**Technology for adolescent mental health**

**Scaling up delivery of evidence-based psychological interventions**

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**Introduction**

Mental health difficulties are among the most common causes of morbidity and mortality among adolescents, as outlined in Chapter 1 ‘Adolescent Health’. Mental distress and disorders impact upon day-to-day functioning, including school attainment, peer and family relationships, quality of life, risk-taking and management of other health concerns. Longer-term, adolescent mental health problems predict increased risk of mental and physical health problems and negative outcomes in adulthood.

Paediatricians often have ongoing relationships with young people and their families. They can be the trusted face of medicine and observe changes in functioning and behaviour. Further, adolescent healthcare includes routine screening for common mental health issues (see Chapter 1). On both counts, paediatricians are uniquely placed to detect mental health difficulties and to provide credible advice. However, this begs the question about how and where to access interventions. In many countries, mental health demands outstrip the supply of mental health services and as a result, young people and their families can be left with frustration about lack of services or can experience dangerous delays.

Digital innovations offer a promising way forward. Over recent decades, psychological therapies have been translated into computerised or online formats. There is a strong evidence-base for many of these, for example, multiple computerised cognitive behavioural therapy (CCBT) programs have been shown to have equivalent effects to evidence-based face-to-face therapies [1-3]. However, there are also a plethora of untested apps and programs [4], and important challenges or questions remain. In this chapter, we outline the opportunities afforded by technology, including current evidence, critical questions, and promising directions.

**Background**

Estimates prior to the COVID-19 pandemic indicated that one in seven adolescents experienced mental health difficulties [5, 6] and these rates appear to be going increasing [7] in part exacerbated by the pandemic [8].Rates of mental health difficulties are higher among adolescents who experience financial hardship [9], are sexual or gender minority [10, 11]are indigenous [12, 13] and those with chronic or complex medical conditions [14, 15]. Talking therapies such as cognitive behavioural therapy (CBT) and acceptance and commitment therapy (ACT) have been shown to be effective for treating mood disorders and anxiety disorders [16-19] including among adolescents with long-term physical conditions [20]. There is some indication that brief interventions may be as effective as more comprehensive programmes [21].While medications can be effective, generally psychological therapies are the first line of treatment and many guidelines recommend that if medication is used, it is in conjunction with talking therapies [22]. Despite these options, less than one-third of adolescents with diagnosable mental health conditions access treatment [23]. Reasons include lack of appropriate, convenient or affordable services [24] and social and psychological barriers such as stigma [23, 24], limited health literacy [23] and ‘help-negating' features of the disorders themselves such as feelings of hopelessness and helplessness [25].

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*Opportunities afforded by technology*

In the face of these challenges, technologies offer important opportunities. Health information, options for help, strategies for dealing with problems and even evidence-based therapies can all be delivered digitally, 24/7, often with low cost for scaling up to large numbers of users. This is potentially transformative, reaching those who would otherwise have limited access to specialist support. Digital interventions can be designed to ensure programme fidelity and provide links to clinical services. They can allow ready translation across languages and adjustments for different settings.

There are four key areas in which digital tools offer promise in adolescent mental health:

* **Reach.** Digital tools can reach large numbers of people, including those in remote areas, those with limited access to appropriate providers, and those who prefer not to use other options. Although there are “digital divides" or disparities in access to devices, the internet and relevant programs, in many cases these are less than divides in access to face-to-face mental health services. In particular, patients from minority identity groups may find it easier to access digital tools tailored for them than to find tailored clinical services in their geographical locality [4, 25].
* **Engagement.** Digital tools offer an ‘engagement’ potential. While some patients will prefer more traditional face-to-face services, many young people are uncertain or reluctant to engage with mental health professionals and may be more likely to engage with digital options [25, 26].
* **Mechanisms of change**. While many digital tools utilise therapeutic techniques that are established in face-to-face therapies, they can utilise new mechanisms of change, for example making use of visual imagery and game mechanics to support experiential learning and behaviour change [27, 28].
* **Support existing practice**. Digital tools can also supplement existing practice, for example gamifying the teaching of social skills, automating routine assessments, or being used alongside face-to-face therapies, for example to teach core CBT skills and allowing a clinician to focus on individual contexts and personal needs [4].

*Varied technologies and integration with services*

The use of technologies for mental health is a diverse and rapidly growing field. The technologies themselves vary widely. They include simple low-cost websites or text messaging interventions which can facilitate help seeking, offer opportunities to communicate with peers or professionals or provide psychoeducation and strategies. They include structured online psychotherapeutic treatments, often offered in a series of modules using video, audio and or text material and sometimes using game-based or alternative formats. They include apps which may offer specific tools such as a mood diary or a mindfulness intervention, or a full standalone treatment [4, 25, 29]. Other formats include automated chatbots, live interaction functions as well as Virtual Reality (VR) and Augment Reality (AR). For example, VR or simulations have been used to address phobias [30]and body dysmorphia [31].

The extent to which technologies are integrated with human support and services also vary. Digital tools can be fully automated self-help interventions, which users can access without referral or the support of a therapist. There are multiple evidence-based self-help tools offering therapeutic components or full evidence-based therapies [32-34].Fully self-help tools can reach large numbers of people at low cost per user and offer anonymous support. However, these typically have lower completion rates than guided interventions where the user works though a digital program with a clinician or assistant providing telephone calls, emails or in-person reminders or support [35].Even brief messages may offer a sense of accountably or support motivation to complete online programs [35]. Digital tools can also be offered in a blended approach [4], where they are integrated into the primary non-digital therapy process, utilising digital tools for assessments, or to augment the therapeutic process, for example having a patient complete an online module as homework [36]. Finally, digital tools can be fully integrated within clinical services, such as when videoconferencing is used to enable remote delivery of services [4].

*Use in practice*

Hospitals and medical facilities worldwide including Johns Hopkins Medicine, and King’s College Hospital are using technology-based interventions to support clinical practice, enhance patient communication and information sharing, and provide brief interventions to their patients. Starship, a major children’s hospital in New Zealand, is using VR to allow young patient to virtually leave the hospital, connect with the world and alleviate boredom or pain.

Public health and other service providers also support access to digital tools such websites, apps or e-therapies. Examples include SPARX for adolescent depression [27, 37] and BRAVE-ONLINE for child and adolescent anxiety [38]. These have been rolled out with government funding in New Zealand and Australia respectively, following robust evaluations [27, 38]. Several evidence-based apps to support adolescent mental health are also available such as Sleep Ninja [39]. Other innovative use of gaming technology includes AKL-T01, a game designed for children with ADHD to improve their attentional functioning [40].

*Case study*

SPARX (<https://www.sparx.org.nz/home>) is a seven module cCBT program delivered in gamified format [27, 37]. It was co-developed by researchers and clinicians (authors of this chapter TF, KS, SM and ML together with Dr Mathew Shepherd), young people, cultural advisors and a game development company, Metia Interactive. SPARX uses a ‘bicentric frame of reference’ where a guide (virtual therapist) introduces the game and each module [27]. After ‘speaking’ to the guide, users enter a fantasy world where they complete quests and solve puzzles which provide non-threatening and autonomy-enhancing ways to discover insights and rehearse skills. For example:

- practicing making decisions, testing them out and trying again if they do not work.

- finding and releasing a ‘bird of hope’ who usually, but does not always, accompany the user thereafter; and,

- ‘shooting’ and categorising ‘gloomy negative automatic thoughts’.

At the end of game-play users return to the guide to consolidate their learning, e.g. via the use of playful quizzes and to reflect on what they will try in real life.

SPARX was not inferior to treatment as usual in a large randomized controlled trial (RCT) [27], and indigenous Māori young people found it to be a useful intervention [41]. It has been adapted for sexual minority youth and other under-served populations [42-44], although versions have been unappealing with young people in a youth justice and some alternative education settings [37, 44]. At the time of writing SPARX is freely available to those with a New Zealand IP address and it can be purchased in Japan. There are various trials of SPARX and developments from it, including a prevention focused version [44-46] and a refined version for indigenous Nunavut young people in Canada [47].

CASE EXAMPLE: Introducing computerised therapy in clinical practice

Lachlan, a 13-year-old cystic fibrosis (CF) patient, is reviewed regularly in a paediatric respiratory clinic. Although Lachlan and his family had previously managed Lachlan’s CF well, his general adherence to treatment had started to deteriorate. During an appointment, it was apparent that Lachlan had been struggling with feeling different from his peers, with concerns about how his body looked and missing out on some peer activities. He was frustrated with his parents’ ‘hovering’ over him and his lack of independence. His mother had noticed that he seemed more withdrawn and had been trying to get him “out of the house more.” Despite Lachlan having negative thoughts, he didn’t meet the criteria for an assessment at his local mental health service and he didn’t want to talk to a therapist.

His paediatrician, recognising that it was important to address these negative beliefs, began to explore alternative treatment options. She discovered an online evidence-based self-help therapy. At a follow-up appointment, she showed Lachlan the program, and they started the first module together during the appointment. Lachlan agreed to complete the rest of the program before their next appointment a month later. Together, Lachlan and his paediatrician spoke to Lachlan’s mother and Lachlan smugly told his mother that his treatment plan was to play an online game.

At their next appointment, Lachlan reported that despite his doubts, the program had helped. Specifically, he found that recognising certain negative thoughts as ‘things to beat’ rather than absolute truths about himself was helpful. He also reported that he had been able to talk to his mother and friends about his difficulties through demonstrating the program to them (which he found easier than talking about what was going on directly).

*Evidence base*

Evidence for technology-based interventions is growing rapidly. A 2021 review for example, identified 246 systematic reviews of digital interventions related to mental health and wellbeing [29]. Diverse therapeutic approaches, differing technologies and varied levels of clinical integration mean that it is of limited value to endeavour to attempt to synthesise the effectiveness of all digital technologies for mental health in single combined analyses, however, there are robust randomised controlled trials of specific digital programs, and multiple systematic reviews and meta-analyses identifying that self-help and guided cCBT programs are effective for mental health problems including depression [e.g., 1,3] anxiety [e.g., 2,3] and somatic disorders [e.g., 48].

At the same time, many commercially available apps, websites and digital therapies are developed with no clinical guidance or evidence base. For example, in a recent review, only 3.4% of apps available on common platforms provided evidence of effectiveness [4].

In the face of this rapidly changing environment, recommendations or endorsement by reputable groups is valuable. Some professional and academic groups offer reviews of the evidence or endorsements for specific tools. For example, see National Health Service wellbeing app guidance, One Mind Psyberguide or the National Registry of Evidence-based Programs and Practices (NREPP) in the United States of America. Several guidelines have been developed to support the adoption of technology into clinical practice, including The National Institute for Health and Care Excellence (NICE) Evidence Standards Framework (ESF) for Digital Health Technologies [49], and the World Health Organization’s Recommendations on Digital Interventions for Health System Strengthening [50]

*Challenges*

Aside from the plethora of rapidly changing options and evidence, challenges in the use of technology-based interventions include high attrition or drop-out rates in many digital tools [51] and uncertainty from both patients and providers.

Patients may expect face-to-face support and require assurance that digital tools are effective. For some groups, access to devices, perceived relevance of digital tools or knowing which tools to trust are problematic.

Likewise, clinicians may be unsure about the effectiveness of digital tools, or have concerns about suitability or safety [52]. There is often the assumption that patients would not want to use technology-based interventions [52]despite evidence that many patients consider technology-based interventions to be acceptable or even, for some, preferable [e.g., 37, 53, 54]. Clinician attitudes are important: recommendations or “prescribing” by clinicians have been shown to influence behaviour. However, this approach is likely to require access to up-to-date resources and training.

**Conclusion**

Technology-based interventions are a rapidly growing and evolving area driven by demand, pressure on health systems and by opportunities afforded via technology. Technology-based interventions can be used to extend the reach of evidence-based interventions and to offer choice and flexibility to users. Tools have been developed for diverse populations and for varied physical and mental health conditions, and more can be expected each year. The growing body of data supporting the evidence and acceptability of technology-based interventions provides assurance that these tools can be adopted into practice, improving opportunities to address important health important health needs at scale.

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