

Computer-Assisted Psychotherapy

JESSE H. WRIGHT, M.D., PH.D.

ANDREW S. WRIGHT

The rationale for using computers in psychotherapy includes the possibility that therapeutic software could improve the efficiency of treatment and provide access for greater numbers of patients. Computers have not been able to reliably duplicate the type of dialogue typically used in clinician-administered therapy. However, computers have significant strengths that can be used to advantage in designing treatment programs. Software developed for computer-assisted therapy generally has been well accepted by patients. Outcome studies have usually demonstrated treatment effectiveness for this form of therapy. Future development of computer tools may be influenced by changes in health care financing and rapid growth of new technologies. An integrated care delivery model incorporating the unique attributes of both clinicians and computers should be adopted for computer-assisted therapy.

(The Journal of Psychotherapy Practice and Research 1997; 6:315-329)

The use of computers in psychiatric treatment has been a controversial subject since the first prototype for computer-assisted psychotherapy was developed in 1966. Advocates of computer-assisted therapy have emphasized the potential for using computers to reduce health care costs and to provide innovative new treatment approaches.¹⁻⁴ However, concerns have been raised about possible dehumanizing effects of having patients interact with a machine and about the ability of computer programs to fully understand human communication and give accurate feedback.¹⁻⁴ Because research on computer-assisted therapy has usually documented treatment effectiveness and excellent patient acceptance, it has been suggested that the primary barrier to using computers for therapy is clinician resistance.¹ In this article, we present a rationale for computer-assisted therapy, review computer tools for psychiatric treatment, and suggest possible future directions for enhancing psychotherapy with computer technology.

WHY USE COMPUTERS IN PSYCHIATRIC TREATMENT?

An important argument for using computers in psychiatric treatment is the possibility that effective software could have a significant

From the Department of Psychiatry and Behavioral Sciences, University of Louisville School of Medicine, and the Norton Psychiatric Clinic, Louisville, Kentucky. Address correspondence to Dr. Wright, P.O. Box 35070, Louisville, KY 40232; e-mail: jwright@iglou.com

Copyright © 1997 American Psychiatric Press, Inc.

positive impact on cost and availability of mental health services.^{1,2} Greist¹ has noted that the number of patients with Axis I disorders who could benefit from psychotherapies with demonstrated effectiveness far outstrips the pool of available therapists. It has also been observed that many distressed individuals do not receive therapy for their disorders.⁵⁻⁷ For example, more than one-half of individuals with major depression do not enter treatment.⁵⁻⁷ Several possible impediments to receiving treatment have been described, including insufficient financial resources, negative attitudes about psychiatric illnesses, and lack of access to therapy.⁸⁻¹⁰ If computer tools could be used to decrease the amount of therapist time required for successful treatment, more patients could be treated with available resources. Access to therapy could be influenced through 1) reduced cost of services, 2) provision of computerized therapy in settings outside the therapist's office (home, school, or work), and 3) provision of alternative therapies that might reach individuals who do not seek treatment through ordinary channels. It has been noted that some patients may find it more acceptable to work with a computer (or a computer-assisted treatment program that combines computerized therapy with visits to a clinician) than engage in traditional clinician-administered interventions.^{1,11,12}

The rationale for computer-assisted therapy also draws on the unique features of computers that could prove to be advantageous in treating psychiatric disorders. Potential strengths of computer-assisted therapy programs are listed in Table 1. One possible asset of computer programs may be an ability to engage patients in the treatment process. The predictions of traditional therapists that patients will refuse computer-assisted treatment or have a negative response to being referred to a "machine" have not been borne out by actual experiences. Patients typically enjoy working on computers and report that the experience is beneficial.^{1-4,11-15} Newer programs have used features such as multimedia, virtual reality, interactive voice response, and

portable palmtop computers to create stimulating and engaging therapeutic experiences.¹⁵⁻²⁰

Although some of the early investigations of computerized therapy focused on programs designed to substitute for clinician-administered treatment, most contemporary research has been directed at finding ways in which computers can assist therapists or enhance the therapy process.^{15-18,20} Instead of pitting machine against human therapist, these investigators have suggested that clinicians can learn to incorporate computer tools into their practices to improve the overall therapy experience.

The capacity of computer programs to provide psychoeducation is an attribute that may be especially useful to therapists.^{3,4} Computer-assisted instruction (CAI) has a number of positive features, including the ability to present concepts in a highly refined way. Generally, developers of CAI expend considerable effort in designing programs that convey core material in an easy-to-comprehend and memorable format.^{3,4} Therapeutic computer programs that employ CAI have been used successfully for treatment of depression,^{21,22} phobias,^{23,24} and sexual dysfunction.^{25,26} Nadelson³ has observed that CAI can allow for the extension of the therapist's efforts by reducing the burden to perform repetitive procedures. Computer-assisted therapy software, such as the multimedia program

TABLE 1. Potential strengths of computer tools for psychotherapy

Computer tools could:

- Reduce cost of treatment
 - Improve access to psychotherapy
 - Promote engagement in the therapy process
 - Provide psychoeducation
 - Give systematic feedback to the user
 - Promote self-monitoring
 - Rehearse coping skills
 - Encourage self-help
 - Store, analyze, and display data
 - Provide built-in outcome measures
 - Function reliably without fatigue
-

developed by Wright and co-workers¹⁵⁻¹⁷ and the palmtop computer system used by Newman et al.,²⁰ frequently contains psychoeducational modules that are designed to reduce the time that the clinician spends on patient instruction. Thus, the therapist can be freed up for more creative aspects of therapy.

Other strengths of computer programs include their ability to give extensive feedback to the user, promote self-monitoring, stimulate practice of coping skills, and encourage the use of homework and other self-help procedures. These aspects of treatment are central features of cognitive and behavioral therapies.²⁷ It is not surprising that the majority of the computer programs for psychotherapy are based on cognitive and/or behavioral treatment principles (as described in Tables 2 and 3). Typically, computer-assisted therapy provides supportive and instructive feedback in areas such as the appropriateness of treatment goals, the pace of treatment interventions, or the user's grasp of treatment principles. Most programs help patients monitor their symptoms and measure changes in level of distress. Homework assignments are usually employed to extend therapy beyond the patient's time with the computer program.^{15-17,19-24}

One of the distinct advantages of computerized therapy is the capacity to store, analyze, and display data. Clinicians record notes on charts and attempt to remember the details of previous therapy sessions, but their ability to recall information may be influenced by a variety of factors such as the interval between sessions, interference from other tasks and concerns, and fatigue. Computers can be counted on to reliably record and process information. Contemporary computer programs for psychotherapy usually contain built-in outcome measurement systems that can be used for clinical monitoring or research.^{15-17,19,20}

Unlike human therapists, computers can perform the functions listed above for long periods of time without rest, food, or recreation. However, computers have obvious limitations compared with human clinicians. Computers cannot feel or express empathy or

form traditional therapeutic relationships. Computer programs designed to conduct therapeutic dialogue may misinterpret the patient's communication.²⁸ No therapeutic computer program has been able to match, or is likely to duplicate, the "thoughtful, caring, accumulated wisdom of experienced psychotherapists."³ It has been observed that cognitive and behavioral therapies may be more suitable for computerization than methods such as dynamic therapy that rely more on the therapeutic relationship and abstract psychological concepts for change.¹

Computers, unlike human therapists, do not have inherent values or ethical standards. However, developers convey their values and ethics in writing software for computer programs. Under a set of ethical guidelines recommended by Sampson and Pyle,²⁹ computerized psychotherapy should provide for the following:

1. Confidentiality.
2. Determination of appropriateness of the specific form of therapy.
3. Adequate introduction to the computer program to reduce anxiety about using the system.
4. Follow-up consultation with a clinician if needed.
5. Up-to-date and accurate information.
6. Well-functioning hardware and software.
7. Supervision of the treatment process by a clinician.

There is a risk that programs that do not meet such standards may be overzealously marketed to patients or clinicians. However, the programs reviewed later in this article appear to have been authored by responsible investigators who were well aware of the importance of developing reputable software.

Another limitation in therapeutic computer programs is their inability to perform thorough psychiatric evaluations or to be as sensitive as trained therapists to changes in clinical conditions. Generally, computer-assisted therapy programs are geared to special

functions such as teaching and rehearsing cognitive therapy interventions or promoting exposure and response prevention. Thus, clinicians who prescribe therapeutic computer programs cannot assume that the computer will complete an accurate diagnosis or discern nuances in symptomatic change.

Despite these limitations, computer tools for psychotherapy have been found to be acceptable to patients and useful in clinical practice.^{1-4,11,30,31} Specific programs for computer-assisted therapy are reviewed below, with the goals of evaluating the current status of computerized psychotherapy and identifying methods most likely to lead to future developments in this area of research.

C O M P U T E R - A S S I S T E D
P S Y C H O T H E R A P Y :
1 9 6 6 - 1 9 9 7

Computer tools for psychotherapy introduced during the time period 1966–1997 are summarized in Table 2. The scope of this review is restricted to computer programs designed to conduct general therapeutic interviews or to be used in the treatment of Axis I disorders. A variety of other software has been developed for habit control, stress management, or self-improvement.³²⁻⁴⁴ Such programs have been reviewed elsewhere.^{11,30,31}

Probably the best-known computer program among clinicians is “Eliza,” a general

TABLE 2. Computer tools for psychotherapy: 1966–1997

Application	Authors	Features
General therapeutic interview	Weizenbaum 1966 ⁴⁵	“Eliza”: uses natural language to simulate therapeutic dialogue
General therapeutic interview	Wagman 1980 ⁴⁹	“Dilemma Counseling System”: teaches problem-solving techniques
Cognitive therapy of depression	Selmi et al. 1982,1990 ^{21,22}	Multiple-choice questions, case vignettes, symptom monitoring, homework
Phobias	Ghosh et al. 1984 ²³	Multiple-choice questions, self-directed exposure, homework
Phobias	Chandler et al. 1986 ⁵⁴	Psychoeducation, systematic desensitization
General therapeutic program	Colby et al. 1989 ²	“Therapeutic Learning Program”: computer plus group therapy, multiple-choice questions, identification of dilemmas and action steps, homework
General therapeutic interview	Slack et al. 1990 ⁵⁰	“Computer-assisted Soliloquy”: uses natural language
Depression	Colby and Colby 1990 ⁵¹	“Overcoming Depression”: psychoeducation, dialogue mode, uses natural language
Cognitive therapy	Wright et al. 1995 ¹⁵	“Cognitive Therapy: A Multimedia Learning Program”: interactive video, multiple-choice questions, homework in manual, feedback to clinician
Phobia	Rothbaum et al. 1995 ¹⁸	Therapist-guided virtual reality exposure for height phobia
Obsessive-compulsive disorder	Greist et al. 1996 ¹⁹	“BT Steps”: interactive voice response with touch-tone telephones, exposure and response prevention, homework in manual
Panic disorder	Newman et al. 1997 ²⁰	Palmtop computers as adjunct to cognitive-behavioral therapy, psychoeducation, self-monitoring, positive reinforcement

therapeutic interview developed by Weizenbaum⁴⁵ more than 30 years ago. In our experience, clinicians often have a distorted view of computer-assisted therapy because they view the Eliza program, with all of its problems and limitations, as confirming the folly of using computers in psychotherapy. Actually, Weizenbaum did not intend this program to be used in clinical practice and made it clear that he believed that his form of human dialogue with a computer should not be construed as psychotherapy.^{46,47} Eliza was designed as a pilot project for the use of "natural language" in communicating with a computer.⁴⁵ A nondirective, Rogerian interview style was adopted. Although at times the interview proceeded fairly well, multiple errors in understanding were usually encountered.⁴⁸

Other attempts have been made to simulate therapeutic dialogue,⁴⁹⁻⁵¹ but it has been concluded that the least likely place for computers to be of benefit in psychiatric treatment is in attempting to replicate the conversations between therapist and patient.¹¹ Only one currently available computer program uses a natural language component. Colby and Colby⁵¹ have included a dialogue mode in their program "Overcoming Depression." A recent report by Stuart and LaRue²⁸ highlighted the challenges of trying to have a computer act as a traditional psychotherapist. They gave several examples of how the dialogue mode of the Colby and Colby program failed to understand the meaning of the patient's communication, such as the following:

COMPUTER: How do you steer clear of depression?

MR. H: I don't believe you can steer completely clear of depression.

COMPUTER: I do not intentionally avoid your topics.

MR. H: I shall go back to my topic of health, then.

COMPUTER: Do you take care of your body by exercising?

MR. H: I do some, yes.

COMPUTER: Are you angry that I suggest you might have some reasons to nourish depression?

MR. H: I'm not angry.

COMPUTER: Thank you for your thoughts on this. We must leave the dialogue mode for now.²⁸

Colby⁵² has emphasized that the dialogue mode in his program is only meant for enhancing "free expression" and cannot carry out the usual functions of a clinician-conducted therapeutic interview. He also has given excellent examples of dialogue in which the computer appears to grasp the meaning of the patient's communication and give helpful feedback.⁵² Nevertheless, it is apparent that developers have not yet been able to construct programs that reliably conduct natural language interviews.²⁸

If computer programs cannot effectively conduct the typical form of interview used in the process of psychotherapy, then what other psychotherapeutic applications might be considered? Most developers of therapeutic software have chosen to emphasize the strengths and unique attributes of computers instead of using a natural language paradigm. For example, Selmi et al.^{21,22} designed a computer program for cognitive therapy of depression that makes use of multiple-choice questions, case vignettes, and self-monitoring to teach patients how to use cognitive therapy principles to reduce symptoms. This program is heavily psychoeducational. Homework is assigned, and the importance of self-help is reinforced throughout. Selmi and colleagues' program is now somewhat outdated because of its user interface and a complete reliance on written text to communicate with the patient. However, the software produced by Selmi et al. was a breakthrough development in computer-assisted therapy. They capitalized on the ability of a computer to reliably present psychoeducational material, provide regular and consistent feedback, allow users to work at their own pace, and record patient responses.

Selmi et al.²² also reported evidence for the efficacy of computerized cognitive therapy for depression (see Table 3). Patients who met the Schedule for Affective Disorders and Schizophrenia criteria for depression (mean Beck Depression Inventory score of 27) were randomly assigned to computerized cognitive therapy, clinician-administered cognitive therapy, or a waiting-list control group. Both active

TABLE 3. Computer-assisted psychotherapy outcome research

Study	Application	Computer Program	Design	Outcome
Goush et al. 1984 ²³	Phobia	CI, self-directed exposure	<i>N</i> = 88; B, CI, TI	All treatments effective; B = CI = TI; gains maintained at FU
Carr et al. 1988 ²⁴	Phobia	CI, self-directed exposure	<i>N</i> = 40; CI, BT	Both treatments effective; CI = B; gains maintained at FU
Selmi et al. 1990 ²²	Depression	Computerized cognitive therapy, multiple-choice questions	<i>N</i> = 36; CCBT, CBT, WL	Both treatments effective; CCBT = CBT > WL
Bowers et al. 1993 ⁵⁷	Depression	"Overcoming Depression": psychoeducation, therapeutic dialogue	<i>N</i> = 22; inpatients; CP + TAU, CBT + TAU, TAU	CBT + TAU > CP + TAU = TAU
Rothbaum et al. 1995 ¹⁸	Height phobia	Virtual reality exposure with therapist guidance	<i>N</i> = 17; VRE, WL	VRE > WL
Greist et al. 1996 ¹⁹	OCD	Interactive voice system via telephone; exposure and response prevention	<i>N</i> = 40; no controls	Significant improvement in OCD symptoms and depression; high levels of acceptance
Newman et al. 1997 ²⁰	Panic disorder	Palmtop computers; self-monitoring and reinforcement	<i>N</i> = 20; computer-assisted CBT (4 sessions; CBT-4), CBT (12 sessions; CBT-12)	Both treatments effective; CBT-4 < CBT-12 on some measures at posttest; CBT-4 = CBT-12 at FU

◆ Note: B = bibliotherapy; BT = behavior therapy; CBT = cognitive-behavioral therapy; CCBT = computerized CBT; CI = computerized instruction; CP = computer program; FU = follow-up; OCD = obsessive-compulsive disorder; TAU = treatment as usual; TI = therapist instruction; VRE = virtual reality; WL = waiting list.

treatments were found to be equally effective and were shown to be superior to the waiting-list control. No adverse effects of using a computer for therapy were reported. The Selmi et al.^{21,22} program was designed to function autonomously. Details on the role of a clinician in computerized therapy were not given, but apparently subjects in this trial were able to be treated successfully by a computer without spending significant time with a therapist.

During the 1980s, several other computer programs were developed that use text and multiple-choice questions to help patients learn to manage psychiatric symptoms. Ghosh et al.²³ described software that is targeted toward treatment of phobias. This program is based on the book *Living With Fear*.⁵³ The computer program elicits the patient's problems and goals for treatment, explains treatment strategies, assesses symptoms with a fear ques-

tionnaire, gives information on coping strategies, presents case histories, gives instruction on self-directed exposure, assigns homework, and provides feedback and encouragement. The effectiveness of this program was studied by randomly assigning a sample of 88 phobic patients to computerized instruction, bibliotherapy, or clinician instruction (Table 2).²³ All three groups improved substantially, and no significant differences were found among the three treatment approaches. The positive results were maintained 6 months after completion of treatment.

The same research group described a similar computerized treatment program for phobias that is conducted in two stages: 1) an assessment "interview" (their quotation marks), and 2) approximately 8 weekly sessions that perform the same functions as their original software.²⁴ The later program "negotiates" an

assignment with the patient of two tasks to be carried out on a daily basis. In the "negotiation," the computer program assesses the level of difficulty of a task and then proposes a suitable assignment drawn from a list of 12 graded versions of the task. Carr et al.²⁴ compared the results of this form of computerized therapy for phobia (20 subjects) with a group of patients ($n = 20$) treated by conventional behavior therapy in the same clinic during the preceding year. Both groups had significant improvement on all rating scales. In each group, 75% to 85% were rated as much improved at the end of treatment.

A different form of computer-assisted therapy for phobia, developed by Chandler et al.,⁵⁴ uses a package of computerized desensitization, audiotapes, and clinician involvement. The computer is used to provide general instruction on treatment methods and to present desensitization hierarchy items. A clinician enters the hierarchy into the computer and is available to provide assistance throughout the computerized treatment program. Audiotapes are used to promote relaxation. There have been case reports of the successful treatment of phobias with this software,^{54,55} but no further research has been published on this method of combining computer-assisted therapy with audiotapes for behavioral treatment.

The most widely used system for computer-assisted therapy to date was developed by Colby and co-workers.^{2,56} Their method, the Therapeutic Learning Program (TLP), involves five 2-hour or ten 1-hour sessions in which patients meet in groups with a therapist and also interact with a computer. Although natural language input is accepted, there is no "conversational dialogue with the computer in everyday language."² Each of the eight steps in the program is introduced by the human therapist. After interaction with the computer, the patient meets with the therapist again to discuss reactions to the computerized therapy module. TLP is directed at identifying problematic interpersonal situations and then coaching the patient on using proactive behavior to manage these problems. The program

also helps users to identify dysfunctional patterns of thinking and to recover "inhibited functions."²

Colby et al.² have described the use of their program in more than 2,000 individuals. In recent years, TLP has been used extensively for Employee Assistance Programs in major industries. However, no outcome research has been reported on the effectiveness of this software. Patient acceptance of TLP was studied in a sample of 278 users (diagnosis and level of symptoms unspecified) in a large health management organization (CIGNA).² Ninety-six percent of the patients reported that they were satisfied with TLP, and 79% reported a high level of satisfaction. Seventy-eight percent of the sample noted that their level of distress dropped greatly after they used the computer program.²

One of the developers of TLP, Kenneth Colby, has produced a computer program that apparently can be used as a "stand-alone" treatment for depression.^{51,52} This program, "Overcoming Depression,"⁵¹ is available in a "home-user" version and a "professional" version that "can serve as a therapeutic adjunct for the mental health professional."⁵² Two types of interaction are included in the program: 1) written text that gives general information about depression and conveys some of the basics of cognitive therapy and 2) a dialogue mode based on natural language. The text material provides "facts, concepts, and explanations about depression, along with cognitive strategies for alleviating the disorder and preventing its recurrence."⁵²

Colby⁵² has noted high satisfaction scores (96%) in patients who have used "Overcoming Depression," but there has been limited research on this method of computer-assisted therapy. Bowers et al.⁵⁷ investigated the usefulness of "Overcoming Depression" in a small sample ($N = 22$) of depressed inpatients. Subjects were randomly assigned to treatment with clinician-administered cognitive therapy (CBT), computer-assisted CBT (CCBT), or treatment as usual (TAU). All patients received antidepressant medication. At discharge from

the hospital, subjects who were treated with CBT were significantly less depressed than those who received CCBT or TAU, and CCBT was not superior to TAU. In a later report on results of this study, Stuart and LaRue²⁸ observed that the Colby and Colby program has significant limitations in the treatment of severely depressed inpatients. The natural language component of "Overcoming Depression" frequently misinterpreted the comments of patients. Lowered energy and physical problems also interfered with use of a program that requires the patient to read large amounts of text, type responses, and understand computerized feedback that can be ambiguous or confusing.

The most recent computer programs for psychotherapy have incorporated new technologies geared toward heightening the power of the learning experience and improving ease of use. For example, Wright and co-workers¹⁵⁻¹⁷ have designed and tested the first multimedia program for computer-assisted therapy. "Cognitive Therapy: A Multimedia Learning Program"¹⁵⁻¹⁷ (CTMP) has six modules that present the basic methods of cognitive therapy, including identifying and modifying automatic thoughts, using behavioral interventions such as activity scheduling and graded task assignments, and altering underlying schemas (beliefs or attitudes). An interactive video format is used to realistically illustrate the use of cognitive therapy in managing commonly encountered problems. Patients use a mouse to select topics, answer multiple-choice questions, complete checklists, and perform self-ratings of symptom levels. Because no typing is required and text material is written at the ninth-grade level, the program can be used by a wide range of individuals.¹⁵

CTMP was designed to be used under the supervision of a clinician as a component of treatment for depression and anxiety. The computer program records and analyzes patient responses to provide feedback to both patient and clinician. Homework is assigned for completion in a companion workbook between computer sessions, and a progress

report is generated for the clinician. The progress report contains information on subjective responses to the program, self-report of depression and anxiety, and comprehension of lesson material. A preliminary report of ongoing research on CTMP indicated excellent patient acceptance of this program.⁵⁸ On questions that measured satisfaction with using the computer program, the first 40 completers in a trial of CTMP plus TAU had mean scores of 4.38 to 4.59 (measured on 1-5 point scale; 5 = most favorable rating). Because this initial investigation was uncontrolled, no conclusions on treatment effectiveness could be reached. Additional research on CTMP is under way.

Rothbaum et al.¹⁸ have developed an innovative method for computerized behavior therapy that uses virtual reality technology for graded exposure to feared stimuli. A clinician guides the patient in using a virtual reality computer program to experience a hierarchy of increasing heights (such as ascending an elevator). In a study of 17 subjects with height phobia, the virtual reality program was found to be superior to a waiting-list control group.¹⁸ Patients appeared to accept exposure with virtual reality, and no adverse effects were reported.

Another recent program, "BT Steps," uses a computer-controlled interactive voice response system (via touch-tone telephone) to assist patients with exposure and response prevention for obsessive-compulsive disorder (OCD).¹⁹ Patients use the touch-tone system to develop assignments for self-directed exposure and response prevention and to report results of homework. They also read material and complete exercises in an accompanying workbook. A preliminary open study of 40 subjects found that use of "BT Steps" was associated with significant reduction in scores on the Yale-Brown Obsessive-Compulsive Scale and improved functioning in work and social situations.¹⁹ When patients were asked about their reactions to the interactive voice response system, a greater percentage stated that they would prefer to receive the computerized therapy (46%) than personal interviews with a

therapist (33%). Seventy-one percent of the sample noted that "BT Steps" improved the quality of their lives.¹⁹

Evidence for effectiveness of computer-assisted therapy has also been reported by Newman et al.,²⁰ who used palmtop computers for augmentation of CBT for panic disorder. Their method for computer-assisted therapy of panic disorder involves a shortened protocol of therapy with the human therapist (4 sessions) plus use of a palmtop computer with two modes: diary and treatment. The diary mode beeps patients daily and asks them to report levels of anxiety and number of panic attacks in the previous 24 hours. The therapy mode includes 1) a series of self-statements and suggestions to help patients remain in anxiety-provoking situations, 2) breathing retraining instructions, and 3) a post-panic intervention that presents self-reinforcing information.

Twenty patients with panic disorder were randomly assigned to receive 4 sessions with a clinician plus the full palmtop computer program (CBT-4) or 12 sessions with a clinician plus only the diary mode from the palmtop computer (CBT-12). The CBT-12 also included weekly assignments in a workbook (Barlow and Craske⁵⁹). CBT-4 subjects were assigned readings in a "very brief workbook."²⁰ At the end of treatment, statistically significant improvements in all major panic symptoms were observed for both forms of therapy. No between-treatment differences were detected in the primary data analysis. However, an additional test of clinical significance, based on the number of patients who were panic free, favored CBT-12 at the posttreatment evaluation. These differences disappeared by the time of a follow-up examination when both treatments were found to be equally effective on all measures.²⁰

FUTURE PROSPECTS FOR COMPUTER-ASSISTED PSYCHOTHERAPY

Research on computer-assisted therapy indicates that computers are usually well tolerated

as treatment tools and that patients report high levels of satisfaction when computers are used in the treatment process. Outcome studies have generally found that computer-assisted therapy can be an effective method of treatment. However, many questions still remain. For example, how much clinician involvement is required? Are there indications for "stand-alone" programs in psychiatric treatment? What techniques do therapists need to learn to effectively integrate computer tools into clinical practice? What types of computer programs are most useful for specific disorders? What are the limitations of computer technology in psychotherapeutic practice? Are there patient variables (such as age, gender, educational level, personality type, or locus of control) that predict better adherence or outcome in computer-assisted therapy?

To date, only a modest number of empirical studies have been completed on computer-assisted therapy. Sample sizes usually have been small, and significant design flaws, such as lack of random assignment to a control group, have been present in some investigations. Clearly, much additional research will be required to answer questions such as the ones posed above and to carefully investigate the effectiveness of computer tools for psychotherapy. Nevertheless, there are several reasons to expect that the use of computer-assisted therapy will grow in the future. These include 1) changes in the economics of health care delivery, 2) technological advances in computer hardware and software, and 3) increased use of computers in society.

Reduced costs and improved access have been goals of computer-assisted therapy from the outset of research on specific computerized interventions for psychiatric disorders.^{1,2,20,23,24,52} Generally, programs have been written to reduce the reliance on the therapist for symptom change. For example, the form of computer-assisted therapy for panic disorder designed by Newman et al.²⁰ cuts the number of sessions with the clinician to 25% of the number used in traditional clinician-administered treatment for panic disorder. If

such programs are found to be effective, they could offer distinct advantages to health plans interested in delivering quality care at reduced cost. It will be important for clinicians to closely monitor this process to ensure that computer tools are used appropriately in managed care settings. In our opinion, high standards for the quality of care delivered to patients with mental disorders should be maintained in any treatment program that uses computer-assisted therapy.

The rapid proliferation of managed care in the United States is likely to place increased pressure on providers to increase the efficiency of treatment. In some situations, such as "carve-out" capitated mental health plans, the incentives may be primarily in the area of providing effective care at the lowest possible cost. However, in health maintenance organizations (HMOs), where the total health of the patient population is valued, there may be a need to increase access to certain forms of therapy in order to better control overall health care expenditures. In both types of managed care environments, computer-assisted therapy could provide methods for effectively treating more patients with fewer resources. Thus, we think that a continued evolution of managed care initiatives will promote development of a broad range of computer-assisted therapies.

Much of the computer-assisted therapy research reviewed here was completed prior to the introduction of high-speed personal computers, multimedia, and specialized software for authoring computer programs. Text-based software that requires the patient to read large amounts of material and to type responses was produced in the 1980s, but the most recent programs have used technological advances such as multimedia,¹⁵⁻¹⁷ virtual reality,¹⁸ interactive voice response,¹⁹ or miniaturization (for example, palmtop computers).²⁰ Further dramatic improvements in computer hardware and software have been predicted.⁶⁰

The pace of technological change is so rapid that it is difficult to envision the specific forms that computer-assisted therapy will take in the future. One possible area of change is

the interface between human and machine. Voice recognition systems are beginning to be used and are likely to become much more reliable translators of human speech. Increased use of cable, fiber optics, and satellites should also make communication between computers much easier. Thus, developers of computer-assisted therapy may design programs that can be run over a network and linked to electronic medical records. With this type of system, a clinician could prescribe a variety of computer-assisted therapy assignments and monitor progress of individuals or groups of patients at multiple sites. HMOs or other clinics could track outcomes for computer-assisted treatment at diverse locations. Of course, as with any other medical record, confidentiality would need to be maintained.

The Internet has potential for computer-assisted self-help, but concerns about confidentiality currently prevent the use of full programs for computerized therapy on this medium. Most forms of therapeutic computer programs involve the input of personal information and measurement of treatment progress. Thus, they are best suited for use in a clinical setting under the supervision of a health care professional. Software that has an educational or self-help focus could possibly be accessed through public channels such as the Internet or interactive television. Such programs would probably take the form of an electronic self-help book instead of comprehensive computer-assisted treatment. However, eventually it may be feasible for clinicians to direct the use of computer tools, delivered via the Internet or interactive television, as components of an overall treatment plan.

Currently available technology is just beginning to be tapped by developers of computer tools for psychotherapy. For example, only one multimedia program for psychotherapy has been released.¹⁵ Software for multimedia authoring is becoming much more sophisticated and easy to use. The recent introduction of DVD (digital versatile disc) is likely to enhance production of multimedia programs that contain large amounts of high-

quality video. Many computer users now expect stimulating learning experiences that include video, animation, and audio. We believe these trends suggest that multimedia programs will become a more common form of computer-assisted therapy.

Rothbaum et al.¹⁸ have pioneered the use of virtual reality in exposure therapy. This technology appears to be ideally suited to exposure-based treatments for phobias and other anxiety disorders. At present, virtual reality programs require specialized equipment that is not readily available. However, if virtual reality hardware and software become less costly and can be used in routine clinical settings, then programs such as the one designed by Rothbaum et al.¹⁸ could become an important part of the treatment of anxiety disorders.

The production of computer-assisted therapy programs has moved away from earlier attempts to conduct therapeutic interviews with natural language. It is possible that future developers may be able to take advantage of substantial increases in computing power and programming complexity to construct systems that can carry on a realistic and helpful dialogue with patients. However, we think that for the near future the most productive approach will be to use technological advances to develop effective tools that assist therapists or carry on special functions (such as psychoeducation, exposure therapy, or coping skill rehearsal) in the process of psychotherapy. Multimedia, DVD, miniature computers, and the expected further evolution of computer technology are likely to fuel a proliferation of therapeutic software. Thus, the therapist of the future may have an extensive "toolbox" of computer programs that can be prescribed for a broad variety of uses.

The final reason to expect a growth of the use of computer-assisted therapy is the increased use of personal computers in homes, schools, and workplaces. Thirty-nine percent of U.S. households owned a computer in 1995.⁶¹ About 15 million households in the United States had access to the Internet in 1996, and this number is expected to rise

substantially over the next few years.⁶² Michael Dertouzos, Director of the MIT Laboratory for Computer Science, has noted that computers are already transforming health care and has predicted an explosive increase of computer applications in medicine.⁶⁰ When computer-assisted therapy was first conceptualized, there were very few persons who used a computer. Now, for many individuals, computers are a part of everyday life. It seems likely that this important and useful part of our contemporary lifestyle will become a significant presence in treatment of mental disorders.

Although a confluence of economic, technological, and societal forces appears to indicate that computer-assisted therapy should become a more important part of clinical practice, there are several barriers to further development and use of therapeutic software. Clinician resistance has been identified as one of the major reasons that a rapid proliferation of computer-assisted therapy has not yet occurred.¹⁻³ Despite the reassurances of developers that computers will never be able to replace human therapists, it is not surprising that clinicians may be wary of a treatment method that they may view as a potential competitor.¹⁻³ Clinicians also may doubt the abilities of computers to provide valuable psychotherapeutic experiences, may be concerned that patients would have negative reactions to computers, or may question the validity of outcome research.

Relatively few clinicians have received training, or have gained any experience, in using computer tools for treatment. Also, most clinicians probably are not fully aware of the research that has been conducted on computer-assisted therapy. We think that the development of new programs, the completion of additional research, pressure to reduce the cost of treatment, and the increased use of computers in health care will influence a greater number of therapists to consider the potential benefits of incorporating therapeutic computer programs into their practices.

Another barrier to growth of computer-assisted therapy is the difficulty in producing high-quality software. Locke and Rezza⁴ have

observed that development of courseware requires both pedagogic and artistic skills and that few educators can produce well-crafted computer programs. Clinicians who may have considerable expertise in a psychotherapeutic approach may not be properly equipped to manage a project that involves authoring software, writing naturalistic dialogue, filming video sequences, and designing data collection and performance-tracking functions. The development of programs for computer-assisted therapy also requires substantial financial backing and extensive time commitments from the authors.

Currently, computer-assisted therapy is not covered as a benefit in health care plans. Lack of payment for this form of treatment could be an impediment to the use of computer tools, especially in a fee-for-service reimbursement environment. Some clinics have been successful in charging patients directly for use of therapeutic software or have been able to use computer-assisted therapy to reduce costs in "case rate" arrangements with insurers. Health care providers that have financial incentives for lowering expenses (such as hospitals that are attempting to reduce the length of stay, fully capitated mental health systems, or HMOs) could include computer-assisted therapy in an overall budget designed to reduce expenditures.

The traditional practice of psychotherapy is based on an empathic therapeutic relationship, open expression of thought and feeling, and conversational dialogue. It is highly unlikely that computers will be able to replicate these human functions anytime in the near future. However, computers have unique features that could be used to positively influence the evolution of psychotherapy. We think the most productive approach for the future will be for investigators to focus on developing innovative models that effectively combine the strengths of human therapists and computers. Integrative methods, in which clinicians use computer tools to enhance the treatment process, could become a major influence on the practice of psychotherapy.

S U M M A R Y A N D
C O N C L U S I O N

Computer programs have been produced for a wide variety of purposes, including general therapeutic interviews, cognitive therapy, adjuncts to group therapy, and treatment of specific conditions such as phobias, panic disorder, depression, and OCD. Despite predictions of clinicians that computer programs would be dehumanizing or be negatively perceived by patients, research has indicated that users of therapeutic software report very high levels of satisfaction. Outcome studies, with the exception of a single investigation of a natural language program for severely depressed inpatients, have found evidence for effectiveness of computer-assisted therapy. Research in this area has had significant limitations, including small sample sizes and, in some cases, lack of suitable control groups. However, preliminary research suggests that computer-assisted therapy may have considerable promise.

Attempts to program computers to conduct therapeutic interviews in everyday "natural language" have been largely unsuccessful. Developers of these programs have shown considerable creativity and ingenuity, but they have not been able to reliably replicate the dialogue between human clinicians and patients. Early programs for computer-assisted therapy required the patient to read large amounts of text and to use a keyboard to type responses. More recent programs have improved the user interface and have incorporated advances in computer technology such as multimedia or interactive voice response. Such programs do not attempt to duplicate the types of therapeutic interviews used in clinician-administered therapy. Instead, the unique attributes of computers are used to perform functions such as engaging the patient, promoting learning, providing exposure and response prevention, practicing cognitive and behavioral interventions, and recording and displaying data.

Computer tools are not used widely in the current practice of psychotherapy. However, increased financial pressures to improve the

efficiency of treatment, further advances in technology, and an increased use of computers in the general culture could fuel the growth of computer-assisted therapy. In the future, it is possible that clinicians will have a therapy "toolbox" that will include a number of different forms of therapeutic software that can be selected to meet the individual needs of patients.

Challenges for computer-assisted therapy include: 1) production of high quality programs that are easy to use and have demonstrated effectiveness, 2) incorporation of emerging technologies, 3) determination of variables that may affect usefulness of specific programs in different patient groups, and 4) development of integrative models in which therapists use computer technology as part on an overall care plan. If these challenges are

met, computer-assisted therapy may become a significant influence in the treatment of mental disorders.

Mary Beth Zickel and Jeffery Kuykendall assisted with the research program and manuscript preparation. Paul Salmon, Ph.D., Aaron T. Beck, M.D., Anne Marie Albano, Ph.D., Monica R. Basco, Ph.D., A. John Rush, M.D., Michael E. Thase, M.D., and Allan Tasman, M.D., provided valuable consultation on the clinical use of therapeutic software. The authors thank these individuals and the staff members of the Norton Psychiatric Clinic who have given strong support to the development of computer-assisted psychotherapy. Research conducted by the authors on computer-assisted psychotherapy was supported by grants from the Alliant Community Trust and the Foundation for Cognitive Therapy and Research.

R E F E R E N C E S

- Greist JH: Computer-administered behavior therapies. *International Review of Psychiatry* 1989; 1:267-274
- Colby KM, Gould RL, Aronson G: Some pros and cons of computer-assisted psychotherapy. *J Nerv Ment Dis* 1989; 177:105-108
- Nadelson T: The inhuman computer/the too-human psychotherapist. *Am J Psychother* 1987; 41:489-498
- Locke SE, Rezza MEH: Computer-based education in mental health. *MD Comput* 1996; 13:10-45
- Weissman MM, Myers JK, Thompson WD: Depression and its treatment in a US urban community: 1975-1976. *Arch Gen Psychiatry* 1981; 38:417-421
- Shapiro S, Skinner EA, Kessler LG, et al: Utilization of health and mental health services. *Arch Gen Psychiatry* 1984; 41:971-978
- Regier DA, Narrow WE, Rae DS, et al: The de facto US mental and addictive disorders service system. *Arch Gen Psychiatry* 1993; 50:85-94
- Yokopenic PA, Clark VA, Aneshensel CS: Depression, problem recognition, and professional consultation. *J Nerv Ment Dis* 1983; 171(1):15-23
- Steff ME, Prosperi DC: Barriers to mental health service utilization. *Community Ment Health J* 1985; 21(3):167-178
- Kamerow DB: Anxiety and depression in the medical setting. *Med Clin North Am* 1988; 72:745-751
- Bloom BL: Computer-assisted psychological intervention: a review and commentary. *Clin Psychol Rev* 1992; 12:169-197
- Zarr ML: Computer-mediated psychotherapy: toward patient-selection guidelines. *Am J Psychother* 1984; 38:47-62
- Slack WV: A history of computerized medical interviews. *MD Comput* 1984; 1:52-68
- French CC, Beaumont JG: The reaction of psychiatric patients to computerized assessment. *Br J Clin Psychol* 1987; 26:267-278
- Wright JH, Salmon P, Wright AS, et al: *Cognitive Therapy: A Multimedia Learning Program*. Louisville, KY, Mindstreet, 1995
- Wright JH, Salmon P, Wright AS, et al: Cognitive therapy: a multimedia learning program. Presented at the American Psychiatric Association annual meeting, Miami Beach, FL, May 1995
- Wright JH, Wright AS: Performance tracking in computer-assisted cognitive therapy. Presented at the American Psychiatric Association annual meeting, New York, NY, May 1996
- Rothbaum BO, Hodges LF, Kooper R, et al: Effectiveness of computer-generated (virtual reality) graded exposure in the treatment of acrophobia. *Am J Psychiatry* 1995; 152:626-628
- Greist JH, Marks IM, Baer L, et al: Computer-assisted behavior therapy for OCD. Presented at the American Psychiatric Association annual meeting, New York, NY, May 1996
- Newman MG, Kenardy J, Herman S, et al: Comparison of palmtop-computer assisted brief cognitive-behavioral treatment to cognitive-behavioral treatment for panic disorder. *J Consult Clin Psychol* 1997; 65:178-183
- Selmi PM, Klein MH, Greist JH, et al: An investigation

- of computer-assisted cognitive-behavior therapy in the treatment of depression. *Behavior Research Methods and Instruments* 1982; 14:181-185
22. Selmi PM, Klein MH, Greist JH, et al: Computer-administered cognitive-behavioral therapy for depression. *Am J Psychiatry* 1990; 147:51-56
 23. Ghosh A, Marks IM, Carr AC: Controlled study of self-exposure treatment for phobias: preliminary communication. *J R Soc Med* 1984; 77:483-487
 24. Carr AC, Ghosh A, Marks IM: Computer-supervised exposure treatment for phobias. *Can J Psychiatry* 1988; 33:112-117
 25. Binik YM, Servan-Schreiber D, Freiwald S, et al: Intelligent computer-based assessment and psychotherapy: an expert system of sexual dysfunction. *J Nerv Ment Dis* 1988; 176:387-400
 26. Servan-Schreiber D, Binik YM: Extending the intelligent tutoring system paradigm: sex therapy as intelligent tutoring. *Computers in Human Behavior* 1989; 5:241-259
 27. Wright JH, Beck AT: *Cognitive therapy. The American Psychiatric Press Textbook of Psychiatry*, 3rd edition. Washington, DC, American Psychiatric Press (in press)
 28. Stuart S, LaRue S: Computerized cognitive therapy: the interface between man and machine. *Journal of Cognitive Psychotherapy* 1996; 10:181-191
 29. Sampson JP, Pyle KR: Ethical issues involved with the use of computer-assisted counseling, testing, and guidance systems. *Personnel and Guidance Journal* 1983; 61:283-287
 30. Burnett KF: Computers for assessment and intervention in psychiatry and psychology. *Current Opinion in Psychiatry* 1989; 2:780-786
 31. Kenardy J, Adams C: Computers in Cognitive-Behavior Therapy. *Australian Psychologist* 1993; 28:189-194
 32. Burnett KF, Taylor CB, Agras WS: Ambulatory computer-assisted therapy for obesity: a new frontier for behavior therapy. *J Consult Clin Psychol* 1985; 53:698-703
 33. Baer L, Surman OS: Microcomputer-assisted relaxation. *Percept Mot Skills* 1985; 61:499-502
 34. Burling TA, Marotta J, Gonzales R, et al: Computerized smoking cessation program for the worksite: treatment outcome and feasibility. *J Consult Clin Psychol* 1989; 5:619-622
 35. Binik YM, Westbury CF, Servan-Schreiber D: Case histories and shorter communications. *Behavioral Therapy* 1989; 27:303-306
 36. Prue DM, Riley AW, Orlandi MA, et al: Development of a computer-assisted smoking cessation program: a preliminary report. *Journal of Advancement in Medicine* 1990; 3:131-139
 37. Agras WS, Taylor CB, Feldman DE, et al: Developing computer-assisted therapy for the treatment of obesity. *Behavior Therapy* 1990; 21:99-109
 38. Taylor CB, Agras WS, Losch M, et al: Improving the effectiveness of computer-assisted weight loss. *Behavior Therapy* 1991; 22:229-236
 39. Jerome A, Frederiksen LW: DietMate: computerized self-management for weight control. *The Behavior Therapist* 1992; 10:256-258
 40. Burnett KF, Taylor CB, Agras WS: Ambulatory computer-assisted behavior therapy for obesity: an empirical model for examining behavioral correlates of treatment outcome. *Computers in Human Behavior* 1992; 8:239-248
 41. Jerome A, Perrone R, Kalfus G: Computer-assisted smoking treatment: a controlled evaluation and long-term follow-up. *Journal of Advancement in Medicine* 1992; 5:29-41
 42. Ochs EP, Meana M, Mah K, et al: Tools for clinical diagnosis and treatment. *Behavior Research Methods, Instruments, and Computers* 1993; 25:189-194
 43. Noell J, Biglan A, Hood D, et al: An interactive videodisc-based smoking cessation program: prototype development and pilot test. *Computers in Human Behavior* 1994; 10:347-358
 44. Burling TA, Seidner AL, Gaither DE: A Computer-directed program for smoking cessation treatment. *J Subst Abuse* 1994; 6:427-431
 45. Weizenbaum J: *Computational linguistics. Communications of the ACM* 1966; 9:36-45
 46. Weizenbaum J: *Computer Power and Human Reason*. San Francisco, CA, WH Freeman, 1976
 47. O'Dell JW, Dickson J: Eliza as a "therapeutic tool." *Computerized Psychotherapy* 1984; 40:942-945
 48. McGuire MT, Lorch S, Quarton GC: Man-machine natural language exchanges based on selected features of unrestricted input. *J Psychiatr Res* 1967; 5:179-191
 49. Wagman M: Plato DCS: an interactive computer system for personal counseling. *Journal of Counseling Psychology* 1980; 27:16-30
 50. Slack WV, Porter D, Balkin P, et al: Computer-assisted soliloquy as an approach to psychotherapy. *MD Comput* 1990; 7:37-42,58
 51. Colby KM, Colby PM: *Overcoming depression*. Malibu, CA, Malibu Artificial Intelligence Works, 1990
 52. Colby KM: A computer program using cognitive therapy to treat depressed patients. *Psychiatric Services* 1995; 46:1223-1225
 53. Marks IM: *Living With Fear*. New York, McGraw-Hill, 1978
 54. Chandler GM, Burck HD, Sampson JP: A generic computer program for systematic desensitization: description, construction, and case study. *J Behav Ther Exp Psychiatry* 1986; 17:171-174
 55. Chandler GM, Burck H, Sampson JP, et al: The effectiveness of a generic computer program for systemic desensitization. *Computers in Human Behavior* 1988; 4:339-346
 56. Colby KM, Gould RL, Aronson G, et al: A model of common-sense reasoning underlying intentional non-action in stressful interpersonal situations and its application in the technology of computer-based psychotherapy. *Journal of Intelligent Systems* 1991; 3:259-272
 57. Bowers W, Stuart S, MacFarlane R, et al: Use of computer-administered cognitive-behavior therapy with depressed inpatients. *Depression* 1993; 1:294-299

58. Wright JH, Salmon P, Wright AS et al: Cognitive therapy: a multimedia learning program. Presented at the Association for the Advancement of Behavioral Therapy 30th annual meeting, New York, NY, November 1996
59. Barlow DH, Craske MG: *Mastery of Your Anxiety and Panic*. Albany, NY, Graywind, 1989
60. Dertouzos ML: *What Will Be: How the New World of Information Will Change Our Lives*. New York, Harper Edge, 1997
61. Von Hoffman N: 1995—The year the computer came home. *Architectural Digest* vol 53, Feb 1996, pp 82–85
62. Sandberg J: U.S. households with Internet access doubled to 14.7 million in the past year. *The Wall Street Journal*, Oct 21, 1996, p 8