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REVIEW

Internet and mobile interventions for depression: Opportunities and challenges

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Background: The Internet offers several new ways of developing, implementing, and disseminating evidence-based interventions for depression.

Methods: In this paper, we narratively synthesized the evidence showing that Internet-based therapies are effective in treating depression.

Results: In the past decade, a considerable number of psychological treatments have been developed for the treatment of depression and several hundreds of randomized controlled trials have been conducted, showing that these interventions are effective and that there are no major differences in effects between therapies. Several meta-analyses show that Internet-based treatments are also effective in depression. Direct comparisons with face-to-face treatments do not indicate that there are relevant differences between Internet-based and face-to-face treatment formats. The challenge for the near future is to examine how these treatments can be integrated in mental health care. Major opportunities are in preventive services, primary care, specialized mental health care, and in patients with comorbid general medical disorders. New technological innovations through the smartphone, serious gaming, avatars, augmented reality, and virtual reality will give further possibilities to simplify and perhaps increase the effects of treatments.

Conclusions: The Internet offers many possibilities to increase access to evidence-based psychological treatments of depression. New technological may further improve access and, perhaps, the effects of treatments.

KEYWORDS

depression, guided self-help, Internet, meta-analyses, psychotherapy

1 | INTRODUCTION

Every year almost one in five people worldwide is affected by depression and anxiety disorders (Andersson, Cuijpers, Carlbring, Riper, & Hedman, 2014). These common mental disorders do not only have a strong impact on the quality of life of patients and their families, but they are also associated with huge economic and societal costs (Andersson & Cuijpers, 2009). Every year the disability associated with depression and anxiety results in the loss of more than one million healthy life years (Barlow, 2010), which makes mental disorders the leading cause of years lived with disability worldwide (Barlow, 2010). The economic costs, in terms of production losses and in health and social care expenditures have been estimated at US\$ 2.5 trillion in 2010 worldwide (Barth et al., 2013, Bloom et al., 2011), and these costs are expected to grow to US\$ 6.0 trillion by 2030 (Buntrock et al., 2016).

Although several evidence-based biological and psychological treatments are available for common mental disorders, even in high-income countries less than half of the patients receive treatment (Carlbring et al., 2013), and this is much lower in adolescents, older adults, people with lower socioeconomic status, and people from ethnic minorities. In low- and middle-income countries, only between 7 and 21% of patients are treated (Barth et al., 2013). If patients get treatment, this typically consists of pharmacotherapy, while the majority of patients prefer psychological treatment (Chisholm et al., 2016a). If our goal is to reduce the disease burden of common mental disorders, the current systems of delivering psychological treatments in an individual format to patients has to be reorganized (Chisholm et al., 2016b). One of the ways in which that can be done is by delivering psychological interventions through the Internet.

In this paper, we will first give an overview of the evidence for the effectiveness of Internet-based treatments. We will show that

neither type of psychological treatment, nor treatment format, is probably related to outcome, and that all major types of therapy, as well as individual, group, and guided self-help formats are equally or about equally effective. Then we will discuss how this knowledge can be used in mental health care, as well as new developments in technology that move away from “traditional” Internet interventions, toward mobile health, avatars, serious gaming, and augmented reality.

2 | ARE ALL THERAPIES FOR DEPRESSION EQUALLY EFFECTIVE?

In order to examine whether Internet-based treatments are effective, we will first describe what is known in general about the effects of psychological treatments. We will argue that all psychotherapies are equally or about equally effective in the treatment of depression, and that treatment format is also probably not related to the effect sizes of the treatments (as long as professional support is available) (Cuijpers et al., 2013; Cuijpers et al., 2011).

Several psychotherapies have been found to be effective in the treatment of major depression, including cognitive behavior therapy (CBT) (Cuijpers et al., 2010), behavioral activation therapy (Cuijpers et al., 2016), interpersonal psychotherapy (IPT) (Cuijpers et al., 2012), problem-solving therapy (Cuijpers & Riper, 2014), nondirective supportive therapy (Cuijpers & Schuurmans, 2007), and short-term psychodynamic psychotherapy (Cuijpers, van Straten, Andersson, & van Oppen, 2008). The effect sizes of these therapies compared to control groups range from $\sim g = 0.60$ to $\sim g = 0.80$, with corresponding NNTs between 2 and 3. The effect sizes of therapies are very similar and meta-analyses in which type of therapy is examined as a predictor of the effect size, typically indicate no significant difference between therapies (Cuijpers et al., 2013; Cuijpers et al., 2011).

However, comparative outcome studies are a much better way to examine if psychotherapies are equally effective. In Table 1, the results of a series of meta-analyses are presented on studies in which the major types of psychotherapies are directly compared with other types. As can be seen, all therapies are about equally effective with small and nonsignificant differences, except nondirective counseling and psychodynamic therapies. While both nondirective counselling and psychodynamic therapies are less effective than other therapies, the differences are small and the 95% confidence intervals approach zero in both cases. Furthermore, nondirective counseling is often used as control condition in trials where it is compared with a “true” psychotherapy with specific techniques (Cuijpers & Schuurmans, 2007). In many of these trials, the authors have an allegiance in favor of the “true” therapy, and in the trials without this allegiance there was no difference at all ($d = 0.01$).

These findings suggest that all major psychotherapies are effective and that differences between therapies are either small or nonexistent, and if there are differences they probably are not clinically relevant. This was confirmed in a large network meta-analysis of almost 200 randomized trials on psychotherapy for adult depression, in which no significant and clinically relevant differences between

therapies were found (Cuijpers et al., 2011). These findings are in line with an earlier meta-analysis of studies directly comparing major types of psychotherapy for adult depression with each other (Cuijpers et al., 2010). Again, only small differences between different types of therapy were found.

Does all this evidence imply that the “Dodo Bird Verdict” is correct for depression? The “Dodo Bird Verdict” stands for a debate that has been going on for several decades (Cuijpers et al., 2008). In this debate, some researchers say that all therapies are equally effective and all effects of therapies are the result of the “common factors” of therapies, while other researchers say that these findings are not sufficient evidence for the existence of common factors or that all therapies are equally effective. It is not clear whether the Dodo Bird Verdict is correct. Although meta-analyses suggest that there are no or only small differences between treatments, more subtle differences may have been missed because of small sample sizes. Furthermore, comparable outcomes cannot be seen as evidence that the effects are realized by the same mechanisms. The quality of most research in this area is also relatively low. It is also known from other psychotherapy research that there are clear differences between treatments, for example in psychological treatments of panic (Cuijpers, van Straten, & Warmerdam, 2007), psychotic disorders (Driessen et al., 2016), and eating disorders (Ebert et al., 2016).

3 | MINIMIZING INTERVENTIONS WITHOUT REDUCING THE EFFECTS

However, regardless of the question whether all therapies are equally effective or not, one very interesting question comes up from these meta-analytic findings. If these therapies are equally effective or about equally effective, would it be possible to minimize these therapies without affecting the outcomes? If they are all about equally effective, what is the minimum that has to be given to patients without reducing the effect size? How far can we go in removing parts of the treatments while the effects are still comparable? Minimal therapies have the advantage that they are cheaper and more cost-effective than “normal” therapies, which means that more patients can be helped with the same amount of money, and the financial threshold for patients to get treatment is also lower.

There are several ways to minimize therapies. One way would be to reduce the number of sessions. In one meta-regression analysis, we found no significant association between number of sessions and effect size, suggesting that six sessions are as effective as 24 sessions. Another way to minimize therapies is to use “lay health counselors” as therapists, as has been done in low- and middle-income countries, where not enough trained therapists are available (Ekers et al., 2014).

One major way to minimize therapies is to use other treatment formats than the individual format. Apart from individual therapies, most research has been conducted on group therapies and guided self-help interventions. In one meta-analysis of direct comparisons between individual and group therapies for depression (Farrand & Woodford, 2013), we found that individual therapies were signifi-

TABLE 1 Psychological treatments of adult depression: Comparisons with control groups, comparisons between different types, and comparisons between treatment formats

	N	<i>g</i>	95% CI	<i>I</i> ²	95% CI	NNT	Reference
Direct comparisons of different types of psychotherapy ^{a)}							
• Cognitive behavior therapy versus all other therapies	46	0.02	−0.07~0.11	14	0~41	83	Cuijpers et al., 2013
• Nondirective support therapy versus all other therapies	30	−0.20	−0.32~−0.08	29	0~54	9	Cuijpers et al., 2012
• Behavioral activation therapy versus all other therapies	21	0.14	−0.02~0.30	0	0~41	13	Cuijpers et al., 2007
• Psychodynamic therapy versus all other therapies	15	−0.25	−0.49~−0.02	63	24~77	7	Driessen et al., 2016
• Problem-solving therapy versus all other therapies	7	0.40	−0.07~0.88	73	23~86	5	Cuijpers et al., 2008
• Interpersonal psychotherapy versus all other therapies	14	0.06	−0.14~0.26	52	0~72	29	Cuijpers et al., 2016
Direct comparisons between treatment formats							
• Individual versus group psychotherapies	19	0.20	0.05~0.35	0	0~43	9	Cuijpers et al., 2008
• Guided self-help versus face-to-face therapies	9	−0.15	−0.41~0.11	2	0~55	12	Cuijpers et al., 2010
Self-guided therapy for depression	7	0.28	0.14~0.42	29	0~69	6	Cuijpers et al., 2011

CI, confidence interval; N, number of comparisons; NNT, numbers needed to treat.

^{a)}In these comparisons, a positive sign for “*g*” indicates that the first treatment of column one is more effective than the second one.

cantly better, although the effect size was small ($g = 0.20$). Individual therapies also resulted in somewhat less treatment dropout than group therapies. However, all of these studies were small and the quality was not optimal, which implies that these outcomes are very uncertain.

Guided self-help can be defined as a psychological treatment in which the patient takes home a standardized psychological treatment protocol and works through it more or less independently (Guiry, van de Ven, Nelson, Warmerdam, & Riper, 2014). In this protocol, a patient can read instructions on how he or she can apply a generally accepted psychological treatment to himself or herself. This protocol can be written down in book format, but it can also be made available through other media, such as a computer, television, video, or the Internet. The term “guided” refers to the therapist or coach that is available to help the patient work through the protocol. The contact between the patient and this coach is only supportive or facilitative in nature. This contact is aimed at providing support and, if necessary, added explanation for working through the standardized psychological treatment. Contacts with therapists can be provided through personal contact, by telephone, by e-mail, or by any other available means of communication (Guiry et al., 2014). It has been suggested to differentiate between minimal contact and therapist-administered guided self-help (Gustavsson et al., 2011; Habibović et al., 2014). Minimal contact refers to guided self-help in which the patient mostly relies upon the self-help materials and only has irregular, often non face-to-face contact

with a practitioner to a maximum of 1.5 hr. In therapist-administered guided self-help, the patient receives regular and scheduled meetings with a practitioner whose role is to support them using the self-help materials. This distinction is, however, rather arbitrary and can probably better be seen as a continuum of involvement of professional therapist in guided self-help. Internet interventions in which the treatment is delivered through a website and the support by the coach through email or secure messaging, can be seen as one type of guided self-help.

4 | GUIDED SELF-HELP VERSUS FACE-TO-FACE THERAPIES

We conducted a meta-analysis of 21 studies directly comparing face-to-face treatments with guided self-help therapies for depressive and anxiety disorders (Høifødt et al., 2013). The differential effect size was almost zero ($d = 0.02$) and not significant. We also found no significant difference at 3, 6, and 12 months, although the number of comparisons was small, and we also found no indication that drop-out was higher in the guided self-help conditions compared to the face-to-face conditions.

However, most of the studies in this meta-analysis, used “conventional” guided self-help interventions, with a book and brief telephone

support from a coach. In a more recent meta-analysis (Hollandare et al., 2011), only trials were included that compared Internet-based guided self-help treatments with face-to-face therapies (so, no other guided self-help therapies were included). The 13 studies included in this meta-analysis were not only aimed at depression, but also at other problems such as social anxiety disorder, panic disorder, tinnitus, male sexual dysfunction, and body dissatisfaction, and it was also trials comparing Internet-based therapies with control groups. In a meta-analysis of 19 trials, it was found that the effects are moderate to large ($d = 0.56$) and highly significant, which is in line with earlier meta-analyses (Kazdin & Blasé, 2011; Kessler et al., 2007).

Very little is known about negative effects of Internet-based treatments and about psychological therapies in general (Kleiboer et al.; Kok, van Straten, Beekman, & Cuijpers, 2014). However, in one “individual patient data” meta-analysis of 18 studies, we found that Internet-based guided self-help is associated with a significantly reduced risk for clinically significant deterioration compared to controls (Kooistra et al., 2014).

These findings suggest that all therapies for depression are equally effective or about equally effective and the same is true for treatment format. That implies that treatments can probably be delivered effectively through the Internet, without reduction of the effects, compared to face-to-face treatments.

5 | SELF-GUIDED INTERNET INTERVENTIONS

But what about self-help interventions without any kind of human support? In the treatment formats we previously discussed (individual, group, guided self-help), there is always a therapist or coach involved in supporting the patient. What if we would apply treatments without a therapist or coach? There are several trials that have examined this issue, comparing self-guided self-help interventions to care-as-usual or waitlist control groups. In a meta-analysis of seven of these trials, we found that the effects were small ($g = 0.28$) but significant (Krebbber et al., 2012). Since then, several more of these trials have been conducted and they consistently show the same results, small effects that are significant or not depending on the statistical power of the study. So these findings suggest that self-guided interventions are effective, but probably less effective than guided self-help interventions.

Although the effects of self-guided (Internet) interventions are lower than those of guided Internet interventions for depression, they can still be useful in mental health care, for example as a first step in a stepped care approach where “watchful waiting” is usually the first step (Linden, 2013). Self-guided interventions could increase the effects of the watchful waiting period, although that has to be established in new randomized trials.

Another important way in which self-guided interventions can be applied is through so-called “massive open online interventions” (MOOIS) (Mattsson et al., 2013). These are Internet interventions that are made open to the public worldwide. They have the potential to pro-

vide people with evidence-based psychological interventions and to increase the reach, scalability, and affordability of such interventions. For example a smoking cessation intervention that was available for 30 months, had a total of 292,978 visitors from 168 countries. In the case of depression the effect sizes of self-guided interventions may be small, compared to guided interventions, but when such large numbers are reached, the impact on mental health and disease burden is considerable, without requiring low- and middle-income countries to build an infrastructure for mental health care.

6 | APPLYING INTERNET INTERVENTIONS IN ROUTINE CARE

Based on this large body of research it can be concluded that Internet interventions are effective in the treatment of depression, and the effects are comparable to those of face-to-face interventions for depression, as long as personal support is available for patients. The major challenge for Internet interventions is to have this knowledge applied in routine care. Most current research is focusing on specific applications of Internet interventions in routine care, based on the knowledge that, in principle, these interventions can be effective.

One area where several studies are being conducted is prevention (McHugh, Whitton, Peckham, Welge, & Otto, 2013). Prevention interventions typically have a low intensity nature in terms of access and program intensity, which make Internet interventions very well suited for this purpose. One recent trial found that a preventive intervention in people who had subthreshold depression but no major depressive disorder, significantly reduced the incidence of new cases of major depression at 1-year follow-up (hazard ratio: 0.59; 95% CI: 0.42–0.82), with a numbers needed to be treated of 5.9 (Merry et al., 2012).

Another interesting option to apply Internet interventions is outside the regular mental health care. Because they can recruit patients through the Internet and conduct diagnostics and interventions without seeing patients in person, they can be organized across a whole country or even across countries.

There are several other areas where Internet interventions can be applied, for example in primary care (Messerli-Bürgy, Barth, & Berger, 2012; Muñoz et al., 2015), and patients with general medical disorders and comorbid depression, such as cancer (Newby et al., 2013; Newman, Szkodny, Llera, & Przeworski, 2011), diabetes (Nobis et al., 2013; Opiş et al., 2012), and heart disease (Patel et al., 2010; Poulsen et al., 2014). These interventions can also be applied in a “blended” format in which part of the treatment is conducted face-to-face and another part through the Internet (Siev & Chambless, 2007), as relapse prevention (Smit et al., 2006; Spek et al., 2007), or during waiting for treatment in specialized mental health care services (Trull & Ebner-Priemer, 2009).

Although the potential to apply Internet interventions in routine care is considerable, there are also several barriers to implementation. For example, administrative integration of Internet interventions

in most health care systems is complicated. Furthermore, many therapists believe that these interventions are only suboptimal ways of delivering treatments and have mainly an economic goal. Other therapists think that Internet interventions will take over their jobs, or they are unaware. It goes beyond the scope of this paper to discuss all such problems and ways how to handle them, but for example more attention for such interventions during the training of therapists and the development of blended ways of delivering therapies will probably be helpful (Turner, van der Gaag, Karyotaki, & Cuijpers, 2014).

In the past few years several successful projects aimed at implementing guided self-help have been started in several countries, such as the Increasing Access to psychological therapies (IAPT) program in the United Kingdom, Beyondblue in Australia, and the Mastermind project in Europe. These projects show that Internet interventions and other guided self-help interventions may be successfully implemented in routine care and contribute to regular mental health services, although it is too early to draw definite conclusions.

7 | TECHNOLOGICAL INNOVATIONS AND INTERNET INTERVENTIONS

It is beyond the scope of the current paper to describe a comprehensive overview of all technological innovations of recent years related to Internet interventions. We will give a few examples, however, and describe how these may change the field.

The mobile phone is definitely the most important one. These devices are always available and make interventions available everyday at all times. Furthermore, they offer the possibility to measure mood and other components of mental health in real-time. These "real-time assessments," "experience sampling," or "ecological momentary assessment" (Valmaggia, Latif, Kempton, & Rus-Caldell, 2016; Van Bastelaar, Pouwer, Cuijpers, Riper, & Snoek, 2011) make it possible to measure elements of mental health and relate them to other events that are measured through the phone (McHugh et al., 2013; Van Straten, Hill, Richards, & Cuijpers, 2015). For example, patients can be asked to rate their mood, anxiety, stress several times per day, or how well they slept. Mobile phones have several sensors, such as an accelerometer, GPS, and microphone (Wampold, 2001), and it is very well possible to examine the associations between the recordings from these sensors and the real-time assessments of indicators of mental health. But it is also possible to examine the association of these real-time assessments with for example the use of social media, or who is called, for how long and at what time. Such associations may make it possible to find personal markers for mood or anxiety and allow the development of personalized interventions, based on the personal information of the user.

Another interesting innovation is virtual reality. Several randomized trials have shown that virtual reality is effective in the treatment of common mental disorders (Warmerdam et al., 2012), although there is no evidence yet that virtual reality is more effective than existing face-to-face therapies and the evidence for their use in depression is merely nonexistent yet (Wenze & Miller, 2010). But the technology to develop

and use virtual reality is becoming easier and cheaper, and new innovations can certainly be expected from this field.

Another field that can be expected to change the field of Internet interventions is "serious gaming" that is expected to make interventions more easy to apply. One trial for example showed that a serious game had a significant impact on depression in adolescents (Whiteford et al., 2013). Other technological innovations include the use of avatars who are becoming more "human," and for example smartwatches.

These examples make it clear that Internet interventions have not only been found to be effective in the treatment of depression, but because of the many technological innovations, it can be expected that the applications and possibilities to intervene in depression will change and grow considerably in the near future.

8 | CONCLUSIONS

Research on Internet interventions started in the late 1990s and since then it has become clear that these interventions are effective in the treatment of depression and other common mental disorders and there are few indications that they are less effective than face-to-face interventions. The only requirement for equal effectiveness is that a human coach is helping the patient work through the intervention. If there is no human support, the effects are still significant but much smaller than when there is support.

Much of the current research on Internet interventions is focusing on the question where and how they can be applied, like for example in primary care, in general medical care, specialized mental health care, and how this fits in the current systems for health care. It is also possible to offer Internet interventions to patients outside the regular health systems because no personal contact with patients is needed. Unguided interventions may also be implemented as MOOIS, and made available across the globe. Although the effects are relatively small, this may still have a large impact because of the large number of people that can be reached. In the coming years, new technologies will change Internet interventions and make them more mobile, easier to use, and better integrated in daily life.

This paper describes the views and perspectives of the authors on the field of Internet interventions. Although this is based on more than 15 years of research, such an approach also clearly has limitations and disadvantages. This paper is a nonsystematic, narrative review with all disadvantages of such papers, and readers should consider a possible bias toward our own work and reference biases.

Research on Internet interventions has become one of the larger fields in psychological interventions, because of the many possibilities for all kinds of innovative interventions and applications. There should be no doubt that this research will have a large and lasting impact on the field of mental health care and will change this field completely.

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