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Computer-Based and Online Therapy for Depression and Anxiety in Children and Adolescents

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Original Article

Computer-Based and Online Therapy for Depression and Anxiety in Children and Adolescents

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Abstract

Objective: The purpose of this study was to provide an overview of computer-based and online therapies (e-therapy) to treat children and adolescents with depression and/or anxiety, and to outline programs that are evidence based or currently being researched.

Methods: We began by defining the topic and highlighting the issues at the forefront of the field. We identified computer and Internet-based interventions designed to prevent or treat depression or anxiety that were tested with children and young people <18 years of age (or inclusive of this age range together with emerging adults). We included randomized controlled trials (RCTs). We summarized available relevant systematic reviews.

Results: There is an increasing body of evidence that supports the use of computers and the Internet in the provision of interventions for depression and anxiety in children and adolescents. A number of programs have been shown to be effective in well-designed RCTs. Replication and long-term follow-up studies are needed to confirm results.

Conclusions: There are now a range of effective computerized interventions for young people with depression and anxiety. This is likely to impact positively on attempts to make psychological therapies widely available to children and young people. We expect to see increased program sophistication and a proliferation of programs in the coming years. Research efforts, when developing programs, need to align with technological advances to maximize appeal. Implementation research is needed to determine the optimal modes of delivery and effectiveness of e-therapies in clinical practice. Given the large number of unproven program on the Internet, ensuring that there is clear information for patients about evidence for individual programs is likely to present a challenge.

Introduction

THERE HAS BEEN A SURGING INTEREST IN computer-based and online therapies (e-therapies) for mental health problems, particularly in the use of computers and digital technologies to deliver or augment psychotherapy. E-therapy programs include computer software or online programs that rely on self-help principles and deliver structured therapy content, and can also include interventions supported electronically, which predominantly use technology to overcome the distance between a therapist and patient (e.g., email, moderated chat rooms, videoconferencing) to support face-to-face therapy. In this review, we have focused on e-therapy involving a software program to deliver therapy content.

Most of the current e-therapies used for depression and anxiety are based on cognitive behavioral therapy (CBT). Computerized CBT (cCBT) is a generic term for any delivery of CBT via an interactive computer interface. A number of cCBT programs have been shown to be effective in treating depression and anxiety in adults, and cCBT is now recommended for use in this population in the United Kingdom (National Institute for Clinical Excellence [NICE] 2009) with programs such as Beating the Blues (Proudfoot et al. 2004) having been introduced in adult primary care services in England and New Zealand. Surprisingly, the development and testing of programs for children and adolescents has lagged behind that for adults, and until 2014 there had been no systematic nationwide inclusion of e-therapies in child and adolescent mental health services. The national roll-out of Smart, Positive, Active, Realistic, X-factor thoughts (SPARX) by Merry and colleagues (2012) in New Zealand (in April 2014) marked the first such introduction.

Rationale for the Use of Technology in Delivery of Treatment

There is growing recognition of the scale of unmet need for psychological therapies for common disorders, alongside the knowledge of the limited availability of clinical services and

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trained therapists. The rapid advancement and acceptance of computer technology in everyday life, coupled with the gap in clinical services, has led to the rise of e-therapies. There are a number of benefits to taking this approach. In particular, fidelity in the delivery of content is assured and patients can access treatment at their convenience and work at their own pace in privacy, and, for some individuals, computers may be more acceptable than traditional face-to-face therapy. There is also evidence that e-therapies save both financial cost and therapists' time (McCrone et al. 2004).

Tailoring E-Therapy for Children and Adolescents

The majority of programs developed for adults are not likely to be developmentally appropriate or appealing to children and adolescents. Programs for this age group should be developed with age-appropriate content, presentation (e.g., readability, simplification of complex therapeutic skills, reduced amount of material) and design. Furthermore, the involvement of parents should be considered, particularly with programs for younger children.

Range of Approaches Used

Interfaces

Many first generation e-therapy programs have been delivered by CD-ROM; however, Internet-based resources are increasingly the norm. The rise of social networking brings both potential challenges and an increased range of options in terms of delivering e-therapy. To date, there is limited information about the effectiveness of such approaches, but the popularity of social media suggests that this area is worthy of further investigations if risks such as contagion of suicidal ideation, or cyber bullying, can be managed. To manage these risks, some sites for mental health have been set up to allow moderated anonymous peer-to-peer support; for example, Big White Wall (www.bigwhitewall.com).

Mobile phones are increasingly being used in health, but to date there are few evidence-based interventions targeting mental health disorders, and few for young people (Free et al. 2013). There has been some research into self-assessment and tracking tools (e.g., monitoring mood) but little in the way of interventions (Luxton et al. 2011). Results from studies of the efficacy of mobile phone-based programs for adults with depression have been encouraging (Harrison et al. 2011; Watts et al. 2013) and given the widespread use of mobile phones by young people, this is an area ripe for development. Already there are many mental health-related apps (including mood diaries and mindfulness exercises) available for download, although for the most part, these have not been formally evaluated.

Therapist involvement

Clinicians may be involved in e-therapies in various ways. At one end of the involvement spectrum are pure self-help programs with no therapist input, whereas at the other end are programs requiring considerable therapist contribution or oversight. Early dropping out from treatment has been high in some studies (Melville et al. 2010) especially from entirely self-directed or open access Web-based interventions (Calear et al. 2009). Conversely, support of e-therapy by a clinician can improve adherence (Christensen et al. 2004) and efficacy (Andersson and Cuijpers 2009) for adults. There has been no consensus on what degree or type of assistance is required; however, it is thought that support need not be provided by highly trained therapists (Marks and Cavanagh 2009). Some programs offer just a few minutes per week of encouragement by telephone or online (Williams and Martinez 2008) by peers or nonclinical personnel. Alternatively, computer programming features might be enhanced to provide automated encouragement (Christensen et al. 2009).

From treatment to prevention

To date, trials of interventions for depression and anxiety have typically evaluated reductions in existing symptoms (Stallard et al. 2011; Merry et al. 2012). However, MoodGYM has been tested universally in a large school-based trial and has shown promise of effectiveness in the prevention of the development of depressive symptoms (Calear et al. 2009) and, on the other hand, an online program CATCH-IT has been demonstrated to reduce vulnerability to depression as well as reducing current depressive symptoms (Van Voorhees et al. 2009). Recent meta-analyses suggest that depression prevention programs (usually delivered by teachers or health professionals in classrooms) may reduce the onset of depressive disorders, hence the development and testing of computerized interventions for prevention may be a promising way forward (Merry 2014). Moreover, there have been recent developments in areas of mental health promotion and resilience, and the potential impact of online interventions to enhance psychological well-being warrants attention (Mitchell et al. 2010).

Modes and media

Interventions identified in this review are predominantly text or multimedia materials delivered on a stand-alone computer or, increasingly, online in the form of a web site with interactive features such as Bite Back (www.biteback.org.au). As technology evolves, new formats of e-therapy are likely to be adopted. Multimedia mobile phone programs and smart phone apps show promise for early intervention and monitoring (Reid et al. 2011; Kauer et al. 2012; Whittaker et al. 2012). The use of immersive gaming interventions for mental health purposes (''serious gaming'') has also begun; interventions such as gNAT Island (Coyle et al. 2011) and SPARX (Merry et al. 2012) incorporate learning via ''play''' in a fantasy-based setting. Virtual reality, or wearable smart devices such as ''smart watches'' are likely to expand the possibilities and allow for real-time monitoring. It is anticipated that there will be a range of innovative applications to deliver health and psychological interventions as the technology matures in the coming years.

Meeting the Needs of Unique Populations

E-therapies have the potential to assist in addressing the mental health needs of historically underserved populations such as indigenous people, ethnic minorities, sexual minority youth (e.g., lesbian, gay, and bisexual young people), or people in high needs settings such as prisons or psychiatric units. E-therapies can also be made available in geographically and socially isolated (or marginalized) communities where access to specialist services may be compromised. Although rates of distress are often high among those from minority backgrounds (Clark et al. 2008; Lucassen et al. 2011) and indigenous or other minority adolescents face particular barriers to accessing professional help for mental health distress (Alegria et al. 2010) to date, few computerized therapies have been trialed in indigenous or minority populations. The exception to this is SPARX (Merry et al. 2012).

SPARX was explicitly designed to maximize appeal for Māori/New Zealand indigenous youth and to include messages that enhance Māori well-being and identity. SPARX appears to be

effective and acceptable to Māori young people and was acceptable to the families, although the families would have preferred a less individually focused approach, and emphasized the need to consider families in interventions for indigenous cultures (Shepherd et al. 2015). SPARX has also been adapted for sexual minority youth (Rainbow SPARX) (Lucassen et al. 2013, 2015a) and has shown some evidence of effectiveness and acceptability in a small open trial (Lucassen et al. 2015b). Moreover, SPARX has been shown to be acceptable (Fleming et al. 2012a) and effective (Fleming et al. 2012b) among adolescents attending alternative education programs for those excluded or alienated from mainstream high schools.

To date, most e-therapy programs have been created in English in the United Kingdom, United States, Australia, and New Zealand. Very few programs have been translated into other languages, or developed specifically for people with non-Western cultural backgrounds. Low-income countries also face significant cost barriers associated with technology, but the lowering costs of mobile phones may offer cost-effective solutions (World Health Organization 2011).

Interventions Selected for our Appraisal

We have identified online and computer programs designed and tested with children and young people to prevent or treat depression or anxiety. We included programs that 1) target symptoms of depression and/or anxiety (including generalized anxiety disorder, social phobia, separation anxiety disorder, simple phobia and posttraumatic stress disorder [PTSD]); 2) rely on software to deliver therapy. Studies were included if they were randomized controlled trials (RCTs). We exluded studies in which all participants were >18 years of age. Interventions and studies are summarized in Table 1.

In Summary

In total, we identified 12 depression and anxiety programs for children and adolescents (5 targeted depression, 6 targeted anxiety and 1 was a general mental health resource), which were evaluated in 16 RCTs (Table 1). Studies varied in quality and size from pilot studies to large cluster RCTs. Most used wait-list as a comparator, two used equivalent face-to-face CBT, one used treatment as usual, and two used placebo-control. Overall, the results suggested that these interventions are effective in improving symptoms, although most studies have not been independently replicated, completion rates varied, and some studies were small. Our findings echo those of four earlier systematic reviews on child and adolescent e-therapies (Calear and Christensen 2010; Richardson et al. 2010; Boydell et al. 2014; National Collaborating Centre for Mental Health 2014). However, each review used slightly different inclusion/exclusion criteria. Two reviews (Calear and Christensen 2010; Richardson et al. 2010) focused on depression and anxiety, and between them identified 12 studies utilizing six interventions. The authors of both of those reviews concluded that there was emerging evidence supporting the effectiveness of e-therapies, with effect sizes ranging from small (0.11) to large (1.49).

In a comprehensive systematic review of e-therapies for children and young people with mental health problems, 63 RCTs were identified, and analyses were performed separately for different disorder groups and modes of delivery (National Collaborating Centre for Mental Health 2014). The authors concluded that there was evidence for the efficacy of cCBT programs for depression and anxiety in adolescents, whereas the evidence for the efficacy of

anxiety programs for children was limited to fewer studies, and was, therefore, less conclusive. In the other recent review, evidence from 126 studies ($\sim$ 20 % were RCTs) was collated for scoping purposes. The authors concluded that there was a high level of satisfaction with a range of interventions by young people and their families, and some evidence of efficacy (Boydell et al. 2014).

Programs Available as Public Health Interventions

We are aware of two child/youth-specific cCBT treatment programs available to the public: SPARX for depression in New Zealand and BRAVE-ONLINE for anxiety in Australia.

SPARX takes the form of an interactive fantasy game and is predominantly based on CBT, but also incorporates some content that encourages mindfulness. In SPARX, the aim was to engage the young person by using a narrative (''a hero to save the world''), immersive graphics, and interactivity, and by creating a sense of mystery (''what happens next?''). Learning in SPARX is underpinned by the bicentric frame of reference (Dede 2005). First, the user interacts in the first person with the character of the ''Guide,'' which provides an exocentric frame of reference for learning by reflection. The Guide puts the game into context, provides education, and sets and monitors real-life challenges (equivalent to therapeutic homework). Next, the young person chooses and customizes an avatar (so that the focus shifts from a first person interaction with the Guide, to a third person game format) and the user undertakes a series of challenges to restore balance in a fantasy world dominated by Gloomy Negative Automatic Thoughts (GNATs). In an immersive 3D game environment, the user ''learns by doing'' via an egocentric frame of reference. Voiceovers are provided to minimize reliance on written text. SPARX was designed and tested for use on computers using CD-ROM. It has since been developed for delivery on the Internet, without changes in content but with a more sophisticated mood monitor embedded within it and an optional email/ text reminder system. The program has seven modules (levels) that are completed sequentially, and each module introduces new CBT skills and strategies (see Table 2). The Guide gauges mood (using a Likert scale in the CD-ROM version and the PHQ-A [Johnson et al. 2002] in the online version) and young people who are not improving are prompted to seek further formal help. SPARX is supplemented by a notebook, which can also be viewed directly on a computer, with summaries of each module and space to add comments about the challenges completed.

BRAVE-ONLINE comes in two versions, one for children (age 7–12) and one for adolescents (ages 13–18). The program consists of 10 1-hour sessions, 5 (in the adolescent version) or 6 (in the child version) accompanying parent sessions, and 2 booster sessions. The two versions of the program consist of age-appropriate CBT content presented through interactive exercises, text, graphics, animation, quizzes, and games. To consolidate learning, homework tasks are set. The sessions need to be completed sequentially at weekly intervals, and if a child or young person misses a session, the system sends automatic reminders. BRAVE-ONLINE was designed as a therapist-supported program. A trained clinician (referred to as a ''BRAVE-Trainer'') reviews child and family responses, and sends weekly emails with encouragement and feedback. The trainer also phones the family to complete an exposure hierarchy session midprogram. The program launched in Australia for public use in 2014 based on the same proven content, but it is pure self-help and does not include therapist input. Tablet and smartphone compatibility is planned. A version of the program for parents of preschool children has been recently evaluated (Donovan and March 2014).

Table 1. E-Therapy Interventions for Children or Adolescents with Depression and Anxiety Tested in Randomized Controlled Trials

Name	Format	Number of sessions and time to complete	Description	Study	Participants, setting, method of delivery	Approach and target symptoms	Study design and control group	Outcomes	Additional information
MoodGYM	Online www.moodgym.anu.edu.au Self-help Available in 5 languages	5 modules 45 minutes each	CBT based Reading materials, demonstrations, scenarios and homework exercises	Calear et al. (2009)	1477 adolescents Ages 12–17 School based under teacher supervision	Universal prevention and early intervention, targeting both anxiety and depressive symptoms	Cluster RCT Waitlist control	Decreased anxiety (Cohen's $d=0.15$-0.25). Decreased depression only in males (Cohen's $d=0.27$-0.43).	
				O'Kearney et al. (2006)	78 adolescent boys School based under teacher supervision	Universal prevention targeting depressive symptoms	RCT Active control	There were no significant differences between groups on depression, attributional style or self-esteem on the intention to treat analysis. Small short-term effects for those who completed more than half the modules (40%). 40% completed half or more of the modules.	
				O'Kearney et al. (2009)	157 adolescent girls 15–16 years old School based under teacher supervision	Universal prevention targeting depressive symptoms	RCT Active control	Faster decline in depressive symptoms. Effect size of $d=0.46$ evident 20 weeks after the intervention. Greater effect for those with high depression scores at baseline ($d=0.92$). 30% completed half or more of the modules.	
Think Feel Do	CD-ROM based Facilitated by a non-CBT clinician	6 sessions, 30–45 minutes each	CBT based Developed from Stallard 2002 Interactive and multimedia	Stallard et al. 2011	20 children and adolescents Ages 11–16 Outpatient mental health services	Treatment of anxiety (generalized anxiety disorder, specific phobia, social phobia or panic disorder) and/or depressive symptoms	Pilot RCT Waitlist control	Significant improvements in depression, social phobia, self-esteem, cognitive schemas	Also evaluated as a universal and targeted intervention in schools proof of concept study (Attwood et al. 2012)

(continued)

TABLE 1. (CONTINUED)

Name	Format	Number of sessions and time to complete	Description	Study	Participants, setting, method of delivery	Approach and target symptoms	Study design and control group	Outcomes	Additional information
Bite Back	Online www.biteback.org.au Self-help	Unstructured	Based on positive psychology and mindfulness. Text, interactive exercises and a moderated online discussion	Manicavasagar et al. (2014)	235 adolescents Ages 12–18 Web site users	Prevention aimed at depressive symptoms and general mental health wellbeing.	RCT Control (placebo) web sites	Usage of site ≥30 minutes per week associated with reported significant decreases in depression and stress and improvements in well-being	
The Journey	CD-ROM Self-help	7 modules 20–30 minutes each	CBT based Animated book with animations and interactive exercises	Stasiak et al. (2014)	34 adolescents Ages 13–18 Adolescents seeking help for depression from school counselors	Treatment of depressive symptoms.	RCT Placebo control computer program	cCBT associated with significantly less depression after intervention. Between-group effect size on the primary outcome measure (clinician assessment) was 1.7	
Unnamed program	Online Self-help with email feedback from clinicians	5 modules	Problem-solving therapy based Content provided as text	Hoek et al. (2012)	45 adolescents Ages 12–21 Mild to moderate anxiety or depression at baseline	Treatment of depressive and/or anxiety symptoms.	RCT Waitlist control	No evidence of effect	Program developed in the Netherlands. Probably underpowered to show difference
SPARX	CD-ROM based. Subsequently developed as online resource Self-help	7 modules 30 minutes to complete each	CBT based Fantasy game format	Merry et al. (2012)	187 adolescents Ages 12–19 Help-seeking adolescents with significant symptoms of depression recruited through clinical services	Treatment of depressive symptoms.	RCT (noninferiority design) Treatment as usual (TAU)	Per protocol analyses (n=143) showed that SPARX was not inferior to TAU in reducing symptoms of depression (clinician-assessment). Recovery in SPARX group (n=31, 43.7%) versus (n=19, 26.4%) in usual care. Improvements maintained or increased at 3 month follow-up. Significant reduction in anxiety.	Since April 2014 freely available in New Zealand as an online program

(continued)

TABLE 1. (CONTINUED)

Name	Format	Number of sessions and time to complete	Description	Study	Participants, setting, method of delivery	Approach and target symptoms	Study design and control group	Outcomes	Additional information
				Fleming et al. (2012)	32 adolescents Ages 12–16 Offered to whole classes (alternative education setting)	Treatment of depressive symptoms.	RCT Waitlist control	Significant differences between SPARX and waitlist on clinician- and self-rated assessment of depression, but not on other measures of psychological functioning. Gains were maintained at 10 week follow-up. Intention to treat analyses confirmed these findings.	
BRAVE ONLINE	Online Therapist and parent supported	10 modules for children/adolescents 5 sessions for parents of adolescents 6 sessions for parents of children 2 booster sessions	CBT based Interactive exercises, text, graphics, animation, quizzes, and games	March et al. (2009)	73 children Ages 7–12 Met diagnostic criteria for an anxiety disorder	Treatment of anxiety disorder (separation anxiety disorder, social phobia, generalized anxiety disorder, specific phobia).	RCT Waitlist	Post-intervention, 30% on BRAVE and 10% on the waitlist were free of the initial diagnosis.	In 2014, BRAVE was revised into a pure self-help format and made freely available online for Australian residents
				Spence et al. (2011)	115 adolescents Ages 12–18 Met diagnostic criteria for an anxiety disorder		RCT Control groups: face-to-face CBT and waitlist	BRAVE and clinic-based CBT significantly superior to waitlist post-intervention with gains maintained to 6 and 12 month follow-up.	
Cool Teens CD	CD-ROM Therapist support through brief telephone calls; parent support	8 modules 30 minutes each	CBT based Combines text, illustrations, audio, cartoons, live videos and interactive forms	Wuthrich et al. (2012)	43 adolescents Ages 14–17 Met diagnostic criteria for an anxiety disorder	Treatment of anxiety disorder (separation anxiety disorder, social phobia, generalized anxiety disorder, panic disorder, specific phobia, obsessive-compulsive disorder, anxiety disorder NOS).	RCT Waitlist control	Significant reductions in anxiety in the cCBT group	

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(continued)

TABLE 1. (CONTINUED)

Name	Format	Number of sessions and time to complete	Description	Study	Participants, setting, method of delivery	Approach and target symptoms	Study design and control group	Outcomes	Additional information
Camp Cope a Lot: Coping Cat	CD-ROM Therapist supported	12 modules	CBT based Based on the Coping Cat CBT manual (Kendall and Hedtke 2006) Intended for 7-13-year-olds	Khanna et al. (2010)	49 children Ages 7–13 Met diagnostic criteria for an anxiety disorder	Treatment of anxiety disorder (separation anxiety disorder, social phobia, generalized anxiety disorder, specific phobia, panic disorder)	RCT Control groups: face-to-face CBT (12 sessions), or a computer-assisted education, support and attention condition	Remission rates 81% in cCBT versus 70% in the face-to-face CBT. Further gains at 3-month follow-up	Program can be purchased online by institutions or individuals.
Unnamed program for social anxiety	Online Therapist feedback	9 modules	CBT-based Based on manualized CBT for social anxiety disorder Text based	Tillfors et al. (2011)	19 adolescents 15–21 years of age Recruited via advertisements	Treatment of social anxiety disorder (participants had to be afraid of giving a public speech).	RCT Waitlist control	Significant improvements on measure of social anxiety, general anxiety, and depression. Gains were maintained at 1 year follow-up. Adherence was low (mean number of sessions completed was 2.9).	Developed in Sweden
Unnamed program for spider phobia	Computer software	Single session lasting 2.5 hours	Hierarchy of images of spiders (from low-fear e.g small cartoon to high-fear e.g. large moving image)	Muris et al. (1998)	26 children and adolescents 8–17 years of age Recruited via advertisements Met diagnostic criteria for simple phobia	Treatment of simple phobia	RCT (3 groups) Eye movement desensitization and reprocessing (EMDR) In vivo exposure	Compared to in vivo exposure there was no evidence of effect on self- or researcher-rated fear and avoidance. Compared to EMDR the results were inconclusive.	Computerized exposure was considered as a placebo treatment, as there was no evidence to support it. Underpowered
'So you have been in an accident' web site	Online https:// kidsaccident .psy.uq.edu.au Self-help, parents given an information booklet to aid child's recovery	Could access the web site as often as they wished	CBT and resiliency theory-based web site Child and teen versions	Cox et al. (2010)	85 children and adolescents 7–16 years of age Recruited from hospital (if stayed overnight following an unintentional injury)	Treatment of anxiety and PSTD symptoms	RCT Assessment only (no treatment)	Significant decrease in anxiety at 6 months compared with an increase in anxiety in the control group. No significant effects on anger, depression, PTSD and dissociative symptoms	

CBT, cognitive behavioral therapy; cCBT, computerized cognitive behavioral therapy; NOS, not otherwise specified; RCT, randomized controlled trial; PTSD, posttraumatic stress disorder.

Table 2. Content Covered in SPARX

Level title	Core skills
1. Canyon Province: "Finding Hope"	• Psychoeducation about depression and introduction to the CBT model • Introducing GNATS (gloomy negative automatic thoughts or unhelpful thoughts) • Introducing "hope" (people recover from depression) • Relaxation: Controlled breathing
2. Ice Province: "Being Active"	• Activity scheduling and behavioral activation • Relaxation: Progressive muscle relaxation • Basic communication and interpersonal skills
3. Volcano Province: "Dealing with Emotions"	• Dealing with strong emotions: Anger and hurt feelings • Interpersonal skills: Assertiveness, listening and negotiation skills
4. Mountain Province: "Overcoming Problems"	• Problem solving using STEPS • Cognitive restructuring: Identifying SPARX – positive/helpful thoughts
5. Swamp Province: "Recognizing Unhelpful Thoughts"	• Cognitive restructuring: Recognizing different types of GNATs (negative/unhelpful thoughts)
6. Bridgeland Province: "Challenging Unhelpful Thoughts"	• Cognitive restructuring: Learning to challenge or "swap" negative thoughts for helpful ones • Interpersonal skills continued: Negotiation skills
7. Canyon Province: "Bringing it all Together"	• Recap of all skills • Mindfulness: Tolerating distress • Relapse prevention: Knowing when to ask for help

CBT, cognitive behavioral therapy.

Health Services' Implementation of E-Therapy

One of the challenges in establishing e-therapy as a treatment option for children and adolescents is to ensure that the public is well informed about which programs work, and which have not been evaluated. There is a plethora of online programs and apps that can be downloaded that purport to treat depression or anxiety, or manage stress. Although some of these are likely to be effective, there is little to guide the user, and the uptake is likely to be determined by initial visual appeal, and potentially by advertising/links from high profile sites. On the other hand, research groups developing and testing interventions may struggle to make programs appealing and do not necessarily have the skills and financial backing to make the programs broadly available to the public. Initiatives such as https://beacon.anu.edu.au/ where users can find out about the evidence for e-therapies may offer a solution. There are a number of factors to consider when implementing programs.

A handful of programs have been nationally or broadly distributed following research testing. Other programs, such as Camp-Cope-A Lot are available for purchase online. SPARX is now funded by the New Zealand government and is available free of charge to anyone in New Zealand. It is supported by a dedicated phone and text counseling service. Because SPARX is a self-help tool, detailed consideration was given to risk management, ongoing monitoring of effectiveness, monitoring of users' mood within SPARX, and the provision of support and information for those who appear to need more help. There is clear information at registration to ensure that those who use the tool know its limitations. As this is a new initiative, the way in which it is being delivered will be reviewed regularly. Similarly, in Australia, BRAVE-ONLINE was adapted into a self-help program and made available on the web to Australian residents free of charge. Programs such as MoodGYM or Bite Back are available online internationally, and MoodGYM can be accessed in five languages (English, Chinese, Finnish, Norwegian, and Dutch).

Discussion

There is a growing body of evidence to support the use of e-therapy in the treatment of depression and anxiety in children and adolescents. Those programs with evidence of efficacy have all been based on CBT, whereas one trial of problem solving therapy did not show any evidence of effect, although this study may have been underpowered to detect differences. A web program based on principles of positive psychology showed promise, but it was not designed as a treatment intervention. Computerized exposure for simple phobias showed no benefits, but the program was designed in the very early days of computer technology.

Programs that are interactive and that use "gamification" may be better accepted by young people than text heavy interventions. Today's "digital natives" are a discerning audience. They are constantly exposed to sleek online/media content, and having software that is out of date or falls short of current expectations is likely to impede uptake.

This is a rapidly changing field, and keeping pace with technology, while also ensuring that programs are effective, is going to be a challenge. We may need to change the way in which we collect evidence, to reduce the lag between program development and implementation (Glasgow et al. 2005). Current and future technologies have the potential to address some of the inequitable distribution of mental healthcare services, both within countries and internationally. The increasing sophistication of mobile phones and tablets, and the design of cheap and readily available computers, will allow for the delivery of care in low-income countries. To date, e-therapies have been predominantly in English and from a Western cultural perspective, and the development of culturally appropriate interventions, or cultural adaptations of existing software, may be needed.

It is important to consider the costs and benefits of e-therapy. It can be expensive to develop, and there are ongoing costs for online hosting and providing a maintenance system to address technical issues. There is also a need to provide systems to protect privacy

and provide security for any data collected. A long-term plan for further development of content and software updates is also required. With these upfront and ongoing investments, delivery to a very large number of people is possible. There are two main funding models that could be considered. One is funding by governments as a public health measure, the other is partnering with commercial companies. In either case, clinical governance around ongoing delivery will have to be worked through as this mode of therapy develops. For example, the distribution of SPARX in New Zealand is dependent upon government funding, whereas its distribution elsewhere will depend upon a commercial model or government funding.

It will be important to weigh the purpose of any intervention and use the technologies appropriately. Technology is moving toward tablets and smart phones, but there has been little research in this area yet. In future program design we need to consider ease of use/user experience for these devices. Apps potentially allow for a richer, more tailored, maximally responsive experience, but this may be at the cost of less interaction and briefer input, which has the potential to erode key therapeutic messages.

Conclusions

Using technology to deliver interventions for children and adolescents with mental health problems has considerable appeal, as well as a number of limitations. The current generation of "digital natives" is growing up immersed in and surrounded by technology. Even in low-income countries, mobile phones are used widely (Bayer et al. 2011). Effective psychological treatments for depression and anxiety have been developed, but access to these is problematic, provision is expensive, and young people may be reluctant to see a therapist face-to-face. The evidence that computerized interventions for these disorders can be effective is accumulating, and there are some potentially rewarding paths to pursue in the future.

The use of technology is likely to require more than a "manuals online" approach. There are opportunities to provide immersive experiences that can model and teach the techniques needed to support emotional regulation. This technology will not be the only answer for difficulties associated with therapy uptake, and it is unlikely that it will usurp the place of therapists. Indeed, some young people would prefer to see a therapist when offered the opportunity (Stallard et al. 2011) and report high levels of satisfaction with both conventional and e-therapies (Merry et al. 2012).

Clinical Significance

There is evidence that e-therapy for depression and anxiety in children and adolescents can be effective and is acceptable. A small number of effective programs have been developed and some are available to the public, but a large number of untested interventions are widely available, whereas some, for which there is evidence, are not. The challenge will be providing information to steer young people toward effective programs. Whereas e-therapies are likely to be a useful tool in the provision of care, they are likely to be only one of many options in a suite of interventions that should be provided to ensure good care across a spectrum of need.

Disclosures

The intellectual property for SPARX is held by UniServices. UniServices is attempting to license SPARX to third parties and, if successful, as the result of a revenue-sharing agreement with UniServices. Professor Merry and Drs. Stasiak, Fleming, Shepherd, and Lucassen stand to gain financially from any revenue received from such licenses.

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