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# The Impact of Psychological Distress Tolerance in the Treatment of Depression

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Keywords: distress tolerance; depression; internet-based therapy; iCBT; emotion regulation

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## Abstract

Distress tolerance refers to the perceived ability to experience and withstand negative emotional states. Minimal research has investigated distress tolerance in the context of mood disorders despite poor emotional coping featuring in theoretical models of depression. The aims of the current investigation were to identify the relationship between psychological distress tolerance and depression, and to evaluate the impact of distress tolerance on treatment adherence and outcome following an internet-based cognitive behavioural therapy (iCBT) program for depression (the Sadness Program). Study 1 included 75 patients prescribed the Sadness Program by their primary care practitioner. Study 2 included 34 patients diagnosed with a major depressive episode participating in a randomized trial. Results of both studies indicated a significant inverse relationship between distress tolerance (DTS) and both depression severity (PHQ9) and psychological distress (K10). Results of intent-to-treat (ITT) marginal model analyses demonstrated that the Sadness Program was effective in reducing depression symptoms and psychological distress (Cohen's  $d$ s > 1), and in increasing distress tolerance (Cohen's  $d$ s > .28). However, patients who entered treatment with lower distress tolerance scores evidenced higher baseline and post-treatment scores on the outcome measures following iCBT. Collectively the findings suggest that distress tolerance is an important variable to consider in the context of treatments for depression. Clinical implications, future directions, and limitations are discussed.

Distress tolerance is a psychological construct relating to an individual's perceived ability to experience and withstand negative emotional states (Leyro, Zvolensky, & Bernstein, 2010). The construct of distress tolerance is gaining interest in psychology, across disorders from substance abuse to anxiety and mood disorders and has theoretical implications for psychopathology generally. It has been proposed that individuals low in distress tolerance will attempt to minimise exposure to distressing situations, often engaging in avoidant behaviours (McHugh & Otto, 2011) or by restricting or limiting their expression of emotions and affectivity (Leyro, Zvolensky, & Bernstein, 2010). The consequent rapid alleviation of distress and decreased experience of negative affect leads to negative reinforcement and continued engagement in such behaviours. The means to escape distress may be in the form of both behavioural and cognitive or experiential avoidance. Experiential avoidance is most commonly defined as the tendency to engage in behaviours that alter the frequency, duration, or form of unwanted internal experiences that encompass physiological sensations, thoughts, feelings, and memories (Hayes, Wilson, Gifford, Follette, & Strosahl, 1996). Simons and Gaher (2005) provide a useful multidimensional conceptualization of psychological distress tolerance that incorporates 1) ability to tolerate aversive experiences, 2) appraisals of the acceptability of aversive experiences, 3) efficient regulation of emotions, and 4) level of psychological absorption or depletion of attentional resources when distressed. The clinical picture of an individual low in distress tolerance is someone who reports that the experience of distress is unbearable, shameful, or unacceptable, who has a weak perceived ability to cope, who makes efforts to avoid experiencing negative emotions or makes efforts to quickly alleviate negative emotions when they do arise, and finally, someone who becomes consumed or absorbed by aversive experiences to the detriment of their functioning (Simons & Gaher, 2005).

The concept of distress tolerance has most notably been developed within the framework of the biosocial model of borderline personality disorder (BPD) which proposes that an unwillingness to tolerate emotional distress is a core mechanism in BPD (Linehan, 1993). Research has demonstrated a relationship between low distress tolerance and a range of other maladaptive behaviours, including deliberate self-harm, disordered eating, drug and alcohol use, gambling, and compulsive buying (Anestis, Selby, Fink, & Joiner, 2007; Brown, Lejuez, Kahler, Strong, & Zvolensky, 2005; Buckner, Keough, & Schmidt, 2007; Chapman, Gratz, & Brown, 2006; Daughters et al., 2005; Daughters, Lejuez, Kahler, Strong, & Brown, 2005; Williams, 2012; Zvolensky et al., 2009). In addition to being linked to various maladaptive behaviours, research has demonstrated that individuals low in distress tolerance employ maladaptive coping strategies in response to anxiety-provoking and distressing situations (Keough, Riccardi, Timpano, Mitchell, & Schmidt, 2010; McHugh & Otto, 2011; Potter, Vujanovic, Marshall-Berenz, Bernstein, & Bonn-Miller, 2011; Zvolensky, et al., 2009). Minimal research has focused on low distress tolerance in the context of mood disorders despite poor emotional coping featuring heavily in theoretical models of depression (Campbell-Sills & Barlow, 2007; Gross & Munoz, 1995) and evidence that the related concept of experiential avoidance is associated with a range of psychological problems including depression (Hayes et al., 2004). It has been proposed that individuals who are intolerant of distress and who subsequently engage in maladaptive coping strategies may have a propensity to experience depression (Campbell-Sills & Barlow, 2007; Gross & Munoz, 1995). The converse hypothesis has also been proposed; that individuals experiencing depression may be more likely to seek out maladaptive behaviours as a means of coping with perceived distress (Gross & Munoz, 1995). To our knowledge, only one study (Ellis, Vanderlind, & Beevers, in press) has investigated the specific construct of

psychological distress tolerance in major depression. Ellis et al. measured distress tolerance *behaviourally* as an individual's ability to pursue a goal while experiencing negative emotions. The authors defined distress tolerance as task persistence during a computerised mirror tracing task known to elicit frustration and anger and evaluated the impact of cognitive re-appraisal and acceptance strategies on a number of variables including task persistence. The Authors reported no differential impact of emotion regulation strategies, but did report that depressed participants terminated the task sooner than their non-depressed counterparts. While demonstrating an important relationship between depression and behavioural distress tolerance, this study did not include a measure of psychological distress tolerance, therefore the findings are limited to the behavioural domain.

The current investigation was conducted with the aim to address the gap in the literature regarding the relationship between psychological distress tolerance and depression. Two studies were conducted focusing on psychological distress tolerance based on the multi-dimensional conceptualisation put forward by Simons and Gaher (2005). In both studies, the relationship between distress tolerance and depression severity was explored in the context of a treatment program for depressed patients. Cognitive behavioural therapy (CBT) is recommended as a first-line treatment of choice for depression (NICE, 2009) and meta-analyses of randomized controlled trials (RCTs) of internet-based CBT programs (iCBT) for depression provide evidence that iCBT is comparable to best-practice face-to-face CBT (Andersson & Cuijpers, 2009; Andrews, Cuijpers, Craske, McEvoy, & Titov, 2010; Cuijpers et al., 2011). In iCBT it is important that patients complete homework tasks and activities to reinforce learning of the program material, therefore requiring patient initiative and motivation. Homework tasks typically require patients to challenge their thoughts and behaviours, and engage in activities, such as exposure, that can be quite distressing.

Considering the behaviours commonly exhibited by those with low distress tolerance, it is reasonable to propose that such patients may be less likely to engage in distressing aspects of the treatment program, and therefore receive less benefit as evidenced by a poorer treatment response. Further, as avoidant coping is antithetical to the principles and skills underpinning CBT, it is likely that patients exhibiting low distress tolerance are less likely to fully engage with, and respond well to treatments that include exposure as a core therapeutic component. A secondary aim of the current investigation was to evaluate these proposals in the context of a validated iCBT program for depression (the Sadness Program: <https://thiswayup.org.au/clinic/courses/courses-we-offer/depression/>).

### **Study 1: The impact of distress tolerance on treatment outcomes for depression in primary care**

Study 1 aimed to identify the relationship between the different psychological domains of distress tolerance and depression, and to evaluate the impact of distress tolerance on treatment adherence and outcome following an iCBT program for depression (the Sadness Program). Based on existing theoretical proposals (Campbell-Sills & Barlow, 2007; Gross & Munoz, 1995), it was hypothesised that there would be an inverse correlation between distress tolerance (DTS) and depression severity (PHQ9), and general psychological distress (K-10) at baseline. Further, it was predicted that patients reporting lower distress tolerance at baseline would be less likely to adhere to the program and therefore evidence a smaller reduction in primary outcome scores (PHQ9, K10) following iCBT treatment.

### **Methods**

Study 1 was conducted as part of the Quality Assurance activities of the Clinical Research Unit for Anxiety and Depression (CRUfAD) at St. Vincent's Hospital, Sydney.



Prior to enrolment in any of the CRUfAD's /This Way Up programs, all individuals are informed that data will be collected and used for research purposes as per the following: *'By participating in THIS WAY UP Clinic, you acknowledge that your data will be pooled, analysed and periodically published in scientific articles to enhance scientific knowledge in anxiety and depression. In any publication, information will be provided in such a way that you cannot be identified'*. All patients provided electronic informed consent that their pooled data could be used for research purposes.

### **Procedure**

Patients were provided with a prescription from a GP or clinician registered with CRUfAD in order to enrol in the Sadness Program. As routine practice, prescribing clinicians were advised that patients are unlikely to benefit if they have very severe depression, persistent suicidal thoughts, drug or alcohol dependence, schizophrenia, bipolar disorder, or are taking atypical antipsychotics or benzodiazepines. Clinical responsibility was maintained by the prescribing clinician who received automatic updates via email regarding each patient's progress. The prescribing clinician also received an email alert if a patient's scores on the K10 indicated elevated distress or the patient endorsed suicidality on the PHQ9. The Sadness Program was developed so that a patient cannot advance to the subsequent lesson without first completing the preceding lesson, downloading the associated homework components, and then waiting 5 days (to ensure sufficient time to review the materials and to complete the homework tasks). All patients have 10 weeks to complete the program and are encouraged to progress through each lesson at a pace of 1 lesson per every 1-2 weeks. Patient progress is tracked automatically through the CRUfAD Clinic system. The program consists of six online lessons representing best practice CBT as well as regular homework

assignments and access to supplementary resources. Each lesson was designed using a cartoon narrative and included: psycho-education, behavioural activation, cognitive restructuring, graded exposure, problem solving, assertiveness skills, and relapse prevention. The Sadness Program has been evaluated in four efficacy trials (Perini, Titov, & Andrews, 2008; Perini, Titov, & Andrews, 2009; Titov et al., 2010; Williams, Blackwell, Mackenzie, Holmes, & Andrews, in press) and an effectiveness study in primary care (Williams & Andrews, 2013).

### Participants

Data from patients referred to the Sadness Program by their treating health-care professional between 21.05.2012 and 03.12.2012 were included. A total of 113 ( $n = 49$  males;  $n = 64$  female) patients had commenced the Sadness Program during the time period of data collection.

### Measures

**Distress Tolerance Scale (DTS;** Simons & Gaher, 2005). The DTS is a 15-item self-report measure with four subscales: Tolerance (“*I can’t handle feeling distressed or upset*”), Appraisal (“*Being distressed or upset is always a major ordeal for me*”), Absorption (“*When I’m distressed or upset, I cannot help but concentrate on how bad the distress actually feels*”), and Regulation (“*I’ll do anything to stop feeling distressed or upset*”). Each subscale is calculated as a mean score (range 1-5) with higher scores reflective of better distress tolerance. The total score is calculated as the mean of the subscales (range 1-5). The DTS demonstrates good psychometric properties, including discriminant validity with measures of negative affect (Simons & Gaher, 2005). Cronbach’s alpha for the full scale in Study 1 was

.92. Reliability indices were .84 for the Regulation subscale and .82 for the Tolerance subscale employed in Study 2.

**Patient Health Questionnaire** (PHQ-9; Kroenke & Spitzer, 2002; Kroenke, Spitzer, & Williams, 2001). The PHQ-9 is a self-report questionnaire, consistent with the DSM-IV diagnostic criteria for major depressive disorders. A four-point frequency scale (0 = not at all, 3 = nearly every day) is used to rate each of the nine items, with total scores ranging from 0-27. Higher scores relate to a higher level of psychopathology (0-9 = normal, 10-14 = mild, 15-19 = moderate, 20-23 = severe, and 24-27 = very severe). The PHQ-9 exhibits strong psychometric properties, and is commonly used to measure treatment outcomes in those with depression and anxiety. The PHQ-9 was administered to participants prior to starting lesson 1 of the Sadness Program and 1-week post treatment. Cronbach's alpha was .89 in Study 1. Due to a technical error, individual item data was unavailable to calculate Cronbach's alpha for Study 2.

**Kessler-10 Psychological Distress Scale** (K10; Andrews & Slade, 2001; Kessler et al., 2002). The K10 is a brief screening tool used to measure generalised psychological distress, including depressive and anxious symptoms. The scale consists of 10 items, each scored on a five-point scale (1 = none of the time, 5 = all of the time). Total scores range from 10 (no distress) to 50 (severe distress). Participants were required to complete the K-10 prior to starting each lesson, and again at one week post-treatment. The K10 demonstrates strong psychometric properties (Andrews & Slade, 2001; Kessler, et al., 2002). Cronbach's alpha was .88 and .89 in Study 1 and Study 2, respectively.

## **Statistical Analyses**

Intent-to-treat (ITT) marginal models using restricted maximum likelihood (REML) estimation were used to account for missing data due to participant drop-outs without assuming that the last measurement was stable (the last observation carried forward assumption; (Gueorguieva & Krystal, 2004). REML models are appropriate for pre-post only designs (Salim, Mackinnon, Christensen, & Griffiths, 2008). Model fit was determined using Schwarz's Bayesian Criterion (BIC). Effect sizes were calculated within groups (Cohen's  $d$ ) using the pooled standard deviation and adjusted for the repeated measure correlation.

## Results

Of the 113 patients enrolled in the Sadness Program, 75 met the study inclusion criterion of a probable diagnosis of depression based on intake PHQ9 scores ( $>9$ ). The sample included 49 females and 26 males with a mean age of 41.93 ( $SD = 15.34$ ). Eighty-five percent of patients ( $n = 65$ ) completed all six lessons. DTS Total scores were not significantly correlated with adherence as measured by the number of lessons completed ( $r = .41, p = .08$ ). Age, gender, and baseline K10, PHQ9, and DTS scores were then entered as predictors in a multivariate logistic regression model predicting the likelihood of completing all six lessons. The only significant predictors were age ( $\beta = 1.04, p < .01$ ) and gender ( $\beta = 3.10, p < .05$ ), indicating that older patients and females were more likely to complete all six lessons. Baseline DTS scores did not differ for males and females,  $p > .05$ .

Pearson  $r$  correlations were conducted to examine the relationship between the DTS subscales and depression severity (PHQ9) and psychological distress (K10) scores at baseline. As predicted, all DTS subscale scores were inversely associated with depression severity,  $r$ 's =  $-.27$  to  $-.40$  and distress,  $r$ 's =  $-.27$  to  $-.36$ , all  $ps < .05$ . Separate marginal model analyses were then conducted to evaluate the impact of treatment on PHQ9 and K10

scores and to determine if treatment impacted DTS scores. For each model, time was entered as a repeated factor. The main effects of time were significant for PHQ9 scores [ $F(1, 45.90) = 53.05, p < .001$ ] and K10 scores [ $F(1, 44.82) = 72.88, p < .001$ ], corresponding to large effect sizes (Cohen's  $d > 1$ ). For the DTS, the main effects of time were significant for all subscale scores [ $F_s(1, 44.23-47.71) = 7.52-10.52, p_s < .01$ ], with the exception of DTS Regulation,  $p > .05$ . Results are reported in Table 1.

To evaluate the influence of distress tolerance on treatment outcome marginal model analyses were then conducted including DTS Total scores as a covariate and as an interaction term. Analyses were conducted separately for PHQ9 and K10 scores. For each model, time was entered as a factor and the DTS Total score and the time by DTS Total score interaction were entered as fixed covariates. Estimated marginal means and standard errors for the value of PHQ9 and K10 scores at the level of Low DTS scores (DTS Total =1) and High DTS scores (DTS Total = 5) are reported in Table 2. For PHQ9 scores the main effects of time [ $F(1, 78.39) = 7.90, p = .006$ ] and DTS Total [ $F(1, 96.14) = 8.57, p = .004$ ] were significant. The time by DTS Total interaction was not significant,  $p > .05$ . For K10 scores the main effects of time [ $F(1, 74.33) = 5.66, p = .02$ ] and DTS Total [ $F(1, 99.42) = 10.83, p = .001$ ] were significant. The time by DTS Total interaction was not significant,  $p > .05$ . Although results indicate that patients evidenced a significant reduction in depression and psychological distress scores irrespective of DTS scores, inspection of the estimated marginal means in Table 2 demonstrate that patients with low distress tolerance at baseline had higher PHQ9 and K10 scores both before commencement of treatment and following iCBT, compared to patients with high distress tolerance.

### Discussion Study 1

Results of Study 1 support the proposed hypotheses that distress intolerance is associated with depression and psychological distress. Results further demonstrate that an effective iCBT treatment for depression can positively impact upon patients' self-reported ability to tolerate distress, appraise the consequences of experiencing distress, and influence the extent to which patients are absorbed or disrupted by emotional distress. Interestingly appraisals of the consequences of distress appeared to demonstrate the largest effect. This is consistent with the role of interpretations and appraisals in the cognitive model of psychopathology (Beck, 1991) emphasised throughout the Sadness Program. There was no evidence that the Sadness Program led to a corresponding increase in DTS regulation scores. Results of the marginal model analyses suggest that contrary to prediction, elevated levels of psychological distress intolerance do not impede iCBT treatment for depression. However, distress tolerance may impact upon treatment outcome as patients with lower levels of DTS entered and completed treatment with higher depression scores compared to patients with a greater capacity to cope with psychological distress and its sequelae (higher DTS scores). If replicated, these findings could have implications for the further refinement of iCBT program modules for depression, and possibly for treatments of depression more broadly. DTS scores were not, however, related to drop-out which suggests that internet-based CBT programs, despite not having a face-to-face clinician to guide and motivate behaviour, are appropriate for patients reporting low levels of distress tolerance. Age and gender were related to drop-out, which is partially consistent with findings obtained in a large effectiveness study of the Sadness Program (Williams & Andrews, 2013) in which age was a predictor of attrition.

Data for Study 1 were collected from patients prescribed the Sadness Program by primary care practitioners in the community, however, because a formal diagnosis was not obtained it is important to replicate these findings in a controlled study with patients diagnosed with a major depressive episode. Study 2 aimed to address this limitation, and further, to explore the impact of distress tolerance on adherence to the iCBT components. It was hypothesised that low distress tolerance would be associated with lower ratings of homework compliance and self-reported effort on the exposure tasks that are an integral component of the Sadness Program.

## **Study 2: The impact of distress tolerance on treatment outcomes for depression in a research framework**

### **Methods**

#### **Procedure**

Data for Study 2 was collected as part of a pilot randomized trial to evaluate the efficacy of delivering the Sadness Program via a newly developed mobile phone application. The full results are reported in Watts, Mackenzie, Thomas, Griskaitis, Mewton, Williams et al. (2013). The study was approved by the Human Research Ethics Committee (HREC) of St Vincent's Hospital (Sydney, Australia) and the trial was registered as ACTRN 12611001257954.

#### **Participants**

Participants were recruited via CRUFAD's research arm (Virtual Clinic; [www.virtualclinic.org.au](http://www.virtualclinic.org.au)). Automated screening questionnaires excluded those who did not meet selection criteria and those who met inclusion criteria were contacted for a telephone

interview, in which the depression section of the Mini International Neuropsychiatric Interview (MINI version 5.0.0; Sheehan et al., 1998) was administered to confirm a DSM-IV diagnosis of a current Major Depressive Episode. Eligible participants were randomized to access the Sadness Program either via computer ( $n = 22$ ) or mobile phone ( $n = 30$ ). The Sadness Program was identical in both treatment arms, therefore the groups were collapsed for the purposes of the current study. Of the 52 participants who enrolled into the study, 35 started lesson 1 and 24 completed all six lessons. The mean age of participants was 41.97 ( $SD = 12.56$ ) and 79% were female ( $n = 27$ ). Due to technical error, data for one female participant was missing and therefore excluded from analyses.

## Measures

The same measures (PHQ9, K10, DTS) as detailed in Study 1 were administered. Due to efforts to reduce participant questionnaire burden, only the DTS Tolerance and Regulation subscales were administered to index distress tolerance. These subscales were chosen based on the assumption that emotional tolerability and regulation efforts would demonstrate the greatest relationship with homework and adherence. Additionally the Homework Rating Scale (HRS) was administered. Participants were asked 1) '*How much effort did you put into the homework?*' (0 = no effort, 4 = complete effort) and 2) '*How much of the assigned homework did you finish?*' (0 = none, 4 = all) prior to commencement of each lesson to establish homework compliance. This scale was established for the purposes of the current study, therefore it has not been evaluated for its psychometric properties.

## Results

As the computer and mobile treatment groups were collapsed into one group, Chi-Square ( $\chi^2$ ) and independent samples  $t$ -tests were first conducted to confirm that no



significant differences existed between the groups at baseline. There were no differences in gender [ $\chi^2(1) = .01, p > .05$ ], age [ $t(31) = 0.32, p > .05$ ], or any of the outcome variables, all  $ps > .05$ . Pearson  $r$  correlations were then conducted to examine the relationships between the Tolerance and Regulation subscales of the DTS and symptom measures at baseline. As predicted, the DTS Tolerance and Regulation subscales were inversely associated with depression severity [ $rs = -.38, ps < .05$ ] and psychological distress [ $r = -.42$  and  $r = .43, ps < .05$ , respectively].

To evaluate the influence of distress tolerance on treatment outcome marginal model analyses were conducted including DTS Regulation and DTS Tolerance subscale scores separately as a covariate and as an interaction term with Time. Analyses were conducted separately for PHQ9 and K10 scores. For each model Time was entered as a factor and the DTS Total score and the Time by DTS Total score interaction were entered as fixed covariates. Result with the estimated marginal means for the value of PHQ9 and K10 scores at the level of Low DTS scores (DTS Regulation/Tolerance = 1) and High DTS scores (DTS Regulation/Tolerance = 5) are reported in Table 3. For both PHQ9 and K10 all main effects of Time and DTS were significant [ $F_s(1, 26.32-54.56) = 5.37 - 17.23$ , all  $ps < .05$ ], reflecting a significant decrease in both outcome variables following iCBT. There were no significant DTS by Time interactions, all  $ps > .05$ .

Secondary analyses were performed to explore whether distress tolerance changed as a function of effective treatment. Marginal model analyses with Time as a repeated factor and the DTS subscale scores entered separately as the outcome variable revealed significant main effects of time [ $F_s(1, 25.07-25.72) = 9.76- 9.81, ps < .01$ ]. There was an increase in ability to tolerate negative emotional states from baseline ( $M = 2.16, SE = .20$ ) to post-treatment ( $M =$

2.88,  $SE = .22$ ) Tolerance scores, corresponding to an effect size of .49 (95% CI = -.06 – 1.04). Similarly, there was an increase from baseline ( $M = 2.24$ ,  $SE = .18$ ) to post-treatment ( $M = 2.75$ ,  $SE = .20$ ) Regulation scores, corresponding to an effect size of .63 (95% CI = .07 – 1.18).

The final hypothesis, that a low distress tolerance would be associated with poorer adherence to homework tasks, was explored through analyses of the homework rating scale data. Contrary to predictions, there was an inverse relationship between baseline DTS Tolerance and Regulation scores and average ratings of homework effort across the program [ $rs = -.43$  and  $-.44$ ,  $ps = .01$ , respectively], suggesting that patients with lower distress tolerance made greater efforts to adhere to the homework tasks. Average ratings of amount of homework completion were unrelated to DTS subscale scores,  $ps > .05$ . Interestingly, self-reported ratings of homework effort for the exposure tasks (during Lesson 3) correlated with gain scores on the subscales of DTS Tolerance,  $r = .40$ ,  $p < .05$  and Regulation,  $r = .51$ ,  $p < .01$ .

### Discussion Study 2

Study 2 aimed to examine the relationship between distress tolerance and depression severity in research volunteers diagnosed with a current major depressive episode. Analyses revealed that participants reported significant increases in their ability to tolerate distress and to regulate responses to distressing situations following treatment. Further, based on existing literature relating distress tolerance to other psychopathologies, it was proposed that individuals low in distress tolerance would be less likely to engage in homework, particularly on tasks that involved an exposure component. Surprisingly, results indicated an inverse association suggesting that patients with lower distress tolerance reported greater efforts on

the homework tasks. This finding was particularly surprising in the context of an iCBT treatment program which requires self-motivation in the absence of face-to-face clinician guidance. Although contrary to predictions, this finding is likely attributable to the fact that patients enrolled in the trial were treatment-seeking volunteers, and therefore presumably willing to make efforts to change their behaviour. Additionally, it is conceivable that patients with low distress tolerance subjectively experienced the homework tasks as more effortful, thereby influencing ratings on the HRS.

### **General Discussion**

The current investigation represents a novel exploration of the impact of distress tolerance on depression severity in the context of iCBT treatment for depression. Data were reported in two separate samples: patients prescribed an iCBT program for depression as part of routine care and volunteers with a current major depressive episode participating in a research trial. As research volunteers can be unrepresentative of real-world patients, the strength of the current investigation is the use of two distinct patient groups. Results from both studies converged to demonstrate that psychological distress tolerance is associated with depression severity and psychological distress. Further, the current findings are the first (to our knowledge) to demonstrate that distress tolerance is amenable to change following successful treatment for depression using an internet-based treatment. Although not targeted directly, patients in both studies evidenced a significant increase in DTS scores following iCBT treatment, although an increase in DTS Regulation scores was not observed in Study 1. Inspection of group means suggest that DTS Regulation scores were higher at baseline in Study 1 patients, therefore the impact of the treatment may have been marginal in comparison to that observed in Study 2. Considering the mixed findings regarding regulation, future

investigations are needed to confirm this effect. The increase in subscale scores corresponded to small effects, but effect size estimates should be regarded as conservative given analyses were conducted in the full sample irrespective of program completion. In the absence of an established clinical significance criterion for the DTS, it is unknown how clinically meaningful these score increases are.

Collectively the results suggest that distress intolerance (as measured by DTS scores) does not impede the effects of iCBT treatment for depression. Further, the results of Study 1 demonstrated that DTS scores were not predictive of attrition, suggesting the appropriateness of iCBT treatments with a subpopulation that might otherwise be expected to demonstrate problems with adherence in the absence of regular contact with a guiding clinician. These results were supplemented by the findings from Study 2 that demonstrated that homework effort was inversely associated with DTS scores. However, it is important to note that patients who entered treatment with lower DTS scores evidenced higher baseline and post-treatment scores on the outcome measures and remained within the clinical range. It will be important for future research to identify whether these patients are more susceptible to relapse or recurrence and to evaluate whether explicitly targeting distress intolerance early in treatment can augment the trajectory of change.

Although there remains a lack of systematic research investigating distress tolerance as a therapeutic target (Zvolensky, Bernstein, & Vujanovic, 2011), recent research suggest that a number of strategies may be beneficial. In a recent randomized control trial for substance use, improvements in distress tolerance were observed following an intervention designed to teach acceptance, healthy distraction, effective interpersonal skills, and emotional exposure (Bornovalova, Gratz, Daughters, Hunt, & Lejuez, 2012). Prominent therapeutic

approaches in the context of personality disorders also highlight the role of emotional acceptance as a therapeutic target (Gratz & Gunderson, 2006; Linehan, 1993; Lynch, Chapman, Rosenthal, Kuo, & Linehan, 2006). These approaches may provide a useful framework for the development of specific distress tolerance modules in the context of iCBT programs.

Any suggestions to target distress tolerance therapeutically should be made with consideration given to the context sensitivity of distress tolerance. As noted by Leyro et al. (2010), high levels of distress tolerance may not always be adaptive or desirable. Having a rigid and inflexible level of distress tolerance may in fact be harmful or result in other psychological or physiological sequelae in situations where it may otherwise be advisable to employ some level of avoidant coping in the short-term, if it prompts more adaptive behavioural change in the long-term. Indeed, research suggests that it is the inflexibility or context insensitivity of such strategies that distinguishes functional responses from their dysfunctional counterparts (Kashdan, Barrios, Forsyth, & Steger, 2006).

The current findings must be considered in light of a number of limitations. The cross-sectional nature of the data precludes inferences about causality. It may be that possessing low levels of distress tolerance functions as a vulnerability factor for poor emotion regulation and depression, or alternatively, that recurrent depression weakens an individual's ability to effectively regulate, and therefore tolerate negative emotional experiences. It is important to note that the mean increase in DTS subscales scores was marginal and reflect small effect sizes. Further, in the absence of a control group it is not possible to attribute the change in DTS scores solely to the depression treatment. A controlled trial would be necessary to confirm these results. It is also important to note that the homework compliance

scale employed in Study 2 has not been validated and was limited in scope. A comprehensive measure to assess homework engagement and adherence would be a valuable addition to the field of iCBT treatments generally. As the sample sizes in both studies were relatively small, results must be considered accordingly. Additionally, it will be important to replicate the association between depression and psychological distress tolerance using other methodologies that do not rely exclusively on self-report. However, it should be noted that the extent to which behavioural tasks measure the same latent construct of distress tolerance is unclear (McHugh, Daughters, Murray, Hearon, Gorka, & Otto, 2011). Finally, as DTS data was not collected beyond post-treatment, future investigations would benefit from inclusion of an extended follow-up period to evaluate the temporal stability of these effects.

Greater understanding of the variables that impact patient response and adherence to psychological treatments for depression is an important area of research. Future studies could aim to provide a more comprehensive evaluation of the potential mechanisms by which distress tolerance exerts its influence on depression symptomatology.

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Table 1

Estimated marginal means (standard errors) at baseline and following iCBT treatment

Measure	Baseline Estimated Marginal Mean (SE)	Post-Treatment Estimated Marginal Mean (SE)	<i>t</i> (df)	Cohen's <i>d</i> (95% CI)
PHQ9	16.40 (.49)	9.25 (.95)	7.28** (45.90)	1.02 (.69 -1.34)
K10	30.77 (.63)	20.38 (1.20)	8.53** (44.82)	1.14 (.81 - 1.46)
DTS Total	2.42 (.08)	2.75 (.11)	3.23** (44.23)	.31 (-.01 - .63)
DTS Tolerance	2.32 (.10)	2.76 (.15)	3.18* (43.42)	.32 (.00 - .64)
DTS Absorption	2.20 (.10)	2.63 (.15)	2.74* (47.71)	.28 (-.04 - .60)
DTS Regulation	2.72 (.10)	2.80 (.13)	.64 (44.16)	.06 (-.26 - .38)
DTS Appraisal	2.46 (.08)	2.81 (.11)	3.24* (44.49)	.39 (.06 - .71)

Note: PHQ9 = Patient Health Questionnaire; K10 = Kessler Distress scale; DTS = Distress Tolerance Scale. \*\* $p < .001$ ; \* $p < .01$



Table 2

Estimated marginal means (standard errors) in outcome measures at the level of low and high DTS scores

	PHQ9 Baseline Mean (SE)	PHQ9 Post-Treatment Mean (SE)	K10 Baseline Mean (SE)	K10 Post-Treatment Mean (SE)
Low DTS	19.77 (1.25)	11.79 (1.82)**	34.64 (1.59)	25.27 (2.30)**
High DTS	10.33 (2.09)	6.39 (2.16)	23.81 (2.65)	14.69 (2.73)*

*Note:* PHQ9 = Patient Health Questionnaire; K10 = Kessler Distress scale; DTS = Distress; Low DTS = DTS Total = 1; High DTS = DTS Total = 5. \*\* $p < .001$ , \* $p < .01$

Table 3

Estimated marginal means (standard errors) in outcome measures at the level of low and high DTS tolerance and regulation scores

	PHQ9 Baseline Mean (SE)	PHQ9 Post-Treatment Mean (SE)	K10 Baseline Mean (SE)	K10 Post-Treatment Mean (SE)
Low DTS Tolerance	16.98 (1.15)	9.83 (1.37)***	33.36 (1.84)	23.15 (2.25)***
High DTS Tolerance	7.72 (3.10)	3.10 (1.54)*	21.33 (3.40)	16.45 (2.59)
Low DTS Regulation	16.56 (1.23)	9.84 (1.60)***	33.06 (1.94)	23.20 (2.55)***
High DTS Regulation	9.26 (2.17)	2.03 (2.00)**	22.74 (3.45)	15.27 (3.22)

*Note:* PHQ9 = Patient Health Questionnaire; K10 = Kessler Distress scale; DTS = Distress; Low DTS = DTS Tolerance/Regulation = 1; High DTS = DTS Tolerance/Regulation = 5.  
\*\*\* $p < .001$ , \*\* $p < .01$ , \* $p < .05$

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## Highlights

- Depression may be characterized by poor distress tolerance (DT)
- Depression severity inversely correlated with DT in two clinical samples
- Effective treatment for depression (iCBT) influenced DT
- DT did not impact depression reductions, but influenced pre and post-treatment scores