e-THERAPY

USING COMPUTER AND MOBILE TECHNOLOGIES IN TREATMENT

Karolina Stasiak & Sally Merry

Apple Macintosh

Karolina Stasiak PhD, MA, BA

Research Fellow, University of Auckland, New Zealand

Sally Merry MB, ChB, MD, FRANZCP, CCAP

Associate Professor of Child and Adolescent Psychiatry, University of Auckland, New Zealand

Conflict of interest: K Stasiak and S Merry (along with T Fleming, M Shepherd and M Lucassen) are the creators of SPARX and may gain financially from its licensing.

Suggested citation: Stasiak K, Merry S. e-Therapy. Using computer and mobile technologies in treatment. In Rey JM (ed), *IACAPAP e-Textbook of Child and Adolescent Mental Health*. Geneva: International Association for Child and Adolescent Psychiatry and Allied Professions 2013.

DEFINITIONS

This is an emerging research and clinical field and consequently the terms used are new and evolving. There is some discrepancy in the terminology used by the various researchers. In this chapter we use the following definitions:

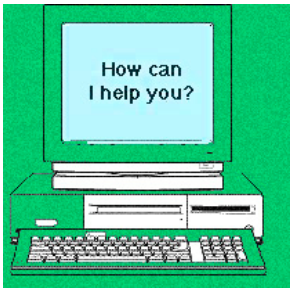
e-Health (e-health or ehealth)	An umbrella term that encompasses the use of information and communication technology in the health sector.
e-Therapy (e-therapy or etherapy)	A generic term that covers a broad range of psychological and behavioural therapies delivered with the assistance of digital/computer technology (it is often used interchangeably with computerised therapy or computer delivered therapy). Modes of delivery can include a personal computer, the internet, telephone interactive voice response (IVR) systems, or a combination of these. e-Therapy can include facilitated 'therapeutic chat rooms' and therapy supported by email.
Computerised cognitive behavioural therapy (cCBT)	A type of e-Therapy that involves the delivery of CBT via a computer interface.
m-Health (m-health or mhealth)	An emerging field within the broader e-Health domain that involves the delivery of health-based services on mobile devices (mobile phones, smart phones, tablets and devices monitoring and collecting patients' data). m-Health interventions vary and can take the form of mobile phones being used to collect and store clinical data, as well as to remind patients of an upcoming appointment or provide text message-based counselling.

- *Effective e-Therapies exist for a range of disorders and client groups.*
- *The vast majority of e-Therapies have been designed for those at the mild to moderate spectrum of mental illness severity or for prevention.*
- *The quality of studies examining the effectiveness of e-Therapy varies but continues to improve. More research is needed with patients in real clinical settings as well as rigorous RCTs with longer-term follow ups.*
- *Systematic reviews of e-Therapies for children and adolescents with depression or anxiety have shown promising evidence for efficacy, safety and acceptability.*
- *The development of and research into e-Therapies for children and adolescents lag behind those for adults but young people's enthusiasm for digital media suggests that this group may be an ideal target.*
- *Rapid technological innovations are predicted to continue and have the potential to reshape e-Therapies into sophisticated interventions that are routinely used in clinical practice.*
- *There is scarce research into e-Therapies with diverse or minority patient groups. Cultural acceptability of e-Therapies has received limited research attention.*
- *The digital divide is slowly diminishing in the low- and middle-income countries as technology costs decrease; however, significant resources are needed to bring effective e-Therapies into clinical practice in these countries.*
- *m-Health programs use mobile phone and other mobile devices to deliver health interventions. They are particularly well suited to low- and middle-income countries as mobile phones are cheaper and ownership rates are rapidly growing.*
- *e-Therapies can be delivered at a fraction of the cost of traditional mental health interventions. m-Health interventions are potentially even more cost effective and may have a wider reach.*

e-Therapy is an emerging and fast developing field of research and practice that involves the application of digital technologies to assist or deliver psychotherapy. Systematic research in this field began two decades ago with mixed results but as computer technology matures so does e-Therapy. Each year more studies are published, extending the application of e-Therapy to different populations, disorders and clinical settings. The potential ability to deliver more psychological care to those who need it (and who otherwise might not be able to receive it), to extend the efficiency of scarce clinical resources and to improve monitoring of outcomes presents a great opportunity as we look to the future. The challenges in evaluating and employing computer programs clinically cannot be understated. Currently, the vast majority of e-Therapy programs has been developed for adults and more work is needed to find the most suitable and engaging ways to do this for children and adolescents. Clinical implementation of e-Therapy has begun in some countries but low-income nations face significant cost barriers. Mobile phones may offer a more cost-effective solution and we describe some m-Health interventions that may be relevant to child and adolescent mental health.

HISTORICAL NOTE

The computer program often credited with being used in psychiatric treatment for the first time was called '*Eliza*' (Weizenbaum,1966). In fact, *Eliza* was designed as a pilot project in the use of 'natural language' between a human and computer. However, because it used a Rogerian, nondirective interview style—largely rephrasing many of the patient's statements as questions and posing them back—it has often been mistakenly assumed that this was an attempt to emulate a therapist. At the time when computers were a mere novelty among the scientific fraternity and were virtually unknown to the general public, the program attracted considerable negative attention. For many years *Eliza* has been used to highlight the limitations of computers in psychotherapy.



Click on the image to view an online version of ***Eliza***. It quickly becomes apparent that the program simply presents back the text written by the user and it cannot adapt to form the flow of a real conversation.

The real beginning of e-Therapy research and practice began in the late 1980s as the decade saw rapid technological development and the spreading use of personal computers. It became apparent that computers' unique attributes of interactivity, storage, analysis and display of data as well as multimedia features could be used to offer self-help in a potentially more attractive and engaging format than written materials (Wright & Wright, 1997). One of the first empirically evaluated interventions was a cCBT program for adults with depression (Selmi et al, 1990), which demonstrated that the computer-delivered therapy was as effective as therapist-delivered CBT in a small trial.

The first e-Therapy programs were really simple and predominately text-based. They essentially involved presenting written text describing self-help strategies to be read off the screen. Interactivity was limited to multi-choice questions. As the technology matured the programs have become increasingly more sophisticated. The new wave of e-Therapy programs allows for greater interactivity, relies more heavily on multimedia (voice, video, animation), incorporates automated emails and text messages (SMS) to enhance adherence or augment the content.

One of the most recent developments is '*gamification*' or the convergence of 'serious games' (games designed for a primary purpose other than pure entertainment) with e-Health and e-Therapy. While computer games have

received some negative attention, particularly around suggestions that violent video/computer games may cause an increase in aggression (Anderson, 2004), the potential of computer games applied to learning is enormous (Lieberman, 2006) and, in particular, it is thought that serious games can make a positive contribution (Connolly et al, 2012). An example of a serious e-Health game is *Re-Mission*, which was shown to improve behavioural outcomes for young patients with cancer in a multisite randomised controlled trial (Kato et al, 2008). An e-Therapy program that uses a platform of a fantasy game to teach CBT skills for adolescents with depression is *SPARX* (see below).

Gamification

The use of game mechanics in a non-game context in order to engage users.

Another innovation that seemingly brings science-fiction into reality is the use of virtual reality in psychiatric care, particularly in the treatment of posttraumatic stress disorder (PTSD) and anxiety disorders. Some of the research has been driven by the need to treat large numbers of returning soldiers from war and other conflict zones. Virtual reality involves a computer-generated

Click on the image to access *Re-Mission*

simulation of a three-dimensional image or environment. Users can interact with it in a seemingly real or physical way by using special electronic equipment such as a helmet with a screen inside or gloves fitted with sensors. Virtual reality treatment offers the potential to create a sense of realism in a safe environment under the guidance of a therapist who can, for example, guide the patient through a series of graded exposure exercises where the feared stimulus is simulated in the safety of the virtual environment. Virtual reality is still a new technique that has not been adopted in routine clinical care, predominantly due to the cost of the equipment. However, laboratory evaluations have shown it to be a safe and effective treatment in some conditions. For example, in a randomized controlled trial (RCT) of 30 military personnel with combat related PTSD, those treated with graded exposure using virtual reality improved significantly more than those given usual care (McLay et al, 2001). A meta-analysis of 21 studies of virtual reality exposure therapy in the treatment of anxiety and specific phobias has shown it to be promising although more rigorous research is needed (Parsons & Rizzo, 2008). Very little is known about the use of virtual reality treatment with children and adolescents in psychiatric settings; however, some successes have been noted in

using virtual reality video games as a distraction to reduce pain in children in an experimental setting (Law et al, 2011).

Another recent innovation being investigated is the application of biofeedback to e-Therapy. Biofeedback is a treatment technique in which people are trained to improve their health by using signals from their own bodies. One of the applications in psychotherapy is to help tense and anxious clients learn to relax. Traditional biofeedback equipment may, for example, include a sensor that picks up electrical signals in the muscles, which are then translated into a form that the patient can easily recognise (e.g., a flashing light or a sound). Biofeedback exercises can be done with a therapist in a clinic; however, biofeedback may also be incorporated into computer-assisted therapy. One exciting proposition is to integrate biofeedback into a serious game to engage a child in a therapeutic exercise. For example, biofeedback may be used in a computer game to teach an anxious child how to relax in order to 'win' a quest. Biofeedback programs that use simple galvanic skin response and heart rate variability sensors, which are placed on fingers to detect stress-related physiological changes, are already available on the market for adults and for children (http://www.somaticvision.com/products). One of the commercially available programs is '*The Journey to the Wild Divine*' (Bell, 2003) in which the user completes a range of tasks (e.g., building a bridge) by controlling the environment through galvanic skin response and heart rate variability sensors. This requires the user to slow down the breathing and reduce muscle tension. Quality empirical evaluations of these games are rare although some studies have been published recently. For example, 24 clinic referred children aged 9-17 with anxiety were randomised to a biofeedback game intervention (*Journey to the Wild Divine* as well as another program, *Freeze-Frame 2.0* (Childre, 2005)) combined with face-to-face therapy or to a waiting list. Those in the intervention group had significantly reduced symptoms of anxiety and depression at the end of an 8-session treatment compared to those on the waiting list (Knox et al, 2011). Other studies which have shown emerging evidence of efficacy include stress management for children (Pop-Jordanova & Gucev, 2010) and relaxation training for children with attention deficit hyperactivity disorder (Amon & Cambell, 2008).

Biofeedback sensors

To date, computer-based programs have been developed to treat a range of mental health conditions including eating disorders, problem drinking, and obsessive-compulsive disorder, to name a few, but the most frequently targeted conditions are depression and anxiety, which are the focus of this chapter. Most e-therapies have targeted the mild to moderate end of the disorder spectrum or are framed as preventive interventions to treat sub-threshold symptoms or prevent the onset of the full disorder. Whether e-therapies can be successfully and safely used to treat the more severe end of these disorders is currently unknown.

No computer program has yet matched full experience of meaningful human-to-human interaction. It is our belief that this is not the goal of e-Therapy. Computer programs that can be used therapeutically are designed to complement or support clinical practice. Instead, it is important to consider the unique features of computer technology and what they can bring to the practice of psychotherapy. Caring and skilled health professionals need not be alarmed that machines will replace them. Instead, clinicians should view e-Therapy programs as part of a growing clinical toolbox and as opportunities to engage patients or support traditional therapeutic techniques.

Mental health professionals need not be alarmed that machines will replace them. Clinicians should view e-Therapy programs as part of a growing clinical toolbox and as opportunities to engage patients or support traditional therapeutic techniques.

INTRODUCTION OF e-THERAPIES INTO CLINICAL CARE

The UK's National Institute for Health and Care Excellence (NICE) has conducted reviews of cCBT for adult depression and anxiety (National Institute for Clinical Excellence, 2004). The review highlighted that more research is still needed in several areas, including trials with patients of all ages, ethnicities and socio-economic groups, as well as patients who are more representative of the clinical populations. Nevertheless, in a review published in 2006, some e-Therapy programs were deemed to have sufficient evidence to be officially endorsed in the review (National Institute for Health and Clinical Excellence, 2006). For example, an online program called '*Beating the Blues*' (Proudfoot et al, 2004) was recommended for use in the stepped-care management of mild to moderate depression in primary and secondary care (National Institute for Health and Clinical Excellence, 2006). This is believed to be the first recommendation of cCBT by a government regulatory body anywhere in the world. '*Beating the Blues*' is currently offered on 'prescription' by general practitioners in parts of the UK and in New Zealand for patients over 18 years with mild to moderate depression. Subsequently, the NICE 2009 review removed references to any particular cCBT programs and instead NICE broadly endorsed cCBT as an option for first line treatment of mild or sub-threshold depression (National Institute for Health and Care Excellence, 2009). To date, no e-Therapy program has been recommended or adopted into routine clinical use in treating child and adolescent depression or anxiety.

Virtual reality equipment. Head-mounted display and wired gloves (courtesy of NASA)

Computer hardware and software technology are rapidly improving and further scientific breakthroughs in computer evolution are predicted. It is important to recognise that current technologies are just beginning to be tapped by software and hardware developers to deliver therapy for mental health problems. In the near future, technological advances such as improved human-computer interfaces, ultrafast broadband and the proliferation of smartphones (a smartphone is a mobile phone with more advanced computing capability and connectivity than a feature phone) are likely to result in a more widespread use of e-Therapy clinically. Looking long-term, other innovations such as virtual reality and body sensors are likely to reshape the way computers may be used in healthcare generally, and in the treatment of mental health problems particularly. Wright and Wright (1997) eagerly predicted more than 15 years ago that "the therapist of the future may have an extensive 'toolbox' of computer programs that can be prescribed for a broad variety of uses" (p. 325). This prediction has not yet come fully to fruition, but e-Therapy programs are indeed making steady inroads into day-to-day clinical practice. It is not unreasonable to expect that future applications of digital technologies to healthcare delivery may dramatically change the field.

WHY THE INTEREST IN COMPUTER TECHNOLOGY TO DELIVER INTERVENTIONS FOR MENTAL HEALTH PROBLEMS?

There are four different yet complementary reasons behind the rationale for using computers and mobile phone technology in therapy. The first is dictated by the economic reality and demands of the modern mental health system and its users. Health care resources are limited and inequitably distributed; it is impossible for the available pool of trained clinicians to deliver care to all those in need, particularly in low-income countries where there may be a child psychiatrist per million population. The second reason is driven by societal changes, especially in relation to attitudes about the use of computers and mobile technologies and their availability. Today, for many individuals throughout the world, computers and mobile phones are an integral part of everyday life, at work and at home. As personal computers become less expensive they become more commonplace

Table A.8.1 Factors that drive research and development of e-Therapy

Economic and workforce factors	Societal acceptance of computer technologies	Features inherent to information technology	Individual preferences
Mental health services are under increasing strain – demands for care outstrip available resources	Vast expansion of computers, internet access and mobile phone use over the last two decades	Computers have unique features (interactivity and multimedia) that are lacking in other self-help options	Anonymity. e-Therapy can be accessed in private, without stigma
Long waiting lists especially for specialist services	Cost of computers and mobile phones continues to decrease reducing the 'digital divide'	Interactivity allows the provision of feedback to the user, facilitating engagement in treatment and self-monitoring	Some people are reluctant to talk to a 'stranger' especially about sensitive issues
Scarce health care resources need to be better distributed to treat more people	Rapid technological innovation is predicted to increase even further. Availability of the internet and mobile phone networks, while still variable, are likely to be broader than the network of mental health professionals	Ability to store, analyse and display data (which can be used to monitor treatment outcomes and improve evidence base)	'Dr Google' – the internet is increasingly the first port of call when searching for health-related information
Low cost interventions should be offered first within a stepped-care approach to healthcare	M-health interventions hold particular promise in low-income nations, due to high phone penetration rates.	Treatment fidelity – computers can present the same material reliably without fatigue	'Digital natives' – young people growing up in the age of information technology are enthusiastic users of computers and readily accept them
	E-therapies can be widely distributed at a fraction of the cost of traditional therapies.		

in ordinary households. Mobile phones have become almost ubiquitous in the high-income countries but the rate of mobile phone ownership in low and middle-income countries is increasing rapidly and is already more than 50%. It is noteworthy also that the boundary between the traditional computers and mobile phones is becoming increasingly blurred. The third factor lies in features inherent to computer technology, with opportunities for delivering mental health interventions in ways vastly more engaging than traditional self-help approaches (e.g., self-help books). The final reason is due to individual preferences in how to use mental health support. Some of the common arguments used to support the introduction of e-Therapy are summarised in the Table A.8.1.

While the introduction of e-Therapy into healthcare has strong proponents, some remain skeptical about its potential to benefit clients and believe that it may lead to delays in appropriate care or may even cause harm. It would be unreasonable to assume that the use of computers in mental health is not without shortcomings or even major limitations. Some of the common arguments around the advantages and pitfalls of e-Therapy are given in Table A.8.2.

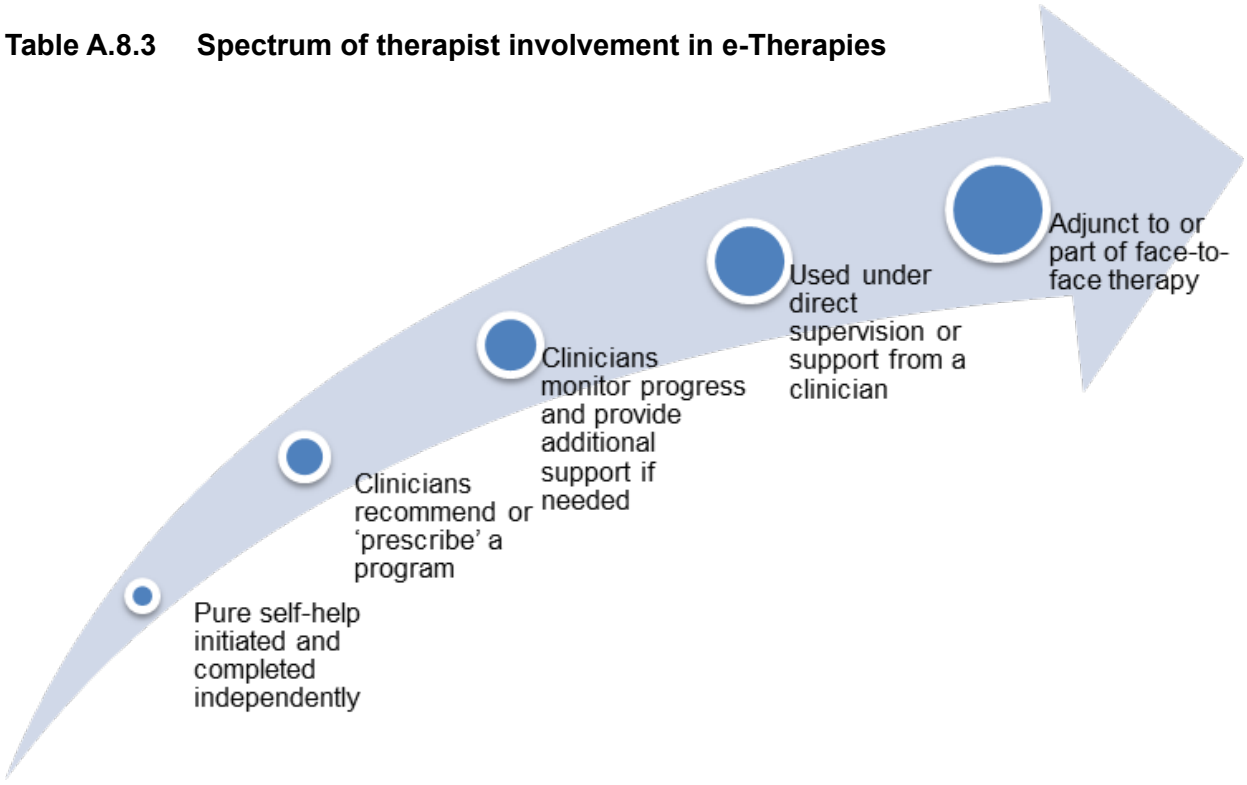
SPECTRUM OF THERAPIST INVOLVEMENT IN E-THERAPY

e-Therapy interventions vary in the degree of therapist input. At one end are programs that are delivered as an adjunct to face-to-face therapy or which entail a large therapist involvement via a chat-room or email. In some programs,

Table A.8.2 Pros and cons of e-Therapy

Commonly cited benefits of e-Therapy	Commonly cited criticisms of e-Therapy
• Patients can access it at their convenience • Available 24/7 in the privacy and comfort of one's home without the need to travel or make an appointment • Patients can work at their own pace – weekly appointments may not suit everyone • It suits those who are concerned about privacy or stigma or are reluctant to engage in traditional face-to-face therapy • It can provide treatment to those who live in geographically isolated areas, otherwise inaccessible	• Inability to deal with complex interpersonal problems, to respond to non-verbal cues or build rapport (Murphy, 2003). • As technology use increases, people's need for real face-to-face interaction may actually increase, making them reluctant to seek help from yet another machine (Murphy, 2003) • Evidence is limited to a number of select programs • The Internet is a reservoir of misinformation (vaccination is a case in point) and poor quality programs. There are calls to establish a set of guidelines to regulate e-Therapy to prevent ineffective programs • Less access to the technology by those from lower socio-economic groups and minorities may propagate, instead of diminish, inequalities in access to treatment • Computer use may be contributing to the very mental health problems computerised therapy is trying to treat (e.g., young people using computers at the expense of forming 'real' relationships)

Table A.8.3 Spectrum of therapist involvement in e-Therapies



therapists' support is present but limited to emails or brief telephone calls (e.g. *BRAVE-ONLINE* (Spence et al, 2008)). At the other end of the continuum are the pure self-help or unassisted e-Therapy programs (see Table A.8.3).

SELF-HELP THERAPY *VS.* CLINICIAN-ASSISTED e-THERAPY

Up to eighty percent of young people with depression do not get professional help (Fergusson et al, 1993). Therefore, it is important to facilitate people's access to free, effective e-Therapy, and many may choose to access it without clinical support. On the other hand, in day-to-day clinical practice, it may be desirable to provide the option of integrating e-Therapy with monitoring and additional support provided by a clinician, particularly at this early stage of development of e-therapies. Research suggests that supported e-therapies may be associated with lower dropout rates (Christensen et al, 2004b). Furthermore, oversight from a clinician is associated with greater efficacy. A meta-analysis of 12 RCTs of computerised psychological treatment for adult depression showed that e-Therapy with professional support is significantly more effective than unsupported programs (approximate effect sizes of 1.1 and 0.65 respectively (Andersson & Cuijpers, 2009)).

The decision about what level of therapist input is required in the provision of e-Therapy lies with the client and with the clinician. Even self-help e-Therapy programs can be used with clinical support or input if deemed appropriate for a given client. The clinician can ask the client to complete e-Therapy sessions at home and then discuss what has been learnt during a therapy session—not dissimilar to 'homework' tasks used in most CBT treatments. If less involvement is desired, clinicians can tell clients about various e-Therapy options and let them

decide which ones they want to try and then discuss their use of these programs at a follow-up appointment.

There are many other ways in which computers or mobile phones can be used to support the delivery of mental health interventions. Examples include simple things like texting or emailing reminders about upcoming appointments, sending messages that reinforce coping strategies discussed in the therapy session, prescribing homework that can be completed and monitored online (both by the client and therapist), asking the patient to rate mood or other symptoms etc.

e-THERAPY FOR CHILDREN AND ADOLESCENTS

Developmental Considerations

The current generation of young people is growing up using computer and mobile technologies ('natives'), so it would seem obvious to design e-Therapy interventions for this population. However, research with this age group lags behind that of adult e-Therapy. The mean age of participants is in the range of 30-45 years in most studies (National Institute for Health and Clinical Excellence, 2005) and the vast majority of cCBT depression and anxiety programs appear to have been designed with an adult population in mind. Further, programs designed for adults may not be appropriate for, accepted by, or appealing to children and adolescents. E-Therapy programs for children and adolescents need to take into account developmental considerations in order to engage this audience successfully. For example:

- The content in adult programs is not likely to be suitable for children and adolescents. Matters relating to work performance or marital problems are likely to be inappropriate. Instead, issues should be more topical and relevant to young people's lives such as school performance, peer pressure, conflict with parents, dating and so forth
- Developmentally appropriate content should also be illustrated using child or adolescent role models and scenarios that reflect their lives
- Content should be presented using simple language without difficult expressions or jargon. Complex ideas (e.g., cognitive restructuring) should be simplified and applied to examples from young people's experiences
- The amount of text, duration and the number of modules need to ensure maximal engagement and to motivate a young person to complete the program
- Parental involvement may be an appropriate component in programs targeting children (see *BRAVE-ONLINE* below). Adolescents may want to choose whether they involve their parents or complete the program independently
- The *whole package* (stylistic design, imagery and features) needs to be designed to make it attractive to young people.

BRAVE-ONLINE

BRAVE-ONLINE, which is not yet available to the public, is an internet CBT program for children and adolescents with anxiety (Spence et al, 2008). It has two versions, for children aged 7 to 12 and for adolescents aged 13 to 18. The program consists of 10 one-hour sessions for the young person (plus two booster sessions) and parallel sessions for parents (5-6 modules). The program includes text, colourful graphics, animation, sound effects, quizzes, games and interactive forms. To avoid activities being skipped, most exercises require a response before the next screen can be accessed. If a child or young person misses a session, the system sends out automatic reminders. The sessions can be accessed once a week.

BRAVE-ONLINE is a therapist-supported e-Therapy. Trained clinicians (referred to as *BRAVE trainers*) introduce themselves to the child or adolescent in the first week of the program by email or phone and explain how, from now on, they will be in contact with the family by email. The children or young people complete *BRAVE* in their own time and log the exercises and homework tasks completed on the website. The *BRAVE* trainers review these answers weekly and send weekly emails with encouragement and feedback. Mid-program, the therapist telephones the family to assist child and parent to create an appropriate exposure hierarchy (*BRAVE ladder*), which is then the focus of the remainder of the program. The therapist's time required is estimated at approximately 15-20 minutes per family.

The content is based on standard anxiety management CBT techniques including psycho-education, relaxation training, recognition of physiological symptoms of anxiety, cognitive strategies of coping self-talk, cognitive restructuring, graded exposure, problem solving, and self-reinforcement. Sessions for parents include strategies to empower them to help their child to implement anxiety management skills and deal with situations in which their child gets anxious.

BRAVE-ONLINE has been evaluated in two RCTs. In a study with 73 children aged 7-12 who were randomised to *BRAVE ONLINE* or to waiting list (March et al, 2009), immediately post-intervention, 30% of those treated by *BRAVE* no longer met criteria for their initial diagnosis compared to 10% of those on the waiting list, though the difference was not statistically significant.

Click on the image to access *BRAVE-ONLINE*

At 6-month follow-up, 75% of *BRAVE-ONLINE* participants were no longer suffering from anxiety; however those previously on the waiting list were given an intervention and thus no longer assessed. At the 6-month follow-up, 72% of parents and 62% of children had completed all their sessions. The adolescent version of the program was tested with 115 clinically anxious adolescents aged 12 to 18 (Spence et al, 2011); 44 were allocated to *BRAVE-ONLINE*, 44 to an equivalent CBT face-to-face clinic treatment, and 27 were on a waiting list. The results showed that *BRAVE-ONLINE* was as effective as the face-to-face therapy and both groups outperformed the waiting list. 12 months after the therapy, 78% of the *BRAVE-ONLINE* group no longer met criteria for their principal anxiety diagnosis compared with 81% of those in the face-to-face therapy group. Adolescents rated *BRAVE-ONLINE* and face-to-face therapy equally, though parents rated clinic therapy slightly more favourably.

SPARX

SPARX is an e-Therapy program for adolescents experiencing mild to moderate depression. The program uses a 3-D fantasy gaming environment to deliver CBT. There are seven modules and each one takes about half an hour to complete. At the beginning and end of each module the user interacts, in the first person, with a character called *the Guide*, who provides psycho-education, assesses mood and sets and monitors real-life challenges, equivalent to homework. The user chooses and customizes an avatar (the graphical representation of the user) and is then transported to the *game world* to undertake interactive challenges to restore balance in a world plagued by negativity and infested with *GNATS* (Gloomy, Negative, Automatic Thoughts). Upon successfully completing each module, the user returns to *the Guide* who puts the skills learnt in the game world into a 'real life' context.

The program is designed to target depression but it includes a number of therapeutic techniques intended to treat symptoms of anxiety (as depression is

Click on the image to to learn more about *SPARX*

SPARX cast of characters

frequently comorbid with anxiety). The program includes psycho-education about depression and teaches core CBT strategies, namely problem solving, relaxation exercises, learning to identify negative thinking, cognitive restructuring and social skills.

SPARX was originally developed in a CD-ROM form but it is being converted for online delivery in 2013. There will be two modes of delivery: unsupported (self-help) and *SPARX* monitored by a clinician (clinicians are able to 'prescribe' it and track progress). *SPARX* is not yet available to the public.

Click on the image to view a video clip about *SPARX*

There have been two RCTs of *SPARX*. In a large trial including 187 depressed participants, 94 received *SPARX* and 93 were assigned to treatment as usual (which on average consisted of four sessions of face-to-face counseling) (Merry et al, 2012). *SPARX* was as effective as usual care in reducing symptoms of depression (interviewer- and self-rated), anxiety, hopelessness and improving quality of life. The program was safe and participants rated it favourably. The second study was a pragmatic randomised controlled trial with 32 adolescents who were excluded from mainstream education (Fleming et al, 2011). Twenty were randomised to complete *SPARX* immediately and 12 were assigned to a waiting list condition (those on waiting list were invited to complete *SPARX* after five weeks). *SPARX* was effective in reducing symptoms of depression (interviewer- and self-rated) and improvements were maintained at a 10-week follow-up.

SUMMARY OF EVIDENCE FOR e-THERAPY INTERVENTIONS FOR CHILD AND ADOLESCENT DEPRESSION AND ANXIETY

As already highlighted, this is an emerging area of research, thus the number of high quality studies is small. Methodological shortcomings include lack of controlled trials, reliance on self-report, recruitment via advertisements and restrictive eligibility criteria. Nevertheless, a growing number of rigorous studies has been recently appraised in two systematic reviews (Calear & Christensen, 2010, Richardson et al, 2010). Calear and Christensen (2010) reviewed only internet-delivered interventions while the other review also included programs on stand-alone computers. Combined, the two reviews identified 12 studies with six interventions (two that target anxiety and four depression):

Click on the image to access *Grip op je dip* online (in Dutch)

- *BRAVE-ONLINE* (Spence et al, 2008) (anxiety)
- *Cool Teens* (Cunningham et al, 2009) (anxiety)
- *CATCH-IT* (Van Voorhees et al, 2009) (depression)
- *MoodGYM* (https://moodgym.anu.edu.au) (Christensen et al, 2004a)
- *Grip op je dip* online (Dutch: 'Master Your Mood') (Gerrits et al, 2007) (depression)
- *Stressbusters* (Abeles et al, 2009) (depression).

Participants in these studies were aged from 7 to 25 years. The programs included treatment and selective, indicated and universal preventive interventions, were based largely on CBT principles and were delivered over 5-14 sessions. Four of the 12 studies were RCTs. None of the RCTs was of a computerised treatment of depression but two were RCTs of computer-assisted anxiety treatment. The

studies ranged in size from case studies or pilot studies with small numbers of participants to large trials. Interventions were delivered in a variety of settings and the amount of therapist support varied from none to regular contact. Outcomes varied between interventions and neither of the reviews conducted a meta-analysis. However, Calear and Christensen (2010) listed the effect sizes, which ranged from 0.11 to 1.49 at post-intervention. The authors of both reviews concluded that, overall, there is emerging evidence supporting the effectiveness of computer- and internet-delivered interventions for anxiety and depression in children and adolescents. The fact that programs vary in format and delivery method and yet produce consistently positive outcomes suggests that e-therapies can be versatile and offer an opportunity to successfully engage young people in the treatment or prevention of anxiety and depression.

Further research is needed to identify the most effective implementation model. Since these reviews were published, there have been more studies, including evaluations of a computerised version of *Think Good, Feel Good* (a manualised CBT program for children and adolescents) (Stallard et al, 2011, Attwood et al, 2012). Trials of *SPARX* (Merry et al, 2012; Fleming et al, 2011) have also been published showing that *gamification* may be an engaging and effective method to deliver e-Therapy. The field continues to grow and we expect to see more inventive programs and research to emerge.

DOES e-THERAPY STACK UP FINANCIALLY?

Although development of a computer-assisted therapy is a complex and a costly undertaking, once developed, computer-assisted therapies are comparatively less expensive to deliver than face-to-face interventions. The cost-analysis studies to date show that e-therapies can be cost effective both by reducing therapist time and improving patient outcomes relative to usual care (McCrone et al, 2004, Cavanagh et al, 2006, Kaltenthaler et al, 2006). There are ongoing costs that need to be factored in such as license fees, hosting of websites (and any data that is being stored) and technical support. Additionally, computer programs and websites need to be frequently updated to remain up-to-date. This cost-benefit argument extends even further if we consider the ability to deliver beneficial effects to a great number of people even with a modestly effective e-Therapy intervention.

m-HEALTH INTERVENTIONS

Implementation of e-therapies can be challenging in situations where access to computers or the internet is limited, or if the resources for computer software and hardware are severely restricted. This may be particularly true in the case of low and middle-income countries as well as in some rural or remote communities. This is where mobile phone technology offers a definitive advantage. There are several features that make mobile phones ideal to deliver innovative e-Health interventions in the developing world (Rashid and Elder, 2009):

- Portability and security – users can take phones along to give them a sense of security
- Mobile phones use radio spectrum and do not depend on expensive infrastructure. Cell phone towers can be run by a generator

Mobile phones are ideal for delivering innovative e-Health interventions

- Mobile phones are relatively simple devices that do not require specialist knowledge from the user
- Mobile networks can be used to send data; and
- The mobile phone industry is highly competitive, driving the prices down.

It is not surprising that mobile phone ownership continues to grow around the world and there is a particularly rapid adoption of this technology in developing countries (World Health Organisation, 2011). Mobile phone networks are common in countries where access to telecommunications used to be restricted due to poor infrastructure. The number of mobile devices (many of these may be devices other than mobile phones such as tablets or portable music players) connected to the network is predicted to reach 50 *billion* by 2020. It is likely that the Internet will be predominantly accessed on mobile phones in the near future (Rainie & Anderson, 2008).

The cost of mobile phone handsets continues to drop. Mobile phones can be a fairly simple device capable of calling and texting but increasingly 'smartphones' are replacing the traditional handsets. Smartphones have a greater functionality as they offer access to wireless internet. There are now over a million applications ('apps') available for download for the different models of smart phones. 'Apps' are software applications, which can be installed on the smart phone to add a new function (program, game etc.). Many of the apps are free and others are relatively inexpensive. A large number of apps concern common health-related topics (e.g.,

diet, fitness, relaxation etc.). Therefore, it was only a matter of time before apps were used in m-Health interventions by researchers.

m-Health interventions vary in complexity from simple programs delivered as text messages (SMS), to multimedia (audio/video) messages which are displayed on the phone's screen, and through apps which allow an integration of internet content and other features. Text-based programs face the challenge of having to deliver messages in 160 characters (including spaces), although some telecommunication services allow stringing more than one message together. While text-based interventions are the least advanced, to date they have been the most widely adopted and least expensive (Cole-Lewis & Kershaw, 2010). Audio/video messages can be sent as a hyperlink that users can open on their internet-enabled phones (which do not have to be smart phones). This requires data transfer and there may be a cost to the user. Apps can take various forms, from simple stand-alone applications to complex programs that require ongoing internet connectivity, linking with social networks, and can include other features like Global Positioning System (GPS) tracking. Apps typically require touch-screen navigation.

An example of a m-Health intervention for young people is *MEMO* (Whittaker et al, 2012). *MEMO* is a multimedia CBT program designed to prevent depression in adolescents. It consists of two messages a day sent over nine weeks (outside of school hours). The messages are a combination of video (short film clips and animations) and text along with access to a simple internet site. The videos include brief appearances from 'celebrities' and a series of video diaries acted out by young actors with a continuing storyline. The website provides a summary of key messages and a downloadable relaxation video. The program is framed as 'living in a positive space' to avoid the potential stigma associated with terms such as mental health or depression. The program was evaluated in a large RCT with 855 high school students. The control group received a program matched for format, duration and intensity but which contained non-CBT messages (healthy nutrition, cyber safety and environmental awareness). The results about acceptability, adherence and perceived usefulness have been published (Whittaker et al, 2012). Over three-quarters of participants viewed at least half of the messages. Most (91%) in the intervention group reported they would recommend the program to a friend. More participants in the intervention group than in the control group said that *MEMO* helped them to be more positive, to get rid of negative thoughts, to relax, to solve problems, to have fun, and to deal with school issues. Results regarding the efficacy of the program have not yet been made available.

Computerised interventions, previously only available online on personal computers, can be increasingly accessed on mobile devices (smart phones or tablets) extending the reach of e-Therapy and blurring the boundaries between eHealth and m-Health. For example, a cCBT intervention ('*The Get Happy Program*') was recently adapted for use on a mobile device (phone or iPad) (Watts et al, 2013). In a pilot trial, the mobile phone adaptation was compared with the computer-delivered program in 35 adults diagnosed with major depression. Both programs had six lessons and the same amount of therapist involvement. Participants in both groups experienced statistically significant improvements in depression symptoms after the intervention, which persisted at a 3-month follow-up.

Because mobile phones are devices that we carry with us most of the time, they offer an opportunity for real-time data collection. This may be beneficial to help people 'tune in' to their feelings or mood. '*myCompass*' is an app designed to help users track their symptoms of anxiety and depression (Harrison et al, 2011). Users then receive feedback based on their results along with contextual information about mental health and self-help strategies. The app is complemented with cCBT modules, which users can access on their personal computer. Forty-four adult participants took part in a six-week pilot study to evaluate the program. Pre-post analysis showed significant improvement in stress, anxiety, depression, overall psychological distress and functional impairment.

There are a number of issues to consider when designing and delivering m-Health interventions (Boschen & Casey, 2008):

- Compatibility—not all mobile phones are alike. What works on one model, may not work on another (this does not apply to simple text/SMS based interventions)
- Cost. Charges (for data, calling and text/SMS) vary between countries and networks. What may be inexpensive in one area, may be unaffordable elsewhere
- Mobile coverage may vary greatly between locations and there may be intermittent coverage that could potentially frustrate users and impede the success of an intervention
- Privacy and security. Consumers need to be assured the information they provide via mobile phone telecommunications is secure and cannot be accessed by anauthorised parties (Proudfoot et al, 2010).

TXT2STOP

Txt2stop is a personalised smoking cessation program delivered on mobile phone for people 16 years and older (Free et al, 2011). The program sends five messages a day for the first five weeks, followed by three messages a week for the next 26 weeks. The program includes motivational messages and behaviour-change techniques. The messages include positive feedback and highlight the benefits of quitting, how to quit and stay smoke-free, and the consequences of smoking. The messages also promote the use of a smoking cessation telephone helpline (available to the program's participants) and nicotine replacement therapy.

The program is personalized with an algorithm that takes into account demographic and other information collected from the users at the beginning, such as smoker's concern about weight gain. There is also an interactive component whereby people can text a pre-programmed keyword and receive specific advice. For example, when the user texts 'crave' this prompts messages that aim to distract and support a person during an episode of craving.

The program was trialed in the UK in a large RCT (Free et al, 2011) comparing it to a control program with text messages unrelated to quitting. 5,800 participants willing to quit took part. Participants in the *text2quit* group were more than twice as likely to quit—and remain tobacco free at 6 months—compared to the control group (11% vs. 5%; relative risk 2.20, 95% CI 1.80-2.68). The self-reported abstinence data was verified for 92% of the trial's participants and the researchers collecting and analyzing the data were blind to treatment allocation.

TXT2STOP

Examples of messages (Free et al, 2011):

— "This is it – QUIT DAY, throw away all your fags. TODAY is the start of being QUIT forever, you can do it"

— "Cravings last less than 5 minutes on average. To help distract yourself, try sipping a drink slowly until the craving is gone"

Table A.8.4 Some of the better-known e-Therapy resources available online at no cost

Name of the program	Click on the figure to access the program	Description	Target group	Evidence of effectiveness
MoodGYM		• CBT skills for people vulnerable to depression and anxiety. • Uses text, graphics and interactive exercises.	• Designed for adults but evaluated in both adults and adolescents. • Available in English, Norwegian, Dutch and Chinese.	• Has been shown to be efficacious in adults (e.g., Christensen et al, 2004a; Christensen et al, 2006) and with adolescents (O'Kearney et al, 2006; O'Kearney et al, 2009; Calear et al, 2009).
Living Life to the Full		• A life skills course that addresses anxiety and depression using CBT strategies. • Uses sound, text, video files and short handouts. Moderated discussion forums are available.	• Adults	• An evaluation is said to be underway.
The Journal		• Program based on problem solving therapy, CBT and psychoeducation to help people overcome depression	• People over 16 years of age. • Tailored to New Zealanders but may be suitable for others.	• Evaluation is underway.
Youth Mental Health: A parent's Guide		• Designed to give parents the information, skills, and support to cope with emotional problems such as depression or anxiety in their child. • Uses sound and text.	• Adults (parents of children with mental health problems).	• One study (Deitz et al, 2009) showed improved knowledge and self-efficacy in dealing with their child's mental health problems.
Depression Experience Journal		• Designed to help families cope with having a child with depression. • Based on psychoeducation and narrative therapy and provides a supportive online community.	• Adults (parents of children with depression).	• A feasibility and acceptability study (Demaso et al, 2006) showed it was safe and useful, reduced social isolation and increased hope for recovery.

Table A.8.4 Some of the better-known e-Therapy resources available online at no cost (continuation)

Name of the program	Click on the figure to access the program	Description	Target group	Evidence of effectiveness
The Lowdown		• Provides information about depression, support for those experiencing it and aims to reduce stigma associated with depression. • Includes a moderated message board to share experiences and connect with others.	• Adolescents. • Tailored to New Zealanders.	
E-couch		• Gives information about emotional problems including their causes, treatments and ways to manage or prevent them. • Includes five separate programs: depression, anxiety and worry, social anxiety, divorce and separation, and bereavement and loss.	• Adults (may be suitable for older adolescents)	• Evaluation is underway.
Bite Back		• A website with resources about positive mental health and allows user to share their stories and find inspiration. • The information is presented in a youth friendly format and is based on positive psychology.	• Adolescents. • Tailored for Australia	

The quit rate in the intervention group compares well to other traditional behavioural forms of supporting smokers wishing to quit. The researchers concluded that an intervention like *text2quit* is easy to scale up for national or international delivery though there may be some adaption and local evaluation required.

e-THERAPY AT YOUR FINGERTIPS

There are numerous freely available e-Therapy programs for a range of problems on the internet. Most are self-help program designed for people to access and complete without therapist input. Some of the programs have undergone peer-reviewed research while many more are untested. As a clinician, you may be asked by your clients about e-Therapy or you might be interested in using it clinically yourself. It is important that when you search for e-Therapy programs, you establish its evidence base and then consider how suitable it will be for your client. A useful resource is '*Beacon*', a site developed and managed by the Centre for Mental Health Research at the Australian National University (Christensen et al, 2010). The *Beacon* site provides users with a directory of e-health applications (websites, mobile applications and internet support groups), and includes reviews, expert ratings and user comments.

Click on the image to access the *Beacon* site that provides users with a directory of e-health applications (websites, mobile applications and internet support groups), and includes reviews, expert ratings and user comments.

In Table A.8.4 we have listed some of the better-known e-Therapy programs targeting depression and anxiety that you can access free of charge. We have included programs which have been designed for adults but which may be appropriate for older adolescents—there are very few free programs for adolescents currently available online. We included programs which have been evaluated or which are currently undergoing research.

Also of note is '*Life Guide*', a resource developed at the University of Southampton. It allows researchers to easily and flexibly create and modify internet-delivered interventions. The software is open source and free. Users can also access examples of other peoples' interventions, upload their own programs and discuss them with the site's registered users. This initiative is an example of how online eHealth interventions may evolve in the future if ideas can be shared and international collaborations can be formed using digital media.

CONCLUSIONS

Click on the image to access the *Life Guide* website.

Despite the promising results, widespread use of e-therapies has not become common in day-to-day practice. We expect significant development and research in this field in the near future. The tremendous potential of e-therapies can only be realised if rigorous research is carried out and if e-therapies continue to evolve taking advantage of the rapid technological advances. It is equally important to establish, through implementation studies, how best to use e-therapies in clinical practice. We need to determine what e-therapies are most appropriate for whom, what level of clinical input is required and when. Finally, e-therapies should complement rather than replace clinical assessment and care, particularly at the moderate to severe end of the clinical spectrum.

REFERENCES

Abeles P, Verduyn C, Robinson A et al (2009). Computerized CBT for adolescent depression ("Stressbusters") and its initial evaluation through an extended case series. *Behavioural & Cognitive Psychotherapy,* 37:151-165.

Amon KL, Cambell F (2008). Can children with AD/HD learn relaxation and breathing techniques through biofeedback video games? *Australian Journal of Educational & Developmental Psychology,* 8**:**72-84.

Anderson CA (2004) An update on the effects of playing violent video games. *Journal of Adolescence,* 27:113-122.

Andersson G, Cuijpers P (2009). Internet-based and other computerized psychological treatments for adult depression: a meta-analysis. *Cognitive Behaviour Therapy,* 38:196-205.

Attwood M, Meadows S, Stallard P et al (2012). Universal and targeted computerised cognitive behavioural therapy (Think, Feel, Do) for emotional health in schools: results from two exploratory studies. *Child and Adolescent Mental Health*, 17:173-178.

Bell C (2003). The Journey to the Wild Divine: user's manual. Boulder, Colorado.

Boschen MJ, Casey LM (2008). The use of mobile telephones as adjuncts to cognitive behavioural psychotherapy. *Professional Psychology: Research and Practice,* 39:546-552.

Calear AL, Christensen H (2010). Review of internet-based prevention and treatment programs for anxiety and depression in children and adolescents. *The Medical Journal of Australia,* 192:S12-S14.

Cavanagh K, Shapiro DA, Van Den Berg S et al (2006). The effectiveness of computerized cognitive behavioural therapy in routine care. *British Journal of Clinical Psychology,* 45**:**499-514.

Childre D (2005). *Freeze-Frame 2.0 Manual.* Heartmath, Boulder Creek, California.

Christensen H, Griffiths KM, Jorm AF (2004a). Delivering intervention for depression by using the internet: randomised controlled trial. *British Medical Journal,* 328:265-269.

Christensen H, Griffiths KM, Korten AE et al (2004b). A comparison of changes in anxiety and depression symptoms of spontaneous users and trial participants of a cognitive behavior therapy website. *Journal of Medical Internet Research,* 6**:**e46.

Christensen H, Griffiths KM, Mackinnon AJ et al (2006). Online randomized controlled trial of brief and full cognitive behaviour therapy for depression. *Psychological Medicine*, 36:1737-46.

Christensen H, Murray K, Calear AL et al (2010). Beacon: a web portal to high-quality mental health websites for use by health professionals and the public. *The Medical Journal of Australia,* 192**:**S40-S44.

Cole-Lewis H, Kershaw T (2010). Text messaging as a tool for behaviour change in disease prevention and management. *Epidemiological Review,* 32:56-69.

Connolly TM, Boyle EA, Macarthur E et al (2012). A systematic literature review of empirical evidence on computer games and serious games. *Computers & Education,* 59**:**661-686.

Cunningham MJ, Wuthrich VM, Rapee RMet al (2009). The cool teens CD-ROM for anxiety disorders in adolescents. *European Journal of Child & Adolescent Psychiatry,* 18:125-129.

Deitz DK, Cook RF, Billings DW et al (2009). A web-based mental health program: reaching parents at work. *Journal of Pediatric Psychology,* 34**:**488-494.

Demaso DR, Eldridge MN, Kinnamon C et al (2006). Depression Experience Journal: A computer-based intervention for families facing childhood depression. *Journal of the American Academy of Child and Adolescent Psychiatry,* 45:158-165.

Fergusson DM, Horwood JL, Lynskey MT (1993). Prevalence and comorbidity of DMS-III-R diagnoses in a birth cohort of 15 year olds. *Journal of the American Academy of Child & Adolescent Psychiatry,* 32:1127-1134.

Fleming T, Dixon R, Frampton C et al (2011). A Pragmatic Randomised Controlled Trial of computerized CBT (SPARX) for symptoms of depression among adolescents excluded from mainstream education. *Behavioural & Cognitive Psychotherapy,* 40**:**529-541.

Free C, Knight R, Robertson S et al (2011). Smoking cessation support delivered via mobile phone text messaging (txt2stop): a single-blind, randomised trial. *Lancet,* 378:49-55.

Gerrits RS, Van Der Zanden RAP, Visscher RFM et al (2007). Master your mood online: A preventive chat group intervention for adolescents. *Australian e-Journal for the Advancement of Mental Health,* 6:1-11.

Harrison V, Proudfoot J, Wee PP et al (2011). Mobile mental health: Review of the emerging field and proof of concept study. *Journal of Mental Health,* 20:509-524.

Kaltenthaler E, Brazier J, De Nigris E et al (2006). Computerised cognitive behaviour therapy for depression and anxiety update: a systematic review and economic evaluation. *Health Technology Assessment,*10.

Kato PM, Cole SW, Bradlyn AS et al (2008). A video game improves behavioral outcomes in adolescents and young adults with cancer: A randomized trial. *Pediatrics,* 122:e305 -e317.

Knox M, Lentini J, Cummings T S et al (2011). Game-based biofeedback for paediatric anxiety and depression. *Mental Health in Family Medicine*, 8:195-203.

Law EF, Dahlquist LM, Sil S et al (2011). Videogame distraction using virtual reality technology for children experiencing cold pressor pain: the role of cognitive processing. *Journal of Pediatric Psychology,* 36**:**84-94.

Lieberman DA (2006). What can we learn from playing interactive games? *In:* Vorderer P & Bryant J (eds.) *Playing Video Games: Motives, Responses, and Consequences.* Mahwah, New Jersey: Lawrence Erlbaum Associates.

March S, Spence SH, Donovan CL (2009). The efficacy of an internet-based cognitive-behavioral therapy intervention for child anxiety disorders. *Journal of Pediatric Psychology,* 34**:**474-487.

McCrone P, Knapp M, Proudfoot J et al (2004). Cost-effectiveness of computerised cognitive-behavioural therapy for anxiety and depression in primary care: Randomised controlled trial. *British Journal of Psychiatry,* 185:55-62.

McLay RN, Wood DP, Webb-Murphy JA et al (2001). A randomized, controlled trial of virtual reality-graded exposure therapy for post-traumatic stress disorder in active duty service members with combat-related post-traumatic stress disorder. *Cyberpsychology, Behavior, and Social Networking,* 14:223-229.

Merry S, Stasiak K, Frampton C et al (2012). A randomised controlled non-inferiority trial of the effectiveness of SPARX, a computerised self-help intervention for adolescents seeking help for depression. *British Medical Journal,* 344:e2598

Murphy MJ (2003). Computer technology for office-based psychological practice: Applications and factors affecting adoption. *Psychotherapy: Theory, Research, Practice and Training,* 40:10-19.

National Institute for Clinical Excellence (2004). *Computerised cognitive behaviour therapy for depression and anxiety update: A systematic review and economic analysis.* London.

National Institute for Health and Care Excellence (2009). *Depression: The treatment and management of depression in adults (updated edition) (CG90).* London: National Institute for Health and Care Excellence.

National Institute for Health and Clinical Excellence (2005). *Depression in children and young people: identification and management in primary, community and secondary care*. London.

National Institute for Health and Clinical Excellence (2006). *Computerised cognitive behaviour therapy for depression and anxiety: Review of Technology Appraisal 51 (TA97).* London.

O'Kearney R, Gibson M, Christensen H at al (2006). Effects of a cognitive-behavioural internet program on depression, vulnerability to depression and stigma in adolescent males: a school-based controlled trial. *Cognitive Behaviour Therapy,* 35:43-54.

O'Kearney R, Kang K, Christensen H et al (2009). A controlled trial of a school-based Internet program for reducing depressive symptoms in adolescent girls. *Depression & Anxiety,* 26:65-72.

Parsons TD, Rizzo AA (2008). Affective outcomes of virtual reality exposure therapy for anxiety and specific phobias: A meta-analysis. *Journal of Behavior Therapy and Experimental Psychiatry,* 39**:**250-261.

Pop-Jordanova N, Gucev Z (2010). Game-based peripheral biofeedback for stress management in children. *Pediatrics International,* 52:428-431.

Proudfoot J, Parker G, Pavlovic DH et al (2010). Community attitudes to the appropriation of mobile phones for monitoring and managing depression, anxiety and stress. *Journal of Medical Internet Research* 12:e64.

Proudfoot J, Ryden C, Everitt B et al (2004). Clinical efficacy of computerised cognitive-behavioural therapy for anxiety and depression in primary care: randomised controlled trial. *British Journal of Psychiatry,* 185:46-54.

Rainie L, Anderson J (2008). *Pew Internet & American Life Project: The Future of Internet III*. Washington, DC: Pew Research Center.

Rashid AT, Elder L (2009). Mobile phones and development: an analysis of IDRC-supported projects *The Electronic Journal of Information Systems in Developing Countries,* 36:1-16.

Richardson T, Stallard P, Velleman S (2010). Computerised cognitive behavioural therapy for the prevention and treatment of depression and anxiety in children and adolescents: A systematic review. *Clinical Child and Family Psychology Review,* 13:275-290.

Selmi PM, Klein MH, Greist JH et al (1990). Computer-administered cognitive-behavioral therapy for depression. *American Journal of Psychiatry,*147:51-56.

Spence SH, Donovan C, March S et al (2011). A randomized controlled trial of online versus clinic-based CBT for adolescent anxiety. *Journal of Consulting and Clinical Psychology,* 79**:**629-642.

Spence SH, Donovan CL, March S et al (2008). Online CBT in the treatment of child and adolescent anxiety disorders: Issues in the development of BRAVE–ONLINE and two case illustrations. *Behavioral & Cognitive Psychotherapy,* 36:411-430.

Stallard P, Richardson T, Velleman S et al (2011). Computerized CBT (Think, Feel, Do) for depression and anxiety in children and adolescents: outcomes and feedback from a pilot randomized controlled trial. *Behavioural and Cognitive Psychotherapy,* 39**:**273-284.

Attwood M, Meadows S, Stallard P et al (2012). Universal and targeted computerised cognitive behavioural therapy (Think, Feel, Do) for emotional health in schools: results from two exploratory studies. *Child and Adolescent Mental Health*, 17:173-178.

Van Voorhees BW, Fogel J, Reinecke MA et al (2009). Randomized clinical trial of an internet-based depression prevention program for adolescents (Project CATCH-IT) in primary care: 12-week outcomes. *Journal of Developmental & Behavioral Pediatrics,* 30:23-37.

Watts S, Mackenzie A, Thomas C et al (2013). CBT for depression: a pilot RCT comparing mobile phone vs. computer. *BMC Psychiatry* 13:49.

Weizenbaum J (1966). Computational linguistics. *Communications of the ACM,*9:36-45.

Whittaker R, Merry S, Stasiak K et al (2012). MEMO—A mobile phone depression prevention intervention for adolescents: development process and postprogram findings on acceptability from a randomized controlled trial. *Journal of Medical Internet Research,* 14:e13.

World Health Organisation (2011). *mHealth: New horizons for health through mobile technologies.*

Wright JH, Wright AS (1997). Computer-assisted psychotherapy. *Journal of Psychotherapy Practice and Research*, 6:315-329.