Use of the Internet to Assist in the Treatment of Depression and Anxiety: A Systematic Review

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Objective: This systematic review aims to describe the Internet's potential role in assisting patients with depression and anxiety.

Data Sources: A MEDLINE search was conducted of articles published between 1998 and 2008 using the terms *depression* and *anxiety* and *Internet*, *computers* and *depression* and *anxiety*, *Internet* and *compliance* and *depression*, and *Internet* and *adherence* and *depression*.

Study Selection: Publications cited include articles concerned with the Internet in screening, supporting, educating, and treating patients with depression and anxiety.

Data Extraction: The efficacy of Internet-based interventions for depression and anxiety was reviewed, alongside the quality of available online information regarding these disorders.

Data Synthesis: Little progress has been made in developing a universally accepted system for quality assurance of medical information Web sites. Furthermore, there is a lack of research describing the effect of self-diagnosis sites on meaningful outcomes, such as the proportion of patients who go on to receive successful treatment for their depression. Early studies of Internet-based cognitive-behavioral therapy for depression were promising; however, results of clinical trials for "e-therapy" have been variable due to methodological issues. A novel compliance support Web site for patients with depression and anxiety is being evaluated to establish whether providing such assistance can improve patient outcomes.

Conclusions: The use of the Internet to assist patients with depression and anxiety is currently in its infancy. However, it appears that the Internet has great potential to support patients with depression and may consequently also be of benefit to physicians.

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In the United States, only 40% of individuals with depression or anxiety receive treatment, while in the United Kingdom, less than one-third of patients with depression are under the care of a physician for their mood disorder.[1,2] Furthermore, a study performed on behalf of the World Health Organization has reported that worldwide an estimated 60% of individuals with depression are not being treated.[3] There is a growing trend for patients to be proactive in addressing their health issues, with as many as 85% of patients aged 20 to 40 years wishing to be more involved in their medical treatment.[4] Moreover, patients who participate actively in their own care manage their condition better and have an improved prognosis.[5]

Computer-based psychotherapy has evolved as an important tool for physicians, as it has the potential to reach out to, empower, and treat a large number of patients with a variety of mental disorders.[6] For patients with depression and anxiety, this support may take the form of therapy programs on stand-alone computers, assistance via interactive phone response programs, or Internet-based therapy sites.[6] Between 70% and 80% of adults in the United States and Western Europe have access to the World Wide Web,[7,8] making it a particularly convenient medium through which to search for medical information, screen for a number of health problems, and perform self-help strategies.

It has been reported that the Internet has recently replaced clinicians as the main source of initial health and medical information for the general public in the United States; this may be due in part to the high cost of health care at a time of economic recession.[9] The same survey also reported that new legislation banning direct-to-consumer pharmaceutical advertising in Europe has compelled increasingly greater numbers of patients to turn to the Internet to find information on diseases and treatments.[9] The very nature of a personal computer means that queries, such as Internet searches on stigmatized illnesses, can remain anonymous and confidential. It has been reported that patients are willing to disclose more information about themselves to a computer than to their therapist, perhaps because they are fearful of communicating personal information directly to another individual.[10] Furthermore, resources held on the Internet are always available, allowing users to absorb information whenever they choose and at their own pace, repeatedly viewing material if necessary.

Use of the Internet to address health care queries is particularly practical for people in remote locations, people who have mobility problems, and people who may not want to leave their home (eg, individuals with anxiety disorders or agoraphobia).[11] Studies performed

Clinical Points

- Depression and anxiety disorders are a major public health problem with inadequate resources available for adequate treatment in most countries.
- Barriers to successful treatment include the stigma of the disease, the lack of availability of psychological treatment, and poor compliance with prescribed antidepressants.
- All 3 barriers are currently being addressed by resources available on the Internet; it is important that doctors are aware of these resources and their potential benefits and limitations.

in Australia indicate that rates of suicide are higher in rural areas than in cities, and fewer people in rural locations—particularly young men—seek help for mental disorders.[12,13] These individuals are a potentially sizeable target population for Internet-based assistance. By combining face-to-face consultations with Internet-based assistance, primary care physicians and therapists may be able to treat a greater number of patients, thus reducing waiting lists for psychological therapy. However, use of the Internet to assist with health care may not be suitable for "technophobes" or people with literacy issues.

This article systematically reviews the evidence for the use of Internet sites for patients with anxiety and depression. These sites fall into 3 categories: information, screening, and therapy sites (mainly cognitive-behavioral therapy [CBT]). In addition, the potential of the Internet as a means to increase patient compliance is discussed. Across chronic conditions, only 50% of patients take their medication as directed, reducing the benefits of therapy and potentially leading to treatment failure.[14,15] Patients with depression are more likely to be noncompliant compared with individuals without depression.[16] This review therefore also describes the format of a Web site that aims to motivate patients to achieve long-term remission by encouraging compliance with antidepressant medication.

METHOD

Data Sources

A MEDLINE search was conducted of articles published between January 1998 and September 2008 using the search terms: *depression* and *anxiety* and *Internet*, *computers* and *depression* and *anxiety*, *Internet* and *compliance* and *depression*, and *Internet* and *adherence* and *depression.* Searches were limited to articles in English, clinical trials, meta-analyses, randomized controlled trials, and reviews; case studies were excluded.

Study Selection

Using the stipulated limits, the MEDLINE search retrieved 75 articles. Articles concerning depression or anxiety as a comorbidity of another condition were excluded, as were articles that dealt solely with the use of stand-alone computers or telephone-interactive voice programs in the treatment of depression and anxiety. The reference lists of the remaining articles were then searched manually to identify additional articles of interest. Publications cited include articles concerning the use of the Internet in screening, educating, and treating patients with depression and anxiety.

Data Extraction

The efficacy of Internet-based interventions for depression and anxiety in clinical trials was reviewed, alongside the quality and relevance of available information regarding these disorders. The validity of Internet versions of "paper and pencil" depression and anxiety measures was also evaluated. In addition, information was included regarding compliance and adherence with medication in patients with depression and anxiety.

RESULTS

Information Sites

In 2001, approximately 20% of the total US adult population and 40% of US adults with Internet access used the World Wide Web to retrieve health information.[17] By 2004, the proportion of individuals with Internet access who used the Web to search for health information had increased to 79%, and 23% of these people were looking for information on mental health issues.[18] Internet use is particularly prevalent in teenagers, and mental health issues are common subjects for Internet searches in this group.[19]

Information sites and stigmatized illness. It has been reported that patients with stigmatized psychiatric illnesses, such as depression and anxiety, are more likely to use the Internet for health information (adjusted odds ratio [OR] = 1.4, 95% CI, 1.2–1.7) and as a means to communicate with a health care provider (adjusted OR = 2.7, 95% CI, 1.6–4.4) than individuals without stigmatized illness.[10] Furthermore, patients who felt that there was a stigma associated with their depression and anxiety reported an increase in their health care utilization as a result of the information they found online (adjusted OR = 2.5, 95% CI, 1.2–5.7).[10]

A study of changes in response to Internet-based interventions for depression indicated that use of information sites (in this instance BluePages [http://bluepages.anu.edu.au/]) was associated with a small but statistically significant reduction ($P = .031$) in personal beliefs about stigma associated with depression compared with a control group of patients who did not use the site.[20] However, beliefs about perceived stigma (by a third party) were not reduced in the group who used the information site compared with the control condition.[20]

Ensuring the quality of information sites. Major considerations when disseminating information about health disorders—particularly mental illness (psychoeducation)—via the Internet are that the information is up to date and of high quality. Griffiths and colleagues[21] have developed a tool for the assessment of depression Web sites—the automated quality assessment procedure (AQA). The AQA ranks depression Web sites according to the quality of their content. In a validation study, the AQA score correlated significantly with an evidence-based rating scale that compared the consistency of Web site content with a series of statements from a systematic guide for the management of depression in the primary care setting ($r = 0.85$, $P < .001$).[21] If it can be produced in a consumer-friendly format, the AQA has the potential to assist Internet users in evaluating the reliability of the health information Web sites that they access.[21]

DISCERN is an alternative tool for assessing the quality of information found on health information Web sites. It is an instrument comprising 15 items and an additional overall quality item, all of which are rated from 1 to 5 (http://www.discern.org.uk/discern.pdf).[22,23] DISCERN scores were reported to correlate with the same evidence-based rating scale for depression as was used in the validation study of the AQA.[21,24] Furthermore, Griffiths and Christensen[24] reported that the correlation between the DISCERN score and the evidence-based rating scale was particularly strong when DISCERN was used by health care professionals ($r = 0.80$, $P < .001$) but was also robust when rating assessments were performed by consumers ($r = 0.62$, $P = .002$). These results indicate that DISCERN could be used by consumers to ensure that the content of depression Web sites is of high quality.[24]

Other methods of assessing the quality of health information sites include the use of gateways such as HealthInsite (http://www.healthinsite.gov.au/). This portal is an initiative of the Australian government that guides users to sites of high quality in addition to providing regular updates and useful information across a variety of areas such as nutrition or mental health. Labels of reliability and credibility, such as the Health on the Net Foundation's HONcode (http://www.healthonnet.org), have also been developed for health Web sites. Worryingly, a systematic review of information sites concerned with anxiety disorders reported that the content of the sites studied was of poor-to-moderate quality, as assessed using DISCERN, and that there was no association between the fulfillment of HONcode validation criteria and the actual quality score of the Web site.[25]

Despite these laudable attempts and similar endeavors in other therapeutic areas, little progress has been made in developing a universally accepted system for quality assurance of Web sites. Some consensus regarding what constitutes a high-quality Web site is required if patients with depression and anxiety are to have peace of mind when accessing health information online.

Screening/Diagnosis Web Sites

Patients' use of screening and diagnosis Web sites may encourage early diagnosis and presentation, resulting in earlier treatment and, subsequently, an improved prognosis.[26] Furthermore, computerized screening for mental health disorders may reduce the burden on therapists by streamlining diagnosis and allowing more effective management of patients with anxiety and depression. Collection of information over the Internet to aid diagnosis also makes screening sites suitable for the recruitment of patients into clinical trials.[27]

An example of the utility of screening Web sites has been described by Allen and colleagues.[28] Patients with upcoming primary care visits who agreed to participate were sent a link to a secure Internet portal called PatientSite (http://www.patientsite.org), wherein they answered targeted questions about depression, mobility, and pain.[29] PatientSite was also used for "e-coaching" of patients by clinic nurses so that the patients could prioritize their queries to better use the time with their physician and to fill in worksheets about their condition to bring to their appointment.[28] In total, 11% of patients screened positive for depression, and PatientSite allowed them to be better informed about their condition and to ask more directed questions during their visit. In this way, Internet screening could improve the efficiency of primary care visits, empower patients, and promote self-care.[28,29] However, the patients enrolled in this study were already registered users of PatientSite and had a scheduled visit with their physician. The highly selective nature of this study population may therefore mean that the favorable results of this randomized trial are not applicable to the general public who are likely to be less proactive with regard to seeking treatment.

Currently, there is a lack of research describing the effect of self-diagnosis sites on meaningful outcomes, such as the proportion of patients who go on to receive successful treatment for their anxiety and depression. Validation studies of the available Internet sites for diagnosis of depression are described below.

Available depression scales. Many screening Web sites use validated depression scales that have been converted

for remote use by patients. For example, the Edinburgh Depression Scale (EDS [originally the Edinburgh Postnatal Depression Scale]) has been converted to an Internet-based screening device comprising the 10 items that are present in the paper-based version (ie, items concerned with lack of enjoyment, inability to have fun, self-blame, self-harm, sadness, tearfulness, insomnia, panic, anxiety, and a sense of being overwhelmed).[30] The Internet-based EDS was reported to have comparable internal consistency with that of the paper-based EDS. Internet-based EDS scores also correlated significantly with Internet-based Beck Depression Inventory (BDI) scores ($r = 0.75$, $P < .001$) and scores on the Internet-based Symptom Checklist-90 depression and anxiety subscales ($r = 0.77$ and $r = 0.72$, respectively, $P < .001$ for both). These results indicate that the Internet-based EDS could be used to screen patients for depression and anxiety with as much confidence as the paper-based version.[30]

Short, simple scales are particularly useful for online self-diagnosis, screening in primary care, or use during follow-up assessments, eg, the Patient Health Questionnaire-9 (PHQ-9) (http://www.patient.co.uk/showdoc/40025272/) and the Generalized Anxiety Disorder-7 (GAD-7) assessment (http://www.patient.co.uk/doctor/Generalised-Anxiety-Disorder-assessment-(GAD-7).htm). The PHQ-9 consists of 9 questions regarding patients' self-esteem, energy, apathy, and activity levels where a score > 10 indicates moderate depression that requires intervention. The GAD-7 comprises 7 questions concerning worry, irritability, and restlessness with a score > 10 indicating moderate anxiety and a requirement for further clinical evaluation.

A number of validated scales have also been used online to screen for depression comorbid with other conditions. For example, Web-based versions of the Hospital Anxiety Depression Scale (HADS) and the Composite International Diagnostic Interview-Short Form have been used to screen for depression in patients with tinnitus and are reported to produce meaningful and valid data in this patient population.[31,32] The Internet-based HADS has also been validated for use in patients with chronic fatigue syndrome.[33] Furthermore, Internet versions of the BDI and the Montgomery-Asberg Depression Rating Scale (MADRS) showed high and significant correlations with their paper-based counterparts in a validation study conducted in a population of 494 patients with panic disorder.[34]

In addition to established depression and anxiety scales, novel tools have been developed for screening patients via the Internet. The Web-Based Depression and Anxiety Test (WB-DAT) is a freely available screening test for major depressive disorder and anxiety disorders that has been developed as a single questionnaire to assist in the diagnosis of these conditions due to their common comorbidity (http://www.depressioncenter.net/wb-dat/). Agreement between the WB-DAT and the gold standard tool for diagnosis of mental health disorders—the Structured Clinical Interview for *DSM-IV* Axis I Disorders[35]—ranged from acceptable to good (Cohen's κ measure, 0.57 to 0.70).[36] As the original validation study was performed in a trial population of 193 patients, the investigators admit that further research in a larger primary care sample would aid conclusions as to the utility of this scale.[36]

The Neuropsych Questionnaire (NPQ) was designed to complement face-to-face assessment of neuropsychiatric patients and can be performed at home or in the clinician's office.[37] The NPQ can be administered for a wide range of neuropsychiatric disorders and consists of 200 questions that take approximately 15 minutes to answer. The patient's partner, caregiver, and family can also answer questions on the NPQ. Results of assessment with the NPQ can then be saved to a central database for analysis by a psychiatrist and may assist in diagnosis and save clinicians' time during patient evaluations.[37] A short form of the NPQ comprising 45 questions and requiring approximately 5 minutes to complete has also been created for follow-up assessment of patients' symptoms over the Internet, and both versions have been shown to be reliable and capable of discriminating between different diagnoses.[37] Because of its role in supporting clinicians, the NPQ has been described as an instrument for measuring patient symptoms as opposed to a tool for self-diagnosis.[37]

To date, despite the online availability of these validated screening and diagnosis scales, there is an absence of published data concerning the frequency of their use by the general population. Whether the use of screening and diagnosis Web sites gives patients the impetus to visit their physician is also unreported at present.

Therapy Sites

CBT involves challenging a patient's negative thoughts and beliefs in order to change behavioral patterns and, ultimately, to address his or her condition. This therapy most often takes the form of relaxation techniques and structured written exercises to identify, discuss, and change how patients respond in certain situations. Face-to-face CBT with a therapist is the most extensively researched and widely applied form of psychotherapy[38,39] and has been shown to be effective in the treatment of a number of disorders, including depression, anxiety, and sleep problems.[40–42] Effect sizes of face-to-face CBT for depression were moderate ($d = 0.5$ to 0.7) in 2 recent meta-analyses.[43,44]

Internet-based CBT. Evidence has emerged of medium-to-large effect sizes for Internet-based CBT in the treatment of disorders such as social phobia,

panic disorder, agoraphobia, and posttraumatic stress disorder.[45–47] However, methodological issues appear to be a common problem in studies of Internet-based CBT. A systematic review of 14 randomized controlled trials of Internet sites that provide remote therapy for health disorders such as obesity, complicated grief, and insomnia has revealed that a majority of these studies (9/14 studies) had methodological limitations and were considered to be of low quality.[48] For example, usual care may be a more appropriate comparator than "waiting for treatment," which is commonly used in clinical trials of Internet-based CBT.[49]

Early studies of Internet-based CBT for the treatment of depression were promising; community registrants to the Australian CBT site MoodGYM (http://moodgym.anu.edu.au) reported significant reductions in self-reported scores on the Goldberg Anxiety and Depression Scales compared with baseline ($P < .0005$ for both).[50] However, the results of clinical trials of Internet-based CBT have been somewhat variable. Table 1 shows the results of randomized controlled trials that evaluated the effectiveness of CBT sites for a number of outcomes related to depression.

Issues to consider with Internet-based CBT. The variation in effect sizes for reductions in depression conferred by online therapy sites (Table 1) indicates that they do not fully replace traditional treatment modalities for depression. Patients may need to use a number of Web sites concurrently to receive the full benefit of "e-therapy." For example, BluePages and MoodGYM contain links to each other to allow patients to receive treatment and information regarding their condition. Furthermore, it is inappropriate to use remote therapy for patients at significant risk of suicide or self-harm. To date, randomized controlled trials of Internet therapy have excluded patients who may be suicidal by identifying (using the EDS) and randomizing patients with subthreshold depression rather than major depressive disorder, querying patient history with regard to suicide attempts, or asking questions regarding suicidal ideation as part of a screening questionnaire (eg, item 9 of the MADRS inquires as to the respondent's will to live/zest for life).[53,55,57]

While the possible ramifications of using Internet-based CBT are still not completely characterized, it seems unwise to suggest that such therapy should fully replace face-to-face CBT for all patients with depression. Furthermore, there may even be the potential for "e-therapy" to exacerbate the very problems it was designed to ease. For example, the idea that Internet-based CBT may completely replace face-to-face therapy is troubling, as "e-therapy" may not be suitable for all patients, and some investigators have argued that it effectively reduces, instead of improves, patient access to effective treatment.[60] In addition, the provision of low-cost Internet support for some conditions may reinforce the low priority of these groups to health service providers and to the patients themselves, further increasing their feelings of isolation. Stigmatized illnesses are also likely to remain stigmatized if they are solely discussed and treated within the confines of anonymous and remote Internet-based therapies.[60]

Another question that must be addressed before the use of Internet-based therapy for depression can become commonplace is whether its reported efficacy in randomized controlled trials can be translated into clinical benefits for spontaneous users of CBT Web sites. Christensen and colleagues[61] compared the outcomes of the BlueMood trial (N = 182), which assessed the effects of the MoodGYM CBT site, with the experiences of public registrants to the same site (N = 3,176). Both public registrants and trial participants experienced significant changes in their anxiety and depression scores provided they completed at least 2 modules of treatment on the site.[61] However, only 16% of public registrants progressed beyond the second module compared with 66% of trial participants, suggesting that regardless of whether CBT sites have value in addressing patients' anxiety and depression, a lack of compliance with the treatment program is likely to limit the effectiveness of CBT Web sites in the real-world setting.[61]

A number of therapists have expressed concern that remote CBT via the Internet does not allow the development of a therapeutic relationship with the patient, leading to poor treatment outcomes. In support of this concern, a recent systematic review reported a significant correlation between the length of time that therapists spend with their clients and the consequent effect size of the therapeutic intervention ($r = 0.75$, $P < .005$).[62] In addition, patients receiving remote therapy may be precluded from experiencing any placebo effect associated with being cared for by a physician. Moreover, therapy via the Internet does not allow assessment of visual cues such as body language and cannot address questions posed by users immediately. Current evidence suggests that positive relationships between clinicians and Internet therapy users are possible via time-tabled telephone contact or e-mail dialogue.[55,63] Furthermore, the effectiveness of Internet-based therapy is closely associated with the level of physician-patient interaction available to site users. Effect sizes were large ($d = 1.0$) for the treatment of depression and anxiety with CBT via the Internet alongside support in the form of e-mail or telephone interaction, whereas effect sizes for Internet CBT given without support were small ($d = 0.2$ to 0.3).[55]

Enrolling sufficient trial participants from the community has proven to be difficult for a number of investigators. For example, Clarke and colleagues[54] mailed recruitment brochures to 12,051 individuals in order to capture the 255 subjects required to meet

Table 1. Results of Randomized Controlled Trials Concerning Internet-Based Cognitive-Behavioral Therapy (CBT) Interventions

Reference (Country)	Study Design	Online Therapy Program and Depression and Anxiety Scales Used	Results	Patient Dropout/ Completion
Clarke et al[51] (United States)	RCT of Internet CBT (n = 144) vs a no-access control group (n = 155); subjects with and without depression were randomly assigned to each group	CBT intervention comprising self-guided interactive tutorials with no therapist support (ODIN); scale: CES-D	No difference between the control group and the intervention group; no change in health care utilization in the 12 mo following randomization	Completion rates were 53%, 65%, 66%, and 59% at 4, 8, 16, and 32 wk postrandomization
Christensen et al[52] (Australia)	RCT of reductions in depression score with Internet-based CBT (n = 182) vs Internet-based psychoeducation (n = 166) vs an attention-control condition (n = 178)	MoodGYM CBT site vs BluePages educational Web site; scale: CES-D	Mean effect sizes for the intent-to-treat population of the CBT and psychoeducation groups were moderate ($d = 0.4$ for both); mean effect sizes for study completers were moderate: CBT, $d = 0.6$ and psychoeducation, $d = 0.4$; mean effect sizes for study completers with CES-D depression scores > 16 were large: CBT, $d = 0.9$ and psychoeducation, $d = 0.8$	79% of subjects completed the study
Griffiths et al[20] (Australia)	RCT of stigmatized beliefs associated with depression after Internet-based CBT (n = 182) vs Internet-based psychoeducation (n = 166) vs an attention-control condition (n = 178)	MoodGYM CBT site vs BluePages educational Web site; scale: NA	Use of either site significantly reduced personal stigma compared with the control group: CBT, $P = .036$ and psychoeducation, $P = .031$; use of the CBT site significantly increased perceived stigma ($P = .004$)	79% of subjects completed the study
Andersson et al[53] (Sweden)	RCT of Internet-based therapy (n = 36) vs a discussion-only control group (n = 49)	8-week, 5-module online CBT intervention for depression and anxiety with e-mail feedback from a therapist; scales: BAI, BDI, MADRS	Moderate-to-large mean effect sizes were found for improvements in depression and anxiety: BDI, $d = 0.9$; MADRS, $d = 0.8$; and BAI, $d = 0.5$; improvements in patients' scores were largely maintained at the 6-mo follow-up	16% had withdrawn at 6-mo follow-up
Clarke et al[54] (United States)	Three-arm RCT with a no-access usual-treatment group (n = 100) vs subjects using an Internet CBT site with postcard reminders (n = 75) vs subjects using the same Internet CBT site with telephone reminders (n = 80)	CBT intervention comprising self-guided interactive tutorials with telephone or postcard reminders (ODIN); scale: CES-D	Mean effect sizes for reductions in depression symptoms for subjects who received either a postcard or telephone reminders were small but statistically significant compared with the control group: $d = 0.3$, $P = .03$; mean effect sizes for intervention subjects with severe depression: $d = 0.5$, $P = .02$	Follow-up completion rates were 64%, 68%, and 66% at 5, 10, and 16 wk postrandomization
Spek et al[55] (various)	Meta-analysis of 12 RCTs (N = 2,334)	Internet-based CBT for depression and anxiety; scales: BAI, BDI, CES-D, DASS, LSAS-SR, MADRS, STAI-S	Mean effect sizes for reductions in anxiety and depression symptoms were large ($d = 1.0$) and small ($d = 0.3$), respectively; mean effect size for Internet CBT with therapist support was large ($d = 1.0$); CBT without support had a small mean effect size ($d = 0.2$ to 0.3)	3%–34% of patients dropped out of the studies included in the meta-analysis
Mackinnon et al[56] (Australia)	Long-term follow-up of an RCT for reductions in depression scores following Internet-based CBT (n = 94) vs Internet-based psychoeducation (n = 107) vs an attention-control condition (n = 124)	MoodGYM CBT site vs BluePages educational Web site; scale: CES-D	Both CBT and education sites significantly reduced symptoms of depression compared with the control condition ($P < .0001$ and $P < .005$, respectively); at 12-mo follow-up, subjects in the CBT group and education site group maintained significant reductions in depression scores vs the control group ($P = .044$ and $P = .024$, respectively)	CBT site, 48%; education site, 35%; control group, 30%
Spek et al[57] (the Netherlands)	1-year RCT of the effects of Internet-based CBT (n = 102) vs group CBT (n = 99) vs a waiting-list control group (n = 100) in patients aged > 50 y with subthreshold depression	8-module online CBT intervention for depression and anxiety with no professional support; scale: BDI	Mean effect size for Internet-based CBT was large ($d = 1.22$); mean effect sizes for group CBT and the waiting-list group were moderate ($d = 0.6$ and 0.7, respectively)	48.3% of subjects completed the online course
van Straten et al[58] (the Netherlands)	RCT of Internet problem-solving therapy for depression, anxiety, and work-related stress (n = 107) vs a waiting-list control group (n = 106)	5 wk of therapy with weekly explanatory e-mails and feedback from master's level psychology students; scales: CES-D, HADS, MDI, SCL-A	Mean effect sizes were small to moderate for patients in the intent-to-treat population who received therapy vs the control group: CES-D, $d = 0.50$; MDI, $d = 0.33$; HADS, $d = 0.33$; SCL-A, $d = 0.42$; mean effect sizes were moderate for subjects who completed therapy vs the control group: CES-D, $d = 0.67$; MDI, $d = 0.56$; HADS, $d = 0.48$; SCL-A, $d = 0.51$	55% of subjects in the therapy group completed treatment
de Graaf et al[59] (the Netherlands)	RCT of online CBT (n = 100) vs online CBT combined with usual care (n = 100)	Online multimedia computerized program (Colour Your Life); scale: BDI-II	Positive expectations and completing > 4 sets of CBT homework were significantly associated with depressive improvement over 9 mo ($P < .05$ for both)	11% of participants had dropped out of the study at 9 mo

Abbreviations: BAI = Beck Anxiety Inventory, BDI = Beck Depression Inventory, CES-D = Center for Epidemiologic Studies Depression Scale, DASS = Depression Anxiety Stress Scale, HADS = Hospital Anxiety and Depression Scale, LSAS-SR = Liebowitz Social Anxiety Scale self-report version, MADRS = Montgomery-Asberg Depression Rating Scale, MDI = Major Depression Inventory, NA = not applicable, ODIN = Overcoming Depression on the Internet study, RCT = randomized controlled trial, SCL-A = Symptom Checklist-Anxiety, STAI-S = State Trait Anxiety Inventory-State Scale.

their statistically determined sample size. The issue of obtaining statistically meaningful results is exacerbated by high rates of patient dropout in clinical trials of Internet-based CBT, which make follow-up in long-term studies difficult and also mean that the number of patients that complete each study is small (Table 1). High attrition rates make it difficult to draw firm conclusions as to the true benefits of "e-therapy"; if patients do not complete treatment within the rigorous confines of a clinical trial, it is unlikely that they will do so as unprompted consumers. Indeed, high participant dropout rates were observed in a recent study of an online computerized CBT program (Colour Your Life).[59] The results of this study suggested that online CBT use was not strongly related to treatment outcome, leading the authors to speculate that unsupported online CBT may not be beneficial for patients with moderate-to-severe depression.[59]

Compliance and the Internet

In addition to information, screening, and therapy sites, the utility of the Internet in improving patient compliance is now being explored. Compliance describes the extent to which patients follow advice given to them by their physician. The term *adherence* is used to indicate that a patient is following a physician's recommendations and reflects the patient's involvement in decisions about his or her own health care due to an active alliance created with the health care provider. In this article, compliance and adherence will be used interchangeably.

Importance of compliance. In order to achieve long-term remission from depression, clinical guidelines recommend that drug treatment should continue for 4 to 6 months after a patient has experienced an acute episode of depression.[64] A systematic review of 31 randomized trials of over 4,000 patients reported that long-term treatment with antidepressants approximately halves the absolute risk of a depressive relapse.[64] However, adherence to medication was shown to decrease as the complexity and duration of treatment increase.[65] Furthermore, patients with depression are 3 times less likely than nondepressed individuals to be compliant with recommendations made by their physician.[16] This finding has been ascribed to a lack of optimism with regard to the possible benefits of treatment for depression, mainly due to the sense of hopelessness that is experienced by many patients with this mood disorder. Familial and social support are also important in maintaining adherence to treatment; however, isolation and withdrawal often accompany depression, increasing the likelihood that patients will not take their medication in the prescribed manner. Finally, depression may be associated with reductions in cognitive functioning that impair a patient's ability to remember when to take his/her medication.[16]

Enhancing compliance. Patients who are well informed about the benefits, adverse effects, and dosing of their treatment are more likely to use their medications effectively than patients who have not been educated in this regard. Moreover, they are likely to be compliant if they understand the consequences of not taking their medication in the required way.[65] A systematic review of interventions to enhance patient adherence has revealed that compliance counseling (regular discussion with patients of the importance of compliance) or a combination of compliance counseling, family therapy (involving the family in maintaining compliance), and patient education were most effective at improving clinical outcomes and compliance.[65] It has been reported that only 21% of patients read the patient-information leaflet provided with their medication, which may partially explain why so many patients do not comply with their treatment regimen.[66] A number of electronic devices have been developed to remind patients when it is time to take their medication, although these compliance tools have had varied success. What is needed is a multifaceted interactive support tool that not only supplies patients with information about their condition, but also explains the importance of complying with their treatment regimen and reminds them to take their medication. The Internet is well suited to fulfill this role by effectively acting as an electronic patient-information leaflet and as an enabler that can respond to specific queries, monitor a patient's progress, and provide encouragement if necessary.

Use of iCAN. Preliminary findings in a study of 144 patients with depression who used a support Web site featuring "e-therapy," progress monitoring, adherence reminders, and psychoeducation suggest that this approach improves clinical outcomes and adherence to treatment.[67] However, these benefits were only evident in patients who received at least 8 sessions of progress-monitoring questionnaires over a 16-week period; attrition rates in this study meant that 50% of enrolled subjects did not fulfill this criterion.[67]

More recently, Lundbeck A/S developed the support Web site iCAN (http://www.ican.co.uk). iCAN is currently available only to patients who are receiving treatment with escitalopram who must enter the batch number of their medication in order to register. This Web site was designed to be tested exclusively in the United Kingdom, but patients from across the globe who were prescribed escitalopram have also registered to access the site.

The author was involved in the implementation of this Web site, which supports patients with depression and anxiety via discussion forums and provides regular tips about coping with their condition while encouraging them to remain compliant with their medication regimen. The Web site also provides information on the importance of remaining positive and taking medication in the prescribed manner. Furthermore, it allows patients to receive prompt feedback from physicians who are experienced in treating mood disorders through the

Table 2. A Summary of the Internet's Current or Promising Applications in Assisting the Treatment of Depression and Anxiety

Application (Example)	Strengths of Application	Weaknesses of Application	Research Priorities/Unmet Needs
Information (http://bluepages.anu.edu.au)	Can be used to remotely educate patients—particularly useful for stigmatized illnesses[10]; information is always available; may reduce personal beliefs about stigma associated with depression[20]	Information on available sites is of poor-to-moderate quality[25]; difficult to ensure that data are current and correct[25]; not suitable for patients who do not regularly use the Internet	Formal regulation is needed to assess the quality of health information sites
Screening/diagnosis (http://www.patientsite.org)	Can facilitate self-diagnosis and encourage patients to visit their physician[26]; may improve the efficiency of primary care appointments[28,29]; may result in earlier treatment and therefore improve patient prognosis[26]	Could increase physician workload—not all patients with a positive self-diagnosis will have a clinical disorder; not suitable for patients who do not regularly use the Internet	Research is required regarding the proportion of patients who use these sites and then go on to receive successful treatment/improved clinical outcomes
Therapy (http://moodgym.anu.edu.au)	May be useful in patients with subthreshold depression as part of a stepped program of care	Not suitable for patients with severe depression or who are at risk of suicide/self-harm; may reinforce feelings of isolation, stigma, unimportance, and low-self esteem[60]; may not increase the number of patients that a physician can treat as its effectiveness is reliant on the level of patient-physician contact[55]; not suitable for patients who do not regularly use the Internet	Research is required regarding whether remote therapy has clinical benefits for spontaneous users outside the confines of clinical trials; direct comparisons are required concerning the efficacy of Internet-based CBT and face-to-face CBT
Compliance support (http://www.ican.co.uk)	May increase compliance and decrease direct and indirect costs associated with depression	Difficult to remotely measure compliance or resultant clinical outcomes as a result of Internet-based support; not suitable for patients who do not regularly use the Internet	Further research is required to establish whether Internet-based compliance support increases compliance and correspondingly improves clinical outcomes/reduces costs

"ask an expert" function. Patients can continually monitor their progress by completing an online HADS questionnaire at 2-week intervals. The results of each rating are then plotted longitudinally and are used in 2 ways. Within the iCAN system, an automatic feedback loop results in appropriate messages being provided to the user on the basis of his/her progress since the previous assessment. The print function allows patients to follow their progress and to identify and discuss specific episodes of good or low mood with their physician.

Patients can also keep track of their mood in an onsite diary that they can either keep confidential or share with other iCAN members, creating an interactive patient community. The HADS chart and diary are therefore a reminder to patients that remaining compliant with their medication leads to better outcomes in terms of symptom resolution and long-term remission. By using these different tools, iCAN simultaneously serves as an information site, an online therapist, and a compliance counselor and also monitors patient adherence. The intention now is to demonstrate whether providing an elaborate interactive Web site such as iCAN really does result in improved compliance and outcomes when compared with the simple provision of educational materials.

CONCLUSIONS

The main findings of this review concerning the use of the Internet by patients with depression and anxiety are summarized in Table 2. The evidence presented here shows that the Internet potentially has an increasingly important role to play in health care—in particular for the management of psychological disorders. Moreover, the Internet effectively makes therapy a 2-way street, as patients can be supported and given basic treatment while information about patients and the most effective treatment approaches can be collected both on an individual and condition-wide basis. Collection of epidemiologic and treatment data in this way promises to improve therapy for patients with depression in the future. Furthermore, the Internet is quick and easy to update, so it is an ideal tool for disseminating new and useful information to patients and clinicians alike. However,

ensuring that all data are current and of high quality is an ongoing battle, and there is an unmet need for guidelines and formal regulation regarding Internet psychoeducation and therapy for patients with depression and anxiety.

Many therapy and information sites also provide a forum facility whereby site users can discuss their depression, share experiences, and support each other. These facilities are of particular value to individuals who feel isolated as a result of their illness. While these sites create a useful support network for patients, it is unlikely that alone they are sufficient to address depression and anxiety, and they also require close moderation. Therefore, discussion boards are probably most useful as an adjunct to Internet-based therapy or psychoeducation.

The applicability of therapy, particularly CBT, on the Internet should be assessed on a case-by-case basis. Favorable results with Internet-based CBT have been reported for a number of health problems, and it may also be useful as part of a stepped program of care for patients with subthreshold depression. Web-based therapy affords patients additional choices regarding their treatment, and some patients may prefer the ease of access and round-the-clock availability of online therapy. So far, Internet-based CBT for depression and anxiety has not been compared directly with face-to-face CBT, and future studies should address this gap in our knowledge,[49] although the design of such a trial may prove problematic. At present, outside the strict discipline of a clinical trial, "e-therapy" appears less than optimal, and it is unlikely that the Internet would ever replace face-to-face interaction with a therapist for patients with severe depression, especially those at major risk of self-harm or suicide. Moreover, it is important to note that this systematic review has, through necessity, discussed only published data and may therefore be the subject of an implicit bias with regard to the efficacy of Internet-based therapy. It seems likely that only those studies that had successful outcomes will have been fully described in the published literature, while unsuccessful trials may have gone unreported.

As discussed above, Web-based CBT requires the development of a solid patient-therapist relationship (via telephone or e-mail) and therefore might not save therapists as much time as first surmised. The design of a study concerning the efficacy and cost-effectiveness of computer-based CBT has recently been published, and it may show whether therapy received through this medium saves physicians time, allows them the opportunity to treat more patients, and reduces expenditure for health care providers and payors.[68] Recommendation of Internet-based therapy by health care providers is becoming more common, and in one recent study,[69] approximately 19% of users of an Internet-based CBT site had been referred to the site by their physician. Benefits in terms of cost-effectiveness may make this form of therapy even more attractive.[69]

Internet therapy, screening, psychoeducation, and compliance support may only be appropriate for a subset of patients who already use the Internet regularly, eg, the affluent and educated.[70] Subjects enrolled in studies to date are generally responding to recruitment via advertisement and are therefore more likely to take an active interest in their own therapy. These patients may display better outcomes than those who are more despondent as a result of their condition or who become cynical due to feeling that they are receiving a less efficacious form of treatment compared with face-to-face CBT. Further studies on the patient characteristics of people most suited to Internet-based therapy would be very useful.[11]

Currently, the use of the Internet in assisting patients with depression and anxiety is still in its infancy. However, the amount of data concerning Internet-based interventions for depression and anxiety is likely to increase exponentially over the next few years as the Internet becomes a more accepted vehicle for accessing health care data. The Internet also has great potential to improve patient compliance, and the effects of a novel Web-based compliance initiative are eagerly awaited.

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