

Managing Depression through a Behavior Change Support System without Face-to-Face Therapy

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Abstract. We present results from a study that examines impact of persuasive reminders and virtual rehearsal on the effectiveness of a Behavior Change Support System. Good Life Compass is a web-based BCSS aimed at supporting people with mild to moderate depression without face-to-face therapy. The content of virtual rehearsal were drawn from Acceptance and Commitment Therapy. Eligible participants were randomized into an intervention study and a control (wait-list) group. In this paper, both groups shall be reported as intervention group 1 and 2 respectively. For data collection, we employed semi-structured questionnaires and post-study interviews. As a result, participants acknowledged persuasive reminders as being helpful in completing weekly tasks and virtual rehearsal as an effective technique for learning new behaviors.

Keywords: Behavior Change Support Systems, Acceptance and Commitment Therapy, persuasive reminders, virtual rehearsal.

1 Introduction

Depression is among most common mental illnesses in modern society. It is expected that by the year 2030, it will contribute towards highest disease burden in developed countries [19, 24]. Depression has often been correlated with suicide, loss of productivity, social isolation, alcoholism and stigma [1]. Developing effective interventions for depression call for innovative solutions. Persuasive systems and behavioral psychology are well-studied research fields hence creating opportunities for intermediations based on amalgamation of cognitive behavioral techniques and information systems (IS).

Existing literature indicates that effectiveness of IS could improve if augmented with cognitive behavior therapy [24]. Noticeably, several hindrances have been reported that prevent people from using online as well as face-to-face treatments. For example, low motivation to reach experts, reluctance to discuss personal matters, lack of available professional services, distantly located health services, high treatment costs and stigma [1]. Human-Computer Interaction (HCI) researchers have shown

growing interest in studying behavior change interventions developed with intent to promote healthy behaviors [2]. Information systems have been developed to overcome said barriers by employing explicit or implicit persuasive techniques. Virtual rehearsal has been proposed as a key software feature that assists users to complete primary tasks [3], however relatively little research has been conducted on rehearsal in the fields of HCI and persuasive systems.

Keeping in mind the aforementioned challenges and the significance of improving mental well-being, we carried out this study using a web-based Behavior Change Support System (BCSS) [cf. 8]. The objective of the study was to evaluate impact of persuasive reminders and virtual rehearsal on the efficacy of a BCSS developed for people suffering from mild to moderate depressive symptoms.

2 Background

Existing literature indicates effectiveness of e-health interventions that are delivered over Internet and employ Cognitive Behavior Therapy (CBT) methods [4], however relatively few studies have reported use of value-based interventions incorporated with Acceptance and Commitment Therapy (ACT), the latest wave of CBT. ACT is known to increase psychological flexibility because it is positively correlated with better mental health [5].

Serious efforts have been made to understand the dynamics of IS for depression and mental disorders. Researchers have focused on evaluating effectiveness of IS in terms of task adherence [21], user satisfaction [20]. HCI researchers have emphasized designing systems that end up bringing intended change in behaviors. Consolvo et al. [6] propose using behavior change theories when designing interventions. Their design strategies [6] are valuable yet evaluating the effect of persuasive features has somewhat been vaguely described. This particular gap is clearly evident when it comes to software features such as virtual rehearsal [cf. 3]. Rehearsal has previously been used primarily in the field of CBT related studies. Psychology experts have acknowledged cognitive improvement through performance-based processes [7]. Significance of rehearsal as a behavior change technique has also been reported by [7] who argue that it is a useful method for improving self-efficacy. It is extraordinary to note that rehearsal, as a software feature, has not received due attention within the research field of persuasive systems [26].

Identifying this gap, we decided to study selected software features and their potential impact on effectiveness of a web-based BCSS for depression. A BCSS is defined as, “an information system designed to form, alter or reinforce attitudes, behaviors or an act of complying without using deception, coercion or inducements” [8]. BCSSs supplement the research field of behavior change interventions by emphasizing on creating desirable behavior/attitude change through non-coercive persuasion. As outlined by [8], interactive IS are expected to provide feedback and facilitate completion of target behaviors. In other words, we classify web-based IS as BCSSs [8] that are persuasive in nature, incorporated with augmented software features including but not limited to feedback, reminders and virtual rehearsal.

Building on Fogg's pivotal work [9], the Persuasive Systems Design model provides an opportunity to methodically design and evaluate persuasive systems [3]. According to [9], persuasive technology should prompt users to perform target behaviors when operating the system. Persuasive reminders could supplement BCSSs to facilitate task completion. Reminders might vary in design and form; for instance, they could be incorporated as guileless messages or feedback [18] and delivered via different means with varying frequencies. Previously, reminders have been employed in persuasive systems [10]. To date, different techniques have been studied to improve the effectiveness of reminders, for example, with tailored content [10]. Because our research employed questionnaires, we used Likert-scale to collect the responses. In addition, structured interviews were conducted. The reason to adopt this research approach is that it helps find common themes from the text using coding and indexing [23].

For this study, we formulated the following hypotheses:

H1. Persuasive reminders help users in task completion.

H2. Users would perceive persuasive reminders as a desirable feature.

H3. Virtual rehearsal helps users achieve improved self-confidence.

H4. Users with improved self-confidence continue to rehearse newly learned skills.

H5. The overall affect of the BCSS would lead to significant decrease in depression.

Both H1 and H2 were derived from the PSD model [3], H3 was based on the theory of Self-efficacy [16], and H4 was based on the Technology Acceptance Model [17].

3 Procedures

Recruitment. The study was conducted between September 2012 and January 2013. Recruitment advertisements were published on the 8th of September 2012. Participants were recruited through newspaper advertisements. It was stipulated in the advertisement that we were aiming to recruit those individuals who felt depressed. In response, 42 people contacted the university clinic via e-mail and/or telephone. Trained psychology student therapists performed initial screening. Keeping in mind professional code of conduct, ethical approval was granted by the Ethics Committee of the University of Jyväskylä and the Central Finland Healthcare District (Diary no: 15U/2012) on 27.08.2012. The application included research plan, measurements for the study, information for the participants about the research, informed consent and report of ethical aspects of the research. The study included no physical or psychological harm to the participants. Participants were provided intention of the study in detail and informed consent were received prior to the start of the study. It was also advised that the participants had no obligation to continue being part of the study. One participant decided to drop out before the screening process began. Consequently, 41 participants were interviewed over phone using a structured interview. Two participants did not meet the eligibility criteria and were dropped out from the study. Therefore, actual sample size comprised of 39 participants. Because the study included actual patients of depressive symptoms, approval was formally

obtained from the Ethical Committee at the University of Jyväskylä, Finland. The inclusion criteria were: (1) self-reported depressive symptoms or depressed mood (2) no parallel psychological therapy at the time of the intervention, (3) possession of an email account, (4) access to computer and Internet, (5) access to telephone and (6) age 18 years or older.

Randomization. Randomization was performed on the 13th of September 2012 followed by pre-study interviews. Participants were randomized into two groups: (1) an intervention group 1 (n=19) that received measurements, automated weekly reminders (via email) and had access to weekly rehearsal exercises, and (2) an intervention group 2 (n=20) that first served as a waiting list control group and had to wait a period of six weeks before they could access the BCSS. The BCSS for intervention group 2 included the weekly rehearsal exercises (similar to those used in intervention group 1), but they did not receive automated weekly reminders. The intervention for group 1 commenced on the 28th of September 2012 and concluded on the 9th of November 2012 followed by final interviews with participants of intervention group 1. Treatment for intervention group 2 began from 17th of November 2012 and concluded in January 2013. Post measurements were taken between January 21 and January 25, 2013. A total of 28 (71.8%) females and 11 (28.2%) males with an average age of 51 years comprised the sample. One participant from the intervention group dropped out before the post-measurement. Thus, the sample size consisted of 39 participants. The results reported in this paper are based on responses from participants of both groups.

The BCSS. Research team at the Department of Psychology, University of Jyväskylä, Finland developed the BCSS and the research team from the Department of Information Processing Science, University of Oulu, Finland integrated software features into it. ACT-based rehearsal exercises provided depression management skills. Virtual rehearsal as a software feature was used to enhance mindfulness, acceptance skills and commitment towards value-based actions among participants by utilizing a variety of metaphors, experiential exercises for mindfulness and behavioral activation [5]. ACT comprises of theoretical processes with an aim to enhance the psychological flexibility in people. Table 1 presents a brief overview of the modules used for the rehearsal content.

Persuasive Reminders and Virtual Rehearsal. Participants were required to complete one rehearsal module per week before moving on to the next level that was made available in the subsequent week. They were encouraged to practice newly learned skills including mindfulness, acceptance skills and to complete value based actions through email-based reminders. Therapists monitored whether participants completed weekly modules each Thursday. Those who did not complete weekly exercises in time were sent an additional reminder. In an event where a participant did not complete the task upon receiving two reminders, the assigned therapist contacted her via telephone. It is worth noting that there was only one client who was approached via telephone and that too for one time only.

Table 1. Acceptance Commitment Therapy Modules with brief descriptions

<i>Week</i>	<i>ACT Modules</i>	<i>Brief explanation</i>
1	Creative hopelessness and values	To offer specific verbal and experiential methods to help them determine their goals.
2	Value-based actions	Values are chosen qualities of purposive action that can never be obtained as an object but can be instantiated moment by moment.
3	Contact with the present moment	ACT promotes ongoing non-judgmental contact with psychological and environmental events as they occur.
4	Cognitive defusion	To alter the undesirable functions of thoughts and other private events, rather than trying to alter their form, frequency or situational sensitivity.
5	Self as context	It helps one become aware of his/her own experiences without any attachment leading to fostered acceptance.
6	Acceptance	It involves the ability to contact the present moment more fully as a conscious human being, and to change or persists in behavior.

Therapists. Graduate students of psychology performed the psychological therapy. Student therapists went through 10 hours of intensive training about ACT. Training sessions included lectures on general principles of ACT and core processes. During training sessions, students were provided with a handbook of ACT [11,12] highlighting detailed description of the therapy, its core processes, 32 metaphors, 18 exercises and practical forms that are commonly used in such therapies. Therapists received two hours of supervision during the first three and last three weeks of the program. The supervisor is an experienced clinician, licensed psychologist and psychotherapist with nearly 30 years experience of clinical work and supervision and 12 years of experience in ACT clinical practice.

Data Collection. Upon completion of the study, participants were asked questions about their experiences with the BCCS. The questionnaire consisted of two parts. The first part included demographic questions devised to collect information about the participants, their computing skills and familiarity with Internet. The second part involved questions about participants' views about system usefulness, ease of use, and impact of persuasive reminders on task completion, impact of virtual rehearsal on self-confidence and intention to rehearse newly learned behaviors. The questions used five-point Likert-type scale where 1 = strongly agree to 5 = strongly disagree. Finally they were interviewed in a post study satisfaction survey where experiences with the intervention were recorded, coded, and analyzed.

Psychological Measures. Symptoms of depression and self-reported confidence were assessed at the beginning and end of the study. For measuring depressive symptoms, Beck Depression Inventory-II [13] and Self-confidence were used as primary measures. Beck Depression Inventory (BDI-II) [13] includes 21 questions about depressive symptoms and their severity. The scale ranges from 0 – 63 (where 0 – 13 indicate no or very few depressive symptoms, 14 – 19 indicate mild depression, 20 – 28 indicate moderate depression and 29 – 63 indicate severe depression). BDI-II has been recognized to have reliability and validity [22, 25] in both nonclinical and clinical populations. To measure self-confidence of the participants, we used the Finnish Descriptive Visual Rating Scales, 0 – 100. The scale has shown good test and retest reliability [14].

4 Results

Researchers have paid significant attention to lack of task completion. For years high dropout rates have been a persistent problem for researchers and efforts have been made to find reasons behind it [15]. We hypothesized that persuasive reminders could lead to improved compliance. In this study, persuasive reminders were sent to the intervention group 1 only. At the end of first intervention period, participants were asked questions relating to their perceptions about the impact of persuasive reminders. Because intervention group 2 did not receive persuasive reminders, at the end of the intervention they were asked whether reminders could have helped them in completing required tasks.

At the end of the second intervention period, participants from both groups were invited to fill out questionnaires. In total 35 participants (Intervention group 1, $n = 18$; intervention group 2, $n = 17$) agreed to fill out the questionnaires. In response to the questions relating to virtual rehearsal and self-confidence, a high majority of participants (88.9%) reported that they felt confident in managing depression. Further a high number (86.1%) of participants not only felt self-confident in tackling depression but also showed intentions to practice newly learnt skills in future.

An overwhelming majority of the participants approved the system. H1 was based on the assumption that persuasive reminders would help users in task completion and H2 assumed that users would perceive persuasive reminders as a desirable software feature. Both H1 and H2 were derived from the PSD model [3], H3 anticipated a positive correlation between virtual rehearsal and self-confidence based on the theory of Self-efficacy [16], H4 assumed that users with improved self-confidence would intend continuous use of the BCSS. It was based on the Technology Acceptance Model [17] and H5 was based on the assumption that meaningful content of the rehearsal feature would be positively correlated with the overall effectiveness of the BCSS.

In response to questions relating to H1, a high majority of participants (83.3%) reported that persuasive reminders helped them in completing weekly exercises thereby supporting H1. Hypothesis 2 was developed assuming that participants from the intervention group 2 would perceive persuasive reminders as a desirable software

feature. In response to the question, an overwhelming majority of participants (83.3%) from intervention group 2 expressed their wish to have received reminders. This finding supports H2. Hypothesis 3 assumed that virtual rehearsal would improve participants' self-confidence in managing depression. A high majority of participants from intervention group 1 (77.8%) and group 2 (100%) stated that virtual rehearsal improved their confidence in managing depression thus supporting H3. Hypothesis 4 was based on the assumption that participants with improved self-confidence would continue rehearsing newly acquired skills. Again, a high majority of participants from intervention group 1 (88.9%) and group 2 (88.2%) indicated intentions to rehearse newly learned skills in future. Thus, H4 is supported. Hypothesis 5 was based on the assumption that the overall affect of the BCSS would be such that participants' depression would decrease considerably. In order to verify Hypothesis 5, we analyzed mean scores for both BDI and Self-confidence. Outcomes from the analysis of pre- and post-measurements of BDI revealed significant decrease in both intervention group 1 (Mean score dropped by 8.72) and group 2 (Mean score dropped by 6.06). Similarly, promising results were prominent when self-confidence was analyzed. Outcomes from the analyses for pre and post-measurements revealed significant improvement in self-confidence in both intervention group 1 (mean increased from 48.11 to 61.83) and group 2 (mean increased from 49.00 to 60.00). Mean values for psychological measurements provide strong evidence for overall effectiveness of the BCSS thereby supporting H5. Table 2 exhibits scores for mean and standard deviations for both intervention groups.

Table 2. Mean scores and standard deviations for psychological measures

<i>Measure Group</i>	<i>BDI Pre</i>	<i>BDI Post</i>	<i>Self-confidence Pre</i>	<i>Self-confidence Post</i>
Intervention Group 1	22.11 (8.00) n = 19	13.39 (10.72) n = 18	48.11 (18.98) n = 19	61.83 (18.03) n = 18
Intervention Group 2	18.00 (7.44) n = 20	11.949 (7.95) n = 16	49.00 (18.19) n = 20	60.00 (23.16) n = 16

Post study questions focused on system usefulness, impact of persuasive reminders on task completion, whether reminders were obtrusive, influence of virtual rehearsal on participants' behaviors, whether rehearsal improved participants' self-confidence and would they continue using the rehearsal exercises in future.

Tables 3 and 4 exhibit validated responses; Mean scores and Standard Deviations from participants of Intervention group 1 and 2 respectively.

Participants generally approved persuasive reminders with a majority giving positive feedback acknowledging that in today's overwhelmingly busy lifestyle, it is easy to overlook important tasks. Participants from intervention group (83.3%) highly approved the use of reminders. Below are some exemplary comments:

Table 3. Responses from participants from Intervention Group 1

<i>Themes for Intervention Group I</i>	<i>Validated Responses</i>	<i>Mean</i>	<i>Std. Deviation</i>
System was useful	Yes (15) (83.3%) No (3) (16.7%)	1.17	.383
Reminders helped complete weekly tasks	Yes (15) (83.3%) No (3) (16.7%)	1.61	.778
Reminders did not interrupt me	Yes (17) (94.4%) No (1) (5.6%)	1.28	.575
Rehearsal influenced my behavior in a positive way	Yes (15) (83.3%) No (3) (16.7%)	1.56	.784
Rehearsal improved my confidence	Yes (14) (77.8%) No (4) (22.2%)	1.22	.428
I intend to rehearse in future	Yes (16) (88.9%) No (2) (11.1%)	1.39	.698

Table 4. Responses from participants from Intervention Group 2

<i>Themes for Intervention Group II</i>	<i>Validated Responses</i>	<i>Mean</i>	<i>Std. Deviation</i>
System was useful	Yes (17) (100%) No (0) (0.0%)	1.00	.000
Reminders would have been a desirable feature	Yes (14) (82.4%) No (3) (17.6%)	1.18	.393
Reminders should be unobtrusive	Yes (15) (88.2%) No (2) (11.8%)	1.41	.712
Rehearsal influenced my behavior in a positive way	Yes (15) (88.2%) No (2) (11.8%)	1.12	.332
Rehearsal improved my confidence	Yes (17) (100%) No (0) (0.0%)	1.00	.000
I intend to rehearse in future	Yes (15) (88.2%) No (2) (11.8%)	1.12	.322

P1. "Reminders assured me to remember doing the assignments; I use email very often."

P2. "They reminded me of doing my homework and I found the link (to be) very handy."

P3. "Reminders give (gave) you the feeling that you are not alone. They encouraged and gave a boost for replying to the assignments. It felt personal."

P4. "In addition to email-based reminders, SMS could be beneficial."

P5. "Add supportive criticism; enveloping criticism in a way that it won't depress (discourage) the person."

Participants of intervention group 2 received the same intervention though reminders were not sent out. A high majority (82.4%) stated that reminders would have been desirable. Some of the exemplary comments are stated below:

P6. "Yes, if one has a tendency towards forgetting things that need to be done (reminders would have helped)."

P7. "Yes, because I forgot, since there were no reminders; the due dates were hard to remember."

Some mixed remarks were also noted. Below are a few representative comments:

P8. "I did not need to be reminded. I was already committed to the program".

P9. "I would try to make reminders and rehearsal (exercises) less demanding".

A high majority of participants approved the rehearsal feature and acknowledged it as a technique to learn new skills. Some of the representative comments are stated below:

P10. "Exercises (rehearsals) were good. All in all, the interaction was excellent".

P11. "Weekly themes (rehearsals) were very good. They (rehearsal exercises) brought me in touch with my (core) values and I learned to be consciously present in the moment".

P12. "I found rehearsal content to be supportive. It kept me on track".

Based on the qualitative feedback from the participants, we identified following themes to further improve users-system interaction.

(1) Provide Positive Criticism/Feedback. Provision of positive feedback is vital for developing effective BCSSs. The PSD model [3] advocates implementing positive feedback. This augments interactivity and user-system dialogue. Previously, the impact of feedback has been studied. One study has been reported that users expressed a desire for meaningful and positive feedback [18].

(2) Supplement Email-Based Reminders with SMS. We propose that email-based reminders could be made more effective when supplemented with SMS. Use of SMS-based reminders has been suggested for e-Health interventions. Similarly, [10] promote the use of mobile reminders for health behavior change. They support their argument by stating that mobile phones are like constant partners therefore making it easier for the persuasive messages to be delivered.

(3) Add Supportive Content in Reminders. It is vital that people suffering from depressive symptoms are not left in a situation where they feel unassisted. One of the emerging themes from the open-ended questions was that reminders should be designed in a way that they make users feel "*important*". We therefore suggest that adding empathy and supportive content to reminders could have a positive influence on users.

(4) **Remind People of Their Values.** The content of rehearsals could further be made effective if it helps people to reflect upon their values. This would mean that the content of rehearsals is developed in a way that people are reminded of their values and goals thereby supporting them to commit to actions that reduce disparity between their values/beliefs and actual actions. Such content could help people in overcoming different situations, for example, unpredictable changes in everyday situations.

5 Discussion

The objective of the study was to analyze the impact of persuasive reminders and virtual rehearsal on the effectiveness of a web-based BCSS. Participants' reflections about its usefulness, persuasive reminders and virtual rehearsal reveal that it was well received. Significant improvements were observed in post study psychological measurements where depressive symptoms decreased noticeably while in parallel participants' self-confidence improved considerably. However, reminders seem not to have an added effect on the efficacy of the BCSS (compared rehearsal only) as measured by observing changes in depression and self-confidence scores. This is an interesting finding. One reason for lack of effect of reminders could be that the ACT-based rehearsals were so effective, engaging and intrinsically motivated the participants. Responses from the participants indicate that they learned new skills for managing depression. We suggest that this is critical for behavior change process. In addition, a high majority of participants felt self-confident in tackling depressive symptoms at their own and indicated their intention to continue practicing newly learned skills. These findings are in line with the theory of Self-Efficacy as proposed by [16].

Our work has several contributions for researchers of persuasive systems in particular and healthcare in general. First, to the best of our knowledge, it is the only study where a web-based BCSS incorporated with ACT-based virtual rehearsals was evaluated involving patients suffering from mild to moderate depression without face-to-face therapy. Second, the findings reveal that although persuasive reminders were positively perceived however they did not have any additional influence on task completion. This study has some limitations. First, the sample size is relatively low therefore it is relatively hard to generalize the results. However, it must be noted that recruiting people with depression is a hard task. Second, the intervention did not include a follow up. In future studies a research setting where a post intervention follow-up is included is recommended.

6 Conclusions

We have presented qualitative evaluation of a web-based BCSS assimilated with value, acceptance and mindfulness-based rehearsal techniques for treating depression without face-to-face therapy. First we studied persuasive reminders and their effect on task completion. Second, virtual rehearsal was evaluated in terms of learning new behaviors leading to potentially higher self-efficacy. Lastly, we evaluated usefulness

of the BCSS and its benefits as experienced by participants. The findings reveal interesting inferences. It is surprising to note that persuasive reminders did not have an added effect on task completion, which calls for further investigation. Virtual rehearsal was well received by the participants and helped them learn new skills and behaviors. The findings are promising because the entire intervention was performed without face-to-face therapy. We believe that the in-depth insights gained through post study questionnaires and interviews have contributed towards existing knowledge relating to behavior change interventions. Presented results are a good starting point for researchers to implement information systems for people with depression and other mental disorders.

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