
The Internet and CBT: A New Clinical Application of an Effective Therapy

David Gratzler, Faiza Khalid-Khan and
Shawwna Balasingham

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Abstract

Mental disorders are disabling and common. Depression, for example, has greater global burden of disease than any physical disorder, and almost a third of people will experience some form of mental disorder in their lifetime. The effectiveness of psychological interventions is well established. Cognitive Behavioral Therapy is particularly effective for mood and anxiety disorders. But CBT is demanding of time and resources, partly explaining its limited availability, even in public systems. More and more people have access to the Internet and smartphones, even in the developing world. Internet therapies (including smart-phone apps) have been developed, offering CBT. Can technology help with access to CBT? In this chapter, we will look at the effectiveness of iCBT for several illnesses, based on new evidence from recent randomized controlled trials and meta-analyses, noting that while there is evidence for this therapy, not all programs have the same results. We consider iCBT in the real world, by looking at some popular apps and websites, including MoodGYM, and also present a case from The Scarborough Hospital (where we implemented a free-at-the-point-of-use iCBT program), demonstrating how it can be applied in an outpatient setting. We also present the current strengths and limitations associated with iCBT. Finally, we consider future directions for this field, considering chatbots and the possibilities with Artificial Intelligence.

Keywords: cognitive behavioral therapy, CBT, Internet-assisted CBT, iCBT, psychological intervention, depression, anxiety, apps, access, physical illness, chatbot, artificial intelligence

1. Introduction

1.1. Key points

- Strong evidence from controlled randomized trials shows that iCBT can be used in clinical practice for some patients.
- Practical considerations suggest that some forms of iCBT are more effective than others.
- Further experimentation, including with AI, has the potential to re-shape therapy.

Mental disorders are disabling and common. Depression, for example, has greater global burden of disease than any physical disorder [1]. 29% of people will experience some form of mental disorder in their lifetime [2]. Yet care is often difficult to access: only 45% of people in developed countries receive care, and the percentage of people who receive treatment is just 15% in developing countries [3]. Even when patients have access to mental healthcare, it may be inadequate. In North America, between 30 and 79% of patients treated for depression receive sub-standard treatment. In a study of patients in British Columbia, Canada, who received treatment for depression, Puyat et al. found that only 13% received any psychotherapy or counseling; women, older patients, and patients in rural areas were less likely to receive adequate psychotherapy or counseling [4].

Cognitive Behavioral Therapy (CBT) is an evidence-based treatment. Beck's Cognitive Triad, the conceptual basis of CBT, is built on the principle that people's thoughts, emotions, and behaviors are connected. By taking control of their thoughts, patients can reframe how they interpret the events around them [5]. CBT has been shown to be equivalent to medication for mild and moderate anxiety and depression. Combining psychopharmacology with CBT may have a synergistic effect [6]. However, CBT requires time and resources, which partly explains its limited availability, even in public healthcare systems like Canada's. Therefore, many primary care physicians and psychiatrists do not offer CBT [7]. As a recent JAMA Psychiatry editorial noted: "Traditionally, psychotherapy developers focused on interventions for specific diagnoses to be implemented by mental health professionals in mental health settings. Once established as evidenced based, these therapies often failed to be disseminated into mental health centres, let alone... primary care clinics" [8].

While access to mental healthcare is not always available, more and more people have access to the Internet and smartphones, even in the developing world [3]. CBT is a good intervention for technology-based applications because the concepts are easily adapted into broadly applicable sessions (or modules) that can be distributed by email, the web, or apps [9]. Not surprisingly, numerous programs have been developed. Studies show Internet-assisted CBT (or iCBT) is cost-effective for patients; it is also more convenient for patients and providers compared with traditional CBT (a literature review follows).

In this chapter, we will look at the effectiveness of iCBT for several illnesses, based on new evidence from recent randomized controlled trials and meta-analyses. We consider iCBT in the real world, by looking at some popular apps and websites. We present a case from a Canadian

hospital where we implemented an iCBT program. We also review the current strengths and limitations of iCBT. Finally, we consider future directions for this field, with an eye on AI.

2. Literature review

iCBT continues to be a hot area of research in psychiatry. A PubMed search of “Internet cognitive behavioral therapy” yielded over 1600 articles, about 300 more than a search conducted just 2 years ago [9]. The literature has been reviewed extensively by ourselves and others [9–18]. Among the best-studied interventions are those for depression, anxiety, and physical illness. Presented here are some of the most recent systematic reviews, meta-analyses, and randomized controlled trials about treatment effectiveness and address some of the most pressing concerns and promising developments in the new field of iCBT.

2.1. Depression

Treatment of depression with iCBT has been well studied. For example, two meta-analyses of iCBT for adult depression – covering 12 studies and four studies, respectively – found pooled effect sizes of 0.41 (95% CI 0.29, 0.54) [19] and 0.22 (95% CI, 0.03–0.41), respectively, for iCBT compared with any type of control [20]. A third meta-analysis of iCBT, covering nine studies – in university students – showed a standardized mean difference of –0.43 (95% CI –0.63, –0.22) supporting iCBT over non-treatment [15]. When comparing iCBT with treatment as usual, a randomized controlled trial showed a significant effect size (0.2; 95% CI 0.00, 0.50) favoring iCBT [21]. Overall, the present data support iCBT as an effective treatment for depression that could have a greater benefit than standard treatment. (For a more comprehensive review of this literature, please see our CMAJ paper, available at: <http://www.cmaj.ca/content/cmaj/early/2015/11/02/cmaj.150007.full.pdf>)

But how can iCBT be done effectively? Could iCBT be offered without any therapist support – essentially, with patients told to use a website or an app? There is strong evidence in favor of therapist support of iCBT, including the results of a meta-analysis comparing iCBT with controls (effect size 0.61; 95% CI 0.45, 0.77) [19] and a Prioritization Summary conducted by the Australian and New Zealand governments (significant improvements in depressive symptoms through 8 months of follow-up; seven included studies) [22].

This raises a question: is self-guided CBT of any benefit? Researchers conducted a meta-analysis evaluating the efficacy of self-guided iCBT for the treatment of depressive symptoms. The authors identified 16 eligible RCTs and obtained patient data of 3876 participants from 13 of the 16 studies. They performed traditional and patient-level meta-analyses. iCBT was more effective at reducing symptom severity than controls, including placebo, no treatment, treatment as usual, or waiting list ($\beta = -0.21$; Hedges $g = 0.27$). iCBT also had a greater treatment response than controls ($\beta = 0.53$; odds ratio, 1.95; 95% confidence interval [CI]: 1.52, 2.50). Their analysis also showed an association between higher adherence and greater symptom reductions ($\beta = -0.19$; $P = 0.001$) and treatment response ($\beta = 0.90$; $P < 0.001$). Based on

their analysis, the estimated number needed to treat to achieve a 50% reduction in depressive symptoms was eight patients [23]. What is particularly notable about this study is the number needed to treat. As first glance, this number seems too high to be clinically relevant. However, when considering the low expense associated with self-guided iCBT and when applying iCBT to an entire population, the investment could be worth the cost.

Another question around implementation: can iCBT be adopted for more than one diagnosis? Depression is often comorbid with other psychiatric diagnoses, such as anxiety. To determine the effectiveness of a transdiagnostic and tailored approach for treating adult patients with depression and/or anxiety, Păsărelu *et al.* conducted a meta-analysis of randomized controlled trials. They included 19 trials with 2952 participants. Transdiagnostic and tailored iCBT yielded controlled Hedges' g values of 0.79 (95% CI: 0.59, 1.00) for depression, 0.82 (95% CI: 0.58, 1.05) for anxiety, and 0.56 (95% CI: 0.37, 0.73) for quality of life [24].

A final question around implementation: can iCBT be offered in the primary care setting? Depression, after all, is most often treated in a primary-care setting [25, 26]. One recent randomized controlled trial investigated the long-term effects of iCBT for depression administered through 16 primary-care centers (the PRIM-NET trial). Researchers compared a three-month therapist-supported iCBT program with treatment as usual for depression. Treatment as usual included in-person therapy, pharmacotherapy, sick leave, and any combination thereof. Patients were followed for 12 months. Within group effect sizes for iCBT and treatment as usual were high (Cohen's $d = 1.42$ and 1.29 , respectively, at 12 months). No significant differences in depressive symptoms, quality of life, and psychological distress were observed between iCBT and treatment as usual at 3, 6, and 12 months. These data indicate that long-term iCBT with therapist support may be as effective as treatment as usual in a primary-care setting [27].

2.2. Anxiety

There is strong evidence in the literature supporting the use of iCBT for anxiety disorders. For example, there are three major meta-analyses that included between 12, 17, and 23 studies, and all showed the effectiveness of this intervention [14, 20, 28]. The Cochrane Collaboration recently updated their systematic review of therapist-supported iCBT for adults with anxiety disorders. They identified 38 randomized controlled trials (11 studying social phobia, eight studying panic disorders, eight studying multiple anxiety disorders, five studying generalized anxiety disorder, two studying PTSD, two studying OCD, and two studying phobias). Trial comparators included controls (i.e., waiting list, information, attention, online discussion groups), unguided iCBT, and face-to-face CBT. 11 trials compared therapist-supported iCBT with controls. For a clinically relevant improvement in anxiety symptoms, the pooled risk ratio (RR) was 3.75 (95% CI 2.51, 5.60; $I^2 = 50\%$) favoring therapist-supported iCBT over controls. Reductions in disorder-specific symptoms and general anxiety symptoms were significantly greater for therapist-supported iCBT compared with controls. Only one very low-quality study compared therapist-supported and unguided iCBT; thus, no conclusions could be drawn. Four studies compared therapist-supported iCBT with face-to-face CBT. For

a clinically relevant improvement in anxiety symptoms, the pooled RR was 1.09 (95% CI 0.89, 1.34; $I^2 = 0\%$), indicating no significant difference between therapist-supported iCBT and face-to-face CBT. Further, no significant differences were observed in disorder-specific and general anxiety symptoms. While most of the evidence was low to moderate quality, the data suggest that therapist-supported iCBT is an effective treatment for anxiety disorders and could be as effective as face-to-face CBT. However, additional, better-designed studies are needed to draw stronger conclusions [29].

Given the technological nature of iCBT, do children and adolescents respond well to this intervention? Recently, Ebert *et al.* conducted a meta-analysis of iCBT for anxiety and depression in children and adolescents. They identified 13 RCTs: seven studying anxiety, four studying depression, and two studying both. The studies used non-intervention or placebo controls. 11 studies used therapist-guided iCBT. Compared with controls, iCBT had a mean effect size of 0.72 (95% CI 0.55, 0.90; $P < 0.001$) on symptoms of anxiety or depression. To get one positive outcome, the number needed to treat was 2.56. Interventions targeted at adolescents had larger effect sizes than those targeted at children ($g = 0.95$ and 0.51 , respectively). While the studies had a variety of treatment strategies and no long-term follow-up, the data seem to indicate that iCBT may be an effective treatment for anxiety and depression symptoms in children and adolescents [30].

2.3. Physical illness

One very promising direction for iCBT is its use to treat distress caused by physical illness. In 2013, researchers conducted a systematic review investigating iCBT as an intervention for psychological distress in patients suffering from physical illnesses. Illnesses included irritable bowel syndrome (five trials), tinnitus (four trials), chronic pain (three trials), chronic back pain (three trials), infertility (two trials), as well as for a variety of other diseases (diabetes, HIV, multiple sclerosis, migraines, early breast cancer, with a trial each). At the time of this chapter's writing, the quality of evidence for iCBT was low and few conclusions could be drawn [31].

Since then numerous programs have emerged, especially for patients with cancer [9]. For example, a recent randomized controlled trial compared iCBT versus care as usual in breast cancer survivors with severe fatigue. The iCBT program started with two face-to-face sessions with a therapist followed by eight web-based modules. Therapists tailored modules and supported patients through the program. One final face-to-face session was conducted approximately 6 months after beginning treatment. At 6 months, participants in the iCBT group had significantly lower fatigue scores (mean difference, 11.5; 95% CI 7.7, 15.3) with a large effect size (Cohen $d = 1.0$) compared with care as usual. The iCBT group also had reduced functional impairment (mean difference, 297.8; 95% CI 145.5, 450.1) and psychological distress (mean difference, 5.7; 95% CI 3.4, 7.9) and increased quality of life (mean difference, 11.7; 95% CI 5.8, 17.7) compared with the care as usual group. Effect sizes of those measures ranged from 0.6 to 0.8 [32]. Some studies of iCBT for use in patients with brain injury, heart disease, and recurrent headaches is provided in **Box 1**.

Brain Injury:

Patients with acquired brain injury often have cognitive symptoms. These symptoms can potentially be addressed with iCBT. Recently, a systematic review of studies using iCBT to treat cognitive symptoms in adult patients with acquired brain injury was published. Among the 14 included high-quality randomized controlled trials, there was strong evidence that iCBT improved processing speed in patients with multiple sclerosis. There was moderate evidence that iCBT improved memory in patients with multiple sclerosis or brain tumors. However, more evidence from trials that use activities, participation, and body structure outcomes is needed to draw a strong conclusion [74].

Heart disease:

Depressive and anxiety symptoms are common following myocardial infarction. CBT has been shown to be an effective treatment strategy for these symptoms, so researchers developed a therapist-supported, self-tailored iCBT program for patients following a myocardial infarction. In a randomized controlled trial comparing iCBT to standard care, patients in the iCBT group selected two to three modules from the ten available. Each module contained two to four steps, and patients were asked to complete a step per week. A pilot study showed that the study was acceptable (68% of eligible patients enrolled) and participants were sufficiently active (50% had completed at least one module assignment within 3 weeks). The full trial is currently ongoing [75].

Recurrent headaches

For children and adolescents with recurrent headaches, psychological interventions, including relaxation and CBT, have proved to be effective treatments. Researchers conducted a randomized controlled trial comparing the effects of iCBT, applied relaxation, and an educational control in children and adolescents with recurrent headaches. All patients received an educational module discussing headaches. The iCBT program had five additional modules that included stress management, cognitive-restructuring, and relaxation techniques. The applied relaxation program had more extensive relaxation training, which included the module provided to the iCBT group. All patients had email contact with a therapist. When comparing iCBT and applied relaxation with education, the numbers needed to treat were 2.0 and 5.2, respectively. Responder rate was significantly higher for iCBT (63%) at post-treatment compared with applied relaxation (32%) and education (19%) but not at the six-month follow-up. At post-treatment, iCBT had the largest within-effect sizes for headache duration and frequency as well as pain catastrophizing. Further studies are needed, but these results support the use of iCBT to treat recurrent headaches in children and adolescents [76].

Box 1: Evidence for using iCBT to treat psychological distress associated with physical illness.

3. Practical applications

As noted above, implementing iCBT in a primary-care setting would be important. To successfully do this, we must first understand how programs perform in the real world rather than the tightly controlled setting of a clinical trial. The REEACT trial was conducted in the UK, and considered how patients in a primary care setting could access iCBT (a pragmatic randomized controlled trial). The study included three groups of patients: those using a commercial program (Beating the Blues) in addition to general practitioner (GP) care, those using a free program (MoodGYM) in addition to GP care, and usual GP care (that is, access to antidepressants, counseling, psychological services, and secondary mental health services). Those patients who used iCBT also received weekly phone calls from trained technicians. In this trial, no differences in depressive symptoms or health state utility were observed between commercially available iCBT, free-to-use iCBT, and usual care. iCBT had a statistically significant benefit over usual care in the mental component of health-related quality of life and general psychological wellbeing at 12 months but not at 24 months. Even with telephone support, adherence was poor in both iCBT groups with only one completed session (as the median

number of sessions completed). There was no observed advantage to using a commercially available program versus a free-to-use one [33]. Neither program was more cost effective than usual GP care [34]. When interviewed, participants liked the autonomy and flexibility of the program, but disliked the lack of interpersonal communication and customizability [35].

Because the patients in the REEACT trial expressed desire for more support, investigators conducted a second trial comparing the effectiveness of MoodGYM alone versus MoodGYM with telephone support (the REEACT-2 trial). The telephone support worker introduced patients to CBT, helped identify issues and set goals, motivated the patient, and discussed future steps. The study showed that telephone support made a difference, with significantly improved depression symptoms. The largest between-group difference was observed at 4 months (Cohen’s $d = 0.32$), but the difference was no longer significant after 12 months. The odds ratio of not being depressed at 4 months was 2.05 (95% CI 1.23, 3.42; $P = 0.0030$) when telephone support was added to MoodGYM. There were also significant between-group differences in depression and anxiety scores. However, the adherence to the program did not increase substantially with 45% of patients completing the first session in the MoodGYM alone group and 65% completing the first session in the telephone-support group. An economic analysis indicated that telephone support could increase quality of life (in quality-adjusted life year [QALY]) and reduce healthcare costs with a likelihood of being cost effective at £6933 per QALY [36, 37].

While the literature is vast, a pattern is clear: iCBT can be effective. Even unguided iCBT, with its number needed to treat of eight, is beneficial to some patients [23]. But it should be noted that the number needed to treat jumps up to 2.56 for children and adolescents with anxiety using therapist-guided iCBT [30]. The emerging data on iCBT effectiveness and cost seem to support a stepped-care model, where patients with less severe illness and more motivation can be treated with unguided iCBT. As illness severity and desire for interaction increases, there is a role for iCBT programs with progressively more support. This model would balance the cost of treatment while providing the most benefit to individual patients and the population as a whole.

4. iCBT and the real world

Beyond the research, there are more and more iCBT programs available to the public. While most iCBT programs contain eight to 12 self-guided goal-oriented modules [22, 38], they can vary in quality and type of care. Speaking to the latter point: iCBT has a broad spectrum of therapist involvement, ranging from none to high-level involvement. Some programs are free, while others

Features	Options
Level of support	Self-guided, staff-supported, therapist-supported, chatbot-supported
Cost	Free, app purchase price, subscription fee
Teaching style	Tutorial, story-based, game-based

Table 1. Available features of iCBT.

are available for a fee. Depending on the country in which the patient lives, iCBT may be endorsed and even funded by government. **Table 1** shows a sample of the various options offered to patients by existing iCBT programs. Below, we explore a few of the currently available iCBT options.

4.1. MoodGYM

One of the most popular and best-studied iCBT programs is MoodGYM. The program comprises an introduction module, five learning modules, and a review module. MoodGYM uses fictional stories built around a set of six cartoon characters to present the principles of CBT in an approachable manner. As the participant progresses through the modules, they learn: (1) how negative thoughts affect their feeling, (2) how to identify those thoughts, (3) how to remove themselves those thoughts to view them objectively, (4) how to reduce stress, and (5) how relationships can affect thoughts and feelings. There are online worksheets, workbooks, and downloadable materials as well as games and activities to complete with each module. Outcome measures are collected before starting and after completing the five modules to determine if MoodGYM improved the participants' symptoms [39].

MoodGYM was developed with the support of the Australian government and is available in five languages. MoodGYM was initially free, but currently this program charges patients \$39 (AUD) for a 12-month subscription to the materials. There are about 850,000 registered users. Recently, a meta-analysis of the effectiveness of MoodGYM for depression and anxiety was performed. For patients with anxiety, MoodGYM had a medium effect size ($g = 0.57$, 95% CI 0.20, 0.94; $I^2 = 85\%$). For patients with depression or general psychological distress, MoodGYM trended toward effectiveness, but fell short of statistical significance ($g = 0.17$, 95% CI -0.01, 0.38 and $g = 0.34$, 95% CI -0.04, 0.68; respectively). Adherence in the included studies ranged widely, from 10–100% of patients completing all modules, though the authors noted that: “adherence rates can be problematic” [39]. The effect size was higher in studies with high adherence (>50% of modules completed) versus those with low adherence ($g = 0.64$, 95% CI 0.15, 1.14, $I^2 = 79\%$ and $g = 0.22$, 95% CI 0.42, 0.41, $I^2 = 72\%$; respectively).

4.2. CBT-I Coach

CBT-I Coach is a smart-device app that can be used for insomnia. The app is available for iOS and Android platforms, and as of February 2016, it has been downloaded over 80,000 times. CBT-I Coach was developed by the United States Department of Veterans Affairs to support their clinician-guided CBT-I program. One of the major components of CBT-I Coach is keeping a Sleep Diary. The app has a diary function built in to keep track of sleep behaviors. The diary function includes drop down menus and places to enter text to facilitate documentation of sleep quantity and quality. The app also includes the Insomnia Severity Index (ISI) scores so the patient can keep track of their progress without visiting their clinician. The app can plot the quantitative diary data and ISI scores graphically so the user can easily see change over time. Both the diary and ISI scores can be sent to the user's clinician to provide a more comprehensive picture of patient progress. Users can set up notifications to remind them to fill out their diary. CBT-I Coach also has extensive educational material, recommendations for sleep hygiene and stimulus control, dynamic checklists to encourage health habits and prevent relapse, audio-guided relaxation exercises, and tools for cognitive restructuring [40].

While the CBT-I program has been studied extensively and has been shown to decrease insomnia symptoms and improve sleep efficiency, fragmentation, and onset latency [41–49], there has been little formal review of the CBT-I Coach app itself. A small pilot RCT assessed the app for feasibility, acceptability, and effects on adherence and sleep outcomes. All participants found the app helpful, and greater than 50% used the educational materials and reminders in the app [50]. Another study surveyed CBT-I clinicians prior to releasing CBT-I Coach and again 2 years after its release. Before the release of the app, clinicians thought that the app was at least moderately likely to improve care, and most (87%) intended to use the app. 2 years after the release of the app, ~60% of clinicians reported using the app and thought it improved homework adherence and outcomes [40].

4.3. FearFighter

FearFighter is a web-based iCBT program offered by a for-profit company in the UK. The program offers nine sessions that offer patients basic information on CBT, and a focus on negative thinking and overgeneralizations. This program is somewhat unique in the inclusion of videos, helping patients better understand basic concepts. At the end of the program, participants are given access to worksheets and summaries for later reference.

The program was endorsed by the UK's National Institute of Clinical Excellence (NICE), and can be "prescribed" by a primary care doctor (allowing for public coverage in some parts of that country), but patients can also self-refer. FearFighter have been the subject of numerous studies [51–56]. FearFighter has been shown to be superior to computer-guided non-exposure controls and as good as clinician-guided CBT for at least 3 months, though adherence to FearFighter was lower than clinician-guided therapy [56]. Both patients and clinicians were satisfied with how easy FearFighter was to use and the results of the program [52, 54–58].

4.4. SuperBetter

SuperBetter is an online and app-based game designed to help build "social, mental, and emotional resilience" to overcome challenges in life. Players are encouraged to set a goal for themselves in real life. Based on the goal, the game will offer appropriate activities for the player. "Power-ups" are activities that you can do in real life to improve resilience. "Quests" are in-site activities the player can participate in to teach them coping skills. "Bad Guys" are physical or mental bad habits that the player must battle. The site recommends completing three Power-ups and three Quests as well as battling one Bad Guy per day. Players can earn points for improving their resilience. Once you have met your goal, you achieve an "Epic Win." If the player sets a new goal, then they start a new game. The site has custom daily and weekly questionnaires to track progress in terms of the amount of time a player is happy, expressed as a percentage, and their resilience. Players can also recruit "allies" (e.g., friends, family). Allies can view the player's progress and offer support in the form of likes or comments. The game is highly customizable and can be adapted to address any challenges, from general life changes to mental and physical illness.

There is one randomized controlled clinical trial where patients with significant depression symptoms used SuperBetter. Players were asked to play the game 10 min a day for 1 month.

Patients playing SuperBetter had larger reductions in depression symptoms, based on CES-D scores, than waitlisted controls at 1-month (Cohen's $d = 1.05$). The game has also been evaluated in an NIH-funded clinical trial but the results are pending.

These different programs are very different in their approach to iCBT. And, of course, there are many other programs available. And while we acknowledge that there is no one right approach to iCBT, we recognize that many of the products on the market today have little or no evidence to support their effectiveness. We offer this advice: potential iCBT users should be careful when deciding on a program (or programs) to use. Users should look for government endorsements, affiliations with academic and/or medical institutions, and published results in peer-reviewed journals. If the program includes therapist support or uses therapists as a content source, a list of their qualifications should be easily accessible on the program's website. However, users should still check the therapist's credentials [9]. Users also should be careful not to be deceived by certifications, as they are not necessarily an indicator of quality. While many of the high-quality programs available do charge a fee, users should be wary of programs that try to sell them products or "cures" [17]. A little due diligence should help users identify a program that can help them address their symptoms rather than simply separate them from their own money.

5. The Scarborough Hospital experience

The authors have been actively involved in the development and implementation of an iCBT program at The Scarborough Hospital (TSH, now part of the Scarborough and Rouge Hospital). This hospital serves Toronto, Canada's diverse east end, and receives roughly 500 outpatient referrals a month. Here we review a case, and then consider the program and outcome data.

A.K. is a 27-year-old woman who suffers from severe anxiety. In the 2 years before her first outpatient appointment with the TSH clinic, she had left her apartment just a half dozen times – all to attend doctor's appointments. She was originally referred by her neurologist (who she had been seeing for non-specific dizziness). In her early 20s, A.K. had a major depressive episode, and a past trial of an SSRI antidepressant. At TSH, she was seen by the first author of this paper, then referred for therapy with diagnoses of Generalized Anxiety Disorder and Panic Disorder. A.K. was bright and motivated – and ready for therapy. But when first offered a referral for CBT she hesitated: it was almost impossible for her to take the bus to the clinic, how could she come on a weekly basis? Like A.K., there are many patients that need CBT but have difficulty accessing the help they need – think of the single mother with childcare obligations and the small businessman who needs to attend meetings during the day.

In 2014, the TSH Mental Health Outpatient Program was completely revamped to increase access to evidence-based interventions. Staff were provided training in CBT, and patients were provided a combination of group and individual CBT sessions. After building staff capacity to provide CBT, we shifted our focus to increasing access to our interventions. We started by offering evening hours for more convenience but better access to in-person CBT did not address access barriers for people like A.K.

Every industry has turned to digital solutions for faster, easier, and more efficient services – could these types of solutions work in mental health service delivery as well? We developed a mental health app library in which apps vetted by our staff were included in our treatment regimen. Therapists used these apps to augment the in-person CBT, allowing patients to keep up with the material even if they had missed several sessions. But it was not enough to just offer CBT, we wanted to ensure that those in need had every chance of receiving it. It was this line of thinking that led to the development of our iCBT.

After a literature review looking at various international models of iCBT, and in collaboration with Queen's University (where they were piloting a small iCBT program for adolescents), we developed our own modules closely mirroring our in-person CBT. The iCBT model consists of a therapist-guided Internet version, where patients complete the program on their own schedule and from a convenient location of their choice (where they have access to the Internet). Originally, patients were provided a total of eight modules that outline the main principles of CBT. This includes the importance of noticing the connections between our thoughts, feelings, and behaviors, scheduling mastery and pleasurable activities, utilizing breathing and relaxation exercises, and reviewing thought logs and restructuring inaccurate thoughts to more accurate ones. Each patient referred is assigned a therapist who communicates largely through email. The patient is emailed a module on a weekly basis for 8 weeks, and is asked to read the module and fill out the attached worksheets to be completed within a week.

Before launching the program, staff were provided 4 hours of training in providing e-therapy from a psychiatry resident at Queen's University. We launched our program with the hope that we could replicate the results achieved in Sweden or Australia. However, a review of the results at 6 months showed that we had completely missed the mark. We had an alarming 90% dropout rate; many patients reported that they did not find the program helpful.

To understand the high dropout rate, we reached out to the patients in the program and asked how the program had failed to meet their needs. We gathered their feedback by asking questions such as, "Why did you drop out?" and "What three things would help you complete the program?" The responses were eye opening and a common theme emerged – the program was too rigid. Some patients felt that the deadlines for homework completion were too anxiety provoking; they could not possibly read through the modules and begin working on their thoughts within a week. The pace was overwhelming, so they did what made them feel better – they avoided the program altogether. Others who were higher functioning found the pace too slow and were eager to get through the concepts faster. Some found the concepts too confusing and wanted more examples and videos to better highlight the material. And some ran into technical issues – they could not download the document and type directly onto them. We had designed the program with what we thought the patients needed without asking them what would work best for them. The result was an inflexible program that did not take individual needs into account. We went back to the drawing board to incorporate the useful feedback provided by our patients and 3 months later relaunched our second version, iCBT 2.0.

With iCBT 2.0, we streamlined the modules to a total of six modules (from eight). We included more examples and visuals to better highlight the material. We addressed the technical concerns by creating the homework sheets as Microsoft Word documents, with which patients

expressed more familiarity. However, the most important change we made was making the program more flexible and increasing interactions with the therapist. We worked collaboratively with our patients to determine timeframes that best worked with their schedules and presenting symptoms. For those whose symptoms were less distressing, we provided one or two modules per week, and for those who were struggling more with their symptoms, we gave them as much time as they needed to complete the modules. However, our therapists did check in weekly to let the patients know that they were available for support and to answer any questions regarding the modules. They also provided phone sessions when needed, to better explain the concepts and to troubleshoot. **Table 2** shows key differences between iCBT 1.0 and 2.0.

A.K. was enrolled in iCBT 2.0 and did well. It took her about 4 months to complete the program, meaning she needed a few weeks per module, and she requested five telephone sessions. However, working collaboratively with A.K. and allowing her the time she needed, resulted in the best outcome for her. When she completed the program, her symptoms of depression, anxiety, and stress had decreased; she had added a number of a number of pleasurable activities to her weekly schedule; she was socializing outside of the house.

iCBT allowed A.K. to receive a gold standard treatment for her symptoms – a patient who otherwise would have fallen through the cracks. Many patients like A.K. never receive the services they need or others who can decline to the point of needing a hospitalization while waiting to gain access to services. We had a program that, if scaled up, could serve more patients without sacrificing quality. But was our iCBT as effective as our in-person CBT? We allowed patients to choose between traditional (group) CBT and iCBT. We collected outcome measures using the short version of Depression, Anxiety, Stress Scale (DASS 21) and the Quality of Life Enjoyment and Satisfaction Questionnaire for all patients receiving CBT whether it was in person or Internet-delivered. This allowed us to make a direct comparison between the two. To date we have had 80 patients complete this program. Preliminary data shows that those who have completed iCBT show a significant reduction in their symptoms of depression, anxiety, and stress with comparable results to our in-person CBT. The dropout rate is even lower for iCBT at 33% than our drop-out rate of 40% for the in person (group) CBT.

iCBT allowed TSH patients to receive CBT with easier and quicker access, at a lower cost. We found a way to serve more patients with no additional resources and without sacrificing quality. For the record, A.K. has welcomed her first child to the world this year, and hopes to return to the workforce in the coming months.

	iCBT 1.0	iCBT 2.0
Focus	General CBT	Behavioral Activation, then CBT
Modules	8	6
Deadlines	Strict	Flexible
Contact	Email	Email + Phone Calls
Content	Powerpoint Slides	Powerpoint Slides + Videos

Table 2. iCBT 1.0 vs. 2.0.

6. Limitations and strengths

Despite substantial research on iCBT in recent years, the limitations and strengths of this treatment modality remain relatively unchanged.

There are several notable limitations of iCBT. The first is the poor adherence. Several studies have looked at potential barriers to adherence. These barriers include lack of motivation, skepticism about iCBT, time constraints, and symptom improvement (reviewed in [59]). Several studies of primary-care-managed iCBT indicated that the lack of engagement may contribute to decreased adherence [26, 60, 61]. Further, depressive symptoms have been reported to interfere with patient engagement even among patients who felt favorably about the program [35], indicating that baseline disease severity can contribute to poor adherence. This hypothesis is supported by several studies showing an inverse association between adherence and baseline symptom severity or baseline psychological distress in patients with anxiety (reviewed in [62]). Oversight by a therapist, primary-care physician, or a trained staff member may be needed for some patients to adhere to iCBT. When patients regularly meet or speak with an individual or if their progress is being monitored regularly, they are more likely to continue to put effort into the program because someone is holding them accountable (reviewed in [60]). However, given the high heterogeneity of the results, it seems likely that the level of support required varies depending on the individual patient's needs and preferences.

The second limitation of iCBT is misdiagnosis or inappropriate treatments. In an ideal world, trained individuals would diagnose patients and refer them to the appropriate iCBT program. The reality is that patients often rely on self-assessment of their mental status and select a program they think might help them. Many programs mitigate this issue by including the same validated diagnostic surveys researchers used to measure symptoms. Inclusion of these surveys has proven highly effective (reviewed in [60]). Further, advances in tailored and transdiagnostic iCBT have created an a la carte treatment plan that can be used to address comorbidities and patient-specific issues that might not be included in disease-specific iCBT [24]. It seems likely that this limitation will prove overblown as more trials are conducted, but it cannot yet be ruled out as a concern.

The third limitation is accessibility. A 2015 Pew Research Center survey showed that Internet and smartphone use is on the rise; however, there are some significant disparities in access. In countries with advanced economies, such as Canada, 90% of adults report they use the Internet or own a smartphone. In countries with developing economies, such as those in sub-Saharan Africa, the percent of adults who use the Internet or own a smartphone falls into the teens. There are large age, education, and income gaps for Internet usage and smartphone ownership. Further, in many countries, men have more access to Internet than women [63]. All of these disadvantaged groups, many of whom are the target audience for iCBT, could potentially be underserved. There is also the issue of comfort using a computer. iCBT is less likely to be used by patients who are not comfortable with technology [64], which is why user-friendliness is critical for achieving effective, sustained responses [65].

The fourth limitation is the variable quality of iCBT programs available. There is almost no barrier to creating a website or an app, and the number of iCBT programs available make

it difficult to identify those that might be helpful. For example, a recent study attempted to characterize mobile phone apps for depression that were available on any app marketplace as of March 5, 2013. Apps were included if they used “depression” in the title or app description, targeted health consumers (i.e., patients, caregivers), and had an English language interface. Their search yielded 1054 apps; however, only 243 met the inclusion criteria. Of the 190 app developers, only 9.5% were medical centers, universities, or institutions; 29.5% were clearly labeled as coming from a commercial developer; and the rest did not provide any affiliation. Regarding content, only 29.6% of the 243 included apps reported an external or expert source as the basis of their app [17]. To the best of our knowledge, there has been no research on the potential harms of using a poor-quality iCBT program.

Despite the limitations, there are numerous strengths of iCBT programs. The first is the flexibility and privacy of iCBT, which can increase patient empowerment. The only thing a patient needs to get treatment is an Internet connection [14, 19]. Treatment is not confined to office hours, which means it can accommodate work schedules and personal responsibilities. It also lets patients have access to treatment as symptoms arise. Geography is not an issue with iCBT. In countries with iCBT, studies have shown that it can be remarkably successful in rural areas where access to mental healthcare is limited [55, 61, 66, 67]. For countries that lack programs specific to their population and culture, well-researched programs can be adapted for a fraction of the cost of making a new program and still yield substantial gains [68]. iCBT provides treatment options for patients who cannot access treatment due to physical, psychological, or mobility issues [10]. Regarding privacy, iCBT lets patients address their symptoms anonymously. This anonymity might help circumvent the social stigma associated with treatment and encourage patients who might not otherwise have sought treatment to get the help they need [19, 69].

The second benefit of iCBT is its increased efficiency. Even for cases of therapist-supported or tailored iCBT, which require clinician input, fewer resources are needed to treat an individual, and responses to patient concerns can be addressed whenever the therapist has time available [19]. One study comparing in-person CBT and iCBT showed that iCBT patients required only 7.5% of the time that in-person patients needed to achieve similar gains [70]. Further, much of the iCBT support can be performed by trained staff rather than a clinician [37, 71]. Many of the behaviors that therapists teach patients, such as task reinforcement, psychoeducation, and deadline flexibility [72], can be performed by trained staff rather than a clinician. Overall, iCBT has been shown to be more resource efficient even with clinician input, which would give more patients access overall.

The third strength of iCBT is its cost efficiency. Numerous studies have evaluated the costs of iCBT [16, 73]. It has been shown to be cost effective and reduce societal cost compared with waitlisted controls and in-person CBT [16, 36, 73]. As discussed above, it is relatively inexpensive to adapt an existing iCBT program [68], indicating that iCBT could potentially be implemented cost effectively.

7. Conclusions and future directions

Increasingly, payers – governments, employers, private insurance companies – are considering new ways of offering CBT. At the same time, people are looking to the Internet for solutions for their mental health problems. Australia has invested in iCBT, as have private companies; iCBT websites and apps are more and more popular; MoodGym has more than 850,000 registered users.

While we applaud the interest in evidence-based care, we offer a word of caution: not all iCBT programs are created equal. Yes, the literature is now rich in research studies on iCBT for common illness – for mental health illnesses, and also for physical health problems. And while the growing if young literature does support the use of iCBT, effectiveness is clearly tied to patient engagement. Clearly, therapist-guided iCBT has better results than non-therapist-guided iCBT.

As the experimentation grows, we suggest two forces will transform iCBT – and therapy itself. First, with declining stigma and increased demand for care, iCBT will be considered more of an option, given its effectiveness, and its advantages over traditional CBT – that is, the convenience and accessibility of iCBT, coupled with its lower costs and privacy. Second, as technology advances, iCBT could well be improved, moving beyond visually-pleasing graphics and – empowered with AI – entering into a world where programs learn from and adapt to the patients that they serve, offering CBT concepts, perhaps delivered with machine-learned empathy.

With regard to the latter point, we note that several products have already been developed with AI. An Indian group developed a therapy chatbot called Wysa. This interactive program claims to learn signs of anger and distress from its patients, and then employs evidenced-based therapy techniques when appropriate. Wysa is simple – but it is available 24 hours a day, 7 days a week – already offering more flexibility than its human therapist rivals.

We are in the early days of AI and mental health. Over time, iCBT programs will grow more sophisticated. How therapy changes exactly, of course, is impossible to predict. This much is clear: the 1970s, Beck-style approach to CBT, with one therapist and one patient, is being replaced as therapy gets modernized.

Author details

David Gratzer^{1,2*}, Faiza Khalid-Khan³ and Shawna Balasingham¹

*Address all correspondence to: david.gratzer@camh.ca

1 Centre for Addiction and Mental Health, Toronto, Canada

2 University of Toronto, Toronto, Canada

3 Ontario Shores Centre for Mental Health Sciences, Whitby, Canada

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