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ORIGINAL ARTICLE

A computer-assisted depression intervention in primary care

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Background. The clinical benefit for depression of an interactive computer-assisted cognitive-behavioral program on CD-ROM, the Wellness Workshop (WW), was evaluated in a randomized controlled trial.

Method. A total of 191 individuals referred by primary-care physicians were randomly assigned to a control group, where physician-directed treatment as usual (TAU) was provided, or to a treatment group, where TAU was supplemented with the WW CD-ROM, delivered by mail (WW + TAU). Data were collected at baseline, at 6 weeks' post-intervention, and at a 6-month follow-up assessment. Participants were given a strong incentive by a reimbursement of $75 for completion of each assessment. Measures included symptom ratings obtained via structured clinical diagnostic interviews, as well as a battery of self-report questionnaires on symptoms specifically targeted by the intervention.

Results. Analysis of results demonstrated evidence for skill acquisition for improving dysfunctional thinking and reducing anxiety. Among those who met diagnostic criteria for depression, WW + TAU participants were three times more likely to remit at 6 weeks' post-test than TAU participants.

Conclusions. The evidence supports the conclusion that the WW intervention added benefit to traditional care for depression. No placebo comparison group was included and the WW + TAU participants received slightly more attention (a supportive telephone contact, $\leqslant$5 min from a psychologist 2 weeks after receiving the program). Overall, the findings add support to the accumulating evidence for the potential clinical benefit of computer-assisted behavioral health interventions.

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Key words: Cognitive-behavioural therapy, computer-assisted intervention, depression, primary care, self-help.

Introduction

Depression is the second most prevalent mental health condition in the United States (Kessler *et al*. 2003). Major depressive disorder (MDD) afflicts more than one in seven adults over their lifetime and patients with subthreshold depressive symptoms are two to three times as prevalent (Katon & Schulberg, 1992; Hays *et al*. 1995). Combined, this sector of the adult population experiences decreases in well-being and in social and occupational role functioning that are comparable with patients with chronic medical illnesses (Hays, 1995; Spitzer *et al*. 1995; Wells & Sherbourne, 1999; Hirschfeld *et al*. 2000; Cuijpers *et al*. 2007). Nevertheless, most people with depressive disorders receive no treatment (Kessler *et al*. 1994; Bijl & Ravelli, 2000; Andrews *et al*. 2001).

About half of American mental healthcare is provided by general healthcare practitioners, who prescribe 70% of psychotropic medications (Strosahl, 1994). However, a high proportion of patients prefer not to take medications and many who fill prescriptions do not adhere to the prescribed regimen (Kessler *et al*. 1994; Frank *et al*. 2002). Concurrently, there is evidence that cognitive-behavioral therapy can provide clinical benefit equivalent to medication and can help prevent relapse (Evans *et al*. 1992; Mintz *et al*. 1992; Shea *et al*. 1992; Hollon *et al*. 2006).

To help find interventions that can reach more people in need, computer-assisted instructional programs applying cognitive-behavioral therapy techniques (CCBT) have increasingly been trialed (Marks *et al*. 2007; Spek *et al*. 2007; Andersson & Cuijpers, 2009; Cuijpers & Andersson, 2009). Computer-assisted

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instruction can efficiently reach wide audiences and can potentially heighten learner engagement by presenting a self-paced learning environment incorporating features such as audio narration, music, graphic design, animation and video. Computer-assisted programs can also provide interactive rather than strictly linear learning environments, presenting personalized responses to user entries and choices. If effective, such a resource could offer a low cost, minimally intrusive adjunct or alternative intervention to usual care that might, in fact, be preferred by patients who commit neither to medications nor therapy.

In recent years, a number of randomized controlled trials have demonstrated the benefits of computer-delivered interventions in comparison with usual treatment and, in some cases, in comparison with therapist-delivered interventions (Proudfoot *et al*. 2003; Grime, 2004; Kaltenthaler *et al*. 2006; Seligman, 2006; Kaltenthaler *et al*. 2008; Spek *et al*. 2008; Andersson, 2009; Green & Iverson, 2009). The accumulating evidence is promising; two recent meta-analyses concluded that a computer-assisted delivery medium can provide a significant clinical benefit (Spek *et al*. 2007; Andersson & Cuijpers, 2009). The present study applied a randomized controlled trial to evaluate a computer-assisted instructional intervention entitled the Wellness Workshop (WW). The study evaluated outcomes among adults perceived to be depressed by a primary-care physician as compared with a randomly assigned control group, who received similar care but no computer-assisted instruction.

WW is a National Institutes of Health-supported, stand-alone interactive instructional program on CD-ROM for delivery on a personal computer. The program was designed to present the essential instructional elements of the coping with depression (CWD) intervention model originally developed in 1969 by P. M. Lewinsohn and associates (Lewinsohn *et al*. 1969; Cuijpers *et al*. 2009). Over the past 40 years, the CWD model has evolved and has been shown to be an effective treatment for depression across adolescent, adult, geriatric, geriatric caregiver, alcohol-dependent and smoking cessation populations (Clarke *et al*. 1990; Lewinsohn *et al*. 1991; Brown *et al*. 1997). A 2009 meta-analysis of 25 CWD studies concluded that the CWD intervention is efficacious across age, gender and race/ethnic groups and can be effectively delivered using a variety of treatment modalities (Cuijpers *et al*. 2009).

The content of the WW program combines cognitive and behavioral strategies aimed at ameliorating the types of problems that have been shown to be troublesome for depressed individuals (e.g. negative thinking, low engagement in pleasant activities, social withdrawal, anxiety and tension, problematic social support). The program presents five modules that provide step-by-step instruction on: (1) increasing pleasant activities; (2) using applied relaxation skills; (3) correcting non-constructive self-talk and solving problems proactively; (4) increasing physical activity; (5) applying communications skills such as active listening, I-statements and conflict resolution.



Fig. 1. Wellness Workshop main menu screen.

The CD-ROM format was selected because it provides a portable multimedia product that the user can take home and own. Unlike a book, WW combines multimedia elements (music, graphic art, text and audio narration) to introduce and provide examples for applying specific cognitive-behavioral skills. In addition, although the relative salience of the interactivity feature remains undetermined (Christensen *et al*. 2004), the program presents interactive quizzes that reinforce key concepts, opportunities for active practice of skills and the opportunity to track mood self-ratings over time. The instruction presents options for self-directed exploration, while also guiding the user to develop personalized plans for managing mood. A graphic representation of the WW main menu is presented in Fig. 1.

The CD-ROM format cannot offer certain significant advantages of the internet, which has lately become the primary medium for CCBT instruction. For example, on the web, providers and patients can exchange information readily through electronic messaging and common access to patient-specific information. Web-based programs can also provide easy access to almost unlimited information and can be continually updated. Ultimately, whether web-delivered or on a take-home disk, an electronic program offers significant cost-efficiencies compared with direct provider interaction with the patient.

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Hypothesis

The current study was designed to test the primary hypothesis that participants assigned the WW would report greater reductions of depression and greater improvements on relevant cognitive-behavioral skills at post-treatment than a control group that received the same usual care, but no exposure to the WW program.

Method

Participants

Participant recruitment was conducted through primary-care physicians (PCPs) in Lane County, Oregon and identified from medical directory listings and the local phone book. The identified physician list was reviewed by a physician consultant, a former medical director for multiple pharmaceutical clinical trials. PCPs included those working within family medicine, gynecology and internal medicine practices. A total of 206 physicians were invited to refer patients to the study and 120 (58%) made participant referrals. A patient was eligible for the study if they were referred by their PCP, met the DSM-IV criteria for depressed mood or anhedonia during the previous 2-week period and were aged between 18 and 65 years old.

PCPs referred 226 patients to the study; 191 met study inclusion criteria and agreed to participate (see Fig. 2). All participants underwent an informed consent procedure approved by the Institutional Review Board at Oregon Research Institute. A computer-generated random list of numbers matched to study condition was allocated to participants at the intake assessment by a research assistant, resulting in simple randomization to one of the two conditions: (1) 'treatment as usual' control (TAU, $n=91$) or (2) treatment as usual plus the WW CD-ROM program (TAU + WW, $n=100$). The sample included 77% female, 90% white, 36% married, 30% with bachelor's degree, 49% employed, 57% with MDD, 7% with dysthymia, 49% with an anxiety disorder, 14% with substance abuse/dependence and their mean age was 43.5 (S.D. = 12.9) years. There were no significant differences on the demographic characteristics by condition. Referring physicians were not informed by the research team of patient assignments to conditions. Patients in each condition were equally likely to receive medication, mental health intervention and/or other interventions as directed by their physician. There was no attempt to coordinate care with referring physicians. We did not collect data on the independent impact on patient outcomes of these additional interventions.

To minimize attrition, participants were compensated $75 at each data point for completing the questionnaire and interview assessments. Attrition was low, especially considering that minimal direct contact was provided to the treatment participants. At the 6-week assessment, 190 (99%) of the participants completed follow-up protocols. At the 6-month assessment, 172 (90%) participants remained available for assessment.

Intervention

Program distribution

The WW was delivered as a stand-alone product by mail to participants in the treatment condition. Three computer sites at hospital-based health education libraries were set up for the TAU + WW participants who did not have access to a home computer. The three sites were located in different areas of the community and were managed by healthcare librarians. The locations of the computer stations within the libraries were comfortable, quiet and private. All data files generated by participants while using the WW program were secured by password protection.

Participants who were assigned the WW received one brief ($\leqslant$5 min) telephone prompt approximately 2 weeks after the WW was mailed. The telephone call was made by a psychologist, who encouraged the use of the program and answered any questions about the navigation or content of the program.

Measurement

Self-report survey data was collected at the intake, 6-week post-treatment and 6-month follow-up assessments and interview data were collected at intake and at the 6-week post-treatment assessment. In addition to basic demographic characteristics (gender, race, marital status, education and employment status) the following six scales were assessed:

Center for Epidemiological Studies – Depression scale (*CES-D*) consists of 20 items assessing the frequency of depression symptoms that had occurred during the past week on a 4-point scale (Radloff, 1977).

Pleasant Events Schedule (*PES*), *Mood-Related subscale* consists of 49 events occurring during the past month that are rated for frequency and pleasantness, both on a 3-point scale (MacPhillamy & Lewinsohn, 1982).

State-Trait Anxiety Inventory (*STAI*) consists of 10 items assessing the degree to which current anxious and relaxed feelings are occurring on a 4-point scale (Spielberger *et al*. 1970).

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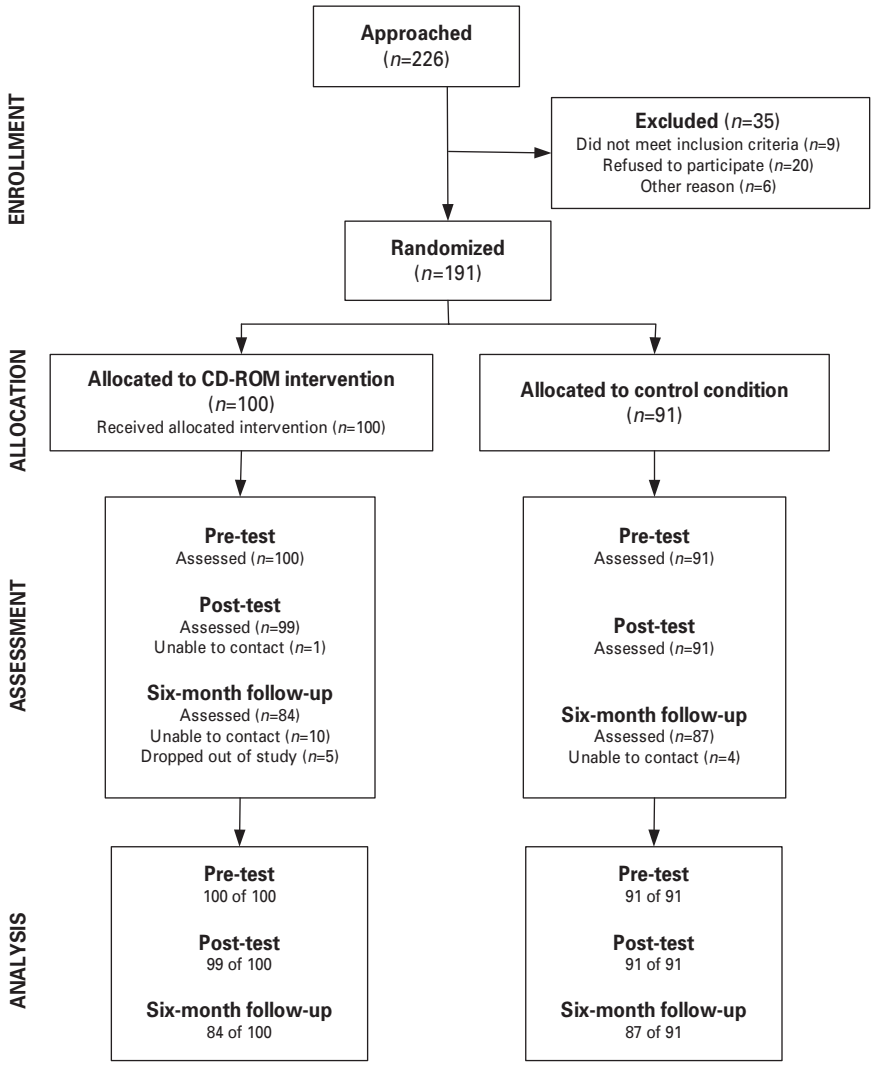


Fig. 2. Flow of participants through each stage of the study.

Dysfunctional Attitudes Scale (*abbreviated*) consists of nine items assessing the degree to which dysfunctional attitudes or beliefs are endorsed on a 5-point Likert-type scale (Weissman & Beck, 1978).

Hope Scale consists of eight items assessing both agency (belief in one's capacity to obtain and sustain actions) and pathways (belief in one's ability to generate routes) to reach goals (Snyder *et al*. 1996).

Consumer opinion survey

A consumer opinion survey, specifically developed for this study, was administered at the post-assessment. Participants were asked to make ratings regarding the program contents and effects based on a 6-point Likert-type scale (strongly disagree – strongly agree). Additional self-report items regarding the amount of program use were added to the survey. No direct electronic records of usage patterns were collected.

Intake interview

Diagnostic interviewers assessed the recruited participants for depression (minor depressive disorder, MDD and dysthymia), substance abuse/dependence and anxiety disorders using the Structured Clinical Interview for DSM-IV (SCID), non-patient version (First *et al*. 1994). The SCID is a widely-used semi-structured interview that yields DSM-IV diagnoses for all major Axis I disorders.

Post-treatment interview

At post-treatment (6 weeks after intake) the Longitudinal Interval Follow-up Evaluation (LIFE; Keller *et al*. 1987) was used in conjunction with the SCID to

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evaluate syndromal or diagnostic changes since the previous interview. The LIFE is a well-established follow-up interview that generates a continuous measure of psychopathology by eliciting detailed information about the longitudinal course of all disorders present at last interview. It also probes for the occurrence of new disorders since the previous interview. By means of careful questioning, the interviewer establishes the approximate dates for critical transition points (i.e. offset of a previous episode; onset of a new episode). On the basis of this information, the interviewer makes weekly ratings of symptom levels for each diagnosis that is being tracked during the follow-up interval. The inter-rater reliability has shown to be satisfactory by the LIFE's authors (Elkin *et al*. 1985; Keller *et al*. 1987).

Interviewers

Diagnostic interviewers were required to have experience in a mental health field and complete a rigorous training programme in the use of the SCID/LIFE procedures, demonstrating an average inter-rater reliability level of $\kappa \geqslant 0.80$ before conducting experimental interviews (κ's $\geqslant 0.70$ are generally considered acceptable). Interviewers were blinded to study condition.

Diagnostician

A PhD-level clinical psychologist reviewed all of the information collected by the interviewer to arrive at 'best estimate' diagnoses for each participant at each assessment point. This review was essential for establishing validity of the diagnoses made by the diagnostic interviewer. The best estimate diagnosis was used in the statistical analyses.

Statistical analysis

The expectation of baseline equivalency due to random assignment of groups was examined. The two conditions were compared on demographic characteristics, diagnostic status and outcome measures collected at pre-test. Contingency table analyses and *t* tests were conducted on categorical and continuous measures, respectively. Bias due to attrition was also examined using contingency table and logistic regression analyses. The effects of study condition and gender on the post-test outcome measures were examined using a two-way, between subjects, multivariate analysis of covariance adjusting for pre-test outcomes. A similar analysis was conducted to evaluate the maintenance of intervention gains on outcome measures assessed at 6-month follow-up. Contingency table and hierarchical logistic regression analyses were used to compare differential rates of onset and recovery of MDD and/or dysthymia occurring between the pre-test and post-test. For all tests, α was set to $p < 0.05$, two-tailed.

Results

Preliminary analysis

The two intervention groups did not statistically differ with regard to demographic characteristics or rates of diagnoses (see Table 1). However, baseline group differences were found for two of the six outcome measures. MDD symptoms were significantly lower ($t_{189} = -2.18$, $p = 0.031$) for TAU + WW participants (mean = 4.6, S.D. = 3.1) than TAU participants (mean = 5.6, S.D. = 2.8). In addition, PES cross product scores were statistically higher ($t_{189} = 2.18$, $p = 0.030$) for the TAU + WW participants (mean = 84.0, S.D. = 29.2) than the TAU participants (mean = 74.8, S.D. = 29.3). All subsequent analyses controlled for these baseline differences between conditions.

Examination of attrition between pre- and post-test showed only one (1%) of the TAU + WW participants dropped out and none of the TAU participants dropped out [χ^2 (1, $n = 191$) = 0.91, $p = 0.339$]. From pre-test to 6-month follow-up, a significantly higher attrition rate was observed for the TAU + WW condition compared with the TAU condition [15% *v.* 4%; χ^2 (1, $n = 191$) = 5.98, $p = 0.014$]. Participants who dropped out of the study between T1 and T3 ($n = 19$) were also compared with those who continued participating ($n = 172$) on the pre-test outcome measures. Compared with the participants who completed both T2 and T3 assessments, those who dropped out had significantly lower means on the Hope Scale (17.4 *v.* 19.4; $t_{189} = 2.03$, $p = 0.044$). However, no significant interactions between condition and baseline measures were found to be significant.

Post-test outcome analysis

A significant multivariate condition effect was observed in which the TAU + WW participants were found to have greater improvement compared with the TAU participants ($F_{6,166} = 2.29$, $p = 0.037$, $\eta^2 = 0.077$). As can been seen in Table 2, significant condition effects were obtained for MDD symptoms ($F_{1,171} = 4.65$, $p = 0.033$, $\eta^2 = 0.026$) and STAI ($F_{1,171} = 7.82$, $p = 0.006$ $\eta^2 = 0.044$). The multivariate gender effect was not significant ($F_{6,166} = 0.91$, $p = 0.490$) nor was the condition × gender interaction ($F_{6,166} = 0.72$, $p = 0.635$).

6-Month follow-up analysis

Neither the multivariate gender nor condition effects were significant at the 6-month follow-up assessment after controlling for pre-tests scores, baseline PES

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Table 1. *Baseline demographics by condition*

	Treatment ($n=100$)	Usual care ($n=91$)	Test statistic	p value
Gender, *n* (%)			0.03	0.859
Male	22 (22.0)	21 (76.9)		
Female	78 (78.0)	70 (23.1)		
Race, *n* (%)			4.68	0.586
American Indian	3 (3.0)	1 (1.1)		
Asian	1 (1.0)	0 (0.0)		
Pacific Islander	1 (1.0)	0 (0.0)		
Black	1 (1.0)	3 (3.3)		
Hispanic	4 (4.0)	2 (2.2)		
White	88 (88.0)	84 (92.3)		
Other	2 (2.0)	1 (1.1)		
Marital status, *n* (%)			3.45	0.631
Single	17 (17.3)	23 (25.3)		
Married	40 (40.8)	28 (30.8)		
Living with someone	8 (8.2)	8 (8.8)		
Widowed	4 (4.1)	2 (2.2)		
Divorced	26 (26.5)	27 (29.7)		
Separated	3 (3.1)	3 (3.3)		
Education, *n* (%)			6.89	0.441
Less than high school	5 (5.1)	5 (5.6)		
High school graduate	19 (19.2)	16 (17.8)		
Some college	32 (32.3)	31 (34.4)		
Associate's degree	10 (10.1)	13 (14.4)		
Bachelor's degree	18 (18.2)	10 (11.1)		
Some graduate school	2 (2.0)	5 (5.6)		
Graduate degree	6 (6.1)	8 (8.9)		
Trade school	7 (7.1)	2 (2.2)		
Employment status, *n* (%)			0.41	0.521
Working	47 (47.0)	47 (51.6)		
Not working	53 (53.0)	44 (48.4)		
Diagnostic status, *n* (%)				
MDD	52 (52.0)	57 (62.6)	2.20	0.138
Dysthymia	5 (5.0)	8 (8.8)	1.08	0.299
Anxiety	45 (45.0)	48 (52.7)	1.14	0.285
Substance abuse/dependence	13 (13.0)	13 (14.3)	0.07	0.796
Age, mean (S.D.)	44 (13.3)	43 (12.5)	0.23	0.822

MDD, Major depressive disorder.

Contingency table analyses and independent observation *t* tests were conducted on categorical variables and age, respectively.

and MDD symptom scores ($F_{5,157}=1.00$, $p=0.417$ and $F_{5,157}=1.33$, $p=0.253$, respectively). As can been seen in Table 2, a significant effect was obtained for dysfunctional attitudes in the predicted direction ($F_{1,161}=4.43$, $p=0.037$, $\eta^2=0.027$). The condition × gender interaction was non-significant ($F_{5,157}=0.67$, $p=0.649$).

Depressive episode onset and remission

In total, 77 (40%) of the study participants had subthreshold levels of depression at baseline and did not meet full criteria for MDD or dysthymia. Of these participants, onset rates of MDD or dysthymia were 10% for the TAU group and 4% for the TAU + WW group. A hierarchical logistic regression analysis controlling for gender, depressive symptomatology and PES cross product scores collected at baseline was conducted to determine the effect of TAU + WW condition on onset of depressive episode between pre- and post-test. The effect of condition on onset was not statistically significant [likelihood ratio $\chi^2(1, n=77)=0.98$, $p=0.323$; odds ratio (OR) = 2.65, 95% confidence interval (CI) = 0.37–18.93].

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Table 2. *Pre, post and 6-month follow-up descriptive statistics and analysis of covariance results for the outcome measures*

	Pre-test		Post-test			6-month follow-up		Pre- to post-condition effect			Pre- to 6-month follow-up condition effect	
Outcome measure/condition	Mean	S.D.	Mean	S.D.	Adj. mean	Mean	S.D.	Adj. mean	*F* test	η^2	*F* test	η^2
SCID depressive symptoms[a]									4.65*	0.026	–	–
Treatment	4.6	3.1	3.1	2.8	3.4	–	–	–				
Usual care	5.6	2.8	4.4	2.9	4.1	–	–	–				
CES-D total score[a]									2.82	0.016	0.23	0.001
Treatment	31.8	10.0	26.3	11.4	27.6	24.4	13.1	25.9				
Usual care	35.5	10.7	31.5	12.0	30.2	28.2	13.5	26.7				
PES cross product[b]									<.001	<0.001	0.29	0.002
Treatment	86.2	28.8	91.9	30.1	87.2	93.9	32.7	90.3				
Usual care	73.9	28.8	79.2	31.7	83.9	87.4	31.5	91.0				
State anxiety[a]									7.82*	0.044	1.51	0.009
Treatment	2.6	0.7	2.3	0.7	2.4	2.2	0.8	2.3				
Usual care	2.7	0.7	2.6	0.7	2.6	2.4	0.7	2.3				
Hope[b]									1.39	0.008	0.27	0.002
Treatment	19.4	4.3	21.0	4.4	20.7	21.2	4.3	21.1				
Usual care	19.2	4.3	19.6	4.9	19.9	20.7	4.5	20.9				
Dysfunctional attitudes[b]									2.45	0.014	4.43*	0.027
Treatment	2.9	0.9	3.0	1.0	3.0	3.2	1.0	3.2				
Usual care	3.0	0.7	2.9	0.8	2.8	2.9	1.0	2.9				

Adj, Adjusted; SCID, Structured Clinical Interview for DSM-IV; CES-D, Center for Epidemiological Studies – Depression Scale.

[a] higher score represents more dysfunction.

[b] lower score represents more dysfunction.

* $p < 0.05$.

Conversely, 114 (60%) of the study participants were diagnosed with MDD or dysthymia at baseline. Of these participants, differential rates of episode remission were observed between the TAU + WW (23%) and TAU controls (10%). A hierarchical logistic regression analysis controlling for gender, depressive symptomatology and PES cross product scores collected at baseline was conducted to determine the effect of treatment condition on episode remission. The effect of condition on recovery was statistically significant [likelihood ratio $\chi^2(1, n = 114) = 4.20$, $p = 0.040$; OR = 3.18, 95% CI = 1.01–10.04] suggesting that the TAU + WW participants were three times more likely to remit than the usual care participants.

Program utilization and viewer satisfaction

Based upon self-report data (computer log records were not available) of the 100 participants assigned to the TAU + WW condition, 27 (27%) did not view the program. Of the 73 active TAU + WW participants, the mean total time of program use was 258.1 min (S.D. = 294.5, range = 10–1500). Active participants used the program for an average of 2.9 weeks (S.D. = 1.8, range = 1–8), 2.2 times per week (S.D. = 1.3, range = 1–8) and 40.5 min per use (S.D. = 21.1, range = 10–120). On a 4-point scale (not at all – most of the time), participants reported they occasionally made use of the journal (mean = 1.9, S.D. = 0.8) and the tool box (mean = 2.0, S.D. = 0.8).

On a 6-point scale (strongly disagree – strongly agree), participants reported the program was friendly and easy to use (mean = 4.9, S.D. = 1.3), instructions were clear and helpful (mean = 4.9, S.D. = 1.3), the program was relevant to their needs (mean = 4.4, S.D. = 1.4), the program helped to achieve changes (mean = 4.0, S.D. = 1.3), they would recommend the program to others (mean = 4.6, S.D. = 1.5) and all of the individual components were useful (mean = 4.5, S.D. = 1.4). On a 5-point scale (poor – excellent), participants' overall rating of the CD-ROM was very good (mean = 3.8, S.D. = 0.9).

Discussion

The findings of the present study suggest benefits for participants using the WW as compared with a TAU control group. The comparison indicated that the WW was associated with significant decreases in self-reported state anxiety symptoms and interview-rated depressive symptoms at 6-week follow-up. TAU + WW participants initially diagnosed with MDD or dysthymia were three times more likely than their counterpart participants in the TAU condition to demonstrate remission of their diagnosis at 6-week follow-up. At the 6-month follow-up, the TAU + WW group continued to demonstrate significant decreases in dysfunctional attitudes, suggesting that cognitive skills acquired during intervention may have been maintained over time. Participants rated the program highly for friendliness and ease of use, relevance to their needs and effectiveness in achieving desired changes.

The present results support prior evidence for the clinical benefit of computer-assisted programs for alleviating depression. The study also demonstrated that the majority of patients identified by PCPs as depressed consistently used the program with satisfaction and perceived it to be helpful. Robust recruitment by PCPs was demonstrated, with 120 out of 206 total physicians making referrals to the study. We had no known negative effects from using a computer-assisted program with a challenging primary-care population.

Given the findings identifying the clinical benefit of CCBT, more recent research is investigating particular contextual considerations. For example, evidence generally suggests that both adherence and efficacy are enhanced when the program is supported with the addition of personal provider contact. However, complexities remain in identifying the most beneficial levels of such contacts for specific programs and populations. One study reported benefit for an unsupported program equal to an intervention that included the program plus provider TAU (de Graaf *et al*. 2009).

A pilot study with a prototype version of the WW yielded data that bear upon the support issue. A psychologist personally introduced the program and followed up personally with the participant after 6 weeks. In this context of increased support and accountability, all participants used the program. Questionnaire outcomes indicated a much more robust benefit using this more personalized delivery approach (Cohen's $d = 1.51$ for pre-post change in depressive symptomatology) than was reported in the present study, where participants received the CD-ROM in the mail and were given only a brief follow-up (<5 min) phone call. Based on the pilot study, even this minimal degree of contact must be considered as a potential influence on outcomes. Without the possibility of comparison with a non-intervention placebo control group, this influence was not measurable in the current study.

Another critical contextual factor relevant to adherence is the presence and level of incentive provided for program use. In the present study, the strong financial incentive was tied to completing the assessments rather than to using the program and compliance with the assessments was very high; it is less

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clear to what extent the monetary incentive influenced actual usage of the program.

Unfortunately, the tradition of American primary care presents disincentives for incorporating CCBT interventions into practice. Reimbursement policies effectively punish providers for time spent on education and counseling regarding behavioral health concerns. Incentives are placed to reward brief visits and to encourage reliance on medications. Although a small investment of clinical contact time can possibly enhance clinical benefit, staffing of medical settings is not geared to provide the personal contact that can support adherence to CCBT programs.

Significant changes in models of delivering primary-care services in the United States are in progress as a result of the healthcare reform legislation of 2010. Emerging new models, such as patient-centered medical homes, may improve the prospects for disseminating computer-assisted interventions by increasing availability of primary-care services and integrating behavioral health interventions into primary-care settings. Such entities will increasingly offer 'bundled' services, which are reimbursed based upon outcomes rather than quantity of services delivered. Over time, this innovation will increase support for the patient to make life-style behavior changes and will reverse the current disincentives for offering holistic, integrated healthcare services.

There are important limitations to the present study that should be noted. First, as discussed, the study omitted a placebo comparison group that would have helped evaluate the relative influence of factors independent of the WW program that distinguished the TAU + WW group from the TAU group. Second, Lane County, Oregon is highly homogeneous and all major ethnic groups are under-represented. Results may not generalize to black, Hispanic, Asian, and/or Native American populations. Third, the large financial incentive may have disproportionately selected primary-care patients for whom this payment was the principal reason for participating. Attrition rate was quite low, even for participants in the TAU condition. High percentages (50%) of participants in both conditions were unemployed. In a situation where no financial incentive is offered, compliance with using the program may differ. Results may not generalize to populations in other socio-economic categories. Fourth, the present cohort included many participants who did not meet criteria for MDD or dysthymia. Those who did often had co-morbid conditions. Those who did not meet criteria for MDD or dysthymia often met criteria for a variety of other behavioral health disorders. This diversity of participant conditions complicates making generalizations from our results about who is most likely to benefit from a computer-assisted intervention. On the other hand, the co-morbid conditions in the present cohort may reasonably reflect the real world of primary-care referral patterns for depression. Finally, the study would have benefited greatly from the availability of diagnostic interview data at the 6-month follow-up to help draw conclusions about longer range diagnostic trends related to use of the WW program.

The present study and the present state of the literature suggest several directions for future research. There is a need to identify the most beneficial points along the continuum of depression care for providing computer-assisted interventions (e.g. preventive, for subthreshold symptomatology, tertiary delivery, for relapse prevention). Our results support use with more clinically complex populations. In addition, more needs to be learned about how much personal support, or 'human touch', is necessary and sufficient for maximizing adherence and providing clinical benefit. As stated, comparison of our present results with our prototype outcomes supports the benefit of personal clinical contact.

The most salient program-specific factors for influencing clinical benefit need to be better identified. Such variables include: (1) instructional content; (2) curriculum design features; (3) degree of interactivity; (4) interactive navigational interface models; (5) participation in exercises; (6) personalized tailoring provided by the program; (7) specific combinations of media elements such as text, graphics, audio narration, music, animation and video (Christensen *et al*. 2004, 2006; Danaher *et al*. 2005; Mayer, 2008; de Graaf *et al*. 2009).

Establishing innovative ways to deliver treatment adjuncts within the current healthcare system looms as an ongoing challenge. Technology can allow for more efficient points of contact via live media (telephone, videoconference, online chat), electronic messaging (voicemail, email, texting) and/or web-based social media (via computer or mobile device). However, the rapid rate of these developments is outpacing the deliberate timetable required by rigorous clinical trials. In addition, the confidentiality and security concerns for protecting personal information will continually constitute challenges.

The personal attention of a healthcare provider will always be the most valued intervention, but the efficiencies of electronic communication media ensure that their role in healthcare will grow. Fortunately, accumulating evidence suggests that computer-assisted interventions offer the promise of providing clinically beneficial, cost-effective services that can contribute significantly to improving public emotional wellness, health and quality of life.

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Declaration of Interest

D. R. Campbell, Ph.D., W. Levin, Ph.D. and K. B. McGovern, Ph.D. hold shares in mPower, LLC, which retains copyright ownership of the WW program.

References

Andersson G (2009). Using the Internet to provide cognitive behaviour therapy. *Behaviour Research and Therapy* **47**, 175–180.

Andersson, G, Cuijpers P (2009). Internet-based and other computerized psychological treatments for adult depression: a meta-analysis. *Cognitive Behaviour Therapy* **38**, 196–205.

Andrews G, Issakidis C, Carter G (2001). Shortfall in mental health service utilisation. *British Journal of Psychiatry* **179**, 417–425.

Bijl RV, Ravelli A (2000). Psychiatric morbidity, service use, and need for care in the general population: results of The Netherlands Mental Health survey and Incidence Study. *American Journal of Public Health* **90**, 602–607.

Brown RA, Evans DM, Miller IW, Burgess ES, Mueller TI (1997). Cognitive-behavioral treatment for depression in alcoholism. *Journal of Consulting and Clinical Psychology* **65**, 715–726.

Christensen H, Griffiths KM, Jorm AF (2004). Delivering interventions for depression by using the internet: randomised controlled trial. *British Medical Journal* **328**, 265.

Christensen H, Griffiths KM, Mackinnon AJ, Brittliffe K (2006). Online randomized controlled trial of brief and full cognitive behaviour therapy for depression. *Psychological Medicine* **36**, 1737–1746.

Clarke GN, Lewinsohn PM, Hops H (1990). *Adolescent Coping with Depression Course*. Eugene, OR: Castalia Publishing.

Cuijpers P, Andersson G (2009). Special issue on computerized treatments of depression. *Cognitive Behaviour Therapy* **38**, 193–195.

Cuijpers P, Muñoz RF, Clarke, GN, Lewinsohn PM (2009). Psychoeducational treatment and prevention of depression: the 'Coping with Depression' course thirty years later. *Clinical Psychology Review* **29**, 449–458.

Cuijpers P, Smit F, Oostenbrink J, de Graaf R, Ten Have M, Beekman A (2007). Economic costs of minor depression: a population-based study. *Acta Psychiatrica Scandinavica* **115**, 229–236.

Danaher BG, McKay HG, Seeley JR (2005). The information architecture of behavior change websites. *Journal of Medical Internet Research* **7**(2): e12.

de Graaf LE, Huibers MJH, Riper H, Gerhards SAH, Arntz A (2009). Use and acceptability of unsupported online computerized cognitive behavioral therapy for depression and associations with clinical outcome. *Journal of Affective Disorders* **116**, 227–231.

Elkin I, Parloff MB, Hadley SW, Autry JH (1985). NIMH treatment of depression collaborative research program. *Archives of General Psychiatry* **42**, 305–316.

Evans MD, Hollon SD, DeRubeis RJ, Piasecki JM, Grove WM, Garvey MJ, Tuason VB (1992). Differential relapse following cognitive therapy and pharmacotherapy for depression. *Archives of General Psychiatry* **49**, 802–808.

First MB, Spitzer RI, Gibbon M, Williams JBW (1994). *Structured Clinical Interview for Axis I DSM-IV Disorders – Non-Patient Edition*. Biometrics Research Department: New York.

Frank E, Rush AJ, Blehar M, Essock S, Hargreaves W, Hogan M, Jarrett R, Johnson RL, Katon WJ, Lavori P, McNulty JP, Niederehe G, Ryan N, Stuart G, Thomas SB, Tollefson GD, Vitiello B (2002). Skating to where the puck is going to be: a plan for clinical trials and translation research in mood disorders. *Biological Psychiatry* **52**, 631–654.

Green KE, Iverson KM (2009). Computerized cognitive-behavioral therapy in a stepped care model of treatment. *Professional Psychology: Research and Practice* **40**, 96–103.

Grime PR (2004). Computerized cognitive behavioural therapy at work: a randomized controlled trial in employees with recent stress-related absenteeism. *Occupational Medicine* **54**, 353–359.

Hays RD, Wells KB, Sherbourne CD, Rogers W, Spritzer K (1995). Functioning and well-being outcomes of patients with depression compared with chronic general medical illnesses. *Archives of General Psychiatry* **52**, 11–19.

Hirschfeld RMA, Williams JBW, Spitzer RL, Calabrese JR, Flynn L, Keck Jr. PE, Lewis L, McElroy SL, Post RM, Rapport DJ, Russell JM, Sachs GS, Zajecka J (2000). Development and validation of a screening instrument for bipolar spectrum disorder: the mood disorder questionnaire. *American Journal of Psychiatry* **157**, 1873–1875.

Hollon SD, Stewart MO, Strunk D (2006). Enduring effects for cognitive behavior therapy in the treatment of depression and anxiety. *Annual Review of Psychology* **57**, 285–315.

Kaltenthaler E, Brazier J, de Nigris E, Tumur I, Ferriter M, Beverley C, Parry G, Rooney G, Sutcliffe P (2006). Computerised cognitive behaviour therapy for depression and anxiety update: a systematic review and economic evaluation. *Health Technology Assessment* **10**, 1–168.

Kaltenthaler E, Parry G, Beverley C, Ferriter M (2008). Computerised cognitive-behavioural therapy for depression: systematic review. *British Journal of Psychiatry* **193**, 181–184.

Katon W, Schulberg H (1992). Epidemiology of depression in primary care. *General Hospital Psychiatry* **14**, 237–247.

https://doi.org/10.1017/S0033291710001935 Published online by Cambridge University Press

Keller MB, Lavori PW, Friedman B, Nielsen E, Endicott J, McDonald-Scott PA (1987). The Longitudinal Interval Follow-up Evaluation: a comprehensive method for assessing outcome in prospective longitudinal studies. *Archives of General Psychiatry* **44**, 540–548.

Kessler RC, Berglund P, Demler O, Jin R, Koretz D, Merikangas KR, Rush AJ, Walters EE, Wang PS (2003). The epidemiology of major depressive disorder: results from the National Comorbidity Survey Replication (NCS-R). *Journal of the American Medical Association* **289**, 3095–3105.

Kessler RC, McGonagle KA, Zhao S, Nelson CB, Hughes M, Eshleman S, Wittchen HU, Kendler KS (1994). Lifetime and 12-month prevalence of DSM-III-R psychiatric disorders in the United States: results from the National Comorbidity Survey. *Archives of General Psychiatry* **51**, 8–19.

Lewinsohn PM, Rohde P, Hops H, Clarke G (1991). *Parent Workbook: Adolescent Coping with Depression Course*. Castalia Publishing Company: Eugene, OR.

Lewinsohn PM, Weinstein M, Shaw D (1969). Depression: a clinical-research approach. In *Advances in Behavior Therapy, 1968* (ed. R. D. Rubin and C. M. Frank), pp. 231–240. Academic Press: New York.

MacPhillamy DJ, Lewinsohn PM (1982). The Pleasant Events Schedule: studies on reliability, validity, and scale intercorrelations. *Journal of Consulting and Clinical Psychology* **50**, 363–380.

Marks IM, Cavanagh K, Gega L (2007). *Hands on Help: Computer-Aided Psychotherapy*. Psychology Press: London.

Mayer RE (2008). *Learning and Instruction*, 2nd edn. Prentice Hall: Upper Saddle River, NJ.

Mintz J, Mintz LI, Arruda MJ, Hwang SS (1992). Treatments of depression and the functional capacity to work. *Archives of General Psychiatry* **49**, 761–768.

Proudfoot J, Goldberg D, Mann A, Everitt B, Marks I, Gray JA (2003). Computerized, interactive, multimedia cognitive-behavioural program for anxiety and depression in general practice. *Psychological Medicine* **33**, 217–227.

Radloff LS (1977). The CES-D Scale: a self-report depression scale for research in the general population. *Applied Psychological Measurement* **1**, 385–401.

Seligman MEP (2006). Positive psychotherapy. *American Psychologist* **11**, 788.

Shea MT, Elkin I, Imber SD, Sotsky SM, Watkins JT, Collins JF, Pilkonis PA, Beckham E, Glass DR, Dolan RT, Parloff MB (1992). Course of depressive symptoms over follow-up: findings from the National Institute of Mental Health Treatment of Depression Collaborative Research Program. *Archives of General Psychiatry* **49**, 782–787.

Snyder CR, Sympson SC, Ybasco FC, Borders T, Babyak MA, Higgins RL (1996). Development and validation of the State Hope Scale. *Journal of Personality and Social Psychology* **70**, 321–335.

Spek V, Cuijpers P, Nyklicek I, Riper H, Keyzer J, Pop V (2007). Internet-based cognitive behaviour therapy for symptoms of depression and anxiety: a meta-analysis. *Psychological Medicine* **37**, 319–328.

Spek V, Cuijpers P, Nyklicek I, Smits N, Riper H, Keyzer J, Pop V (2008). One-year follow-up results of a randomized controlled clinical trial on internet-based cognitive behavioural therapy for subthreshold depression in people over 50 years. *Psychological Medicine* **38**, 635–639.

Spielberger CD, Gorsuch RL, Luschene RE (1970). *Manual for State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press.

Spitzer RL, Kroenke K, Linzer M, Hahn SR, Williams JBW, deGruy FV, Brody D, Davies M (1995). Health-related quality of life in primary care patients with mental disorders: results from the Prime-MD 1000 study. *Journal of the American Medical Association* **274**, 1511–1517.

Strosahl K (1994). Entering the new frontier of managed mental health care: gold mines and land mines. *Cognitive and Behavioral Practice* **1**, 5–23.

Weissman AN, Beck AT (1978). Development and validation of the Dysfunctional Attitude Scale. Presented at the Annual Meeting of the Association for the Advancement of Behavior Therapy, Chicago, IL, 18 November 1978.

Wells KB, Sherbourne CD (1999). Functioning and utility for current health of patients with depression or chronic medical conditions in managed, primary care practices. *Archives of General Psychiatry* **56**, 897–904.

https://doi.org/10.1017/S0033291710001935 Published online by Cambridge University Press