Predictors of adherence and outcome in Internet-based cognitive behaviour therapy delivered in a telephone counselling setting

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The trial on which this paper is based was funded by an Australian Research Council Linkage Project Grant (LP0667970). KMG is supported by a National Health and Medical Research Council Fellowship (525413). HC is supported by a National Health and Medical Research Council Fellowship (525411). PJB is supported by a National Health and Medical Research Council Early Career Fellowship (1035262).

Nicole Hayes (nee Burgess) coordinated and conducted data collection for the trial. Dawn O'Neil was involved in obtaining funding for the trial and coordinating Lifeline Australia's collaboration with the ANU. Associate Prof Richard O'Kearney provided guidance on the background to this study. Trevor Carlyon was also involved in coordinating Lifeline staff and volunteer involvement in the trial and supported Nicole in her role.

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Abstract

This study investigated predictors of adherence and outcome in a sample of callers to a national crisis counseling service who were randomized to receive a 6-week, online, self-administered psychoeducation and cognitive behavioral therapy (CBT) intervention. Age, sex, relationship status, employment status, level of education, baseline depression symptom severity, and motivation to undertake the intervention were examined as predictors of adherence to the intervention in participants assigned to receive the online intervention (n = 83). Predictors of depression outcome were assessed using mixed models repeated measures ANOVA, comparing the two web-CBT intervention groups to the tracking and control groups (n = 155). Lower baseline depression severity was significantly associated with greater adherence to the intervention. A significant interaction was found between measurement occasion and motivation to undertake the intervention. At 6 month follow-up, participants with low

and moderate levels of motivation had lower depressive symptoms than those with high levels of motivation. At 12 month follow-up, those with moderate levels of motivation had lower depressive symptoms than those with high motivation. The findings suggest that lower pre-intervention depression symptoms may positively influence adherence to online treatment for depression, while low and moderate levels of motivation appear to be optimal for treatment outcome. The factors that relate to adherence and outcome need to be understood to prevent dropout and maximize treatment effectiveness in online interventions.

Keywords: online cognitive behavior therapy, depression, adherence, outcome

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Internet-delivered interventions are effective in the treatment of depression and other mental disorders (Andersson & Cuijpers, 2009; Andrews, Cuijpers, Craske, McEvoy, & Titov, 2010; Griffiths, Farrer, & Christensen, 2010). Many users of Internet-based interventions do not complete the intervention in its entirety, and not all who complete Internet programs benefit from treatment. Premature dropout from face-to-face treatment appears to prolong depressive episodes and increase the likelihood of symptom relapse (Pekarik, 1985, 1986). Therefore, the characteristics that predict adherence to treatment need to be identified and understood.

Several factors have been found to be associated with treatment adherence and outcome in relation to face-to-face treatment, including demographic characteristics (e.g., age, sex, educational level, employment status, and relationship status), clinical characteristics (e.g., severity of symptoms, chronicity or stability of symptoms, complexity of diagnostic presentation), and motivational factors (e.g. client expectations about the effectiveness of treatment, treatment credibility beliefs and client self-efficacy) (Arnow et al., 2007; Hillis, Alexander, & Eagles, 1993; Last, Thase, Hersen, Bellack, & Himmelhoch, 1985; Oei & Kazmierczak, 1997; Westra, Dozois, & Boardman, 2002; Wierzbicki & Pekarik, 1993). However, relatively few studies have investigated these variables as predictors of adherence and outcome in online interventions for depression and anxiety. Furthermore, studies conducted to date have yielded equivocal results possibly due to considerable diversity in sample sizes and characteristics, definitions of adherence, and disorders targeted. Thus, there are few consistent predictors of adherence and outcome in the literature.

Two of the more consistent findings are that higher educational attainment and being married or in a partnered relationship appear to be associated with better adherence to online

interventions. This has been reported among participants in treatment trials (Lange et al., 2003; Spek, Nyklicek, Cuijpers, & Pop, 2008; van Straten, Cuijpers, & Smits, 2008; Warmerdam, van Straten, Twisk, Riper, & Cuijpers, 2008) and community-based users of online interventions (Batterham, Neil, Bennett, Griffiths, & Christensen, 2008). There is less certainty regarding the status of age and sex as predictors of adherence. Two studies found that females (Batterham et al., 2008; Lange et al., 2003) and younger individuals (Batterham et al., 2008) are more likely to adhere to online interventions, whereas others have found that better adherence was associated with older individuals (Lange et al., 2003) or that age and sex were unrelated to adherence (Clarke et al., 2005; Clarke et al., 2002). The relationship between employment status and adherence to online treatments has not yet been investigated.

Studies of clinical predictors of adherence have typically reported that baseline depression symptom severity is unrelated to adherence in online interventions (Andersson et al., 2005; Kenardy, McCafferty, & Rosa, 2003; Warmerdam et al., 2008). However, one study reported greater adherence among individuals with higher baseline depression symptom severity (Batterham et al., 2008). The sample of this study was considerably larger than the one used in other studies; moreover, it was composed of community-based users. The impact of motivational factors on adherence to online interventions was also investigated in one study. Results showed that pre-treatment expectations and perceived credibility of the treatment did not predict subsequent program completion (Cavanagh et al., 2009).

Evidence concerning demographic factors of treatment response in Internet-based interventions is also mixed. Results from several studies suggest that age, sex and education level are not associated with response to treatment, either in terms of reduced post-treatment symptom severity (Clarke et al., 2002; de Graaf, Hollon, & Huibers, 2010) or pre- to post-treatment symptom change (Andersson, Bergström, Hollandare, Ekselius, & Carlbring, 2004; Button, Wiles, Lewis, Peters, & Kessler, 2012; de Graaf et al., 2010; Spek et al., 2008).

However, one study found that response to treatment was superior for females and those with higher levels of education (Spek et al., 2008). The much older age of the sample examined in this study may partially account for the differences in findings compared to other studies. There is a small amount of contradictory evidence regarding the effect of relationship status on response to online CBT, with one study reporting better outcomes among married individuals (Spek et al., 2008), and another study reporting better outcomes among those who were separated, widowed or divorced (Button et al., 2012). However, the latter finding is at odds not only with the finding reported by Spek and colleagues, but also with those reported by several face-to-face CBT trials (Jarrett, Eaves, Grannemann, & Rush, 1991; Sotsky et al., 1991; Thase et al., 1992). Button and colleagues acknowledge that differences in the way their relationship variable was coded and the potential for Type I error may have accounted for their unexpected finding.

Clinical predictors of treatment outcome have also yielded equivocal results. Three studies found that greater pre-treatment depression symptom severity was associated with greater response to online CBT (Button et al., 2012; de Graaf et al., 2010; Spek et al., 2008). However, Andersson and colleagues found that depression symptom severity at baseline was significantly positively correlated with depression symptom severity at 6 month follow-up (Andersson et al., 2004). The association between baseline symptom severity and change in depression scores from pre-treatment to 6 month follow-up was not examined.

Unsurprisingly, given the small number of studies involved and the differences in measures used, findings regarding the role of cognitive/motivational variables in treatment outcome in computerized and Internet-based CBT interventions are also mixed. Of the two studies which have examined this question, both reported that perceived treatment *credibility* was unrelated to outcome (Cavanagh et al., 2009; de Graaf, Huibers, Riper, Gerhards, & Arntz, 2009). However only one of the studies found that treatment *expectations* were

positively related to outcome (de Graaf et al., 2009), with the second reporting no association (Cavanagh et al., 2009).

It is generally assumed that greater treatment adherence results in improved outcomes. There is some evidence in Internet-based CBT studies to support this assumption although findings are mixed, possibly due to differences in the measurement of treatment adherence. One study reported that a higher number of logins, greater total time spent using the treatment and greater use of an online mood diary were predictive of better outcome at 3 months post-intervention (de Graaf et al., 2009). Compliance with homework exercises was also significantly associated with better treatment outcome at 9 months (de Graaf et al., 2009). However, Warmerdam and colleagues found no differences in improvement of depressive symptoms between those who completed treatment in its entirety and those who did not (Warmerdam et al., 2008).

Overall, to date, few factors have been consistently identified as predictors of adherence in online interventions for depression and anxiety. The most consistent findings are that higher educational attainment and being in a married/partnered relationship are predictive of better adherence, and that baseline depression symptom severity is largely unrelated to adherence. On the other hand, baseline depression appears to be associated with treatment outcome, whereas age, sex, and education level do not. Clearly, these conclusions must be treated with caution as they are based on relatively few studies. In addition, there are inconsistencies in the outcomes of these and other studies of the predictors of online adherence and outcome. This is not surprising given the inherent heterogeneity in these studies such as the different methodologies employed, and the potential for type 1 errors in those investigating multiple potential predictors.

In this study we undertook exploratory analyses to examine predictors of adherence and outcome in a trial of a 6-week online intervention for depression (Farrer, Christensen,

Griffiths, & Mackinnon, 2011). We sought to provide additional evidence in an attempt to further clarify the inconsistent and contradictory findings reported to date.

Method

Design

The study was a randomized controlled trial with four conditions: (a) *Web only:* online psychoeducation and CBT (n = 38), (b) *Web with tracking:* online psychoeducation and CBT, plus weekly telephone tracking (n = 45), (c) *Tracking only:* weekly telephone tracking only (n = 37), (d) *Control:* no online psychoeducation and CBT or telephone tracking (n = 35). The method of the study has been fully described elsewhere (Farrer et al., 2011). Ethical approval for the trial was granted by the Australian National University Human Research Ethics Committee (Protocol no. 2007/12).

Participants

Participants were callers to Lifeline's 24 hour counseling service, who were recruited into the trial by telephone counselors from Lifeline centres based in four major Australian cities. Callers were eligible for inclusion in the trial if they spoke English, had access to the Internet for at least 30 minutes per week, were aged 18 years or older, and scored 22 or above on the 10 item Kessler Psychological Distress Scale (K10) (Kessler et al., 2002). Only those participants allocated to the *Web only* (n = 38) and *Web with tracking* (n = 45) conditions were analyzed in the current study.

Interventions

Participants assigned to the *Web only* condition completed 6 weeks of online psychoeducation and cognitive behavior therapy for depression. Depression psychoeducation was delivered in week 1 of the intervention using BluePages (http://bluepages.anu.edu.au), a freely accessible website that contains information about depression symptoms, effective

treatments and links to online resources. Online cognitive behavior therapy was provided in weeks 2 to 6 of the intervention by MoodGYM (http://moodgym.anu.edu.au), a free to end-user, online program containing 5 modules composed of written information, animations, interactive exercises and quizzes. An instructional manual for logging in to and using the websites was mailed to participants at the start of the trial. Participants assigned to the *Web with tracking* condition were provided with the same intervention as those assigned to the *Web only* condition, and in addition, were provided with a weekly 10 minute telephone call from a Lifeline counselor. The purpose of this call was to briefly review the week's intervention content and to address any issues associated with participants' use of the online programs.

Measures

The following demographic variables were used as predictors of adherence and outcome: sex (male or female) age (years), level of education (total years of primary, secondary and further education), employment status (currently employed full-time/part-time or unemployed) and relationship status (married/de facto or never married/divorced/separated/widowed').

Baseline depression symptom severity was examined as a predictor of adherence. Depression symptom severity was measured using the 16-item Centre for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977). The scale is widely used and has strong reliability and validity (Husaini, Neff, Harrington, Hughes, & Stone, 1980; Knight, Williams, McGee, & Olaman, 1997; Radloff, 1977; Roberts, 1980; Roberts & Vernon, 1983; Ross & Mirowsky, 1984).

Motivation to participate in the intervention, assessed as a continuous score at baseline, was also investigated as a predictor. This was measured using the Nijmegen Motivation List for Prevention (NML-P) (Allart-van Dam, Hosman, & Keijsers, 2004).

This measure was only administered to participants allocated to the *Web only* and *Web with tracking* conditions. The NML-P consists of 48 statements and is designed to measure motivation to participate in a psychoeducational intervention. The scale examines four main dimensions of motivation: participants' readiness to participate, doubt concerning participation, social support of participation and the extent to which the participants are distressed by mental disorder symptoms. Total scale scores range from 0 to 210, with higher scores indicating higher motivation to participate in the intervention. The original scale was modified to make it more relevant to the online intervention delivered in the current study. The word 'course' was replaced with 'website program', and, in an effort to reduce the length of the scale, 6 items with the lowest factor loadings were removed, producing a shorter 42-item scale. Internal consistency for the four dimensions of the NML-P is high (Allart-van Dam et al., 2004). However, given that the NML-P is a recently developed scale, test-retest reliability and validity have yet to be extensively evaluated. In the current sample, internal consistency for the scale was 0.66 (N = 45).

Data relevant to adherence were directly downloaded from the administration interface of the MoodGYM and BluePages websites. Adherence was defined as the number of completed weeks of the intervention, ranging from 0 to 6. Completion of 1 week of the intervention was defined as having at least one visit to the BluePages website but subsequent failing to complete any MoodGYM modules. Completion of weeks 2 to 6 of the intervention was measured by number of MoodGYM modules completed, in addition to a visit to the BluePages website in week 1. Participants who visited the BluePages website in week 1 and completed all 5 modules of MoodGYM were considered to have achieved full adherence to the intervention. Scores thus ranged from 0 to 6.

Procedure

Ethics approval for the trial was granted by The Australian National University Human Research Ethics Committee (Protocol no. 2007/12). Informed written consent was obtained from participants and baseline data were collected using a self-report questionnaire mailed to participants. Following this, participants were randomly allocated to one of the four trial conditions. Participants completed further assessments post-intervention, and at 6 and 12 months post-intervention.

Statistical analysis

Data were analyzed using SPSS release 18.0.1 for Windows (SPSS Inc., 2009) and Stata Intercooled version 10.1 (StataCorp., 2007). Logistic regression analyses (conducted in SPSS) were used to identify significant predictors of dropout (failure to complete an outcome assessment) at each measurement occasion. Data for dropout (missingness) were coded as follows: 0 (not missing) and 1 (missing). Separate analyses were conducted for each measurement occasion, using the following predictors: pre-intervention levels of depression symptoms, pre-intervention levels of anxiety symptoms, intervention condition, age, and sex.

Linear regression analyses using robust methods for calculating standard errors (conducted in Stata) were used to examine the predictors of adherence at post-intervention, 6 month follow-up and 12 month follow-up. The robust standard errors provided by Stata are more generally known as Huber/White/sandwich estimates. These standard errors (and thus significance tests derived from them) have been established as being accurate under a wide variety of deviations from the classical linear model including non-normality and heteroscedasticity of residuals (Hox, 2010). Only participants allocated to the *Web only* and *Web with tracking* conditions were included in the analyses concerning predictors of adherence. Several demographic predictors were dichotomized for analysis. Relationship status was dichotomized into 'married or defacto' and 'never married, divorced, separated or widowed'. Employment status was dichotomized into 'employed full or part time' and

'unemployed or not in the labour force'. First, all predictors were analyzed univariately. Then all predictors were entered into one regression model simultaneously.

Predictors of outcome were analyzed using mixed models repeated measures ANOVA, with measurement occasion as a within groups factor and intervention condition as a between groups factor. Each predictor was modelled separately, and the three-way interaction between measurement occasion, intervention condition (Web only and Web with tracking = 1, Tracking only and control = 0) and each predictor was examined. However, only the two-way interaction between motivation and measurement occasion could be estimated because the NML-P was only administered to participants in the *Web only* and *Web with tracking* conditions. Within person variation was modelled using an unstructured covariance matrix. Mixed modelling allows the use of all available data for each participant to yield unbiased estimates of effects under the assumption that missingness is either completely at random (MCAR) or at random conditional on observed data (MAR) (Hamer & Simpson, 2009). In addition, adherence was investigated as a predictor of outcome.

Results

Participants

Table 1 shows the demographic and baseline characteristics of the trial participants. Eighty-three participants were randomly allocated to the *Web only* (n = 38) and *Web with tracking* (n = 45) conditions, and 72 participants were randomly allocated to the *Tracking only* (n = 37) and *Control* (n = 35) conditions. The sample was predominantly female and middle-aged. A majority of participants were not partnered and approximately half were in either full-time or part-time employment. Mean baseline depression scores were high, well above the widely-used cutoff score of 16 to indicate clinical depression caseness (Whooley, Avins, Miranda, & Browner, 1997; Williams, Pignone, Ramirez, & Perez Stellato, 2002). Of

the 83 participants allocated to either the *Web only* or *Web with tracking* conditions, 51 (61.5%) participants completed the motivation to participate in a depression intervention survey (NML-P) (Note that this measure was only administered to participants in the *Web only* and *Web with tracking* conditions). Scores on this survey ranged from 7 to 75, with a mean score of 54.5 (SD = 15.94). The flow of participants through the trial is documented elsewhere (Farrer et al., 2011). 107 (69%) participants completed the post-intervention survey, 92 (59%) completed the 6 month follow-up survey and 57 (37%) completed the 12 month follow-up survey.

Predictors of dropout (failure to complete outcome assessments)

The odds of dropout (failure to complete an outcome assessment) were greater for participants in the Internet plus tracking condition, relative to participants in the control condition post-intervention (OR 6.46, p = .002) and at 12 month follow-up (OR 3.70, p = .01). Those who completed fewer MoodGYM modules also had greater odds of dropout post-intervention (OR .49, p <.001), at 6 month follow-up (OR .56, p <.001) and at 12 month follow-up (OR .66, p = .001). In addition, those with higher levels of pre-intervention psychological distress (OR 1.10, p = .04), and those with lower pre-intervention anxiety symptoms (OR .93, p = .03) were more likely to dropout at 12 months.

Adherence to the intervention

Table 1 shows the number of weeks of the intervention completed by participants assigned to the *Web only* and *Web with tracking* conditions. Approximately 16% of participants completed all 6 weeks of the intervention.

Predictors of adherence to the intervention

Table 2 shows the results of the univariate regression analyses (n = 47). Adherence was significantly associated with level of education, level of motivation and age, such that those with more years of education, those with higher levels of motivation and younger

participants were more adherent to the intervention. Pre-intervention depression approached significance as a predictor of adherence (p = .052). When all the predictors were modelled together, none of the predictors that were univariately associated with adherence were significant. However, pre-intervention depression was associated with adherence when all the variables were taken into account. Those with lower levels of baseline depression were more adherent to the intervention (Beta = -.27, p = .043).

Predictors of outcome

No significant effects were found for the three-way interactions between measurement occasion, condition (web CBT conditions vs. tracking only/control conditions) and any of the following predictors, including: sex (F(3,88.9) = .67, p = .58, n = 153); age (F(3, 82.4) = 1.62, p = .19, n = 153); level of education (F(3,86.5) = .31, p = .82, n = 148); relationship status (F(3,83.4) = .33, p = .81, n = 153); employment status (F(3,88.9) = .74, p = .53, n = 153); adherence (F(3,83.4) = 1.06, p = .37, n = 153). A significant interaction between measurement occasion and motivation was found for depression symptoms (F(3,38.3) = 2.85, p = .0499, n = 50), indicating different patterns of change in depression symptoms over time among participants with different levels of motivation. It was not possible to investigate a three-way interaction using the motivation variable because the NML-P was only administered to participants assigned to the *Web only* and *Web with* tracking conditions. A quadratic effect of motivation was also tested, to assess evidence for a curvilinear effect of motivation, specifically whether high and low levels of motivation led to poorer outcomes than moderate levels of motivation. When the model was re-estimated using both linear and quadratic motivation terms, both were significant (linear F(3,36.9) = 3.44, p = .027; quadratic F(3,43.2) = 4.88, p = .005). Based on change in -2 log likelihood, the addition of the quadratic effect explained significantly greater variance in the depression outcome ($\chi^2(4)$ = 12.02, p = .007). In order to illustrate the interaction effects, the motivation variable was

categorized evenly into 3 groups, representing “low”, “moderate” and “high” levels of motivation. Figure 1 depicts the estimated marginal means for depression by motivation level and measurement occasion. Post-intervention, depression symptoms did not differ significantly between participants with different levels of motivation. At 6 month follow-up, depression symptoms were lower for both the low motivation ($t = -2.09$, $p = .043$) and moderate motivation groups ($t = -2.49$, $p = .017$), compared with the high motivation group, based on estimates obtained from the fixed effects model. At 12 months, depression symptoms were significantly lower in the moderate motivation group, compared with the high motivation group ($t = -2.44$, $p = .019$).

Discussion

Contrary to prior findings, lower baseline depression was significantly associated with better adherence to the intervention in the present study. It is possible that self-help online interventions create a greater attentional load on the individual, and thereby require greater levels of concentration and motivation to complete.

Several significant findings emerged from the univariate analyses. These should be interpreted with caution, given the small sample size and propensity for type 1 error when multiple tests are conducted. Univariately, higher level of education was positively related to adherence, which is consistent with the results of previous studies (Batterham et al., 2008; Spek et al., 2008; Warmerdam et al., 2008). An association between education and better adherence may reflect the fact that the MoodGYM and BluePages programs are primarily text-based, and that effective engagement with CBT interventions requires a necessary level of verbal and conceptual reasoning skill. Those with higher levels of education may also be more proficient in their use of computers and the Internet, which may increase their

propensity to engage with a treatment that is delivered online. Nevertheless, given the present sample was somewhat homogeneous in terms of education level, these effects may be more pronounced in samples with a broader range of educational attainment.

Consistent with Batterham and colleagues, the present study also found that younger participants were more adherent to the intervention, which may reflect the fact that MoodGYM was originally designed for young adults. Those with higher levels of motivation to participate in the intervention showed greater levels of adherence in the present study. This finding is consistent with the theory of planned behavior, which posits that attitudes towards a behavior and self-efficacy to perform that behavior are predictive of behavioral intentions (Ajzen, 1991). It might be expected that those with higher positive expectations, lower levels of doubt and higher perceived need for treatment would be more likely to engage with the intervention.

Relationship status, sex of the participant and employment status were unrelated to adherence. The null finding with regard to relationship status is inconsistent with previous studies that suggest that those in partnered relationships are more adherent to online interventions. It is possible that our participants who were recruited through a helpline did not have partners or other sources of support to whom they could turn. Males and females also showed similar levels of adherence to the intervention in the current study, in contrast to previous studies of online interventions (Batterham et al., 2008; Lange et al., 2003). The difference between the current study and the studies by Batterham and Lange may be due to the type of sample in the ECCO trial. Both Batterham and Lange recruited their samples from the general community, not a specialized helpline. Moreover, Batterham's sample was extremely large (82,000 participants) and composed of spontaneous community online intervention users, not participants enrolled in a trial. Employment status was found to be unrelated to treatment adherence. Studies of face-to-face treatments suggest that a

relationship exists between dropout and lower income and lower socioeconomic status (Arnow et al., 2007; Wierzbicki & Pekarik, 1993). However, income may not be a critical issue in adherence to online CBT given the possible lower cost of this treatment compared to face-to-face CBT.

Interestingly, although our results found that higher motivation was linked to greater adherence, different patterns were observed between motivation and treatment outcome. Individuals with high levels of motivation had poorer outcomes compared to those with low and moderate levels of motivation at 6 month follow-up and those with moderate levels of motivation at 12 month follow-up. This is seemingly inconsistent with other studies that report an association between positive expectations for treatment and better treatment response (de Haan et al., 1997; Keijsers, Hoogduin, & Schaap, 1994; Keithly, Samples, & Strupp, 1980; Sotsky et al., 1991; Weinberger & Eig, 1999). However, the present study may offer a finer-grained analysis of this relationship. Our findings show that an optimal level of motivation may facilitate the best outcomes. Those with higher motivation may have held unrealistic expectations upon entering the trial, and, thus, been more prone to disappointment or dissatisfaction with the intervention.

The fact that there was no relationship between adherence and outcome was surprising, and inconsistent with the findings of de Graaf and colleagues (2009) who reported that better treatment outcome was associated with greater number of logins, greater total time spent using the intervention, and greater compliance with homework exercises. It is possible that the null finding in the present study is related to high rates of attrition in the study, leading to reduced power to detect adherence effects. It may also be due to differences in the measures of treatment adherence used.

Relationship status, employment status and level of education were unrelated to outcome in the current study. This finding is inconsistent with studies that have examined

relationship status and outcome in online CBT (Button et al., 2012; Spek et al., 2008). The lack of association found between employment status and outcome is consistent with one study of online CBT for depression (Warmerdam et al., 2008), but contrasts with the findings of another which reported that unemployment was linked to worse outcome following online CBT (de Graaf et al., 2010). The reason for the discrepancy with the de Graaf study is unclear; additional evidence is required to investigate the role of unemployment and outcome in online CBT. Level of education was also unrelated to outcome in the current study. However, level of education in the current sample was high, and the lack of a significant effect may reflect restriction in the range of levels of education among participants. Those who chose to participate in the ECCO trial may have been more highly educated and more computer literate than those who did not. Sex of the participant was found to be unrelated to outcome. This result adds weight to the findings of the small complement of existing online depression studies that have demonstrated that online CBT is equally effective for men and women (Andersson et al., 2004; Clarke et al., 2002; de Graaf et al., 2010).

An attempt was made to assess the reasons for dropout in participants who completed less than 3 weeks of the intervention. Unfortunately, data was obtained from only 10 participants (21.3%). A wide range of reasons were endorsed by participants, and participants could endorse more than one reason. The most commonly cited reasons were: lack of time (n = 5), feeling too depressed (n = 5), slow or unreliable Internet connection (n = 4), the intervention contained too much text (n = 4) or CBT was too complicated to understand (n = 4). Identifying and addressing the modifiable reasons that people discontinue online interventions may be important for improving adherence to these interventions. It must be remembered that participants in the current trial initially made contact with the service for quite a different form of assistance. This alone may have been responsible for some discontinuation.

Assignment to the Internet plus tracking condition and lack of adherence to the intervention were significant predictors of failure to complete follow-up assessments. These factors may be related. A large majority of participants allocated to the intervention conditions failed to complete the program in its entirety, making it probable that they dropped out of the trial prior to completing the post-intervention and follow-up assessments. Despite efforts on the part of research staff to convey to participants the importance of completing follow-up assessments, it is possible that participants who did not start or complete the intervention either did not see the need to provide further data or were concerned that their data would distort the results of the trial. Participants in the Internet plus tracking condition who did not engage with the intervention may have been more likely to withdraw from the trial in order to stop receiving weekly telephone calls.

There are several limitations associated with this study. Within trial attrition (failure to complete follow-up assessments) was high in the ECCO trial (possibly due to unique characteristics of the sample), and thus, the findings regarding the predictors of adherence and outcome may not be as reliable as those found in other studies. It is important to acknowledge the uncertainty of both the significant and null findings of this study afforded by the small sample analyzed (particularly the subgroup sample included in the predictors of adherence analyses). Uncertainty also surrounds the null findings, in that even if small or moderate effect sizes exist for these predictors, the analyses may have been inadequately powered to detect them. Thus, replication of these analyses is required in a larger sample. In designing future research trials, consideration should be given to the complexities of recruiting in a helpline setting.

Although the measure of adherence used in the current study was objective (rather than based on participant self-report), it provided little information about the degree to which participants engaged with the intervention content and it is possible that the lack of

association found between adherence and outcome is partly due to this. Also, motivation was not assessed in the control and tracking only conditions, so the conclusions regarding the effect of motivation on outcome should be regarded with caution.

This study also examined only a small number of the many possible predictors of adherence and outcome. It was beyond the scope of this study to examine all of the predictors of adherence and outcome that have been identified in the literature. However, there would be merit in examining additional clinical factors in future studies of online self-help programs such as chronicity and co-morbidity.

The study of treatment adherence and outcome is rarely guided by a cohesive theoretical model. Online intervention research has until recently lacked a theory which might explain the factors that influence website usage, behavior change and symptom improvement. Ritterband and colleagues have proposed a behavior change model for Internet interventions that aims to explain how user and environmental factors might interact with website characteristics, which in turn might lead to behavior change and symptom improvement (Ritterband, Thorndike, Cox, Kovatchev, & Gonder-Frederick, 2009Ritterband, Thorndike, Cox, Kovatchev, & Gonder-Frederick, 2009). Studies that separately examine the predictors of adherence and outcome in different samples and settings with different programs can create a disjointed picture of how these variables operate and interrelate. Using Ritterband's model as a possible guide, future investigations of adherence to online programs might look beyond client and clinical characteristics to other factors that may interact with these variables, including environmental (family/community/media), support (type/intensity) and website (content/appearance/delivery) factors.

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Table 1

Baseline Characteristics and Intervention Adherence for Trial Participants

Characteristic	Trial condition	
	Web only and web with tracking (n = 83)	Tracking only and control (n = 72)
Age (years), *M* (SD)	39.7 (12.2)	43.5 (12.3)
Education (years), *M* (SD)	13.7 (2.7)	13.2 (2.6)
Sex (female), *n* (%)	68 (84.0)	57 (79.2)
Relationship status (married/de facto), *n* (%)	21 (25.9)	22 (30.6)
Employment status (employed full/part-time), *n* (%)	40 (49.4)	31 (43.1)
Depression (CES-D), *M* (SD)	34.7 (10.4)	38.1 (9.8)
Motivation to participate (NML-P)[a], *M* (SD)	55.7 (16.6)	N/A
Intervention completion		
None of intervention completed, *n* (%)	28 (33.7)	N/A
1 week completed (BP), *n* (%)	5 (6.0)	N/A
2 weeks completed (BP + MG 1), *n* (%)	14 (16.9)	N/A
3 weeks completed (BP + MG 2), *n* (%)	6 (7.2)	N/A
4 weeks completed (BP + MG 3), *n* (%)	9 (10.8)	N/A
5 weeks completed (BP + MG 4), *n* (%)	7 (8.4)	N/A
6 weeks completed (BP + MG 5), *n* (%)	14 (16.9)	N/A
Weeks of intervention completed, *M* (SD)	2.5 (2.28)	N/A

Note. [a]*n* = 51, *M* = Mean, SD = Standard Deviation, CES-D = Center for Epidemiologic Studies Depression Scale, NML-P = Nijmegen Motivation List –Prevention, BP = BluePages, MG = MoodGYM

Table 2

Univariate Linear Regression Analyses Predicting Intervention Adherence (N = 47)

Predictor	**Beta**	**Std. Err.**	**P value**
Sex (Female)	.09	.41	.23
Age	-.18	.02	.04
Total years of education	.25	.05	.000
Employment status (Employed)	.06	.34	.47
Relationship status (Married)	-.06	.36	.47
Pre-intervention depression	-.15	.02	.05
Pre-intervention motivation	.29	.02	.03

Note. Std. Err. = Standard Error

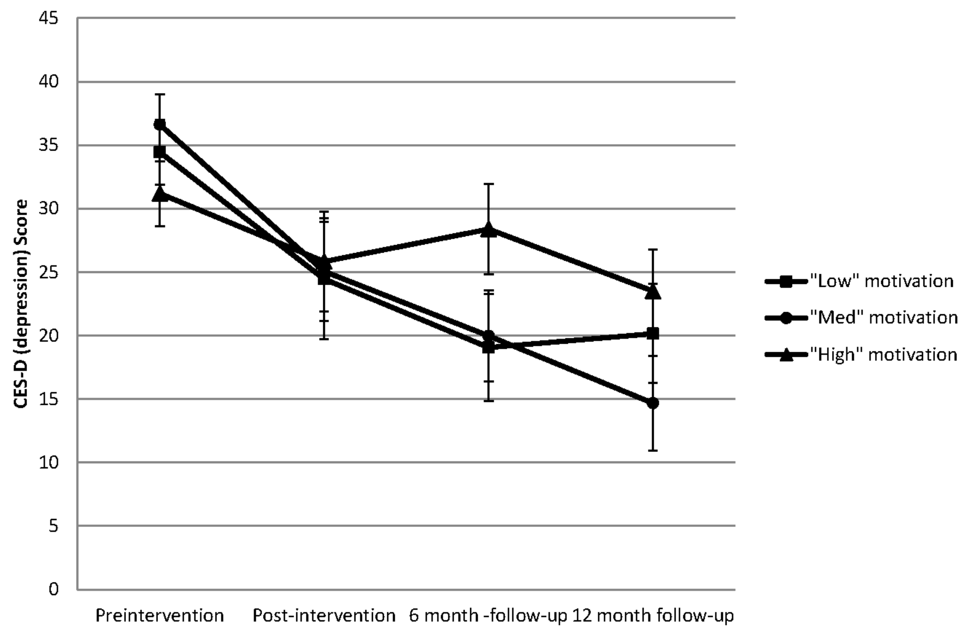

Figure 1. Estimated marginal means and standard errors (±1 SE) for depression (CES-D) symptoms by level of motivation at each measurement point (*n*= 50).