REVIEW ARTICLE

Harnessing the Power of Technology for the Treatment and Prevention of Eating Disorders

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ABSTRACT

Objective: The objective of this article is to review the available literature regarding the development and evaluation of technology-enhanced interventions for eating disorders.

Method: Literature was reviewed pertaining to interventions that use technology (e.g., Internet, mobile phones) for prevention, guided self-help, treatment, relapse prevention, and carer support.

Results: A number of technology-enhanced approaches have been developed for each facet of the care spectrum, and experiences that are reported with their implementation are overall promising. However, only few of them have been evaluated in adequately designed and powered trials.

Discussion: This review suggests that technology-enhanced interventions offer multiple opportunities to improve care for eating disorders. More research is needed on the efficacy, effectiveness, cost-effectiveness, and reach of these approaches to ultimately estimate their public health impact. It is discussed to what extent innovative models of care integrating technology-enhanced interventions and face-to-face interventions may improve service delivery for eating disorders. © 2013 by Wiley Periodicals, Inc.

Keywords: eating; disorders; prevention; intervention

Introduction

Interventions that are based on information and communication technologies are increasingly suggested as a means to address some of the major challenges in the prevention and treatment of mental illness. These challenges include the limited availability, scalability, accessibility, and uptake of evidence-based services. It is assumed that technology-enhanced interventions may extend the reach of providers and thus allow the delivery of services to underserved populations, to reduce barriers to help seeking, to facilitate access to treatment, and to contribute to an overall optimization of care on a population level.[1,2]

The purpose of this article is to review technology-enhanced interventions in the field of eating disorders and to discuss how they may improve service delivery. We introduce approaches that were developed for various facets of the health care spectrum ranging from prevention and early intervention to guided self-help, treatment, aftercare, and relapse

prevention. We also address the area of technology-enhanced support for carers of individuals with eating disorders. For each of these areas of care we outline the specific potential of technology-enhanced care before describing examples of available interventions and the current evidence base.

Prevention and Early Intervention

Interventions that prevent illness onset may be associated with huge payoffs from a public health perspective. However, their implementation, dissemination, and sustainability are typically hindered by barriers such as limited resources and inadequate infrastructure to support translation from research to practice. Internet-based delivery has been discussed as promising approach in prevention research for various reasons: from a provider perspective, it allows us to reach out to large populations independent of geographic distances and without requiring trained staff that can deliver the program in face-to-face settings. In addition, delivery of the intervention is easier and less expensive to standardize (improving the chances of fidelity) and to maintain over time (improving the chances of sustainability) than in face-to-face programs. Moreover, technology allows us to provide interactive contents and to support participants flexibly by tailoring the type and intensity of

support to their needs. From a user perspective, advantages include that interventions can be accessed anonymously, and independent of time and location.

Several Internet-based eating disorder prevention programs have been introduced. Of these, the most research has been conducted on the program *Student Bodies*, an 8-week, structured cognitive-behavioral (CBT) program including moderated online discussion groups, targeting eating disorder attitudes and behaviors in college-age women at risk of developing an eating disorder. Significant effects of the program on weight and shape concerns in at-risk samples have been reported by researchers in the United States[3,4] and Germany.[5] In a randomized controlled trial (RCT) including a sample of 480 college-age women, the efficacy of the program in terms of prevention of illness onset could not be confirmed. However, moderator analyses revealed that a decrease in the onset of clinical and subclinical eating disorders was achieved in two subgroups, that is, participants with an elevated body mass index or those who reported compensatory behaviors at baseline.[4] Recently, an adapted version of *Student Bodies* showed promising effects on eating disorder symptoms in a sample of women with subthreshold eating disorders.[6]

Two studies have compared the effects of face-to-face versus Internet-based delivery of prevention programs. Paxton et al.[7] found that the effects of an 8-week manualized CBT program targeting body image concerns and eating problems (*Set Your Body Free*) were slightly more pronounced in the face-to-face delivery mode. Stice et al.[8] reported no difference in effects between a 4-week in-person dissonance-based eating disorder prevention program (*Body Project*) and an Internet-based version of the program. However, the sample size in both studies was too small to draw definite conclusions on the equivalence of the two delivery modes.

Despite the advances in risk factor and prevention research, it remains a challenge to prevent illness onset and to substantially reduce the incidence of eating disorders that is, prevention researchers need to have strategies in place for cases in which prevention fails. Technology-enhanced programs offer unique opportunities to integrate education, prevention, early detection, and early intervention around eating disorders. Therefore, in contrast to manualized fixed-intervention approaches that assign the same dosage of intervention to all participants, a more flexible program (*Essprit*) linking prevention and early intervention has been introduced.[9] This program takes

into account that young people have largely varying needs concerning information, and frequency, duration, and intensity of support in the context of prevention. Online screening and monitoring procedures assess attitudes, behaviors, and symptoms related to eating disorders and provide tailored feedback to participants throughout their participation. Additional modules allow for peer discussion and chat-based counseling. In the case of occurrence of severe self-reported eating disorder symptoms, participants are encouraged to seek more intense help. If needed, online counselors support them in getting access to regular face-to-face health care (e.g., by addressing concerns that may prevent them from seeking in-person help and by providing information on different treatment modalities, contact details of providers, etc.). It is assumed that the program counteracts the development of eating disorders and in cases where onset cannot be prevented facilitates timely access to more intense support.

The efficacy of an adapted version of the program for high school students (*YoungEssprit*) in preventing the onset of self-reported eating disorder symptoms was studied in an RCT with 1,667 healthy participants. Although results from the first recruitment wave proved the program to significantly decrease the onset of eating disorder symptoms, no difference between intervention and control groups was found in the second subsample.[10] The potential of an enhanced version of the program is currently being investigated as part of the initiative *ProYouth* (www.pro-youth.eu) supported by the European Commission in seven European countries (Germany, Czech Republic, Romania, Hungary, Italy, Ireland, and the Netherlands). Research priorities of the ProYouth network concern the acceptability, reach, and effectiveness of the Internet-based platform in various target populations and health care systems as well as the identification of best-practice strategies for the implementation and dissemination of the program. Furthermore, its effect in terms of reduction of barriers that prevent individuals from seeking professional support is being studied and its potential to facilitate timely access to routine care is being explored.

Guided Self-Help and Treatment

From a population-based view the biggest challenge in the treatment of eating disorders is that only a relatively small proportion of affected

individuals actually seek and receive effective interventions.[11] On the basis of empirical evidence, guided self-help has been recommended as an additional resource in the treatment of bulimia nervosa and binge eating disorder as it can be delivered by a range of health care professionals, requires less specialized training, and is associated with less cost and a lower level of contact between patient and provider than is psychotherapy using conventional modes of delivery.[12]

Extending the reach of effective treatment and guided self-help is essential in order to reduce the overall burden of illness caused by eating disorders. In this context, technology-enhanced, especially Internet-based, modes of delivery may play an important role. The potential of different Internet-based guided self-help programs has been explored in several studies, with encouraging findings. However, only a few interventions have been investigated in RCTs so far. These include (a) an approach that used 12 weeks of online coaching in combination with the self-help book *Overcoming Binge Eating* in a sample of patients with bulimia nervosa and binge eating disorder,[13] (b) a self-help approach for bulimia nervosa based on the *Overcoming Bulimia Online* program in combination with email support over 12 weeks (*iCBT*)[14], and (c) an Internet-based self-help approach (*SALUT*) for binge eating disorder including six months of email contact between participants and a coach.[15] Each of these three interventions proved superior to a wait list control condition in terms of symptom reduction. However, replication of these findings in larger samples and efficacy trials against active control groups are needed. In the area of binge eating disorder, a large RCT is currently underway comparing Internet-based guided self-help and individual CBT.[16]

Only two approaches have focused on the delivery of an empirically supported manual-based psychotherapy through a technological platform so far. Mitchell et al.[17] found no substantial differences in effectiveness between 20 sessions of CBT delivered individually either face-to-face or through telemedicine. Similar outcomes were achieved at substantially lower cost in the telemedicine group, that is, delivery through telemedicine may be recommended to make specialized treatment of eating disorders available in underserved geographic areas.[18]

In an ongoing noninferiority trial, Bulik et al.[19] compare an Internet-based version of CBT for bulimia nervosa (*CBT4BN*) and traditional face-to-face delivery in group format in terms of their relative efficacy, attrition, adherence, acceptability, and cost-effectiveness. If not inferior to in-person treatment, the Internet-delivered program would have the potential to substantially enhance the reach of CBT for bulimia nervosa to currently underserved populations.

Relapse Prevention and Maintenance Treatment

The maintenance of treatment gains after completion of treatment for an eating disorder has proven to be a challenge for many patients and considerable relapse rates have been reported. Technology-enhanced programs offer the opportunity for clinicians and treatment centers to provide additional support to patients beyond the termination of in-person treatment. Three approaches for bulimia nervosa and related eating disorders not otherwise specified (EDNOS)[20–22] and one approach for anorexia nervosa[23] have been introduced so far. Bauer et al.[20] developed and evaluated a system based on mobile phones and text messaging to provide support to patients with bulimia nervosa or related EDNOS following their discharge from inpatient treatment. The program consists of a supportive monitoring system where patients send reports on their bulimic symptoms in a standardized way through text messaging and receive tailored feedback messages that communicate support and remind patients of strategies they learned in their previous CBT-oriented treatment in hospital. A recent RCT confirmed the efficacy of the 4-month text messaging intervention in comparison to a control group that did not have access to the program. Although the findings (remission rates: 59% in the intervention group vs. 44% in the control group) indicate that such a low-intense intervention was sufficient to maintain treatment gains in part of the sample, they also provide evidence that many patients need more intensive aftercare support.[20]

The efficacy of two more comprehensive technology-enhanced programs in the maintenance treatment of bulimia nervosa and related EDNOS is currently investigated in ongoing RCTs. Gulec et al.[21] study a 16-weeks program that uses a similar monitoring component as described above in order to track participants impairment throughout participation and provide tailored supportive feedback at regular intervals. In addition, participants communicate among one another and with a clinician through online forums and chat sessions that are delivered in group format (weekly) and

individual format (on demand). Preliminary evidence points to the feasibility and acceptability of the intervention.[21] The potential of a manualized CBT-oriented approach in the aftercare of bulimia nervosa is studied in another trial.[22] The 9-month intervention includes 11 sessions. In addition, patients can participate in an online discussion group and receive feedback and support from a moderator through email and chat.

For anorexia nervosa, an Internet-based program for relapse prevention following inpatient treatment has been developed and evaluated by Fichter et al.[23] The 9-month program follows a manualized approach with additional interactive modules such as message boards and therapist-guided chat groups. The findings of the efficacy trial showed that participants who completed the online intervention gained more weight during the 9-month observation period compared with the treatment as usual control group.[23]

In summary, these initial findings on aftercare delivered via Internet and mobile phones following completion of specialized treatment for eating disorders are promising for both anorexia nervosa and bulimia nervosa. Future studies should investigate to which extent these findings from Europe may translate to other countries, other treatment settings (e.g., outpatient treatment) and other health care systems.

Future research may also study the potential of technology-enhanced programs in the long-term management of eating disorders. Given that a substantial proportion of patients with eating disorders experience multiple illness and treatment episodes or even a chronic course of the illness, continuity of care, and innovative strategies for treating individuals with longstanding eating disorders are urgently needed.[24] Technology-enhanced systems may make an important contribution to such strategies by facilitating the connection between different levels of care (see below) and thus improving the coordination and delivery of services.

Carer Support

Several studies have emphasized the important role that carers of individuals with eating disorders may play in the recovery process. Research also indicates that carers of individuals with eating disorders experience high levels of psychological distress. Technology-enhanced programs offer innovative ways to provide information, professional support, and a forum for mutual exchange to carers without putting extra burden on them (e.g., by expecting them to travel to meetings).

So far, only one RCT studied the efficacy of a clinician-guided Internet-delivered CBT intervention (*Overcoming Anorexia Online*) for carers of individuals with anorexia nervosa. The results provide preliminary support for the efficacy of the intervention in reducing carers' anxiety and depression compared with a control condition.[25]

Internet-based support may also be provided to carers in addition to face-to-face sessions. For example, the potential of an Internet-delivered intervention for parents who undergo family-based treatment (FBT) has been explored in a pilot study by Binford et al.[26] who evaluated the technical feasibility and acceptability of a therapist-guided, chat-based group intervention for parents involved with FBT for adolescent eating disorders. Findings provided preliminary support for the potential of the Internet-based program as adjunct to FBT with the majority of participants reporting that the program helped them to feel supported and to cope with their child's eating disorder.

As in other areas, more research in larger samples is needed. In addition to investigating the effect of technology-enhanced interventions on impairment of carers, future research may also study the impact that such interventions may have on impairment, treatment compliance, and treatment outcome of the family members that suffer from eating disorders.

Directions for Future Developments and Research

Technology-enhanced care for eating disorders is still a relatively new field. There is sufficient evidence available today to conclude that incorporating technology represents a promising option to enhance prevention and treatment of eating disorders. However, there is a clear need for further research.

On the basis of the current state-of-the-art, we see the following priorities for future development and research: first, more rigorous evaluation of technology-enhanced interventions is needed. Many of the interventions described in this article have been studied in "underpowered" RCTs and/or included wait-list control groups, that is, technology-enhanced interventions were tested against the weakest of all comparators. Comparisons against alternative interventions (ideally against the best available treatment alternative and

using adequately sized samples) will allow to decide whether an intervention is effective enough to argue for its implementation and dissemination as part of a routine care.

It should be noted that from a services research perspective we do not necessarily expect a new technology-enhanced intervention to be superior or equivalent in terms of efficacy compared with the best currently available face-to-face treatments. If we can show that a new intervention has a more modest effect but at the same time allows us to reach significantly more individuals and/or to improve uptake, adherence, completion, and acceptability compared with a conventional intervention, the implementation and dissemination of this new intervention would be well-justified and it may ultimately have a major impact in terms of optimization of health care (see paper by Fairburn and Wilson, this volume).

This shift in perspectives has implications for study planning. On the one hand, such research requires noninferiority trial designs. These designs allow us to investigate whether in terms of efficacy a new intervention is not worse than an active comparator by more than a pre-specified amount. Two ongoing trials comparing a technology-enhanced intervention and a face-to-face intervention use such designs.[16,19] On the other hand, questions related to the implementation and dissemination of these interventions need to be explicitly addressed. Most researchers in the field of technology-based care would claim that their interventions enhance the reach of care because individuals can access them from anywhere at any time and utilization is convenient and inexpensive. However, no study has shown that with our current technology-enhanced approaches we do actually reach a larger or more heterogeneous or underserved population of participants. Most of the interventions reviewed in this article have been reported to be well-accepted by users. However, little is known about the general acceptability to and compliance among both potential users and potential providers outside of the research environment. It is crucial to address barriers to the implementation and dissemination of technology-enhanced care as early as possible in the process of development and initial evaluation. Ideally, various parties such as researchers, technicians, clinicians, and users are involved in the development process to ensure that the intervention—in case of its successful evaluation—has a realistic chance to be translated from research to practice and sustained beyond the period of initial research (funding).

Second, research is needed to better understand how and for whom technology-enhanced interventions work and which approach is best suited for which target population. So far, little is known about predictors of response versus non-response, mechanisms of change and the process-outcome relationship in these interventions. Automated monitoring systems that track participants' symptom development throughout their participation may be used to investigate these aspects.[27]

In this context, relevant questions also concern the involvement of clinicians and other healthcare professionals in the delivery of technology-enhanced interventions. Besides costs for technical developments and maintenance, the costs of these programs are predominantly determined by the amount of professional time and the degree of professional training that their delivery requires. Compared to traditional care, technology-enhanced interventions offer much more flexibility to both providers and users. For example, in Internet-based programs, briefer and more frequent check-ins become feasible as contacts do not require participants to travel to a treatment center. There is preliminary evidence that technology-enhanced pure self-help without guidance may not be beneficial to a large proportion of participants.[28] However, it has not been investigated yet how much guidance is needed and sufficient in guided self-help. In general, technology-enhanced programs offer the opportunity to combine standardized and automated components on the one side and those that are more personalized and involve input by a professional on the other side, in order to ultimately serve the maximum number of users in light of limited resources.

Third, more research is needed on the combination or integration of technology-enhanced programs and face-to-face treatments. On a community level, this includes the question whether broadly disseminated technology-enhanced initiatives may facilitate access to in-person care by reducing psychosocial barriers that impede the help seeking behavior of individuals affected by eating disorders (e.g., perceived stigma and lack of mental health literacy). In a recent systematic review, Hart et al.[11] pointed out that "Given current evidence on barriers to care, an important step in increasing appropriate treatment seeking would be the development of public health and community interventions, which reduce the stigma of eating disorders, facilitate detection of symptoms and improve knowledge of effective treatments" (p. 733).

To that end, Internet-based campaigns and interventions may make an important contribution.

In principle, such interventions may be delivered at low cost to large samples via the Internet. However, making a program publicly available on the Internet is probably not sufficient to attract a large number of individuals that will engage in this program, especially if they are not affected by eating disorders at the time when they hear about the program. It is currently unknown how and by whom such programs have to be implemented and disseminated in order to reach the maximum number of individuals in the most efficient way (possible channels for dissemination include promotion of programs through high schools, colleges, community health care providers, Internet, and (social) media). Some of these aspects are currently studied as part of the European project *ProYouth* described above. A lot more research is needed to identify strategies how to best address target populations on a broad basis. Furthermore, it needs to be studied whether such initiatives may actually improve help seeking intentions and help seeking behaviors, and ultimately increase timely uptake of appropriate care.

On a treatment level, technology-enhanced and face-to-face care may be integrated as part of multilevel health care models, such as stepped care[29] or adaptive treatment models[30] that both aim at improving outcome while maximizing the efficiency of use of scarce therapeutic resources. Stepped care typically starts with the most simple, low-intensity, and low-cost intervention from which a patient may benefit. The outcome of this first-level intervention is assessed and in case of no sufficient benefit, a more intensive treatment is initiated. In the eating disorders field, only one study used a technology-enhanced (CD-ROM-based) unguided self-help approach as first-level intervention. In the case of a lack of benefit, the intervention was stepped up to CBT. However, results did not provide evidence for this specific form of stepped care, which might be related to the limited acceptability of unguided self-help.[28] Examples of step-down interventions through technology include the maintenance approaches for anorexia nervosa[23] and bulimia nervosa[20,22] described above.

Typically, stepped care combines two or more fixed-intervention approaches (i.e., the same dosage of the intervention is offered to all patients who undergo a specific step of care). In contrast, adaptive interventions acknowledge that patients differ in their response to any therapeutic intervention and therefore it is important that interventions are "individualized and repeatedly adapted over time to individual progress" (p. 21), which can only be achieved by continuous outcome monitoring and timely transitions between different levels of care if

indicated.[30] For example, in the context of self-help, continuous monitoring could help providers to identify early when patients do not benefit from the intervention, which would allow them to be referred to more intensive treatment rather than expecting them to complete the full course of the manualized self-help program first. Similarly, in the context of maintenance treatment, monitoring allows us to detect deteriorations early and thus providers may be able to counteract full relapse by initiating a more intense intervention when the technology-enhanced program does not seem to be sufficient (e.g., readmission to face-to-face treatment). Future research should use innovative trial designs (e.g., sequential multiple assignment randomized trials[30]) that have been recommended to systematically inform the development of such adaptive interventions. This type of research may ultimately contribute to more flexible and individualized models of care, in which type, dosage, and duration of an intervention are determined by participants' needs, that is, their response or non-response to an intervention or by their speed of symptom change over time.[31]

Fourth, in addition to the development of stand-alone interventions based on technology, it seems worth exploring technology-enhanced modules that can be used as an adjunct to evidence-based treatments. Mobile devices are ideal to deliver such add-ons as they reach patients in their everyday lives and in the time between treatment sessions.[32,33] For example, Shapiro et al.[34] developed and piloted a self-monitoring tool for patients with bulimia nervosa based on text messaging. While undergoing a 12-weeks face-to-face CBT group program, patients submitted daily information on the number of binge eating and purging episodes and on their urges to binge and purge. The system automatically sent back a tailored supportive feedback message and reminded patients to enter their data if they failed to do so. The findings indicate good acceptability of the monitoring and feedback system and good adherence to self-monitoring (87% of participants).[34] Controlled studies are needed to investigate whether mobile interventions may actually help to improve patients' adherence to treatment protocols (e.g., compliance with homework assignments, skills training between treatment sessions, reduction of dropout from face-to-face treatment) and ultimately improve the outcome of evidence-based care.

Finally, in the search for new strategies for service delivery, researchers need to analyze the specific challenges, gaps, and barriers in the respective health care system that they wish to

address, that is, when we talk about "optimization of care through technology-enhanced interventions" we need to be aware that this may actually mean different things in different countries and service systems and thus locally specific solutions may be required. Although some challenges may be universal (e.g., late detection of eating disorders, delayed uptake of treatment, high relapse rates, lack of interventions for carers), countries and health care systems vary largely in terms of the availability of evidence-based care, in terms of the extent to which such care is accessible to individuals with eating disorders (e.g., health insurance coverage for mental health care, cost of treatment, waiting times), and in terms of specific under-served minority groups that might benefit from technology-enhanced care.

Conclusion

The purpose of this article was to review opportunities that technology provides for optimizing the care of eating disorders. Across the spectrum of health care there are promising approaches that deserve further research. It is important to note that the development and evaluation of technology-enhanced interventions are associated with a shift in emphasis from efficacy research to services research.[19] Even though there is definite room for refinement of conventional eating disorder treatment approaches in terms of efficacy and effectiveness, we should probably not expect technology-enhanced care to outperform the currently best available face-to-face treatments in this respect. However, technology-enhanced interventions may be superior to conventionally delivered care in several other ways such as they may provide support to large populations, increase flexibility of treatments, and connect different levels of care, which all may ultimately contribute to a major public health impact.

Considerable further research is needed to determine how to best realize the potential of technology in the prevention and treatment of eating disorders. The investment of resources for such research appears well justified considering the potential payoffs in terms of reducing the personal and societal burdens arising from these severe illnesses.

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