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## Computerised cognitive behavioural therapy for gender minority adolescents: Analysis of the real-world implementation of SPARX in New Zealand

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**Computerised cognitive behavioural therapy for gender minority adolescents: Analysis of the real-world implementation of SPARX in New Zealand**

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Manuscripts

## Introduction

Research has consistently highlighted that sexual and gender minority (e.g. lesbian, gay, bisexual and transgender/LGBT) adolescents frequently experience harmful social environments (Hillier et al., 2010; Lucassen, Clark, et al., 2015) and depression (Lucassen, Stasiak, Samra, Frampton, & Merry, 2017; Marshal et al., 2011; Reisner et al., 2016). Transgender (trans) and other gender minority adolescents are those young people whose gender identity and/or gender expression contrasts with the norms associated with the sex they were assigned at birth. Trans adolescents are thought to be at an especially high risk of mistreatment which is associated with elevated rates of compromised mental health (Reisner et al., 2016; Strauss et al., 2020a, 2020b). To date, studies in the wider adolescent LGBT health field have been dominated by work that has tended to focus on sexual minority (e.g. lesbian, gay and bisexual) adolescents, with gender minority (e.g. transgender) adolescents infrequently the focus. If included in studies, despite their greater need, gender minority adolescents are often grouped together with sexual minority adolescents, usually resulting in an overall LGBT category (Institute of Medicine, 2011). Moreover, until recently, where research was conducted separately with gender minority people, the studies were primarily conducted with adults. For instance, Reisner and colleagues (2016) noted 'a dearth' of research about transgender young people in their review of the health needs of transgender populations, where only 15 (out of 116) studies published between 2008 and 2014 were conducted with transgender children, adolescents, and young people. Their review was inclusive of all quantitative data in relation to disease burden in transgender people of any age (Reisner et al., 2016). Even less has been reported on the experiences of gender minority adolescents which draws on population-based

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3 data, making establishing accurate prevalence estimates in relation to mental health  
4 problems challenging. For example, a systematic review and meta-analysis of  
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6 suicide attempts amongst LGBT youth, based on population-based data, identified  
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8 only one study where the results for transgender adolescents were presented as a  
9  
10 separate group (Di Giacomo, Krausz, Colmegna, Aspesi, & Clerici, 2018). In this  
11  
12 particular study (i.e. Clark et al., 2014) transgender adolescents, as cited in Di  
13  
14 Giacomo and colleagues' (2018) meta-analysis, had an odds ratio of 5.9 (95%  
15  
16 confidence intervals, 3.5-9.8) in regards to suicide attempts compared to their peers  
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18 who were not transgender (i.e. are cisgender). This same study, which was  
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20 nationally representative of high school students in New Zealand, reported that  
21  
22 41.3% of transgender adolescents had clinically significant depressive symptoms,  
23  
24 compared to 11.8% of cisgender adolescents (odds ratio 5.7, 95% confidence  
25  
26 intervals 3.6-9.2) (Clark et al., 2014). However, research on adolescent gender  
27  
28 minority individuals and their mental health has expanded considerably in the past  
29  
30 six years. For example, work published since Reisner and colleagues' (2016) review  
31  
32 has suggested higher rates of mental health problems not just amongst transgender  
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34 adolescents when compared to cisgender adolescents, but also when compared to  
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36 transgender people in older age groups (James et al., 2016; Tan, Ellis, Schmidt,  
37  
38 Byrne, & Veale, 2020).

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48 Given that gender minority adolescents are an under-served population in terms of  
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50 their mental health needs further efforts have been recommended in relation to  
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52 refining, researching and delivering evidence-based psychotherapies to this unique  
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54 population (Austin & Craig, 2015). At present only a very small collection of  
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56 interventions are focused on reducing mental health problems amongst gender as  
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58 well sexual minority adolescents, with the emphasis in treatment so far being on  
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3 sexual minority adolescents (Coulter et al., 2019). In particular, a systematic review  
4  
5 (to January 2019) found only nine interventions in the peer-reviewed literature  
6  
7 designed to reduce substance use, mental health problems, or victimization in  
8  
9 gender and sexual minority adolescents (Coulter et al., 2019). Only three of these  
10  
11 were gender minority–specific interventions, and these all examined transition-  
12  
13 related gender-affirming care (e.g. the effects of cross-gender hormones and  
14  
15 gender-affirmation surgery on mental health). It is perhaps unsurprising that there is  
16  
17 only a small collection of such interventions outlined in the peer-reviewed literature,  
18  
19 as the Royal Australian and New Zealand College of Psychiatrists has previously  
20  
21 highlighted that both gender and sexual minority people have historically been  
22  
23 “criminalised, pathologised and invisibilised” (2016, para. 3) in their position  
24  
25 statement which focused on recognising and addressing the mental health needs of  
26  
27 these under-served populations. These populations however should not be  
28  
29 overlooked, especially when considering that according to population-based data,  
30  
31 gender and sexual diversity are not that rare. In fact, in New Zealand, it is estimated  
32  
33 that 9% of secondary school students are gender and sexual minority adolescents  
34  
35 (Lucassen et al., 2019). This figure is inclusive of 1.2% of adolescents who identify  
36  
37 as transgender and a further 2.5% who are not sure about their gender (Clark et al.,  
38  
39 2014).

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41  
42 Socio-cultural contexts matter and typically gender minority adolescents (like other  
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44 adolescents frequently exposed to mistreatment) cannot simply leave harmful social  
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46 environments, due to the practical constraints around their schooling and their  
47  
48 economic dependence on their families. Unfortunately a proportionately large  
49  
50 percentage of transgender adolescents will have parents who mistreat them (Strauss  
51  
52 et al., 2020b), many will also experience abuse from people outside their family  
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3 (Strauss et al., 2020b) with bullying at school being particularly commonplace,  
4  
5 especially when transgender adolescents are compared to cisgender adolescents  
6  
7 (Clark et al., 2014). Hence, there is a need to address the “pervasive mistreatment  
8  
9 and violence” (James et al., 2016, p. 4) experienced by many trans individuals,  
10  
11 which in turn is associated with compromised mental health. There is now also an  
12  
13 urgent need for widely accessible and effective help to assist transgender  
14  
15 adolescents to develop the best possible skills to thrive. Gender (and sexual)  
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17 minority adolescents in high-income countries are thought to be ‘coming out’ earlier  
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19 in relation to their gender and/or sexual minority status, further exacerbating the  
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21 challenges (Gnan et al., 2019; Lucassen, Clark, et al., 2015). This trend is occurring  
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23 even as transgender adolescents are acutely aware that the adults in their lives are  
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25 instructing them to wait until they ‘grow up’ before ‘making decisions’ about their  
26  
27 gender identity (Singh, 2013). This is noteworthy, because an LGBT adolescent  
28  
29 coming out before the age of 16 years is associated with compromised mental  
30  
31 health, hypothesized to be related to peer group rejection and discrimination (Gnan  
32  
33 et al., 2019). This suggests that interventions delivered when young people are still  
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35 in school are likely to be required (Gnan et al., 2019). Assistance or interventions  
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37 should be available online, because prior work from Australia, the United Kingdom  
38  
39 and North America has established that gender minority adolescents seek informal  
40  
41 support online for issues pertaining to their mental health and wellbeing (Austin,  
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43 Craig, Navaga, & McInroy, 2020; McDermott, Hughes, & Rawlings, 2016; Singh,  
44  
45 2013; Strauss et al., 2017). Moreover, previous research has highlighted that  
46  
47 professionals (including commissioners of mental health services) have recognised  
48  
49 the importance of online interventions for widening access for the help designed to  
50  
51 support these adolescents (Lucassen et al., 2018). However, the ‘Inverse Care Law’  
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3 refers to policies that (often inadvertently) restrict needs-based care in the  
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5 populations with the poorest health outcomes (Watt, 2018) and that “the availability  
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7 of good medical care tends to vary inversely with the need for it in the population  
8  
9 served” (Hart, 1971, p. 405). This is likely to apply to gender minority adolescents  
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11 who have previously reported significant difficulties accessing health care (Clark et  
12  
13 al., 2014). This is not necessarily because they are hard to reach, but because, like  
14  
15 other under-served populations, they are easy to over-look or neglect (Watt, 2018).  
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21 Despite gender minority youth having very high mental health needs, and although  
22  
23 when transgender youth are combined with those not sure about their gender they  
24  
25 make up almost 4% of the adolescent population (Clark et al., 2014), some perceive  
26  
27 that they are too small in size to warrant the roll out of an LGBT- or transgender-  
28  
29 specific online intervention (Lucassen et al., 2018). In theory such interventions can  
30  
31 feasibly be provided across nations and regions in areas where there are no LGBT  
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33 supportive mental health services when delivered as an electronic (digital)  
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35 psychotherapy (e-therapy for brevity). Earlier work has already outlined how  
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37 transgender-affirming adaptations can be made to cognitive behavioural therapy  
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39 (CBT) (Austin & Craig, 2015) and research with other minority populations,  
40  
41 specifically ethnic minorities, also suggests that therapy must be cognisant of a  
42  
43 client’s culture and context (Miranda et al., 2005). Therapy attuned to a client’s  
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45 context is understandably important in order to facilitate adequate engagement with  
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47 treatment (Miranda et al., 2005). However it has been suggested that a minority  
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49 population-specific intervention may not actually be any more effective for minority  
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51 individuals than an intervention designed for the majority (Pachankis, 2018).  
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3 SPARX is a form of self-help computerised cognitive behavioural therapy for  
4 adolescents with symptoms of depression, shown to be least as good as treatment  
5 as usual in primary healthcare settings (Merry et al., 2012). Since April, 2014,  
6 SPARX has been made freely available online to everyone with a New Zealand IP  
7 address (see [www.sparx.org.nz](http://www.sparx.org.nz)). Although the original version of SPARX was  
8 developed with input from LGBT young people (Lucassen et al., 2013) and a  
9 'rainbow version' was developed and assessed in a mixed methods open trial  
10 (Lucassen, Hatcher, et al., 2015; Lucassen, Merry, Hatcher, & Frampton, 2015), only  
11 the original 'mainstream' version of the program is currently available in New  
12 Zealand. Very few e-therapies have been made available to adolescents on a  
13 national-level and to the best of our knowledge none have gathered data on gender  
14 minority users. The aims of this study are to explore whether a 'mainstream'  
15 resource like SPARX, which was developed to appeal to a diverse range of  
16 adolescents, can support the mental health of transgender adolescents as well as it  
17 supports the mental health of cisgender adolescents. We developed three *a priori*  
18 hypotheses for this research. First, given that transgender adolescents are more  
19 likely to report clinically significant depressive symptoms in comparison to their  
20 cisgender peers we hypothesised that transgender adolescents registering to use  
21 SPARX would also be more likely to have high mental health needs at baseline  
22 relative to both male and female adolescent registrants. Secondly, as individuals in  
23 the community with high mental health needs may engage more fully with e-  
24 therapies (March et al., 2018), we hypothesized that transgender adolescents would  
25 be more likely to complete SPARX, than both male and female registrants. Finally,  
26 we hypothesized that transgender adolescents would have equivalent reductions in  
27 depressive symptoms when compared to both male and female registrants, as the  
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3 SPARX program was created to support the mental health of a wide cross-section of  
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5 adolescents.  
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## 10 **Methods**

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12 We conducted a secondary analysis of five years of SPARX usage data, from the  
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14 national launch in New Zealand (i.e. from April, 2014). Thus, this study is a large  
15  
16 open 'real world' trial of SPARX amongst male, female and transgender users of the  
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18 program. Over that period the program was actively promoted via social media  
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20 advertising (specifically on Facebook), government websites (e.g. by the New  
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22 Zealand Ministry of Health [https://www.health.govt.nz/your-health/services-and-  
23  
24 support/health-care-services/mental-health-services/mental-health-services-where-  
25  
26 get-help](https://www.health.govt.nz/your-health/services-and-support/health-care-services/mental-health-services/mental-health-services-where-get-help)), schools and health professionals. At registration individuals are asked to  
27  
28 respond to a combined sex/gender question, where a person could select only one  
29  
30 of four options, in particular "Male", "Female", "Transgender" or "Intersex" (of note,  
31  
32 the results pertaining to intersex users of SPARX are to be reported elsewhere).  
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34 Individuals were also asked their ethnicity (where they could select more than one  
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36 response). To be included in the analyses participants:  
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- 42 • Had to be within the SPARX intervention's target age range at registration (i.e.  
43 12 to 19 years old);  
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- 45 • Had to identify as male, female or transgender; and,  
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- 47 • Had to have completed the program's registration process and begun using  
48  
49 the SPARX program (i.e. had started Module 1).  
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54 All participants in this study had therefore, at the very least, begun the SPARX  
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56 program, which is described briefly below.  
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### *Ethics*

The study was approved by the New Zealand Health and Disability Ethics Committee (HDEC) Reference: 15/NTB/183 (Youth e-Therapy Implementation Study).

### *The intervention*

SPARX is a computerised CBT self-help program for the treatment of depressive symptoms in adolescents. It uses the medium of a fantasy world, where the user's avatar is faced with a series of challenges to rid a virtual world of gloom and negativity (Merry et al., 2012). Each of the seven modules (or levels) takes approximately 30 minutes to complete and each has a direct teaching component whereby a skill from the fantasy world is applied to the user's real-life context (Merry et al., 2012). It has been rolled out nationally in New Zealand with the Patient Health Questionnaire - modified for Adolescents (PHQ-A - further outlined in the 'Outcome Measure' section below). The PHQ-A replaced a Likert-based mood scale used in earlier clinical trials of the program, with the PHQ-A embedded in Modules 1, 3 and 7 of SPARX for the purposes of the national roll-out. Every module begins with "the Guide" (a type of "virtual therapist") greeting the user, providing information about depression and, after the first module, reviewing the content covered in the last module a user completed. Each user customizes their avatar (see Figure 1), which, in SPARX, consists of a character that is 'conventionally' male or female in appearance (i.e. the avatar options are gender binary). In each module the user enters the fantasy world and their avatar completes a mission, after which "the Guide" explains the significance of the challenge and how it applies to real life. SPARX is based on core CBT skills, and set challenges (i.e. homework tasks) are provided to allow practice and facilitate skill generalization. The main CBT skills

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3 covered in SPARX are physically represented by “the shield against depression” with  
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5 six “gem stones” each of which corresponds to certain CBT content, specifically:  
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7 “Relax” (relaxation training); “Do it” (behavioural activation); “Sort it” (social skills  
8  
9 training); “Spot it” (recognizing or naming cognitive distortions); “Solve it” (problem  
10  
11 solving); and, “Swap it” (cognitive restructuring). The shield has a central core, which  
12  
13 is hope. The shield against depression is used at key stages throughout SPARX to  
14  
15 highlight the skills used, and the user collects a “gem stone” associated with the  
16  
17 shield (gems which they find in the fantasy world during the course of each module)  
18  
19 as a reward for completing that level. The physical appearance of each module is  
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21 reflected in metaphors for the concepts covered. For instance, Module Four is the  
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23 “Mountain Province” and users are required to apply problem solving (“Solve it”  
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25 skills in order to climb a mountain in that level.  
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33 *[Insert Figure 1 about here]*  
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### 36 *Outcome Measure*

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38 The PHQ-A is a brief severity measure of depressive symptoms for adolescents, it is  
39  
40 frequently used in primary healthcare and has sound psychometric properties  
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42 (Johnson, Harris, Spitzer, & Williams, 2002). Specifically, it has previously  
43  
44 demonstrated satisfactory sensitivity (73%), specificity (94%) and overall diagnostic  
45  
46 accuracy (92%) (n=403) when compared to clinical interview for Major Depressive  
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48 Disorder in adolescents (Johnson et al., 2002). It consists of nine items, focused on  
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50 the past two weeks in the current study, based on the lead question “How often have  
51  
52 you been bothered by each of the following symptoms...?” measured on a 4-point  
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54 scale (0=Not at all; 1=Several days; 2=More than half the days; and 3=Nearly every  
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56 day). The last question, which assesses an adolescent’s thoughts of suicide and  
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3 self-harm, is “Thoughts that you would be better off dead, or of hurting yourself in  
4 some way?” Total scores range from 0 to 27, and depression symptom severity is  
5 categorized: 0-4=No or minimal symptoms; 5-9=Mild depression; 10-14=Moderate  
6 depression; 15-19=Moderately severe depression; and, 20-27=Severe depression.  
7  
8 In order to assess for changes in depressive symptoms SPARX users are asked to  
9 complete the PHQ-A at the start of Module 1 (i.e. baseline), at Module 4 (i.e. a mid-  
10 point assessment), and at Module 7 (i.e. the post-SPARX measure).  
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### 20 *Analyses*

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22 Descriptive statistics including numbers, percentages, means and standard  
23 deviations were used to summarise results related to: participant demographics;  
24 baseline depression; SPARX adherence and engagement; and, changes in PHQ-A  
25 scores. In relation to ethnicity, participants who chose more than one ethnic group  
26 were assigned a single ethnic group using the Statistics New Zealand ethnicity  
27 prioritization method (Statistics New Zealand, 2005). Adolescents were categorised  
28 as having ‘high mental health needs’, if they had a baseline PHQ-A total score in the  
29 “moderately severe depression” or “severe depression” range and/or a baseline self-  
30 harm and suicidal ideation score indicating medium or above risk. Specifically, in this  
31 study a response of 2 (i.e. “More than half the days”) or 3 (i.e. “Nearly every day”) for  
32 the PHQ-A suicide and self-harm item. Chi-square tests for independence were used  
33 to compare transgender participants to male and female participants for categorical  
34 data. For continuous data (e.g. baseline PHQ-A scores) means for transgender,  
35 male and female participants were compared with a one-way between-groups  
36 ANOVA. Statistical analyses were performed using IBM SPSS Statistics version 24.  
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38 A *p*-value <0.05 was taken to indicate statistical significance in all analyses.  
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## Results

There were 13,489 youth within the target age range (i.e. 12 to 19 years old) who had accessed SPARX, primarily via a personal computer, although more recently users have been able to access SPARX on electronic devices (e.g. tablets) or their mobile phone. In total, 9,079 youth completed the registration process and began using the SPARX program (i.e. they had at least begun Module 1). Of those completing registration and using SPARX, approximately two-thirds reported that they were female (65.7%), almost one-third reported that they were male (32.0%) and 2.3% reported that they were transgender. The majority of users were younger adolescents, who were aged between 12 and 15 years old (Table 1). However, male users were more likely to be younger than female and transgender users ( $p < 0.001$ ). Broadly reflective of the overall adolescent population in New Zealand, approximately two-thirds of SPARX users were New Zealand European, with the next largest ethnic group of users being Māori. There were no significant differences by gender group and ethnicity.

*[Insert Table 1 about here]*

More than 9 out of 10 (91.4%) of those completing registration and beginning SPARX completed the baseline depression assessment. Of the transgender users completing the baseline depression assessment ( $n = 185$ ), more than two-thirds were categorised as having high mental health needs (69.0%) and they were significantly more likely to have high needs in comparison to males and females ( $\chi^2_{(2)} = 289.79$ ,  $p < 0.001$ ). Transgender and female SPARX users had higher mean PHQ-A scores than males, with the mean scores of the male users of SPARX in the moderate

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3 depression range ( $M = 11.1$ ), whilst mean scores for the transgender and female  
4 users of the program were in the moderately severe depression range (at  $M = 16.7$   
5 and  $14.7$ , respectively) (Table 2). A one-way between-groups ANOVA comparing  
6 transgender, male and female SPARX users in terms of mean PHQ-A score at  
7 baseline was conducted, and the differences were significant  $F(1, 192.36) = 38.68$   
8  $p < 0.001$ .

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18 *[Insert Table 2 about here]*  
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21 Approximately half of those completing registration and beginning SPARX completed  
22 at least the first module (i.e. they were well orientated to the program), with males  
23 being less likely to complete a module compared to females and transgender  
24 adolescents ( $p < 0.038$ ) (Table 3). Transgender users who had completed at least  
25 Module 1 of SPARX were less likely to complete Module 4 ( $p = 0.005$ ) and Module 7  
26 ( $p = 0.048$ ) in comparison to males and females who had completed at least Module  
27 1. However, overall completion rates at Module 4 and 7 were low for all users of the  
28 program (i.e. less than 10%), and numbers were particularly small for transgender  
29 users at both Module 4 and Module 7. Users of SPARX (on average) spent less than  
30 25 minutes per module of SPARX in this study. There were no significant differences  
31 between the three groups on average time spent per module  $F(1, 112.74) = 0.026$   
32  $p = 0.99$ .

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48 *[Insert Table 3 about here]*  
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51 Of those completing a baseline and subsequent PHQ-A, both male and female users  
52 of SPARX had improvements in their scores (mean improvement of 2.68 and 3.15  
53 points respectively), whereas transgender users did not. The changes in PHQ-A  
54 scores were statistically significant with both males and females improving and  
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3 transgender users showing no improvement (Table 4). However, caution is required  
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5 when interpreting these results, given the very small number of transgender users  
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7 (i.e. n=14).  
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10 *[Insert Table 4 about here]*  
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## 13 **Discussion**

### 14 *Principal findings and comparisons to previous research*

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16 This is the first study describing the impact of an e-therapy on transgender young  
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18 people. Several points stand out. The first is that 2.3% of SPARX registrants  
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20 reported that they were transgender, which is almost double the proportion of the  
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22 overall transgender adolescent population (i.e. 1.2%) previously estimated in New  
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24 Zealand (Clark et al., 2014). This suggests that transgender young people will use  
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26 an e-therapy, such as SPARX.  
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34 A second key point is that, as hypothesized, transgender registrants had high mental  
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36 health needs, with more than two-thirds of these youth being categorized as such.  
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38 Furthermore, almost half (i.e. 44.9%) had a PHQ-A baseline score in the “severe  
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40 depression” range. This is in line with the statement from the Royal Australian and  
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42 New Zealand College of Psychiatrists (2016) that greater attention is urgently  
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44 needed to address the high vulnerability and poor mental health outcomes of gender  
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46 minority individuals.  
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52 A third key point is that completion rates in this study were very low compared to trial  
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54 data, with less than 10% of participants completing Module 4 and less than 4%  
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56 completing Module 7, compared with 86% and 60% respectively in the original  
57  
58 SPARX study (Merry et al., 2012). Our completion rates in the current study are in  
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3 line with experiences from other implementation efforts, with adherence to e-therapy  
4 interventions one of the major challenges faced currently (Graham, Lattie, & Mohr,  
5 2019). It has been estimated that e-therapy engagement rates are 4.06 times higher  
6 in published trials (where participants are proactively recruited and followed up) in  
7 comparison to the real-world usage of the exact same program (Baumel, Edan, &  
8 Kane, 2019). Furthermore, a systematic review of the real-world uptake and  
9 engagement of digital self-help interventions reported that only 0.5% to 28.6% of  
10 users complete interventions in the 'real world' (Fleming et al., 2018). However,  
11 SPARX completion rates for transgender users, most of whom had high mental  
12 health needs, were especially disappointing, especially in comparison to male and  
13 female users.  
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31 A fourth key point is that the 'look and feel' of SPARX for gender minority  
32 adolescents may in part explain the low completion rates. The forced gender binary  
33 is inherent in the program (i.e. the user can only customize a male or female avatar  
34 with no in-between option). This is an issue LGBT youth have identified, and they  
35 have recommended non-binary options for gender diverse users of the program  
36 (Lucassen et al., 2018). Other aspects of SPARX may also be problematic for  
37 transgender young people, such as the lack of representation of gender diverse  
38 characters that are 'out' (i.e. are open about being a gender minority individual).  
39 However, earlier work suggests that whilst some trans adolescents will not want to  
40 access interventions specifically targeted towards LGBT, youth others have  
41 recommended programs be specifically targeted and tailored to meet the needs of  
42 gender minority youth (Strauss et al., 2019). It is not yet known whether e-therapies  
43 designed specifically to treat depression in transgender adolescents will yield better  
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3 results than a 'mainstream' resource like SPARX in its current form. Efforts are  
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5 underway to refine SPARX in Australia, where the intervention is being adapted  
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7 specifically for transgender young people. This version of SPARX will soon be  
8  
9 evaluated amongst transgender adolescents in Western Australia (Strauss et al.,  
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11 2019). Further, an evaluation of AFFIRM, a bespoke transgender affirmative CBT  
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13 intervention delivered face-to-face in Canada, was effective in significantly  
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15 decreasing depression scores in a pilot study with 8 transgender adolescents where  
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17 decreases persisted through to a 3-month follow-up assessment (Austin, Craig, &  
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19 D'Souza, 2018) indicating the preliminary efficacy of a tailored depression  
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21 intervention for transgender young people. Moreover, seven out of the eight  
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23 transgender participants in the study either strongly agreed or agreed that they  
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25 'would recommend AFFIRM to other youth with sexual and/or gender minority  
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27 identities' (Austin et al., 2018, p. 6).  
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35 The fifth and final key point is that, on average, transgender users did not report  
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37 improvements in their depressive symptoms, although this is a tentative finding given  
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39 the very small number of transgender users completing more than one PHQ-A  
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41 assessment (i.e. n=14). Nevertheless, the high demonstrated need, poor SPARX  
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43 completion rates relative to males and females, and our tentative results in relation to  
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45 depression scores indicate more should be done to support the mental health of  
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47 transgender adolescents.  
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### 53 *Strengths:*

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55 This study has several strengths. In particular, to the best of our knowledge, it is the  
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57 first national study of transgender adolescents seeking assistance for their mental  
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3 health utilising an e-therapy. The measure built in (i.e. the PHQ-A) is widely used,  
4  
5 psychometrically sound and was completed by all users who engaged with the  
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7 applicable modules. The large-scale 'real world' context of this study is a strength, as  
8  
9 the participants used a freely available self-help intervention. Because there were  
10  
11 almost 10,000 users included in this study a sizeable number of transgender users  
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13 were included and despite only 14 transgender participants completing more than  
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15 one PHQ-A assessment, the study is comparable in size to other treatment studies  
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17 in the trans youth field (e.g. Austin et al., 2018).  
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### 23 24 *Limitations:*

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26 Although almost 300 transgender adolescents were originally recruited, completion  
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28 rates were disappointingly low. Demographic data and symptom scores were based  
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30 on self-report. The single sex/gender item was restrictive, because users could only  
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32 select "Male", "Female", "Transgender" or "Intersex" and they were not permitted to  
33  
34 select more than one response, nor were they given the opportunity to describe  
35  
36 their gender in their own words. Ideally gender identity should have been determined  
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38 using the 2-item approach, as recommended by transgender health experts (e.g.  
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40 Reisner et al., 2014); specifically an item on birth-assigned sex followed by an item  
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42 on gender identity. Employing this two-item response may have resulted in an even  
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44 larger proportion of gender minority participants than in our study. This is especially  
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46 true when the second item is inclusive, as when Rider and colleagues asked  
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48 participants, "Do you consider yourself transgender, genderqueer, genderfluid, or  
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50 unsure about your gender identity?" [response options = yes or no] amongst over  
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52 80,000 adolescents in the Minnesota Student Survey, 2.7% were categorised as  
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54 transgender and gender nonconforming (Rider, McMorris, Gower, Coleman, &  
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3 Eisenberg, 2018). Striking a balance between routine collection of data, which is  
4 concise and comprehensible for all adolescents, that does not adversely affect  
5 registration alongside gathering more detailed data for unique sub-populations  
6 creates some challenges. These challenges could be overcome with specific  
7 transgender interventions (either online or offline), as in the AFFIRM intervention,  
8 where psychotherapies such as CBT are refined with gender minority adolescents in  
9 mind. Alongside the need to develop evidence-based interventions that support the  
10 mental health of trans adolescents are improvements in regards to system-level  
11 policies in education, health care and community settings (Coyne, Poquiz, Janssen,  
12 & Chen, 2020). Policies that reduce trans adolescents' exposure to harmful and  
13 distressing experiences are necessary, as bullying and discrimination have  
14 repeatedly been highlighted as negatively impacting upon the mental health of trans  
15 adolescents (Coyne et al., 2020).  
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## 35 **Conclusion**

36 Adolescent transgender users of the SPARX program had high mental health needs.  
37 The poor completion rates and lack of change in depressive scores indicate that  
38 SPARX is probably less effective for these young people. SPARX as currently  
39 delivered without any adaptations, does not appear to meet the needs of this group.  
40 More must be done to address the mental health problems faced by transgender  
41 adolescents and this study underscores the need to design or refine interventions so  
42 that they appeal to gender minority youth.  
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**Figure 1. SPARX characters (the female character dressed in red holding a staff and the male character immediately beside her are the avatars)**

Table 1. Demographics

	Transgender (nN=294)	Male (nN=4135)	Female (nN=9060)	Statistical comparison
<b>Age (years)</b>				
12-15	131 (63.3%)	1927 (66.4%)	3595 (60.2%)	$\chi^2_{(2)}=31.22,$ $p<0.001$
16-19	76 (36.7%)	977 (33.6%)	2373 (39.8%)	
<b>Ethnicity<sup>§,§</sup></b>				
Māori	32 (15.5%)	458 (15.8%)	881 (14.8%)	$\chi^2_{(8)}=10.85,$ $p=0.21$
Pacific	9 (4.3%)	103 (3.5%)	221 (3.7%)	
Asian	8 (3.9%)	231 (8.0%)	466 (7.8%)	
Other	21 (10.1%)	236 (8.1%)	432 (7.2%)	
NZ European	137 (66.2%)	1876 (64.6%)	3968 (66.5%)	

<sup>§</sup> Prioritized ethnicity – if multiple ethnicities were selected users were assigned a single ethnic group (based on the Statistics NZ ethnicity prioritization method) in the following order: Māori; Pacific; Asian; 'Other' ethnic groups (except NZ European); NZ European; <sup>§</sup> Missing ethnicity data for 3 females and 1 male participant.

**Table 2. Baseline depression**

<b>Baseline PHQ-A</b>	<b>Transgender (n=185)</b>	<b>Male (n=2621)</b>	<b>Female (n=5489)</b>
No or minimal symptoms (scores <5)	24 (13.0%)	644 (24.6%)	572 (10.4%)
Mild depression (scores 5-9)	10 (5.4%)	566 (21.6%)	822 (15.0%)
Moderate depression (scores 10-14)	30 (16.2%)	548 (20.9%)	1165 (21.2%)
Moderately severe depression (scores 15-19)	38 (20.5%)	417 (15.9%)	1300 (23.7%)
Severe depression (scores ≥20)	83 (44.9%)	446 (17.0%)	1630 (29.7%)
<b><i>High mental health needs</i></b>	<b>129 (69.0%)</b>	<b>978 (37.3%)</b>	<b>3109 (56.6%)</b>
	<b>Mean (SD)</b>	<b>Mean (SD)</b>	<b>Mean (SD)</b>
<b><i>Mean PHQ-A score</i></b>	<b>16.7 (8.2)</b>	<b>11.1 (7.8)</b>	<b>14.7 (7.2)</b>

**Table 3. SPARX adherence and engagement**

<b>SPARX module completions</b>	<b>Transgender (n=207)</b>	<b>Male (n=2904)</b>	<b>Female (n=5968)</b>	<b>Statistical comparison</b>
At least Module 1	111 (53.6%)	1504 (51.8%)	3263 (54.7%)	$\chi^2_{(2)} = 6.54, p=0.038$
Between Modules 1 & 3	99 (47.8%)	1283 (44.2%)	2692 (45.1%)	$\chi^2_{(4)} = 14.99, p=0.005$
Module 4 or more	12 (5.8%)	221 (7.6%)	571 (9.6%)	
Between Modules 1 & 6	106 (51.2%)	1411 (48.6%)	3024 (50.7%)	$\chi^2_{(4)} = 9.61, p=0.048$
Completed all 7 Modules	5 (2.4%)	93 (3.2%)	239 (4.0%)	
	<b>mins (SD)</b>	<b>mins (SD)</b>	<b>mins (SD)</b>	
Average time spent (in minutes) per Module	23.5 (36.3)	21.4 (21.5)	25.4 (30.2)	$F(1,112.74)=0.03, p=0.99$

Table 4. Changes in PHQ-A scores

Change in PHQ-A total score from baseline to last Module (4 or 7)	Improvements in PHQ-A scores					Statistical comparison
	N	Change in score		95% CI for Mean		
		Mean	SD	Lower CI	Upper CI	
<b>Transgender</b>	14	-0.43	11.09	-6.83	5.97	<i>F</i> (1,888)=3.93, <i>p</i> =0.048
<b>Male</b>	247	2.68	6.68	1.84	3.52	
<b>Female</b>	630	3.15	5.92	2.68	3.61	