This is the first report of a palmtop computer program developed to increase the efficiency and cost-effectiveness of cognitive behavioral therapy for generalized anxiety disorder (GAD). The computer program offers advantages to researchers, therapists, and clients. These advantages include continuous, unobtrusive collection of process data on treatment adherence as well as on the impact of cognitive behavioral therapy techniques in the client’s natural setting. In addition, the computer extends treatment beyond the therapy hour and motivates clients to comply with homework assignments by prompting practice of cognitive behavioral strategies. The successful application of the palmtop computer program reported in this integrated series suggests a new line of research directed toward increasing the cost-effectiveness of what is currently the gold-standard treatment for GAD.

A Palmtop Computer Program for the Treatment of Generalized Anxiety Disorder

MICHELLE G. NEWMAN
Pennsylvania State University
ANDRÉS J. CONSOLI
C. BARR TAYLOR
Stanford University

In recent years, several researchers have developed a number of computer therapy programs for the treatment of anxiety disorders...

AUTHORS’ NOTE: We would like to thank Dr. Thomas D. Borkovec for his generosity in providing us with his therapist manual and handouts as well as for his feedback on our computer therapy manual and computer program. In addition, we would like to thank Steve Herman for his assistance in the development of the computer program and Louis G. Castonguay, Ph.D., for his editorial feedback. Moreover, we would like to thank Debby Rovine, M.A., Stephen Colbert, Michelle Spomer, M.A., and Jennifer Cullen who served as research assistants for this study. This project could not have been carried out without each of their help. Correspondence concerning this article should be addressed to Michelle G. Newman, Department of Psychology, Penn. State University, 310 Moore Bldg., University Park, PA 16802-3103; e-mail: mgn1@psu.edu. Preparation of this manuscript was supported in part by the National Institute of Mental Health Research Grant MH-39172.
with encouraging results (e.g., Baer, Minichiello, Jenike, & Holland, 1988; Baer & Surman, 1985; Carr, Ghosh, & Marks, 1988; Newman, Kenardy, Herman, & Taylor, 1996, 1997). Initial research focused on the use of desktop computer programs that clients used in a therapist’s office (e.g., Biglan, Villwock, & Wick, 1979; Buglione, DeVito, & Mulloy, 1990; Carr et al., 1988; Chandler, Burck, & Sampson, 1986; Chandler, Burck, Sampson, & Wray, 1988; Ghosh, Marks, & Carr, 1988; Wilson, Omeltschenko, & Yager, 1991), whereas more recent research has begun to employ the developing technology of the highly portable palmtop computer (e.g., Baer, Minichiello, & Jenike, 1987; Baer et al., 1988; Newman et al., 1996, 1997). Despite promising results, this research is quite preliminary and the specific applications of palmtop computer technology are still being explored. Nonetheless, these applications have the potential to make psychological treatment more efficient, cost-effective, and in the long run, more available to people seeking treatment for anxiety disorders and other psychological problems.

Palmtop computers can increase the reliability and validity of self-monitoring. The computer is used in the environment the person typically inhabits so external validity of assessment is built in. In addition, palmtops avoid retrospective recall biases because they can assess phenomena the moment they occur. Palmtops also allow for repeated assessments of the relevant behaviors and large numbers of assessments produce more reliable samples. Moreover, specific responses can be chosen from a menu, and the computer permits branching of questions dependent on the user’s response, so inapplicable items can be skipped. As a result, computer-administered assessment can be less time consuming to complete than a paper-and-pencil form and can be used to gather more information in greater depth than is possible in a questionnaire format. The computer also eliminates the need for data transcription or data entry as data can be directly downloaded to a desktop computer and immediately analyzed. This feature avoids errors and reduces data management time and costs.

Palmtop computer programs can also increase the efficiency of cognitive-behavioral therapy (CBT). Because the computer modifies its instructions based on clients’ responses and facilitates review of material as needed, clients can proceed at an individualized pace as
they are learning cognitive and behavioral techniques. Moreover, a palmtop is available whenever the person is anxious so it provides unlimited treatment occasions. These features reduce the likelihood of treatment failures due to insufficient therapist pacing and inadequate numbers of treatment occasions. The computer can also be used to monitor clients’ momentary response to intervention techniques such as cognitive restructuring, exposure, relaxation training, breathing retraining, or positive imagery. For example, Subjective Units of Distress (SUDs) ratings can be requested from clients before and after their use of each technique wherever they are. Such an assessment provides the therapist with more information about the effectiveness of various CBT components and of the process of change responsible for such effectiveness. Computer-assisted therapy (CAT) also offers the advantage of exact reproducibility of the therapy provided. Techniques from leading practitioners can be included in the program and the resultant expertise can be made widely available.

CAT efficiency may lead to increased cost-effectiveness of CBT. Lack of compliance to homework is one of the biggest barriers to the success of CBT, and the computer provides greater structure and motivation to comply with homework assignments by prompting practice of cognitive behavioral strategies the moment anxiety occurs. Moreover, by providing unlimited structured treatment opportunities in the absence of the therapist, CAT may reduce the amount of therapist contact time required (Newman et al., 1997). As it is providing treatment, it is also automatically saving a record of client interactions that can be used by the therapist to track client progress and to inform the therapy. Furthermore, by reducing the effort required to train clients in CBT techniques, CAT can free clinicians to spend extra time on more complex aspects of any one case. Although the cost of palmtop computers can range from $200 to $450 per unit, the computers can be reused by multiple clients, thereby reducing costs per use to approximately what a client might spend on a workbook or manual.

The majority of previous studies on computer treatment of anxiety disorders have used nonambulatory desktop computers and tested computer programs that applied only one behavioral technique. Individual techniques tested included relaxation (e.g., Baer & Surman, 1985; Buglione et al., 1990), systematic desensitization (e.g., Buglione
et al., 1990; Chandler et al., 1988), or self-exposure (e.g., Carr et al., 1988; Ghosh et al., 1988). Only two programs have been tested using an ambulatory computer (Baer et al., 1987; Baer et al., 1988; Newman et al., 1996, 1997) and only one of these programs applied more than one technique (Newman et al., 1996, 1997). The first program (Baer et al., 1988) prompted obsessive compulsive clients to adhere to response prevention exercises. This program was tested in two case studies that found that clients reduced compulsions when they were using the program but relapsed when they stopped using the program. The second program, developed for the treatment of panic disorder, trained clients in breathing retraining and cognitive therapy (Newman et al., 1996, 1997). This program was used in conjunction with four sessions of CBT and compared to 12 CBT sessions without the computer. Results of this study showed that the CAT was as successful as the 12-session individual therapy. Clients in both conditions began with an average of six panic attacks per week and finished with zero.

The integrated series described herein uses the first computer program to incorporate cognitive restructuring, exposure, breathing retraining, relaxation, pleasant imagery, and continuous self-monitoring in the same portable package. This is also the first computer program specifically designed for individuals diagnosed with generalized anxiety disorder (GAD). GAD is a common and disabling disturbance occurring in up to 5% of the adult population (American Psychiatric Association [APA], 1994). It is characterized by persistent anxiety and excessive and/or unrealistic worry (apprehensive expectation). The course of GAD is chronic and frequently worsens during times of stress (APA, 1994).

In recent years, CBT has been shown to be effective in the treatment of GAD (Borkovec & Whisman, 1996). This treatment involves identification of early cognitive and physiological cues that lead to anxiety and the deployment of cognitive restructuring and relaxation procedures to reduce detected anxiety (Newman & Borkovec, 1995). Although CBT is considered to be a brief therapeutic approach, the average number of contact hours reported in a survey of CBT practitioners who treat GAD was 23.2 costing about $2,181 per person (Turner, Beidel, Spaulding, & Brown, 1995). Thus, despite being the gold-standard treatment for GAD, CBT is expensive. A less expensive but
equally effective treatment would allow it to be more accessible to a
greater number of individuals. In the current climate of cost contain-
ment, an examination of the viability of efficient psychotherapy
approaches has become crucial. Such examination is important because
counselors have arrived at a time when health insurance companies
actively restrict the number of therapy sessions and may soon dictate the
type of therapy provided. The development of a palmtop computer pro-
gram is an effort to creatively respond to such constraints.

The goal of this article is to describe an innovative methodology of
a palmtop computer program that was used as an adjunct to CBT for
GAD and to present data averaged across three individuals who par-
ticipated in a group where this method was successfully implemented.
Although empirical validation was not the goal of this article, a con-
trolled outcome study to test the effectiveness of this methodology is
currently being conducted.

METHOD

PARTICIPANTS

Participants were recruited through paid advertisements in local
newspapers. Respondents were phone-screened and qualifiers were
invited for an in-person diagnostic interview using the Anxiety Disor-
der Interview Schedule-IV (ADIS-IV) (Brown, DiNardo, & Barlow,
1994) and assessment of severity of GAD symptoms (Barlow et al.,
1984). This interview was conducted by a postdoctoral fellow who
was experienced in structured assessment. The participants had to
meet DSM-IV (APA, 1994) criteria for GAD as the primary diagnosis
with an assessor severity rating of moderate or higher. Rule out criteria
included suicidality, hyperthyroidism, hypoglycemia, alcohol/substance
abuse/dependence, schizophrenic disorder, organic brain disorder, an
adequate dose of CBT for GAD in the past (adequate dose defined as a
CBT treatment that proved beneficial to a client for some time), and
unwillingness to remain on a stable psychotropic medication regimen
for the duration of the study if currently on one.
The therapy group began with four people, however one dropped out because his wife had initiated a divorce, leaving three remaining participants who took part in a six-session group therapy format. A brief description of the remaining participants follows.

Ms. Q. was a 40-year-old Caucasian, divorced woman, employed as a librarian and suffering from self-reported, life-long symptoms of anxiety. Ms. Q.’s symptoms had exacerbated in the last 2 years subsequent to a divorce. At the time of her screening interview, she met *DSM-IV* (APA, 1994) criteria for principal GAD, as well as for an additional diagnosis of panic disorder. She was taking no psychotropic medication and was not smoking. Her caffeine intake was limited to two sodas a day, and her alcohol consumption was at most two glasses of wine a week. Ms. Q.’s worry themes included financial issues, her son’s school performance, growing old alone, and losing things. She rated the interference and distress caused by the anxiety and worry as severe. She also experienced multiple physical signs of anxiety such as restlessness, muscle tension, difficulty concentrating, and irritability. The assessor severity rating (Barlow et al., 1984) reflected marked severity (7 on an 8-point scale).

Mr. J. was a 31-year-old Asian American single male, employed as an architect and suffering from a range of physical and psychological signs of anxiety including muscle tension, inability to relax, and apprehensive expectations. Although some of the symptoms had been present in a milder form for most of his adult life, they had reached a critical point 4 years prior to treatment subsequent to complications following a surgical procedure to correct a bone defect. Mr. J. did not smoke or drink coffee. Caffeinated beverages were limited to a cup of tea per day. Mr. J. met criteria for GAD as his principal diagnosis given his worries related to health, career, social life, and physical attractiveness as well as the physical symptoms of feeling keyed up, muscle tension, difficulty concentrating, and irritability. Mr. J. labeled the interference and distress caused by his worries as moderate. He considered the physical signs of anxiety more severe than the psychological signs, ascribing a severe level of interference to them. The assessor estimated his GAD severity rating as moderate (4: definitely disturbing/disabling).
Mr. K. was a 55-year-old Caucasian married man, employed as an accountant. His presenting complaints included worrying about work and paper work, his relationship with peers, as well as death and being alone. These worries had spanned the last 20 years of his life. In addition to the psychological aspects of his anxiety, he complained of physical aspects—primarily muscle tension, easy fatigability, and irritability. He rated the distress caused by the symptoms and their interference as severe. Mr. K. met criteria for a GAD diagnosis and the assessor estimated his severity rating between moderate and marked (5 on an 8-point scale).

ASSESSMENT MEASURES

In addition to the momentary diary data collected by the computer (see subsequent section for a description), ADIS-IV (Brown et al., 1994), and assessor severity of GAD symptom ratings (Barlow et al., 1984), several self-report measures were administered at pretreatment, posttreatment, and 6-month follow-up including the Trait version of the State-Trait Anxiety Inventory (STAI-Trait) (Spielberger, Gorsuch, & Lushene, 1970), the Penn State Worry Questionnaire (Meyer, Miller, Metzger, & Borkovec, 1990), the Dysfunctional Attitude Scale (DAS) (Beck, Brown, Steer, & Weissman, 1991), the Sheehan Disability Scale (Leon, Shear, Portera, & Klerman, 1992; Sheehan, 1983), the Beck Depression Inventory (BDI) (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961), and the Reactions to Relaxation and Arousal Questionnaire (RRAQ) (Heide & Borkovec, 1983).

COMPUTER-ASSISTED THERAPY

The CBT treatment package was chosen because of its demonstrated efficacy in previous GAD research (Borkovec & Costello, 1993). This treatment included cognitive restructuring, relaxation training, diaphragmatic breathing, and self-control desensitization (Beck & Emery, 1985; Bernstein & Borkovec, 1973; Goldfried, 1971). In an effort to increase the cost-effectiveness of the CBT treatment used by Borkovec and colleagues, it was translated from 14 ses-
sions of individual therapy (first 4 sessions were 1.5 hours and subsequent sessions lasted 1 hour) to 6 sessions of computer assisted group therapy (CAGT), preserving the most fundamental features of the approach. The group session was 2 hours in length and was conducted by an experienced therapist. By translating the individual therapy to a brief group therapy, researchers significantly reduced the required therapist contact time from 16 hours per person to a maximum of 4 hours per person (assuming a minimum of three people per group). The group met once each week for four sessions and then biweekly for the last two sessions. Clients were asked to carry the computer with them at all times during the 8 weeks they were in therapy and for 4 weeks after the end of treatment, giving them access to a total of 12 weeks of CAGT. To prevent potential embarrassment about the computer beeping in public, participants were told that observers were likely to view the computers as personal organizers rather than as therapy aids. At the end of 12 weeks, the computers were returned to the experimenter and posttherapy assessment occurred in the 13th week. Follow-up assessments were conducted 6 months later.

A self-help manual detailing the planned interventions was provided to participants at the first therapy session. The manual incorporated what had been distributed to clients as separate handouts in a preceding therapy trial conducted by Borkovec and his colleagues (Borkovec & Costello, 1993). These handouts encompassed information regarding anxiety as well as a detailed discussion of the therapeutic components including diaphragmatic breathing, progressive muscle relaxation, self-control desensitization, applied relaxation, and cognitive therapy. In addition, the manual incorporated instructions on how to use the palmtop computer to implement each therapy technique during daily living.

The palmtop computer used in this study was a Hewlett Packard®, 200LX. It weighs about 312 g (about 11 oz), and when folded, measures 16 x 2.5 x 8.5 cm. (6.3 x 3.4 x 1 inch). It unfolds into two sections: a QWERTY keyboard with function keys and a screen (16 lines x 40 characters). The model selected has a random access memory capacity of 1 megabyte, sufficient to house the GAD software as well as to store the data entered by participants. The computer is equipped with a
connectivity package that allows a simple plug-in connection to a
desktop computer facilitating the uploading and downloading of data
and programs.

The software developed for this study incorporates the basic prin-
ciples of CBT for GAD specified by Borkovec and colleagues
(Borkovec & Costello, 1993). The GAD software, The Stress Man-
ager©, has several modules. Figure 1 presents an overview of the vari-
ous modules. The first module is a diary only module designed to
obtain participants’ baseline information prior to treatment. In this
module the computer beeps the client at fixed intervals (8 a.m., 12
p.m., 4 p.m., and 8 p.m.) to respond to a series of questions. These
questions assess current level of anxiety, highest level of anxiety in the
last hour, number of acute anxiety episodes since last diary assess-
ment, and percentage of time spent worrying in the last hour. At 11
p.m., the computer prompts clients to enter their average level of anx-
ity, highest level of anxiety, and percentage of time they spent worry-
ing that day. In this module, clients have no access to the treatment
components of the program.

After participants have used the computer in the diary only module
for 1 week, they attend their first psychotherapy meeting. At this time,
the program is advanced to the recognizing triggers module and the
therapy module. The recognizing triggers module initiates an inten-
sive 2-day monitoring period during which the computer beeps clients
every waking hour and asks them to identify current anxiety cues. This
module builds on the belief that GAD stems from a process of mal-
adaptive habitual interactions among cognitive (worrisome thinking
and catastrophic imagery), behavioral (behavioral avoidance), and
physiological (feeling keyed up and muscle tension) response sys-
tems. These interactions result in the spiraling intensification of anx-
ity. Coping strategies are most effective when deployed in response to
the earliest signs of anxiety, and the primary purpose of this module is
to help clients recognize early cues that trigger their anxiety in real
time. Once clients have learned to become aware of their anxiety trig-
gers, they can interrupt what would otherwise be a worry or anxiety
episode (Borkovec, 1994; Newman & Borkovec, 1995).

The therapy program permits access to three sets of modules (Fig-
ure 1). The first is a relaxation module that includes six different ver-
sessions of progressive muscle relaxation as well as diaphragmatic breathing retraining and pleasant imagery. This provides clients with instruction and feedback on the implementation of each technique. Figure 2 illustrates an example of the computer sequence presented to
Figure 2. Diaphragmatic breathing sequence presented by the computer.
a client who indicates that he or she would like to practice diaphragmatic breathing. The second module prompts clients to use cognitive therapy. This module invites participants to logically examine the evidence for their fears, to make probability estimations about the likelihood of a negative outcome, to identify logical errors (such as filtering, black and white thinking, mind-reading, catastrophizing, etc.), and based on which error is chosen, raises questions for clients to ask themselves to restructure their cognitions. The module also offers definitions for each logical error and provides examples of ways to redress faulty logic. Figure 3 provides an example of the computer sequence presented to a client who indicates that his or her primary cognitive distortion is black and white thinking. Participants are encouraged to initiate the computer when they are anxious or when they want to practice any of the therapy techniques.

The therapy program includes the same time-defined assessment prompts found in the diary only mode. However, contrary to the diary only mode, the assessment is followed by words of encouragement to clients scoring within an appropriate range (e.g., less than 3 in a 0 to 10 scale of anxiety). Moreover, if participants indicate that their present anxiety is above 3 on a 0 to 10 scale, they are invited to implement a therapy technique (e.g., “Would you like to practice some relaxation techniques?”) and can initiate any of the therapy program components by choosing from a menu.

At each therapy session, all raw data that had been entered into the computer was downloaded to a desktop computer and saved for future analyses. The GAD software automatically printed out a summary that included information concerning participants’ average daily level of anxiety, number of acute anxiety episodes, percentage of time spent worrying, as well as the most common cognitive error and the average anxiety difference between pre- and postrelaxation or pre- and post-cognitive therapy. This information was used by the therapist to gauge client progress.

RESULTS

Ms. Q. and Mr. J. attended five of the six group sessions whereas Mr. K. attended all six sessions. The sessions spanned 8 weeks, and all
participants continued to use the computer for 4 additional weeks as planned.

Weekly means were calculated across group responses to the four time-defined computer daily diary prompts as well as the end-of-the
day prompt. Results provided support for a gradual decrease in anxiety of group members during the 13 weeks that they carried the computers (includes baseline assessment). Figures 4 and 5 show a steady decrease in their average level of daily anxiety and in the highest level of anxiety experienced during the previous hour. Figure 6 shows a decline from 16 to 1 in the total number of acute anxiety (> 5 on a 10-point scale) episodes per week reported by the group. Group gains were also reflected in the STAI-Trait, Worry Questionnaire, Disability Scale, RRAQ, and Dysfunctional Attitude Scale mean scores (see Table 1). Despite the fact that the computer was taken away from all clients after 13 weeks, 6-month follow-up data reflected either maintenance of gains or continued improvement.

The number of initiations of the therapy program were also calculated. During the first week of therapy, clients used the therapy programs a total of 61 times but by the 12th week, the total group usage...
Figure 5. Computer diary data: Highest anxiety level mean per week.

Figure 6. Computer diary data: Total number of acute anxiety episodes per week.
was 2. Because the overall goal of the CAT was to teach clients to use
the techniques on their own, the decrease in computer use for therapy
prompting provided evidence that clients did not become dependent
on the programs and over time may have begun to initiate the CBT
techniques of their own accord.

Group compliance to the diary prompts also changed during the
course of the 13 weeks that the computer was carried (see Table 2). Compli-
cance to the 4 daily prompts averaged 75% during the first 7
weeks and then began to decrease, reaching a low of 31% by the 12th
week. Compliance to the end-of-the-day prompt was much higher and
averaged 92% during the first 7 weeks with the lowest compliance rate
reaching 52%. It is possible that as client need for the computer to pro-
vide therapy prompting decreased, so did the motivation to comply
with the diary prompts. However, given the 5-minute window that cli-
ients had to respond to any one beep, these results support a substantial
degree of compliance.

An evaluation of the three participants at the end of the 12-week
treatment period found an absence of cognitive and physical signs of
anxiety in Ms. Q., who did not meet criteria for GAD or panic disor-
der. These gains were maintained at the 6-month follow-up evalua-
tions. Although still meeting criteria for GAD with respect to psycho-
logical symptoms, Mr. J. and Mr. K. reported a significantly decreased

<table>
<thead>
<tr>
<th>Measure</th>
<th>Pretreatment Score (SD)</th>
<th>Posttreatment Score (SD)</th>
<th>Follow-Up Score (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severity score</td>
<td>5.33 (1.53)</td>
<td>2.00 (1.73)</td>
<td>0.00 (0)</td>
</tr>
<tr>
<td>BDI</td>
<td>12.00 (3.00)</td>
<td>9.67 (9.61)</td>
<td>4.00 (4.58)</td>
</tr>
<tr>
<td>DAS total</td>
<td>310.33 (60.86)</td>
<td>356.67 (47.38)</td>
<td>385.67 (28.01)</td>
</tr>
<tr>
<td>Disability scale</td>
<td>8.33 (1.53)</td>
<td>7.67 (3.51)</td>
<td>4.67 (3.51)</td>
</tr>
<tr>
<td>STAI-Trait</td>
<td>53.00 (6.93)</td>
<td>43.00 (9.61)</td>
<td>40.67 (8.74)</td>
</tr>
<tr>
<td>Worry questionnaire</td>
<td>64.00 (13.00)</td>
<td>48.00 (14.18)</td>
<td>49.33 (10.97)</td>
</tr>
<tr>
<td>RRAQ</td>
<td>20.00 (19.67)</td>
<td>8.33 (3.51)</td>
<td>5.67 (2.31)</td>
</tr>
</tbody>
</table>

NOTE: BDI = Beck Depression Inventory. DAS = Dysfunctional Attitude Scale. STAI-Trait = Trait version of the State Trait Anxiety Inventory. RRAQ = Response to Relaxation and Arousal Questionnaire. Higher scores on the DAS represent fewer dysfunctional attitudes.
# TABLE 2

Mean Percentage Compliance With Computer Diary Monitoring by Week

<table>
<thead>
<tr>
<th></th>
<th>Baseline Assessment</th>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3</th>
<th>Week 4</th>
<th>Week 5</th>
<th>Week 6</th>
<th>Week 7</th>
<th>Week 8</th>
<th>Week 9</th>
<th>Week 10</th>
<th>Week 11</th>
<th>Week 12</th>
<th>Overall Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four-times-per-day diary</td>
<td>76</td>
<td>97</td>
<td>77</td>
<td>73</td>
<td>69</td>
<td>64</td>
<td>71</td>
<td>51</td>
<td>48</td>
<td>62</td>
<td>44</td>
<td>44</td>
<td>31</td>
<td>58.70</td>
</tr>
<tr>
<td>End-of-the-day diary</td>
<td>95</td>
<td>90</td>
<td>100</td>
<td>90</td>
<td>95</td>
<td>81</td>
<td>90</td>
<td>67</td>
<td>76</td>
<td>95</td>
<td>52</td>
<td>81</td>
<td>57</td>
<td>82.20</td>
</tr>
</tbody>
</table>

NOTE: The four-times-per-day diary assessed client anxiety and worry during the previous hour at 8 a.m., 12 p.m., 4 p.m., and 8 p.m. The end-of-the-day diary prompted clients at 10 p.m. every night to assess overall ratings of anxiety and worry during the course of that day.
number of physical symptoms at the end of treatment evaluation and were judged by the assessor to be below the clinical threshold (3 on an 8-point scale). At 6-month follow-up, none of the participants met criteria for GAD, although they both maintained some of the symptoms (two or fewer worries and one or fewer physical symptoms).

The three participants had fairly positive reactions to the computer. These reactions were captured in comments such as, “I like this thing altogether, it makes me think,” and “the computer helps me to keep on top and not get sucked into unrealistic fantasies.” Participants expressed appreciation for the variety of interventions made accessible to them by the computer (e.g., breathing retraining, progressive muscle relaxation, cognitive therapy, and exposure). Participants also stated their appreciation for the guidance the computer provided to them. In fact, as one computer crashed, the participant using it mentioned that he missed it for the day it took to get it back up. Two participants found it easier to access information through the computer than through the self-help manual.

Reactions to the standardized nature of the computer program were mixed. On the one hand, participants appreciated having the computer lead them through the therapy steps in a standardized manner because this facilitated learning the techniques. On the other hand, as they became well-versed in the program and its succession of screens, participants reported paying less attention to the content. One participant suggested that the computer be programmed to vary the praising statements (e.g., “Good relaxation!”) that were presented because over time, the same statement tended to lose its positive impact.

None of the participants expressed concerns about or difficulties in carrying the computer at all times. One participant did report that he would have preferred a smaller device. Two of the participants worked in social settings, whereas the workplace of the third participant was isolated from others. Nonetheless, participants neither demonstrated a pattern of missing the prompts at work nor did they report any discomfort in using the computer in such a setting. In addition, participants did not appear to avoid carrying the computer or using it in social situations. In fact, one participant took it with him on a previously scheduled vacation. Furthermore, all participants brought the com-
puter with them to the therapy sessions, yet from time to time forgot to bring their manuals and/or filled out forms.

Criticisms of the computer program were related to the scheduled diary prompts. Some participants experienced frustration because they were unable to respond to the scheduled prompts within the 5-minute time limit. For example, Mr. J. initially missed the noon prompts as he was on the road most of the days at that time. This complaint was easily addressed by reprogramming the noon prompts to 11:45 a.m. Another participant did not like the scheduled prompts and characterized them as “annoying,” having to respond to them at “their wish.” He chose to access the therapy modules at his own initiative and to respond to the diary prompts with the minimum amount of input. As he put it, “It is a control thing.” Despite these criticisms, Ms. Q. reported that she appreciated the prompts because they reminded her of the work she needed to do and the therapeutic tasks in which she could engage.

DISCUSSION

This is the first attempt to examine the application of a palmtop computer program for adjunctive use with brief group therapy for GAD. The computer was used by the clients to continuously monitor their functioning as well as to potentiate their mastery and practice of CBT. Results of the continuous computer monitoring reflected steady improvement on a variety of measures during the course of therapy. Additional measures taken at pretreatment, posttreatment, and 6-month follow-up supported the client’s improvement as well as the maintenance of gains after the computer was taken away. Thus, the clients benefited from the computer but did not develop a dependency on it.

The computer program used here was developed to incorporate all of the components of the current gold-standard therapy for GAD (Borkovec & Costello, 1993). The use of the latest ambulatory computer technology allowed for a portable program that trained clients in numerous relaxation and cognitive restructuring techniques.
The current study also tested the use of the computer in conjunction with a reduced number of therapy sessions within a group modality. By reducing the number of therapy sessions and substituting group therapy for individual therapy, the authors substantially decreased the number of therapist contact hours required for each client. The reduction of therapist contact hours also greatly reduces the cost of the treatment. Assuming that each therapist contact hour costs $90, a reduction from 16 hours per person to 4 hours per person (12 hours of total group time divided by the number of group members) leads to a savings of $1080. Even factoring the cost of one palmtop computer per person at $450.00 still leads to a savings of $630 per person. However, if as demonstrated in this study, the palmtop computer is taken away from a client after 12 weeks, it can be reused by subsequent clients thereby substantially reducing its overall cost. If one palmtop computer is used by 20 people, then the computer only adds $22.50 to the cost of each individual’s treatment. Using this formula, the computer-assisted group therapy saves $1057.50 per person when compared to the 14-session individual therapy.

The computer program may increase cost-effectiveness of CBT in other ways. CBT is based on the assumption that change processes take place primarily outside of sessions. As a result, compliance to homework is the linchpin. The ambulatory computer may potentiate compliance by prompting clients to apply cognitive and behavioral strategies in anticipation of, or in response to, day-to-day stressors. If lack of adherence is due to a problem with the client’s ability to self-structure, the computer program can provide structure through timed, programmed practice as well as with immediate, accessible guidance. The portability of the palmtop may also help avoidant patients feel better equipped to approach feared situations. For example, Kenardy and Adams (1993) found that agoraphobic women reported feeling safer with a palmtop computer and viewed it as mode of support.

A common criticism of CAT is that such a treatment may put clients off. However, research has found the opposite to be true. Studies show that the accessibility and privacy of computerized interventions may enhance clients’ level of comfort, receptivity, and response to treatment. For example, Ghosh and Marks (1987) found that compliance to
treatment was highest in the computer-assisted condition. In addition, Ghosh and associates (Ghosh et al., 1988) ended up with unequal sample sizes because more people in the therapist-instructed condition refused treatment than book-instructed and computer-instructed conditions. Moreover, studies that have compared standard therapies to computer-administered therapies consistently find no difference in drop-out rates between the two conditions (Buglione et al., 1990; Carr et al., 1988; Ghosh & Marks, 1987; Ghosh et al., 1988; Newman et al., 1997).

The limitations of this integrated series center around its small sample size and the lack of controlled comparisons. Obviously, three participants provide limited data with respect to the potential benefits of an ambulatory computer for GAD. Controlled outcome studies will be necessary to demonstrate its absolute and relative effectiveness.

REFERENCES


Michelle G. Newman, Ph.D., is an assistant professor of psychology at Pennsylvania State University. She received her Ph.D. from the State University of New York at Stony Brook in 1992. Her research interests include the etiology, classification, individual predictors of psychotherapy outcome, and impact of brief psychotherapy with respect to generalized anxiety disorder, panic disorder, social phobia, and trauma. Current research projects include cognitive behavioral and interpersonal experiential therapy for generalized anxiety disorder (GAD); evaluation of brief individual and group palm-top computer assisted therapy; classification of generalized and specific social phobia, panic disorder, and GAD; long-term health implications of trauma; and impact of various types of psychotherapy on anxiety disorders and health.

Andrés J. Consoli, Ph.D., is an assistant professor in the Department of Counseling, College of Health and Human Services, at San Francisco State University. His interests include the role of values in psychotherapy, the training of psychotherapists, psychotherapy integration, and access and use of mental health services by ethnic minorities.

C. Barr Taylor, M.D., is a professor of psychiatry in the Department of Psychiatry and Behavioral Sciences at Stanford University Medical Center. He received his A.B. from Columbia University and his M.D. from the University of Utah and completed his psychiatry residence at Stanford Medical Center. He is a past president of the Society of Behavioral Medicine. He has published extensively on issues related to cognitive and behavioral interventions as applied to anxiety and eating disorders and cardiovascular risk reduction. His recent work has focused on issues related to developing, standardizing, and disseminating efficacious cognitive-behavioral interventions.