for example, being aware of how teachers, parents and peer norms shape children' access to technology and to incorporate this into programme interventions. It is also important that interventions use gender-sensitive language, recruit gender-sensitive teachers or facilitators and ensure a good representation of women facilitators (UNESCO, 2019).

4.2 Designing the interventions

Use an integrated approach: It has been recommended to design multicomponent digital strategies (Huang et al., 2019). As chapter 2 demonstrates, many approaches combine a social media component (e.g. online peer support) with information (e.g. resources on mental health) and the option to access individual support (e.g. counselling). Huang et al. (2019) found interventions to be more successful at addressing child mental health if they included various components, such as web-based education, collaborative consultation and performance feedback.

Combine with face-to-face services: Even though little is known about the best practice of combining digital and face-to face components, several studies found that users prefer a combination of these services (Clarke et al., 2017; Chipise et al., 2019). Blended interventions can increase accessibility, continuity and consolidation (Valentine et al. 2020). Complementing digital approaches with face-to-face interventions may be particularly important in LMICs with limited internet availability (Huang et al., 2019). For example, face-to-face interventions could be used to recruit participants for online interventions (ibid.) or digital interventions could be used to follow-up on treatment received in clinics (Sobowale et al., 2016).

Use relevant types of technology: If young people use phones more than computers (as in Vietnam and Tanzania), interventions designed for phones are likely to be most effective. Different technologies suit different purposes, for example, text messages work well as reminders, while phone calls may be more suitable for consultations (Montague et al., 2015). Rather than asking young people to download a new app or software, it may be easier to rely on technology young people already use, such as WhatsApp (e.g. Headspace, 2020). For example, young people in Tanzania recommended using Facebook to promote health messages (Pfeiffer et al., 2014).

Make it relatable, engaging and fun: Learning is likely to be more effective if young people experience the products as meaningful (Pieterse and Quilling, 2018). It is therefore recommended to build digital media interventions on content that young people are familiar with and can relate to (Livingstone et al., 2017), such as personalised content (Goodyear et al., 2019), pictures, music, videos and games (Kenny et al., 2016) or real-world stories (Gonsalves et al., 2019). The websites/apps reviewed in Table A1 tended to use bright colours, photos, cartoons and videos, stories, up-to-date blogs and interactive. WHO (2020b) research in Jamaica, Nepal, Pakistan, South Africa and West Bank and Gaza Strip found that adolescents were particularly positive about mental health app prototypes using a 'chatbot' – an automated 'chat agent' that gives the feeling of speaking to a human. Some digital approaches have also used avatars or guide characters that young people can relate to (e.g. Gonsalves et al. 2019).

For digital sexual and reproductive health interventions in Tanzania, 15–19-year-olds recommended using humorous material, real-life stories, photo novels, songs, interviews with celebrities, cartoons and 'catchy' ways of conveying messages (copying the approach of the Tanzanian youth magazines Femina Hip, Fema and SiMchezo!) (Pfeiffer et al., 2014). Tran et al. (2018) found that young people in Vietnam are more interested in entertaining rather than educating apps, and suggest incorporating games in digital mental health interventions.

Provide short and clear messages/information: Research suggests that young people prefer easy and efficient content on mental health that does not require much time to engage (Goodyear et al., 2019), is concise, to the point, and expressed in language relevant to young people (Kenny et al., 2016). This may also include concrete examples and emoticons to engage young people and improve understanding (Gonsalves et al., 2019). The websites/apps reviewed in Table A1 tended to use short text and easy language. Focus groups with youth and parents in Danang, Vietnam (Sobowale et al., 2016) found most students were reluctant to spend more than 30 minutes at a time on a mental health website.

Use incentives and reminders: Incentives can encourage young people to participate in digital interventions (see for example, BITE BACK mental fitness challenge described in Table A1).

Huang et al. (2019) also found that parents were more likely to finish parenting courses when interventions included incentive strategies (e.g. raffle tickets, prizes, achieving badges, sharing progress in online communities). Reminders such as notifications or text messages can also encourage use of mental health technologies (Kenny et al., 2016).

Let young people be in control: It is important not to 'force' young people to use technologies but to give them control over how, when and how often they want to use them. For example, young people in Ireland (Kenny et al., 2016) emphasised that they did not like to be told what to do and should be in control of how they used mental health apps.

Allow for offline access: To address the issue of limited internet connection (particularly in LMICs), some interventions make the games/apps/learning tools available offline (e.g. Gonsalves et al., 2019).

4.3   Implementation and sustainability

Provide training: Given that it is a relatively new field, it is important to have sufficient training on digital mental health approaches, both for facilitators and users (Huang et al., 2019). This may include ongoing training on how to use technology and how to engage people from diverse cultures and with different levels of digital literacy (Chipise et al., 2019).

Ensure privacy and data security: It is important to ensure digital technologies for mental health are secure, private and confidential (Gonsalves et al. 2019) and include password protection (Kenny et al., 2016). For telepsychology, Hamady and Marinos (2020) suggest the following security measures:

- Both settings should be private and secure (identify all persons present at both sites).
- Use highly encrypted programmes like WhatsApp.
- Clarify the importance of confidentiality.
- Ask participants to use a password on their phone.
- Ask participants to delete traces of call if using someone else's phone.

- Use a headset and ask participants to use headsets.
- Do not send data via text message.

Raise awareness and build partnerships: To encourage use, it is important to raise awareness about tools, including both offline and online approaches, such as word of mouth, Facebook, Twitter, websites, magazines, newspapers, television and radio (Kenny et al., 2016). Awareness-raising approaches may also involve partnership building. For example, young people in Vietnam (Sobowale et al., 2016) suggested partnering with the Youth Union – the largest socio-political group in Vietnam – to increase awareness of digital interventions to address mental health.

Consider sustainability: When designing digital interventions, it is important to consider long-term affordability and maintenance (WEF, 2019). Internet interventions need ongoing maintenance and upgrades of software systems, which need to be adequately planned for (WEF, 2019).

4.4   Evaluation and learning

Evaluate impact: Several studies have called for robust evaluations of digital approaches to mental health (e.g. WHO, 2019 cited in WEF, 2019) – with large enough sample sizes (Osborn et al., 2020). Huang et al. (2019: 806), in their scoping review of e-health approaches to child mental health, concluded that 'well-designed, high-quality evaluations are needed to better understand the factors and service delivery approaches and contexts that that contribute to of eHealth-related benefits' (see Janokovic et al., 2020 for a systematic review of methods for evaluating digital mental health interventions).

Longitudinal approach: Some studies have emphasised the need for a longitudinal approach, assessing impact at different intervals of time (Pendergrass et al., 2019; Osborn et al., 2020).

Make sure control group participants do not feel left out: It has been recommended to involve participants from control groups so they do not feel left out or unfairly treated (Pieterse and Quilling, 2018). For example, Osborn et al. (2020) designed a digital study skill intervention for control group participants.

'Test and learn' approach: The 2019 WHO guidelines on Digital Interventions for Health System Strengthening (cited in WEF, 2019) recommend a 'test-and-learn approach' to evaluate digital health interventions. This includes being flexible in the design and approach to trials and to allow for the ever-evolving nature of digital interventions in the test design. A test-and-learn approach can allow for continual assessment and improvement and help to identify unintended consequences of interventions (WEF, 2019).

4.5   Gaps in the literature

The literature review has shown a growing interest in digital approaches to addressing mental health, but some gaps in the literature remain.

LMICs: Most high-quality websites/apps/ training courses on adolescent mental health were developed for and are targeted at young people in HICs (e.g. United Kingdom, Australia and the United States). More research is needed to understand the potential of technology for addressing mental health in LMICs, especially for adolescents. A recent review of digital technology for mental health problems in LMICs identified 49 studies, out of which only four focused on adolescents or youth (Naslund et al. 2017 cited in Gonsalves et al. 2019). Hampshire et al. (2015) found that out of 4,500 young people in Ghana, Malawi and South Africa, the large majority of participants had never heard of mHealth programmes. Research on mental health digital technologies in LMICs is particularly important because low-income communities and countries are most underserved in terms of mental health services (WEF, 2019).

Vietnam and Tanzania: There is a lack of high-quality mental health websites that specifically address young people and are currently available in Vietnam (Sobowale et al., 2016). Tran et al. (2018) argue that few young Vietnamese use health apps because there is a lack of such apps in the Vietnamese language. The few apps available (e.g. eDoctor and Bacsi24) mainly focus on connecting healthcare facilities and patients and are not specifically targeted at youth. The authors also note that most mHealth apps in Vietnam have not had their effectiveness evaluated nor been officially approved by

healthcare authorities, which may make them less acceptable. Even less is known and available in terms of digital technologies for addressing youth mental health in Tanzania.

Involving different groups (especially young people): The review could not identify much literature on how digital approaches to adolescent mental health can best involve different groups, such as youth from different backgrounds, parents and teachers. Sobowale et al. (2016) call for more research on whether interventions improving caregivers' knowledge on adolescent mental health can improve youth mental illness and promote help-seeking in Vietnam. There is also a lack of research about involving young people in the design, implementation and evaluation of interventions. Hermawati and Lawson (cited in Tran et al. 2018) found that only 22.5% of the mHealth trials they reviewed involved targeted populations in the development phase. Livingstone et al. (2017) also suggest that there is limited information on children's own views on and concerns about using the internet.

Under 18 age group: A systematic review of the available evidence on mobile apps for mental health of young people under 18 years (Grist et al., 2017: 10) concluded there is insufficient evidence to support the effectiveness of apps in addressing the mental health of that age group. Few apps have been specifically developed for young people and the benefit of mental health mobile apps for young people is unclear. The authors call for 'methodologically robust, adequately powered research evaluating the safety, efficacy, and effectiveness of mental health apps for children and young people with mental health problems'. Further, the literature review could not identify much information on what approaches work best to address the mental health issues of particular age groups, such as early, mid, and late adolescents.

Combing digital with face-to-face approaches: Some studies found that young users prefer a combination of digital and face-to-face approaches to mental health (Clarke et al., 2017; Chipise et al., 2019; Valentine et al., 2020), but little is known about how to do this effectively (Valentine et al. 2020). Further research could investigate how face-to-face interventions can address some of the disadvantages of digital approaches discussed above.

'Serious games' apps: Even though serious games have long been considered an important way to address young people's mental health, a limited number of studies has evaluated app-based serious games for mental health (Gonsalves et al. 2019). There is particularly limited evidence on mental health games in Africa (Pendergrass et al., 2019). Less empirical work has been done on video games in Vietnam, even though many Vietnamese high school students play video games (Sobowale et al., 2016).

Tools and 'what works': There is a need to develop and test new methodologies and measurement tools for assessing eHealth interventions and target users, readiness and usability (Huang et al., 2019). In a review of the literature, Rauschenberg et al. (2020) found that evidence on long-term effects, process quality and cost-effectiveness of digital approaches to address mental health is very limited. Research that investigates 'what works' in different contexts and for different young people can help to harness the potential of digital technologies.

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Annex 1   Overview of digital approaches to addressing adolescent mental health

Table A1 provides examples of some digital approaches to address adolescent mental health and is based on the interventions/studies that came up following our search strategy.[3] It is far from comprehensive, but offers an overview of what has been done and indicates the outcomes of interventions, where available.

Table A1 Overview of some digital approaches to address young people's mental health

Name, source and funder	Country and target group	Objective	Main component	Impact/evaluation
Workshop interventions				
Digital storytelling intervention (Pieterse and Quilling, 2018) Supported by the UKZN University Teaching & Learning Office	South Africa, 172 girls in a Girls' High School (Grade 9 and 10)	Reflecting on psychological factors and supporting more informed decision-making	Pupils created digital stories and commented on public and peer videos. They worked in self-selected groups of two to four members after school hours. They downloaded a video screenplay template called 'Inside Outside' from a website (Nab'Ubomi) and used it to write and act a 10-minute screenplay, which dealt with internal psychological and external/environmental factors in their lives. Recordings were made with Sony podcast videos, mobile phones or webcams. The intervention lasted for three school terms.	A qualitative study found that participants improved their understanding of emotions and behaviour and engaged in reflexive practice. Other outcomes included feeling more appreciative of their own situation, more sympathetic of others, less judgemental and determined to change for the better. There were some difficulties with group work, with peer comments on videos proving emotionally disruptive for some. Some videos were of technically poor quality.

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3   In addition to these examples of digital interventions that directly address young people's mental health, there are also many examples of digital interventions with indirect effects on youth mental health. For example, digital approaches have been used in sexual and reproductive health, HIV/AIDS, maternal health, empowerment and civic engagement, education and in humanitarian settings.

Table A1 Overview of some digital approaches to address young people's mental health (continued)

Name, source and funder	Country and target group	Objective	Main component	Impact/evaluation
SSI Shmiri-Digital intervention (Osborn et al., 2020) Funded by Shamiri Institute	Kenya, 13–18-year-olds (those with and without clinically elevated symptoms of depression or anxiety) from secondary school in Kimabu Country	Improving mental health of young people	The Shmiri-Digital (Shamiri means 'thrive' in Kiswahili) intervention was a universal (i.e. delivered to all youths in a setting rather than solely those with elevated symptoms), computerised self-help single session intervention. It was adapted from non-digital activity (see Osborn, et al., 2019 cited in Osborn et al., 2020). The intervention took place in groups of 18 or fewer participants at the school computer lab. 103 students filled in a baseline online questionnaire and completed the activities, followed by a feedback and demographic questionnaire. Students were given as much time as they wanted; on average they took 90 minutes to complete all three stages. Students participated either in the mental health intervention or in a control group study skills activity intervention (on note-taking skills and effective study habits) and completed a follow-up questionnaire after two weeks. The mental health intervention included the following reading and writing exercises: 1. **Growth mindset:** to strengthen beliefs that personal characteristics can improve. This involved learning about the brain's ability to grow; reading a growth testimonial of a Kenyan peer and writing their own growth stories about a challenge they had faced and overcame. 2. **Gratitude intervention:** to promote recognition and appreciation of good things. In a 'good things' exercise students listed three things in their lives that they were thankful for. 3. **Value affirmation:** to encourage participants to reflect on their core values. They wrote about a time when they used their values to guide life decisions.	A randomised controlled trial found that compared to the control group, Shamiri-Digital had significant effects on depressive symptoms in the full sample and even more substantial effects in the high-symptom sub-sample. There were no significant effects on anxiety symptoms, well-being or happiness.
PRIDE project (Premium for Adolescents) (Sangath, n.d.) Supported by Sangath, The Wellcome Trust, Harvard Medical School, London School of Hygience and Tropical Medicine	India, 11–19-year-olds with mental health problems	Developing and evaluating a psychosocial intervention programme	The PRIDE project (2016–2020) developed three interventions for common mental health problems: 1. A self-help intervention delivered through a workbook. 2. A self-help intervention delivered through a mobile app. 3. A psychological intervention delivered by counsellors. The project launched a platform (www.itsoktotalk.in) to encourage young people to share their experiences of mental health. The 'Find help' function offers information and includes links to a free mental health chatbot, Wysa. The creators worked with illustrators to create intervention material in the form of graphic narratives.	Not aware of evaluation.

Table A1 Overview of some digital approaches to address young people's mental health (continued)

Name, source and funder	Country and target group	Objective	Main component	Impact/evaluation
Kazakhstani Family Together (KFT) Intervention (Ismayilova and Terlikbayeva 2018) Funded by the National Institute on Drug Abuse	Kazakhstan, 14–17-year-olds who reported at least one risk factor (e.g. substance-using, family members or friends/ parental criminal history)	Supporting mental health and reducing drug abuse of young people	During focus group discussions and co-design workshops, participants expressed a preference for games with real-word stories. The intervention involved three sessions (each 25–30 minutes long). Participants were divided in two groups: 1. Usual Care Alone, a school-based health education programme on HIV and drugs. 2. Usual Care and KFT intervention, which included three computerised sessions on sexual and drug risk reduction, resistance to peer pressure and strengthening family relations. All participants completed baseline, three- and six-month computer-assisted surveys.	A randomised controlled trial found that participation in the KFT intervention improved personal and social competencies, such as assertiveness and self-esteem at three months and better self-control skills, helping to reduce emotional distress.
Digital storytelling workshop (Duveskog et al., 2012) Funding from the Academy of Finland	Tanzania, Iringa rural primary school students	Developing solutions to overcoming challenges in life	Before the workshops, all students were individually interviewed about their hobbies, computer knowledge, preferred software and life dreams. Students worked in teams to develop digital stories about their dreams and solutions to overcoming challenges in life. The story evolved around four challenges: 1. Failing studies. 2. Resources and the learning environment. 3. HIV and friendship. 4. Partnership, marriage, and family. Students felt motivated as facilitators will combine the pupils' products into an online storytelling game platform.	Not aware of evaluation, but qualitative data suggests that digital storytelling has advantages over traditional storytelling. The authors recommend following six principles for successful digital storytelling workshops: 1) commitment, 2) contextual grounding, 3) previous exposure to the context, 4) involvement of local experts, 5) atmosphere of trust, and 6) realistic flexible planning.
Discover learning (HPON, 2020) Funded by Save the Children, Dalberg, Bill and Melinda Gates Foundation	Tanzania, Dar es Salaam, 10–11-year-olds	Providing new insights into early intervention opportunities for improving the life trajectories of adolescents	The project will involve 12 after-school sessions (each two hours long) with an adult facilitator. Youth work in mixed-gender teams of five persons. Activities include laptop-based learning activities and non-digital components (e.g. team building and collaborative group work, time for reflection).	Not yet evaluated.
Apps, websites and games				
SocioEmpathy app (Panatagama et al., 2018) Information on funding source, not available	Indonesia, young people whose parents are divorced and/or who have suffered from domestic violence	Supporting children whose parents are divorced and/ or who have suffered from domestic violence	Interviews were carried out to understand young people's needs. Based on the findings, a free app was developed with the following features: 1. **Timeline for sharing stories**: young people can share their thoughts and problems, and others can comment. 2. **Mood tracker**: users can choose an emoticon that represents their mood on the day they log in. They can track how they felt over the past week/month. 3. **Panic button for emergency situations**: users can either send a message to their friends or connect with others with similar problems. 4. **Personal chat**: users can add other users as friends and send messages to each other. For a fee, users can also use the app to book two-hour treatment sessions with a professional.	The authors found that users were generally happy with the application, but they did not carry out a rigorous evaluation.

Table A1 Overview of some digital approaches to address young people's mental health (continued)

Name, source and funder	Country and target group	Objective	Main component	Impact/evaluation
Mentally Aware Initiatives (2018) NGO funding from various sources	Nigeria, adolescents (and adults)	Ending mental health stigma, and creating a comfortable environment for open conversations about mental health issues	Mentally Aware Nigeria Initiative is Nigeria's largest youth-run and youth-focused mental health organisation They provide simplified and easy-to-read resources both offline and via social media and run projects across psychiatric hospitals, universities, and prisons. Users can take mental health tests on the websites and seek advice if the test shows that they have symptoms. Tests include: 1. depression test (in English and Spanish); 2. postpartum depression test; 3. anxiety test; 4. psychosis test; 5. bipolar test; 6. eating disorder test; 7. post-traumatic stress disorder (PTSD) test; 8. parent test; 9. youth test; 10. addiction test. The website explains what the tests are and who should use them. Each test has about ten easy multiple-choice questions and asks for demographic information. The website also includes links to surveys to generate data and information.	Not aware of evaluation.
Wazi (2019) Business charging users fees	Kenya, adults and adolescents	Talking to a local counsellor over the phone (anonymous digital counselling wherever you are)	The app/website connects people with local certified Kenyan therapists. You can access Wazi through Facebook messenger or telegram (a messenger app); there is no need to download a new app. Users are encouraged to use anonymous and can provide feedback after the session. Wazi also provides digital tools for counsellors, counselling groups, NGOs and government. The website is in English only, uses bright colours and catchy images, and is short and easy to read (you can read the whole page in about three minutes). Users pay for the service. There is also an option to 'gift Wazi to someone'.	Not aware of evaluation.
POD (Problems, Options, Do it) Adventure app game (Gonsalves et al. 2019) Part of the PRIDE research programme; see above	India, 12–17-year-olds in local schools in New Delhi and Goa	Not publicly available	This problem-solving game-based app is available offline on smartphones. It includes: 1. **Adventures**: games; short vignette-based stories exploring different adolescent characters and their problem-solving; this includes guided imagery, breathing, and relaxation exercises. The design of the game was based on photos taken at the schools and surrounding areas. The game aims to be non-directive and to provide user choice. 2. **POD** (identifying 'Problems', generating 'Options', and creating a 'Do it' plan) consolidates learning from the previous steps through real-world application. This includes forced-choice and open-text questions, for example, 'Write down some good things about this option'. It also includes an 'Options bank' around different life domains (e.g. school, at home, neighbourhood). Navigation within and between the sections is supported by a guide character.	A randomised controlled trial is planned to evaluate the intervention.

Table A1 Overview of some digital approaches to address young people's mental health (continued)

Name, source and funder	Country and target group	Objective	Main component	Impact/evaluation
SPARX (Smart Positive Active Realistic X-factor thoughts) game (Merry et al., 2012 cited in Pendergrass et al., 2019; Paperny and Starn cited in Pendergrass et al., 2019) Supported by the Prime Minister's Youth Mental Health Project and the University of Auckland	New Zealand. Also used in other countries, adolescents	Helping adolescents dealing with depression	This game was developed with young people. It is a three-dimensional interactive game where the user can choose an avatar and solve challenges in a fantasy world dominated by GNATs (Gloomy Negative Automatic Thoughts). The player travels through six provinces with the following themes: 1) finding hope; 2) being active; 3) dealing with emotions; 4) overcoming problems 5) recognising unhelpful thoughts; and 6) challenging unhelpful thoughts. Before and after completing each level, a guide provides education and sets real-life challenges as homework. Participants also have a paper notebook that summarises each level and allows users to add comments and thoughts.	A randomised controlled trial with 187 participants from school-based counselling services, youth clinics and general practices shows that participants who played SPARX had a higher reduction in depression than the control group. The same was found at a 5-months follow up.
Headspace app/ website (2020) Initiative of the National Youth Mental Health Foundation Ltd, which is funded by the Australian Government Dept. of Health	Australia, adolescents and their friends and family	Providing information about mental health challenges for young people and friends and family	The free website/app includes the following features: 1. **Headspace centre**: book face-to-face visits with health professionals. 2. **Online and phone centre**: online, email, or phone consultation with a qualified professional. 3. **Spaces**: manage and collect resources for personalise mental health toolkit. 4. **Group chat**: connect with other people, led by professionals. 5. **Blog** with youth mental health topics. They also have FAQs and a disclaimer that it is not an emergency service	Not aware of evaluation.
BITE BACK (2020) Supported by the Australian Government Department of Health	Australia, 12–18-year-olds	Free self-guided online wellbeing and resilience programme for young people	Released in April 2018, BITE BACK has received over 10,000 registrations during its first 12 months. It uses fun, interactive activities, quizzes, animations and information and links across nine **positive psychology domains** including: 1) gratitude; 2) optimism; 3) flow; 4) meaning; 5) hope; 6) mindfulness; 7) character strengths; 8) healthy lifestyle; and 9) positive relationships. BITE BACK's **Mental Fitness Challenge** guides users through five domains of positive psychology: 1) gratitude; 2) mindfulness; 3) character strengths; 4) social connections; and 5) meaning and purpose. Each week they participate in animations, quizzes and activities. At the end they can enter a draw for gift vouchers for their selected brands. Commitment is up to the user. They also have a youth educator page with a range of resources and videos. The website is colourful, with images and videos.	A randomised controlled trial finds that the more often young people engage with BITE BACK the greater the benefits to their mental health and wellbeing. Qualitative data suggests that the acceptability of the BITE BACK website was high.
TeenMental Health (2020) Information on funding source unavailable	Global, 12–25-year-olds, families, educators, health providers, policy-makers and others	Disseminating the highest quality mental health information	Free website with trustworthy resources/toolkits about a variety of topics, such as, social anxiety disorder, OCD, panic disorder, depression, bipolar disorder. The websites use colourful cartoons and quotes. It also provides targeted information for friends, health professionals, parents and educators. They also have a YouTube channel with videos explaining mental health and brain development.	Not aware of evaluation.

Table A1 Overview of some digital approaches to address young people's mental health (continued)

Name, source and funder	Country and target group	Objective	Main component	Impact/evaluation
MeeTwo app/ website (2020) Partners include Expo Live, School for Social Entrepreneurs, Anna Freud National Center, Fair Education Alliance, Birkbeck University of London	UK, adolescents	Free fully moderated mental health support for young people	The free website/app includes the following functions: 1. **Chat**: Users can post questions and other users and peer supporters provide advice. Moderators check all posts and replies to eliminate all bullying, judgement or humiliation. 2. **Educational resources**: are developed in response to users' needs. 3. **Helplines**: users can call a helpline. 4. **Shop**: users can order books and materials.	About 5,500 young people use the app every month, mainly from the UK. Each post receives an average of three replies. Users enjoy reading others' stories and find it helpful to find out about other apps and products that improve wellbeing. A review by Thackery (2018 cited in MeeTwo 2020) found that using MeeTwo **increased self-esteem** of young people who received counselling.
Childline (2020) An initiative of the National Society for the Prevention of Cruelty to Children (NSPCC)	UK, Young people	Mental health support for young people	The free website includes the following features: 1. **Advice and resources**: on bullying, you and your body, your feelings, friends, relationships and sex, home and families, school, college and work. 2. **Get support**: young people can call, chat online or send an email to a counsellor (for free) (they have a specific help section for deaf children). 3. **Message board**: users can use to talk to other safely and anonymously. 4. **Write to ask Sam**: young people write letters to Sam who will answer the letters on the website. 5. **Toolbox**: includes games and video, such as wall of expression (write on the wall and then watch your worries crumble away) or balloon (play our game and feel our worries float away). 6. **Locker**: personal place: save resources, receive and send messages. 7. **Get creative**: ideas for activities, calm zone (calming activities). 8. **Videos**: e.g. build your confidence after online bullying; dealing with stress and anxiety. There is also a variety of other interactive features, such as 'this month's topic'; or 'how are you feeling?'. Bright colours and accessible images are used.	Not aware of evaluation.
The Mix (2020) Charity getting funding from various sources	UK, under-25s	Supporting under-25s in the UK	The free website includes: 1. **Resources**: on a variety of topics (relationships, body, mental health, drink and drugs, housing, money, work and study, crime and safety, travel and lifestyle). 2. **Social media/discussions**: share thoughts, group chat discussion boards. 3. **News and research**. 4. **Apps/games**, including: Stresshead (phone is turned into stress killing machine); Motimator (digital mate to motivate); Stepfinder (points to nearest local support service); Wishfund (keeps track of what you are saving for).	Not aware of evaluation.
Young Minds (2020) Supporters and partners are the Lottery fund, Heads Together, Helplines, Esmee Fairbairn Foundation	UK, adolescents, parents and professionals	Providing advice for adolescents, parents and health professionals	The free website includes: 1. **Find help section** with resources and information. 2. **Get involved**: become a youth activist, find an event. 3. **Online advice for professionals**. 4. **Parents helpline** (free).	Not aware of evaluation.

Table A1 Overview of some digital approaches to address young people's mental health (continued)

Name, source and funder	Country and target group	Objective	Main component	Impact/evaluation
Rise above (2020) Supported by Public Health England	UK, adolescents	Support young people's mental health	This free website includes: 1. **Advice section** 2. **Games**: e.g. Play up to you (play your way though some tricky social situations); Made up (shows how images of stars are altered to improve body images); Relationstick (Make your own sticky person and work through choices to find the best ending to each story.	Not aware of evaluation.
Kooth app/website (2020) Part of XenZone which has partnered with Clinical Commissioning Groups (CCGs), local authorities and Councils.	UK, adolescents	Free, safe and anonymous online mental health support	On the app/website you can find the following free functions: 1. **Magazines**: articles, personal experiences and tips from young people and the team. 2. **Discussion boards**: start a discussion on different topics. 3. **Chat with the team**: message team members or use live chat. 4. **Daily journal**: write in the journal to track feelings and emotions and encourage reflection. There are 153 counsellors with profiles listed on the website (without photos and surnames). It is unclear whether students can choose a specific counsellor. The website provides detailed information on keeping yourself safe, respecting others, publishing and downloading and sensitive topics.	Not aware of evaluation; but data suggests Kooth has 1,500 log-ins every day, 34,000 one-to-one online chat sessions a year, and that 95% of young people would recommend Kooth to a friend.
CopeSmart (Kenny et al., 2016). Funded by the Irish Research Council	Ireland, adolescents		As part of a study to understand young people's perspectives on mental health mobile apps, the authors developed an image of an app prototype and asked participants in focus group discussions to comment on it. The prototype included: 1. **Rate my mood**: Right now, to what extent to you feel happy? angry? Depressed? Stressed? Anxious? Users use a bar to indicate how they feel; they can track their mood in a calendar function and see how they felt over a period of time. 2. **Coping with problems**: users note stressors/problems and ways of coping. 3. **Resources**.	Participants identified 1) safety; 2) engagement; 3) functionality; 4) social interaction; 5) awareness; 6) accessibility; 7) gender; and 8) young people in control as important factors to think about when designing mental health mobile apps.
Learning courses/platforms				
EQUIP (Ensuring Quality in Psychological Support) online platform (WHO, 2020) A WHO initiative	Online sources available worldwide, mental health professionals and individuals	Developing and disseminating resources on the delivery of psychological and psychosocial support	Since 2017, EQUIP has developed assessment tools and guidance to address psychosocial support. Tools have been field-tested in Ethiopia, Jordan, Kenya, Lebanon, Peru, Uganda, Zambia. The dedicated WHO EQUIP online platform will be formally launched at the end of 2020. Freely available resources will range from free digital tools, downloadable guidance and eLearning courses.	Not aware of evaluation.

Table A1 Overview of some digital approaches to address young people's mental health (continued)

Name, source and funder	Country and target group	Objective	Main component	Impact/evaluation
Suicide Research and Prevention E-Learning (2020) A WHO initiative	Online sources available worldwide, mental health professionals	Education about suicide prevention	The WHO Collaborating Centre for Surveillance and Research in Suicide Prevention has developed an E-Learning Programme. Modules include: 1. Background and terminology. 2. Development and implementation. 3. Training for staff. 4. Reporting of surveillance outcomes and dissemination, maintenance and sustainability. 5. Overview of existing surveillance systems or projects for suicide attempts and self-harm. 6. Supplementary material. On the top of the screen, a box shows the module progress in percentage. Users can move between different modules.	Not aware of evaluation.
Aqoon e-learning (Murphy et al., 2017) Supported by the Tropical Health and Education Trust (THET) and the British Council	UK and Somaliland, Medical students, aged 21–33 years	Peer-to-peer global mental health e-learning	Pairs of one UK and one Somaliland student were matched randomly (18 pairs in total); pairs were encouraged to complete eight online meetings to work through a tutorial guide on mental health based on the Mental Health Gap Action Programme (mhGAP) modules:[4] 1. getting to know each other, introduction to mental health assessment; 2. addressing affective disorders; 3. psychosis; 4. child and adolescent mental and behavioural disorders; 5. Dementia; 6. substance misuse; 7. self-harm; 8. suicide.	All students who completed the final survey (18) agreed that the intervention had improved their understanding of mental health. 30% said that they had enjoyed learning about another culture.

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4   The WHO's mhGAP intervention guide for neurological and substance use disorders in non-specialised health settings can be accessed at: https://apps.who.int/iris/handle/10665/259161.

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