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## **Technology Matters: SPARX – computerised cognitive behavioural therapy for adolescent depression in a game format**

Theresa Fleming<sup>1</sup> Mathijs Lucassen<sup>2</sup>, Karolina Stasiak<sup>3</sup>, Kylie Sutcliffe<sup>1</sup> and Sally Merry<sup>3</sup>

1. Victoria University of Wellington, New Zealand
2. The Open University, England
3. University of Auckland, New Zealand

### **Context**

Adolescent depression is common and its prevalence is thought to be increasing in many high income nations. Addressing adolescent depression has proven challenging using traditional face-to-face psychotherapies, with major barriers including workforce shortages internationally and reluctance to seek help among some adolescents. There is substantial evidence to support the use of digital tools to treat mental health problems, with the National Institute for Health and Care Excellence (NICE) now recommending such tools as a first-line treatment. In this article, we outline the evidence base for SPARX, a digital tool named specifically in NICE guideline NG134, and discuss its use in clinical settings. We also consider implementation issues and future research directions.

### **SPARX**

SPARX (Smart, Positive, Active, Realistic, X-factor thoughts) is an online program designed to treat adolescent depression (Merry et al., 2012). The program delivers core cognitive behavioural therapy (CBT) content in a game-like format comprising seven modules of around 30 minutes each. It uses a 'bicentric frame of reference', in which a virtual therapist (the 'guide') welcomes users in a first-person interface and introduces them to the intervention. The guide's approach is designed to be warm, friendly and empathic and to instil hope. Prior to 'game play', the guide outlines the rationale for each module and invites users to begin play. Users then 'enter the game world', where they are challenged to 'restore the balance' in a world of negativity and hopelessness. Players discover and use CBT knowledge and skills to complete quests, solve puzzles and restore the 'gems of power'. The program employs metaphors, such as behavioural activation to thaw the frozen 'ice province', problem solving strategies to scale a seemingly insurmountable cliff and identifying and collecting 'SPARX' (positive thoughts that manifest as rotating energy balls). This format allows user-driven, discovery-based learning through metaphor and play. Towards the end of each module, users return to the guide and engage in chat-based activities that prompt them to reflect on their experience, integrate skills from the fantasy world to real life, and set their own real-world goals.

The game features of SPARX were developed in order to support learning and behaviour change, and, to support uptake and engagement. Computer games have been shown to be effective for learning and integrating complex cognitive processes. They are also among the most popular entertainments globally. Far from early stereotypes of gaming being the prerogative of teenage boys, the average gamer is about 33 years old, and use is relatively equal among males and females.

When tested in a multi-site randomised controlled trial (RCT), SPARX was not inferior to treatment as usual (TAU) for 187 adolescents seeking help for depressive symptoms in schools or primary health care settings in New Zealand (Merry et al., 2012). Participants in both the SPARX and the TAU

arms had significant reductions in symptoms of depression and anxiety, with per protocol analyses showing higher remission rates in the SPARX arm ( $p=0.030$ ). Smaller trials of SPARX have shown it to be an acceptable and promising intervention for indigenous Māori adolescents and their families (Shepherd et al., 2015), and for lesbian, gay, bisexual and transgender young people (Lucassen et al., 2015), and acceptable and effective among culturally diverse 13–16-year-olds excluded from mainstream education (Fleming et al., 2012).

User feedback highlights that aspects of the SPARX format appeal to many, such as the feeling of personal support from the guide, the overall narrative and sense of discovery, and the feeling of being in control. For example, users reported that it '*felt like the guide cared*', that '*the bird of hope would be at [their] side*' and that the program supported them to really understand and use skills which they had previously only heard about (Fleming et al., 2016). However, adolescents have also expressed the need for a *range* and *choice* of digital and face-to-face supports. Indeed, recent analyses indicate that the inclusion of games or game elements will *increase* appeal among some users while *decreasing* appeal among others, highlighting that diverse approaches are necessary and 'one size will not fit all', even among those with similar demographic characteristics and similar mental health needs (Fleming et al., 2019a).

### Use in practice

SPARX is available in New Zealand as a self-help resource. In the original trials of SPARX (i.e. Merry et al., 2012; Lucassen et al., 2015; Fleming et al., 2012), the program was used without clinical support, although users were referred by service providers or support agencies. Since 2014, SPARX has been available without referral as a pure self-help resource for anyone with a New Zealand internet protocol (IP) address, with optional email or text reminders and helpline support available by phone, text or webchat. Most New Zealand users now access SPARX on the recommendation of a clinician or school, although the program can also be found via the internet, e.g. by searching the term 'depression'. A Japanese version of SPARX (translated and with minor graphics changes) is available on Japanese app stores at a small cost. In Japan, reach has been highest among adult men, whereas adolescents comprise the majority of New Zealand users.

A revised version of SPARX ('SPARX-R') was developed for universal use, for example in school health classes (Fleming et al., 2019a), and was shown to be effective in preventing the onset of depression in a large study in Australia (Perry et al., 2017). This is one of the first e-therapy trials to show a depression prevention intervention effect (Perry et al., 2017). However, trials of earlier versions of SPARX-R delivered to high-needs youth faced technical challenges and low uptake (Kuosmanen et al., 2017; Fleming et al., 2019b).

SPARX can be used as an adjunct to face-to-face clinical practice – for example, as an intervention for adolescents on waitlists – or in a blended-care approach alongside or within therapy. For example, some clinicians report using SPARX to supplement regular therapy sessions to rehearse and/or reinforce core CBT skills in a novel manner (Personal communication). Notably, SPARX has not been formally tested in this way, nor as an intervention delivered with minimal therapeutic support, such as by a wellbeing practitioner. Evaluating these means of delivery would be valuable.

### Challenges and future directions

SPARX was designed in 2008/2009 and developed with research and health funding. This funding model is in stark contrast to that underpinning for-profit commercial games, which are created and updated rapidly, often with very large budgets. SPARX was developed on CD-Roms with subsequent adaptation for delivery via the internet and, later, smartphones. Securing funds for such updates remains challenging for researchers, and commercialising digital interventions presents a further challenge. Users expecting a health tool to function like a commercial game may be disappointed, making updates and clear framing of user expectations especially important. Rather than presenting SPARX as a game that an adolescent might play for fun, for example, clinicians may be better to describe it as a 'game-like' program, with a more playful approach than conventional treatments.

It is important to consider potential harms or risks of digital interventions. For example, there would be risks if the computer-based tool replaced or put users off seeking human help or if energy and motivation were increased without an improvement in mood. Trials of SPARX did not find increased harms or risks among the SPARX group, and a clinical monitoring group has overseen the rollout of SPARX and has not reported problems. The SPARX program includes clear directions to users about when and how to seek further help and free telephone, text and webchat support has been available to users (via contracted helpline services). We consider that such processes are an important part of safe provision of self-help programs. Interestingly, most participants in a small SPARX trial considered that doing the program would mean teenagers were more likely to seek clinical help if they needed it, as they would have the words to do so and the processes of therapy and support had been demystified (Fleming et al., 2016).

Reach and engagement are critical for digital tools to have impact. Classically, trials measure efficacy or effectiveness alone. In contrast, routinely gathered online analytics demonstrate reach and usage outside of trial settings. SPARX analytic data demonstrate wide reach but lower adherence than that seen in trials. This is a consistent pattern seen among many digital and face-to-face interventions in the transition from trials to routine implementation (Baumel, Muench, Edan, & Kane, 2019). Even with this caveat, future developments should improve engagement by maximising within-program efforts (e.g. enhanced telepresence, refined game play and improved persuasive design), which should be employed alongside external supports, such as use in school classes, blended-care approaches and promotional activities.

Finally, as technology continues to develop, there will be opportunities to improve digital tools to better fit contemporary Internet behaviour. For instance, many early evidence-based digital CBT programs were designed to mimic face-to-face models of therapy provision, with weekly sessions of approximately 30–60 min. In contrast, apps and other digital programs may be more optimally delivered in shorter, more frequent dosages. Future directions should include optimising user choice, as is common for Internet applications, and improving integration between digital tools and clinical services.

## **Conclusion**

SPARX has good evidence of efficacy and has been successfully made available nationally in New Zealand for the last six years, reaching large numbers of people in the convenience of their own locations. Keeping up with changing technology trends and expectations will be needed to ensure ongoing appeal. Future work should focus on continuing to develop a range of clinically safe, evidence based engaging and scalable tools to meet the needs of adolescents with depression.

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## Conflict of interest

The intellectual property for SPARX is held by UniServices at The University of Auckland. Any proceeds from licensing or selling SPARX outside of New Zealand will be shared in part with UniServices, The University of Auckland and the developers (Sally Merry, Karolina Stasiak, Matt Shepherd, Mathijs Lucassen, Theresa Fleming).

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